Black Point Quarry Project
Municipality of the District of Guysborough, NS

Environmental Impact Statement

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and
TABLE OF CONCORDANCE

Vulcan Materials Company

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Appendix I: Freshwater Habitat Assessment Supporting Documentation

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Appendix K: Mi'kmaq Ecological Knowledge Study

Appendix L: 2011 and 2014 Archaeological Resource Assessments

Appendix M: Consultation and Engagement References

Appendix N: Species at Risk Supporting Documentation

Appendix O: Air Quality Technical Report

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Between the
CEAA Guidelines (June 2014) for the Black Point Quarry Project
and the
Black Point Quarry Project Environmental Impact Statement

Black Point Quarry Project
Guysborough County, NS

February, 2015

Table of Concordance: CEAA EIS Guidelines and Black Point Quarry Project EIS Report

CEAA EIS Guidelines		Black Point Quarry Project EIS Report
Section	**Title**	**Title**
1.0	**Introduction**	1.0 Project Introduction
2.0	**Guiding Principles**	N/A
2.1	Environmental Assessment As A Planning Tool	N/A
2.2	Public Participation	11.0 Consultation and Engagement
2.3	Aboriginal Consultation	11.11 Engagment of Aboriginal Communities
3.0	**Preperation and Presentation Of The EIS**	N/A
3.1	Agency Guidance	11.9 Government and Agency Consultation
3.2	Study Strategy and Methodology	5.0 Environmental Effects Assessment Methodology
3.3	Intergration of EA, Aboriginal and Public Consultation Information	11.0 Consultation and Engagement
3.4	Use of Information	N/A
3.4.1	Scientific Advice	11.9 Government and Agency Consultation
3.4.2	Community Knowledge and Aboriginal Traditional Knowledge	11.11 Engagment of Aboriginal Communities; App. K MEKS Study
3.4.3	Existing Information	6.0 Existing Conditions
3.4.4	Confidential Information	11.9 Government and Agency Consultation
3.5	Presentation and Organization of the EIS	1.1 Report Organisation
4.0	**Summary of Environmental Impact Statement**	Summary Report
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5.2	Regulatory Framework and the Role of the Government	2.0 Regulatory Framework
5.3	Participants in the Environmental Assessment	1.6 Participants In the Assessment
5.4	The Proponent	1.6.1 The Proponent
5.5	Purpose of the Project	1.8 Purpose of The Project
5.6	Project Components	3.1 Overview Of Project Components and Site Layout
5.7	Project Activities	3.2 Construction Phase; 3.3 Operations Phase; 3.4 Decommissioning Phase
6.0	**Scope of the Project**	5.1 Overview
7.0	**Scope of Assessment**	5.0 Environmental Effects Assessment Methodology
7.1	Factors To Be Considered	2.0 Regulatory Framework; 5.0 Environmental Effects Assessment Methodology; 7.18 Changes to the Enviornment Within Federal Jurisdiction
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9.0	**Baseline Conditions**	6.0 Existing Conditons
9.1	Existing Environment	6.0 Existing Conditions
9.1.1	Methodology	6.0 Existing Conditions
9.1.2	Biophysical Environment	6.1 to 6.7 Existing Conditions
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9.2	Potential Or Established Aboriginal and Treaty Rights and Related Interests	6.8.3 First Nation Communiteis; 6.10.4 First Nation Fisheries; 11.11 Engagement Of The Aboriginal Communities
10.0	**Effects Assessment**	N/A
10.1	Environmental Effects	7.0 Environmental Effects Assessment

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Section	**Title**	**Title**
10.1.1	Methodology	5.0 Environmental Effects Assessment Methodology; 7.0 Environmental Effects Assessment
10.1.2	Changes to the Environment	7.18 Changes to the Enviornment Within Federal Jurisdiction
10.1.3	Effects of Changes to the Environment	7.18 Changes to the Enviornment Within Federal Jurisdiction
10.2	Adverse Impacts on Aboriginal and Treaty Rights and Related Interests	7.17 Aboriginal Land And Resource Use; 11.11 Engagement of Aboriginal Communities
10.3	Public Concerns	11.0 Consultation and Engagement Programs; 11.14 Identified Issues and Concerns; Tables 11-7, 11-8 and 11-12 Issues And Concerns; Table 10-3 Issues Raised
11.0	**Mitigation**	
11.1	Environmental Mitigation	7.0 Environmental Effects Assessment; Table 10.1 Proposed Mitigation and Monitoring by VC
11.1.1	Methodology	3.5.5 Health, Safety and Enviornmental Management; 7.0 Environmental Effects Assessment; Table 10.1 Proposed Mitigation and Monitoring by VC
11.1.2	Summary of Environmental Mitigation	Table 7.18-1 Summary of Enviornmental Mitigation
11.2	Measures to Address Impacts on Aboriginal Rights	7.17 Aboriginal Land and Resource Use
11.3	Measures to Address Public Concerns	11.0 Consultation and Engagement Programs; Table 10-3 Issues Raised During the Assessment and Proponent Commitments
11.4	Follow-Up Program	7.0 Enviormental Effects Assessment; Table 10-2 Monitoring Commitments by VC
11.5	Proponent Commitments	7.0 Enviormental Effects Assessment; Table 10-2 Monitoring Commitments by VC
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12.1	Residual and Cumulative Environmental Effects	9.0 Cummulative Environmental Effects; Table 12-1 Summary of Residual Adverse Effects
12.1.1	Residual Environmental Effects	7.0 Enviormental Effects Assessment; Table 12-1 Summary of Residual Adverse Effects
12.1.2	Cumulative Environmental Effects	9.0 Cummulative Environmental Effects; 12.3 Cummulative Effects
12.1.3	Summary of Residual Environmental Effects	Table 12-1 Summary of Residual Adverse Effects
12.2	Outstanding Aboriginal Issues	11.11 Engagment of Aboriginal Communities; Table 10-3 Issues Raised During the Assessment and Proponent Commitments
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13.0	**Significance Determination**	5.0 Environmental Effects Assessment Methodology; 7.0 Environmental Effects Assessment; Table 12-1 Summary of Residual Adverse Effects, Significance Thresholds, Significance of Residual Effects
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13.1.1	Methodology	5.0 Environmental Effects Assessment Methodology; 7.0 Environmental Effects Assessment
13.1.2	Summary of Significant Adverse Environmental Effects	Table 12-1 Summary of Residual Adverse Effects, Significance Thresholds, Significance of Residual Effects
14.0	**Summary Tables**	7.0 Environmental Effects Assessment

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15.2	Benefits of the Project	1.9 Benefits of the Project
16.0	**Monitoring Program and Environmental Management Plans**	3.5.5 Health, Safety and Environmental Management; Table 10-1 Proposed Mitigation and Monitoring by VC; Table 10-2 Monitoring Commitments by VC; Table 10-3 Issues Raised During the Assessment and Proponent Commitments
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	Information Regarding the Proponent	1.6.1 Proponent
	Nature of the Undertaking	1.2 Project Overview
	Purpose and Need of the Undertaking	1.8 Purpose of The Project; 1.9 Benefits of the Project
	Construction and Operation Schedules	1.7 Project Schedule
	Description of the Undertaking	3.0 Project Description
	Environmental Baseline Information	6.0 Existing Conditions
	Steps Taken to Address Public and Aboriginal Concerns	11.0 Consultation and Engagements; Table 10-3 Issues Raised During the Assessment and Proponent Commitments
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	Locaton of Project; Nature and Sensitivity of Area	1.3 Project Location; 1.4 Geographical Overview; 6.0 Existing Conditions
	Size, Scope and Complexity of the Undertaking	3.0 Project Description
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	Environmental Effects	7.0 Environmental Effects Assessement
	Schedules	1.7 Project Schedule
	Planned or Existing Land Use	7.13 Local Economy, Land and Resource Use
	Other Undertakings in the Area	9.0 Cummulative Effects
	Whether Compliance will Mitigate Effects	Table 10-1 Proposed Mitigation and Monitoirng by VC
	Other Information	Table 12-1 Summary of Residual Adverse Effects

NA=Not Applicable

Black Point Quarry Project
Municipality of the District of Guysborough, NS

Environmental Impact Statement

TABLE OF CONCORDENCE and SUMMARY REPORT

Vulcan Materials Company

February 2015

C 1340-026

Table of Concordance: CEAA EIS Guidelines and Black Point Quarry Project Summary Report

	CEAA EIS Guidelines	Black Point Quarry Project Summary Report
Section	**Title**	**Title**
1.0	**Introduction**	1.0 Introduction
2.0	**Guiding Principles**	N/A
2.1	Environmental Assessment As A Planning Tool	N/A
2.2	Public Participation	5.1 Public Engagement
2.3	Aboriginal Consultation	5.2 Aboriginal Engagement
3.0	**Preperation and Presentation Of The EIS**	N/A
3.1	Agency Guidance	3.0 Scope of the Project and the Assessment
3.2	Study Strategy and Methodology	3.0 Scope of the Project and the Assessment
3.3	Intergration of EA, Aboriginal and Public Consultation Information	5.0 Public and Aboriginal Engagement
3.4	Use of Information	N/A
3.4.1	Scientific Advice	3.0 Scope of the Project and the Assessment
3.4.2	Community Knowledge and Aboriginal Traditional Knowledge	5.2 Aboriginal Engagement; 6.17 Aboriginal Land and Resource Use
3.4.3	Existing Information	6.0 Summary of the Environmental Effects Assessment
3.4.4	Confidential Information	N/A
3.5	Presentation and Organization of the EIS	1.0 Introduction and Environmental Assessment Context
4.0	**Summary of Environmental Impact Statement**	Summary Report
5.0	**Introduction and Project Overview**	1.0 Introduction and Environmental Assessment Context; 2.0 Project Overview
5.1	Geographical Setting	2.2 Project Location
5.2	Regulatory Framework and the Role of the Government	1.0 Introduction and Environmental Assessment Context
5.3	Participants in the Environmental Assessment	1.0 Introduction and Environmental Assessment Context
5.4	The Proponent	1.0 Introduction and Environmental Assessment Context
5.5	Purpose of the Project	2.1 Project Need and Justification
5.6	Project Components	2.3 Project Components
5.7	Project Activities	2.4 Project Activities
6.0	**Scope of the Project**	3.0 Scope of the Project and the Assessment
7.0	**Scope of Assessment**	3.0 Scope of the Project and the Assessment
7.1	Factors To Be Considered	3.1 Scope of the Assessment
7.1.1	Valued Components	3.2 Environmental Assessment Methods
7.1.2	Effects of Potential Accidents or Malfunctions	6.18 Accidents and Malfunctions
7.1.3	Effects of the Environment On The Project	6.19 Effects Of The Environment On The Project
7.2	Scope of the Factors	3.1 Scope of the Assessment
7.2.1	Spatial Boundaries	3.2.3 Boundaries
7.2.2	Temporal Boundaries	3.2.3 Boundaries
8.0	**Alternative Means of Carrying Out The Project**	4.0 Alternative Means of Undertaking the Project
9.0	**Baseline Conditions**	6.0 Summary of the Environmental Effects Assessment
9.1	Existing Environment	6.0 Summary of the Environmental Effects Assessment
9.1.1	Methodology	6.0 Summary of the Environmental Effects Assessment
9.1.2	Biophysical Environment	6.1-6.12 Summary of the Environmental Effects Assessment
9.1.3	Human Environment	6.13-6.17 Summary of the Environmental Effects Assessment
9.2	Potential Or Established Aboriginal and Treaty Rights and Related Interests	5.2 Aboriginal Engagment; 6.17 Aboriginal Land and Resource Use
10.0	**Effects Assessment**	N/A
10.1	Environmental Effects	6.0 Summary of the Environmental Effects Assessment
10.1.1	Methodology	3.2 Environmental Assessment Methods
10.1.2	Changes to the Environment	6.21 Changes to the Enviornment
10.1.3	Effects of Changes to the Environment	6.21 Changes to the Enviornment
10.2	Adverse Impacts on Aboriginal and Treaty Rights and Related Interests	5.2 Aboriginal Engagment; 6.17 Aboriginal Land and Resource Use
10.3	Public Concerns	5.1.2 Stakeholder Questions and Comments

	CEAA EIS Guidelines	Black Point Quarry Project Summary Report
Section	**Title**	**Title**
11.0	**Mitigation**	
11.1	Environmental Mitigation	Table 10 Proposed Mitigation and Monitoring by VC
11.1.1	Methodology	3.2 Environmental Assessment Methods
11.1.2	Summary of Environmental Mitigation	Table 10 Proposed Mitigation and Monitoring by VC
11.2	Measures to Address Impacts on Aboriginal Rights	Table 8 Comments and Issues Raised by Mi'kmaq Communities
11.3	Measures to Address Public Concerns	Table 10 Proposed Mitigation and Monitoring by VC
11.4	Follow-Up Program	Table 10 Proposed Mitigation and Monitoring by VC
11.5	Proponent Commitments	Table 10 Proposed Mitigation and Monitoring by VC
12.0	**Residual Effects**	N/A
12.1	Residual and Cumulative Environmental Effects	6.20 Cummulative Effects; Table 11 Residual Advserse Effects
12.1.1	Residual Environmental Effects	Table 11 Residual Advserse Effects
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12.1.3	Summary of Residual Environmental Effects	Table 11 Residual Advserse Effects
12.2	Outstanding Aboriginal Issues	Table 8 Comments and Issues Raised by Mi'kmaq Communities; 5.2.3 Aboriginal Questions and Comments
12.3	Outstanding Public Concerns	Table 10 Proposed Mitigation and Monitoring by VC
13.0	**Significance Determination**	3.2 Environmental Assessment Methods; Table 11 Residual Adverse Effects, Significance Thresholds, Significance of Residual Effects
13.1	Significance of Adverse Environmental Effects	N/A
13.1.1	Methodology	3.2 Environmental Assessment Methods
13.1.2	Summary of Significant Adverse Environmental Effects	Table 11 Summary of Residual Adverse Effects, Significance Thresholds, Significance of Residual Effects
14.0	**Summary Tables**	Table 10 Proposed Mitigation and Monitoring by VC; Table 11 Summary of Residual Adverse Effects, Significance Thresholds, Significance of Residual Effects
15.0	**Benefits to Canadians**	N/A
15.1	Changes to the Project Since Initially Proposed	2.1 Project Need and Justification
15.2	Benefits of the Project	2.1 Project Need and Justification
16.0	**Monitoring Program and Environmental Management Plans**	Table 10 Proposed Mitigation and Monitoring by VC
17.0	Nova Scotia Environment Requirements	N/A
	Section 9 (1A) Environmental Assessment Regulations	N/A
	Name and Location of the Undertaking	2.0 Project Overview; 2.2 Project Location
	Information Regarding the Proponent	1.0 Introduction and Enviornemntal Assessment Context
	Nature of the Undertaking	2.0 Project Overview
	Purpose and Need of the Undertaking	2.1 Project Need and Justification
	Schedules	2.5 Project Schedule
	Description of the Undertaking	2.0 Project Overview
	Environmental Baseline Information	6.0 Summary of the Environmental Effects Assessment
	Steps Taken to Address Public and Aboriginal Concerns	Table 10 Proposed Mitigation Measures and Monitoring Programs
	Public and Aboriginal Concerns Regarding the Undertaking	5.1.2 Stakeholder Questions and Comments; 5.2.3 Aboriginal Questions and Comments
	List of Approvals and Authorisations	Table 2.1 of the EIS Report
	Sources of Public Funding	None - 2.0 Project Overview
	Section12 Environmental Assessment Regulations	N/A

	Locaton of Project; Nature and Sensitivity of Area	2.2 Project Location; 6.0 Summary of the Environmental Effects Assessment
	Size, Scope and Complexity of the Undertaking	2.0 Project Overview
	Public and Aboriginal Concerns Regarding the Undertaking	5.1.2 Stakeholder Questions and Comments; 5.2.3 Aboriginal Questions and Comments
	Steps Taken to Address Public and Aboriginal Concerns	Table 9 Proposed Mitigation Measures and Monitoring Programs
	Sufficiency of Baseline Information	6.0 Summary of the Environmental Effects Assessment
	Environmental Effects	6.0 Summary of the Environmental Effects Assessment
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1.0 INTRODUCTION AND ENVIRONMENTAL ASSESSMENT CONTEXT

Vulcan Materials Company (Vulcan), a U.S.-based aggregate producer and Morien Resources Corporation (Morien), a Nova Scotia-based resource development company, have jointly prepared this Environmental Impact Statement (EIS), which outlines the proposed development, operation, and decommissioning and abandonment of a hard rock quarry and marine terminal at Black Point in Guysborough County, Nova Scotia (**Figure 1**). **Black Point Aggregates Inc.**, a wholly owned subsidiary of Vulcan Materials Company, is the named Proponent of the Project. Following the environmental assessment process, Black Point Aggregates Inc. will develop and operate the quarry and marine terminal.

This Environmental Impact Statement (EIS) has been prepared to obtain approval pursuant to the federal *Canadian Environmental Assessment Act, 2012* (CEAA, 2012) and, at the same time, approval for a Class I undertaking pursuant to the provincial *Environmental Assessment Regulations* made under the Nova Scotia *Environment Act*.

The EIS has been prepared to respond to Project-specific *Guidelines for the Preparation of an Environmental Impact Statement* pursuant to CEAA, 2012 and the Nova Scotia Registration Document pursuant to the Nova Scotia Environment Act, which were developed for the Project by the Canadian Environmental Assessment Agency (CEA Agency) and Nova Scotia Environment (NSE) with input from other government departments and agencies and the public.

Project:	Black Point Quarry Project
Proponent:	Black Point Aggregates Inc.
Postal Address:	1200 Urban Center Drive Birmingham, Alabama USA 35242
Contact Name:	Mr. Frank Lieth, Vice President
Telephone (Direct)	770-454-3626
Telephone (Mobile)	404-293-1933
Fax	205-298-2927
Email	liethf@vmcmail.com

2.0 PROJECT OVERVIEW

The Black Point Quarry Project property has a total surface area of 354.5 ha of which the finished quarry will occupy approximately 180 ha while the processing plant, administration and stockpile areas together will occupy approximately 28 ha. Rock reserves in the proposed quarry are estimated at more than 400 million metric tonnes (MT).

Rock will be quarried using industry standard drilling and blasting procedures from the granite reserve creating a quarry pit that will expand in depth and size over the 50+ year lifetime of the mine. As mining progresses a series of rock benches will be created in the quarry pit for safety reasons. Quarried rock will be crushed, screened, washed and stockpiled on site, then offloaded

via a deep water marine terminal into Panamax-sized bulk carrier ships for transport to markets along the eastern and Gulf coast markets of the United States

The anticipated average annual production rate will exceed 1.0 MT with a peak production rate of 7.5 MT per year, which is roughly 5.0 MT of product sales should market conditions support that sales volume. The Project is anticipated to have capital costs on the order of US$80-$110 million and will be a significant employer in Guysborough County throughout its expected 50+ year lifespan. No public funding is currently being sought for this Project.

2.1 Project Need and Justification

The purpose of the Black Point Quarry Project is to supply construction aggregate to markets predominantly on the eastern and Gulf coasts of the United States and possibly to markets in eastern and central Canada. Although construction aggregates have numerous end uses, their general application is in the production of building materials such as concrete and asphalt.

While materials used to produce construction aggregates are relatively abundant, these resources must be located in areas that are geographically accessible. In addition, the rights and permits to recover the resources must be obtainable, and there must be sufficient market capacity to support the planned production of the mining operation. Finally, aggregates must meet strict quality requirements related to the chemical and physical characteristics of the rock. Most rocks do not meet these geographic conditions and quality specifications and cannot qualify as viable construction aggregate resources.

In the U.S. market, the majority (80% or more) of aggregates are transported by truck from the quarry to the consumer. This form of transport is expensive and limits the typical aggregate operation to a market radius of about 80 km from the quarry. The south eastern U.S. aggregate market is a prime target for bulk vessel transported aggregate due in part to the geologic absence of suitable aggregate resources in coastal areas.

The revenue generated from the Project will provide economic benefit to the people and governments of Guysborough County and Nova Scotia through direct and indirect employment, royalties and taxes paid, dollars invested into goods and services directly by the Project Proponent, and indirect dollars that will go into local businesses and services from employees and contractors working on the Project and at the quarry.

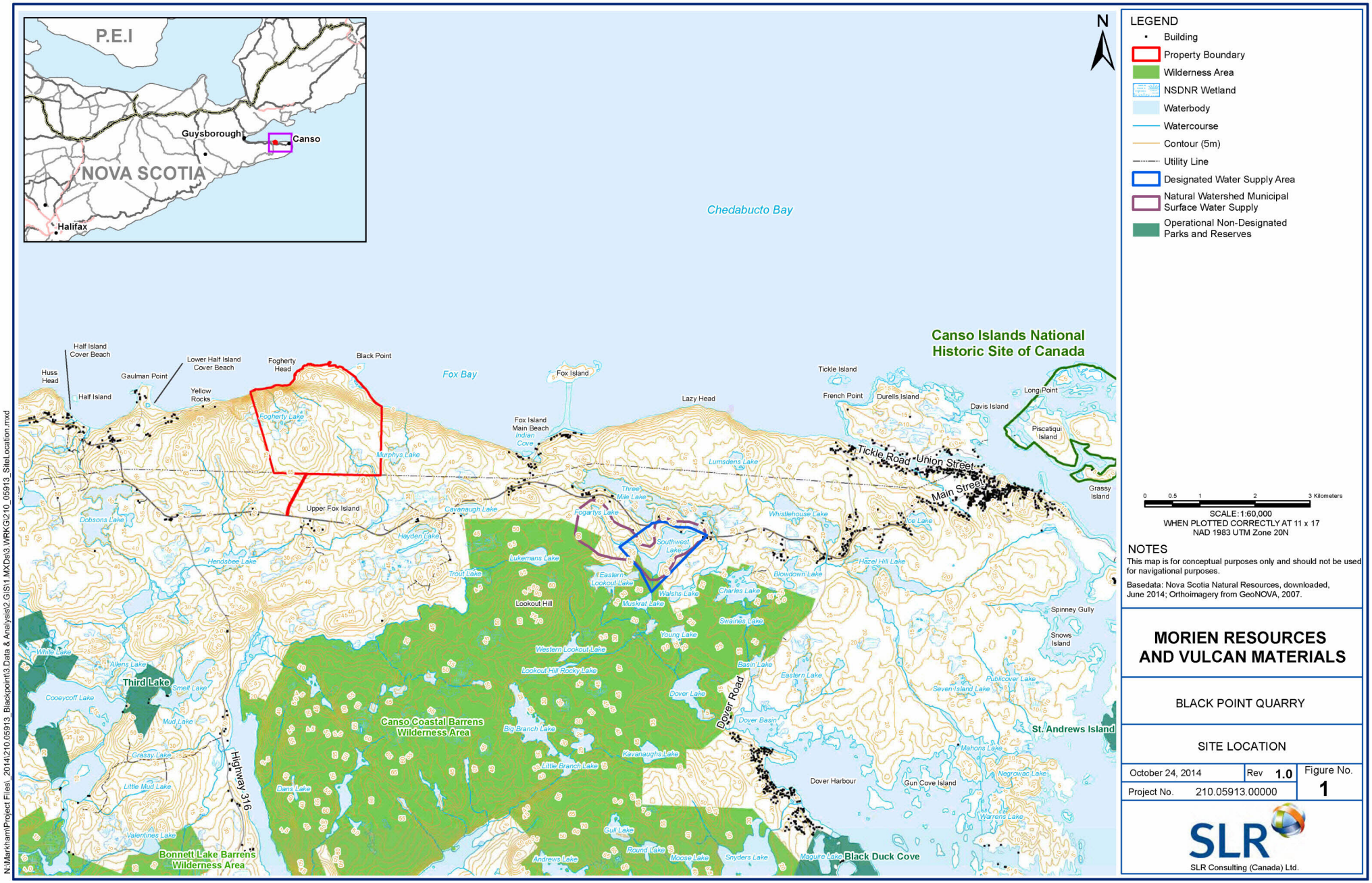
2.2 Project Location

The lands to be developed are owned by the Municipality of the District of Guysborough (MODG) and will be leased to the Proponent. The approximate center of the Project site is located at:

45º21’13.25”N

61º08’56.15”W

The generalized property boundaries are shown on **Figures 1** and **2.** Table 1 provides coordinates for the four corners of the Property and the submerged Crown Land Lease, currently being reviewed by the province that will host the marine terminal.



LEGEND

- Building
- Property Boundary
- Wilderness Area
- NSDNR Wetland
- Waterbody
- Watercourse
- Contour (5m)
- Utility Line
- Designated Water Supply Area
- Natural Watershed Municipal Surface Water Supply
- Operational Non-Designated Parks and Reserves

0 0.5 1 2 3 Kilometers

SCALE: 1:60,000
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

MORIEN RESOURCES AND VULCAN MATERIALS

BLACK POINT QUARRY

SITE LOCATION

October 24, 2014	Rev 1.0	Figure No. 1
Project No. 210.05913.00000		

SLR Consulting (Canada) Ltd.

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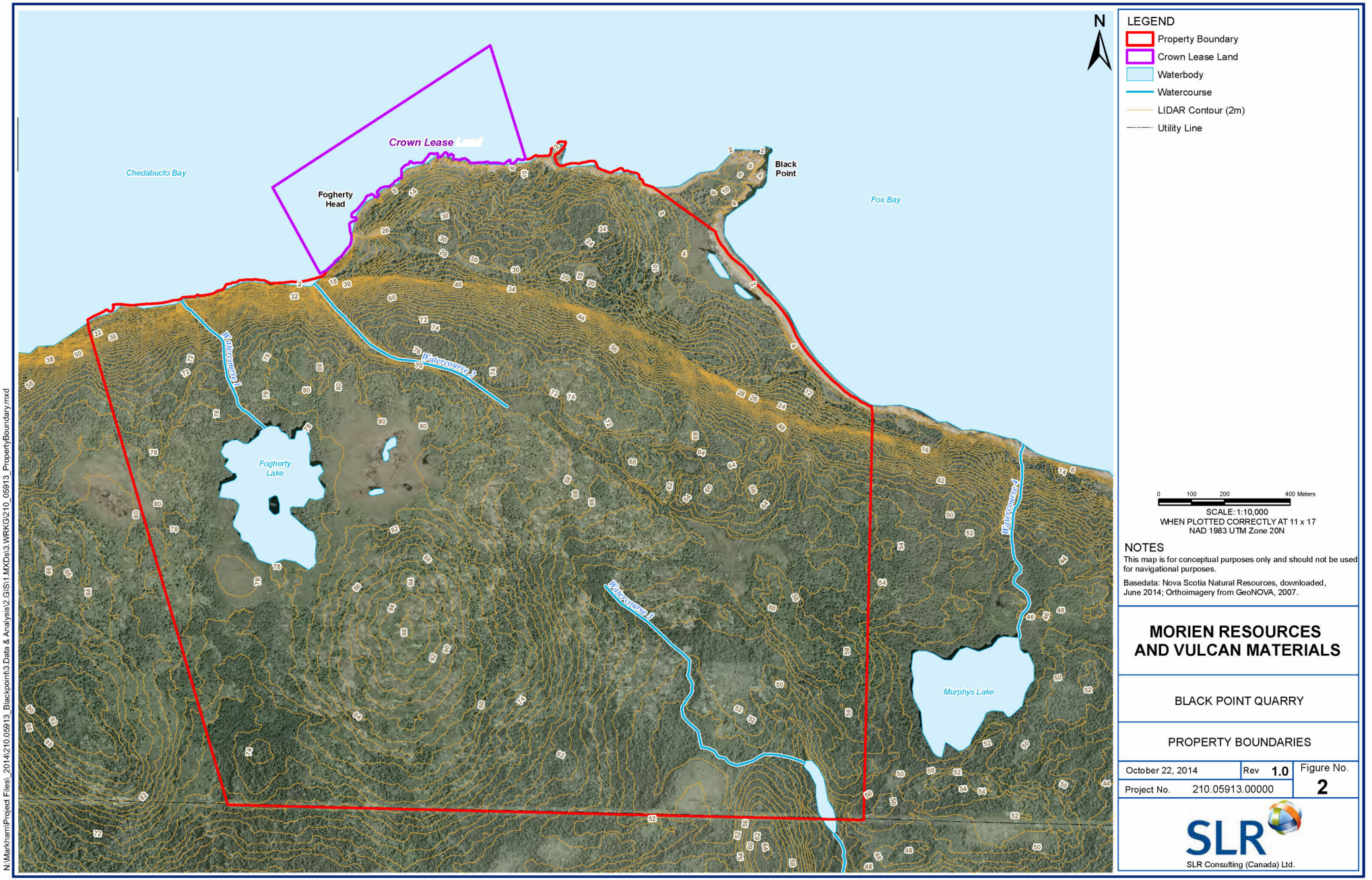
C 1340-035



LEGEND

- Property Boundary
- Crown Lease Land
- Waterbody
- Watercourse
- LIDAR Contour (2m)
- Utility Line

0 100 200 400 Meters

SCALE: 1:10,000
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

MORIEN RESOURCES AND VULCAN MATERIALS

BLACK POINT QUARRY

PROPERTY BOUNDARIES

October 22, 2014	Rev 1.0	Figure No. 2
Project No. 210.05913.00000		

SLR Consulting (Canada) Ltd.

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Table 1:
Proposed Boundary Coordinates

Boundary Location	Easting	Northing
Terrestrial Property		
North West Corner	643573.480	5023895.438
South West Corner	644005.711	5022431.120
South East Corner	645930.498	5022389.912
North East Corner	645955.893	5023627.756
Submerged Crown Lands Lease		
North West Corner	644130.37	5024312.49
South West Corner	644275.16	5024050.04
South East Corner	644900.62	5024394.53
North East Corner	644791.83	5024744.29

2.3 Project Components

The primary components associated with the Project include:

1. An unpaved access road from provincial Route 16 into the quarry;
2. The quarry and primary crushing area;
3. The processing (finishing) plant consisting of secondary and tertiary processing (crushing and washing) and a stockpile laydown area;
4. Modular buildings that comprise the administration complex; and,
5. A 160 m long marine terminal and load-out facility.

The locations of the primary project components are depicted in **Figure 3.**

2.3.1 Access Road

A single private unpaved access road to the quarry, processing plant and marine terminal will be constructed prior to mining. The access road will be 10 m wide and proceed north from Route 16 to the southern property boundary, a distance of approximately 800 m. From the southern property boundary, the road will be extended easterly and northerly approximately 2.5 km to access the processing area and marine terminal.

2.3.2 Open Pit Quarry and Primary Crusher

The final quarry footprint will comprise approximately 180 ha (**Figure 3)**. The quarry will be developed initially in a westerly direction before proceeding in a southerly direction and to a grade at or near elevation -30 m asl (i.e., 30 m below sea level).

Benches will generally be 15 m in height, although during the initial development phases, face heights could be less. Safety benches will be established every two benches and will have a width of approximately 7.5 m. The final slopes for the quarry will have face angles of 85 degrees with a maximum pit slope of 65 degrees. Working benches will have face angles of 70 to 75 degrees.

Freshly mined rock will be transported to and reduced in size by a primary crusher located on a bench on the east side of the quarry. The crushed material will then be transported via conveyor to the processing plant.

2.3.3 Processing Plant

The processing plant site is approximately 28 ha and will be located in the northern section of the Project site along Chedabucto Bay as shown on **Figure 3**. This area will be used for secondary and tertiary crushing, screening, washing and conveying, as well as stockpiling aggregate products, equipment, fuel and material storage, ship loading and administrative buildings.

The area will contain two ponds beginning in Phase 3 (development phases are described below), located on the western edge of the plant site against the cliff. Each pond will be sized to hold approximately 6,100 m^3. One of the ponds will be dedicated to stormwater retention and the other for process water. During Phase 1, temporary ponds will be utilized as required to manage stormwater. In Phase 2, one of the permanent ponds will be constructed and dedicated to stormwater retention.

This portion of the site will also include two surge piles, various aggregate product piles (fractionated, screenings and base material) and approximately 1,000,000 tons of product ready for shipment.

Based upon the preliminary design, there will be five phases of the processing plant ranging from an initial portable circuit utilized for site development to a large fixed plant capable of producing an anticipated peak production of 7.5 MT and producing 5.0 MT of saleable product. Plant development phases are shown on **Figure 4** to **Figure 8.**

Phase 1

A small portable plant with a capacity up to 1,000 tonnes per hour (TPH) will be utilized for initial site development. The plant will consist of two portable track-mounted crushing plants that include vibrating feeders and a number of conveyors. The plant will be used to produce a coarse fill material for site development needs. Power for the plant will be provided by diesel powered generators.

Phase 2

In the second phase plant, two additional track mounted crushing modules will be added to the Phase 1 equipment. This plant will produce a fine graded fill material for final site development needs. Power for this plant will be provided by diesel powered generators built into the track mounted crushing units.

Phase 3

Major components of Phase 3 include the Phase 2 equipment described above, two additional portable track-mounted screening plants and one track mounted tertiary crushing plant with a belt feeder and conveyors.

These additional mobile units will be used to begin production to meet the initial aggregate sales demand. Power for the additional units will utilize diesel powered generators with combined capacity of 260 kW in addition to the existing generators identified in Phases 1 and 2. Production during Phase 3 is expected to be approximately 500 TPH.

Marine terminal construction (see below) is expected to begin during Phase 3.

Phase 4

When the sales demand dictates a higher production rate, the mobile plant will be replaced by a fixed plant. The plant will have a flexible design that will allow it to be expanded as the market demand increases. The initial fixed plant will have the capability to produce up to 1,400 TPH through the tertiary plant. Electrical power for the plant will be provided via Nova Scotia Power Inc.

Phase 5

As the sales demand increases and production rates approach the limit of the initial fixed plant, the final phase will be initiated. This plant will upgrade the tertiary portion of the Phase 4 plant by installing a parallel, identical tertiary processing circuit. Production through the finishing plant will be increased to 2,800 TPH.

2.3.4 Administrative Buildings

Approximately 2.5 ha will be dedicated for an administrative area located on the eastern edge of the plant site (**Figure 8**). In this area, two buildings (modular or fixed) will be erected. One will contain offices and the administrative functions while the other will contain facilities for on-site workers such as a locker/shower room, washroom, first aid station, lunchroom, quality control laboratory and shop. This area will also include a site to store fuel and other maintenance fluids. Mobile equipment will be parked adjacent to the shop.

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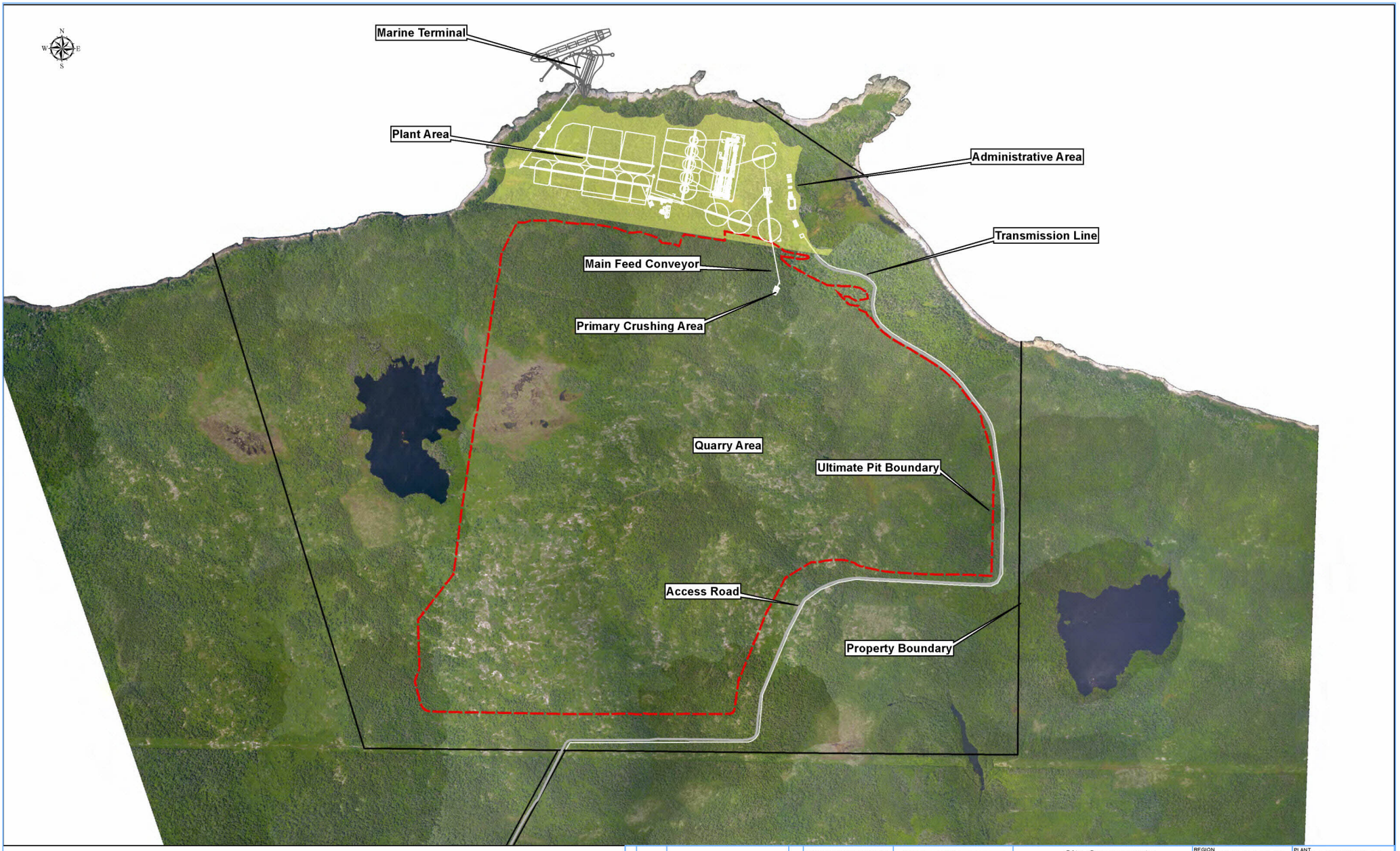

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DATE | REVISION | BY | ISSUE DATE:

Vulcan Materials Company

Site Components

REGION: NOVA SCOTIA
DWN BY: CKR | DATE: 01/16/2015 | CHK BY:
JOB NO: | SCALE: 1 in = 250 m
PATH:

PLANT: BLACK POINT
DWG. NO.: Figure 3

PLOTTED: | LAST UPDATE:

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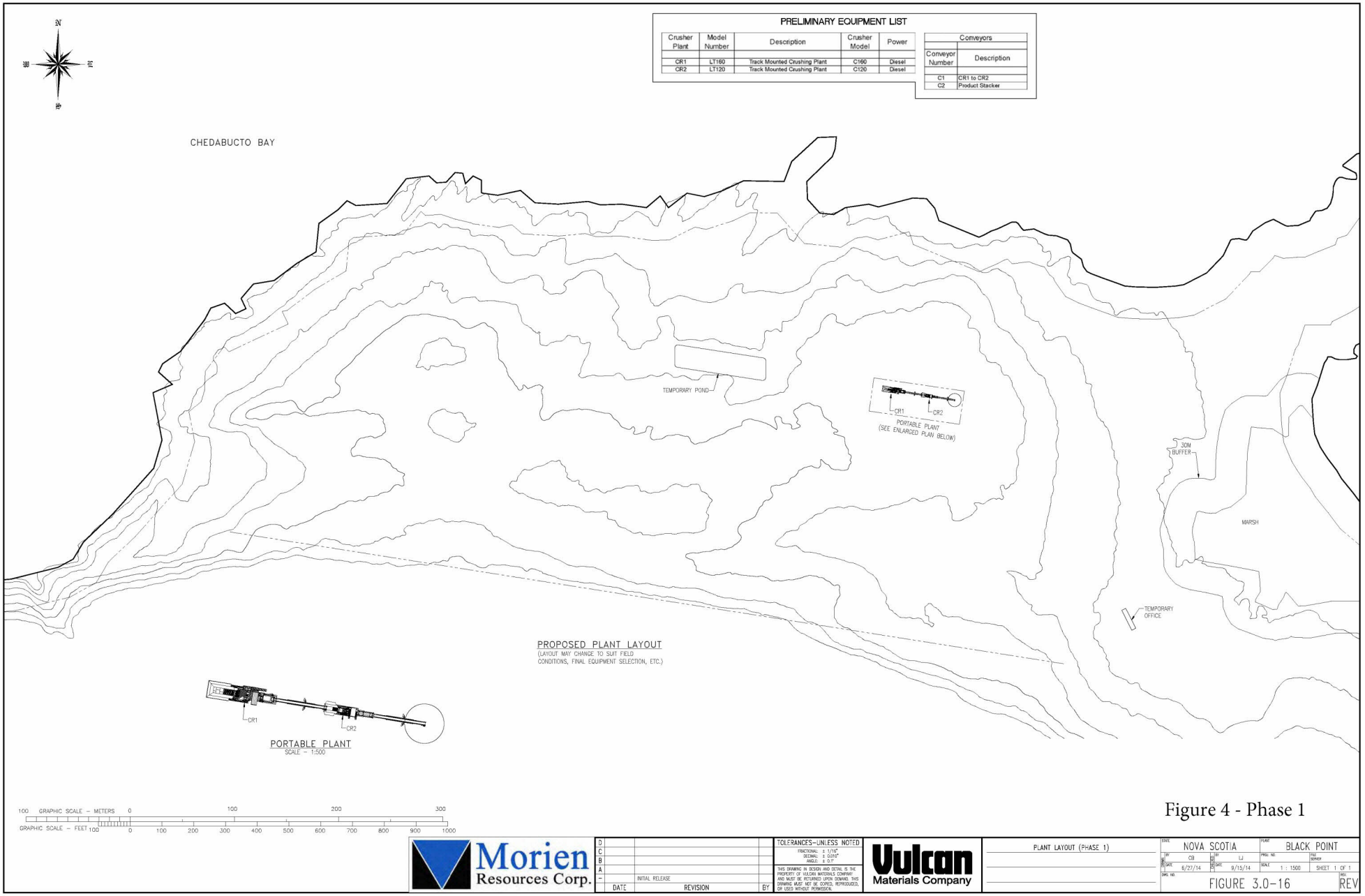


Figure 4 - Phase 1

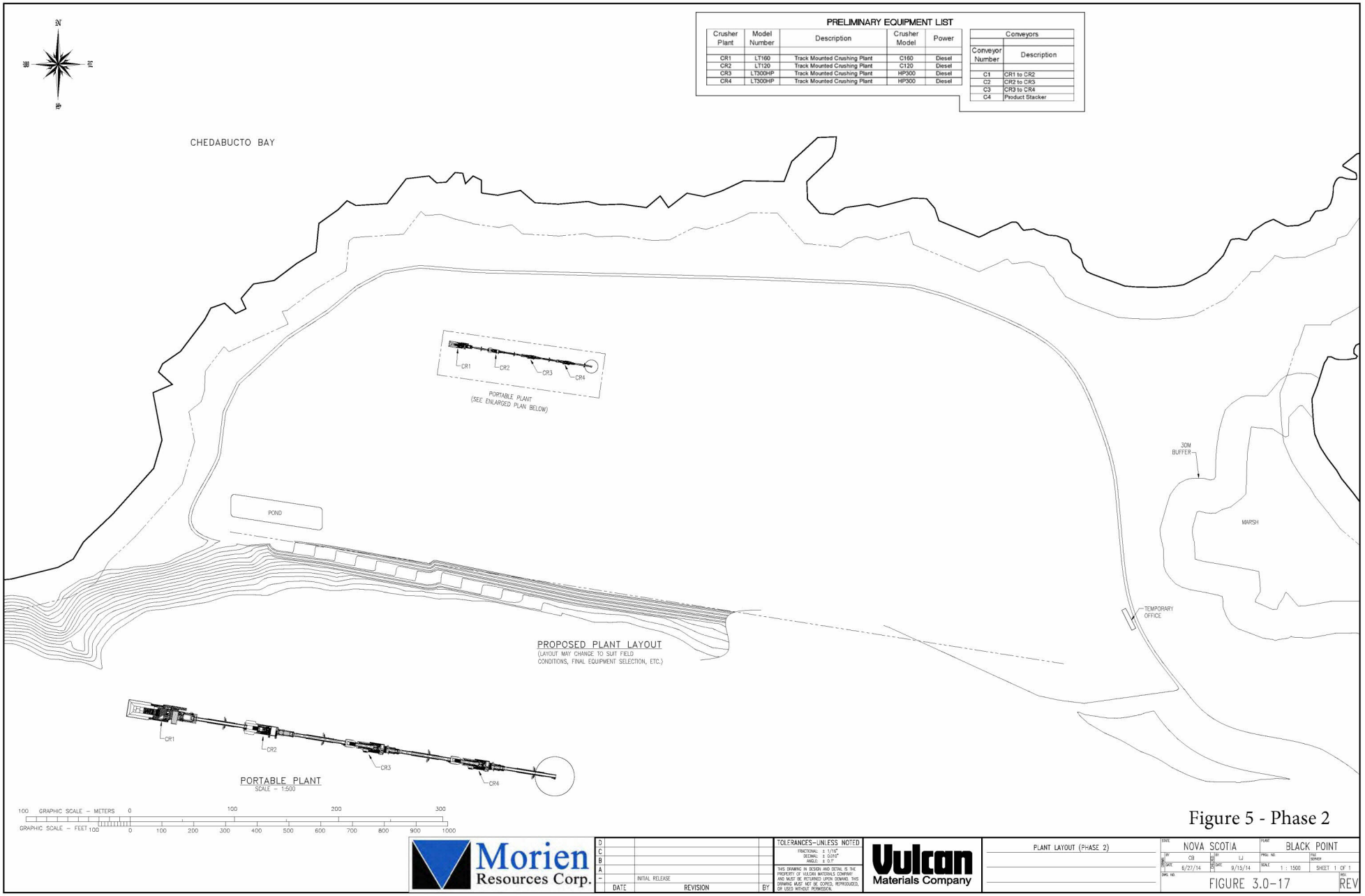
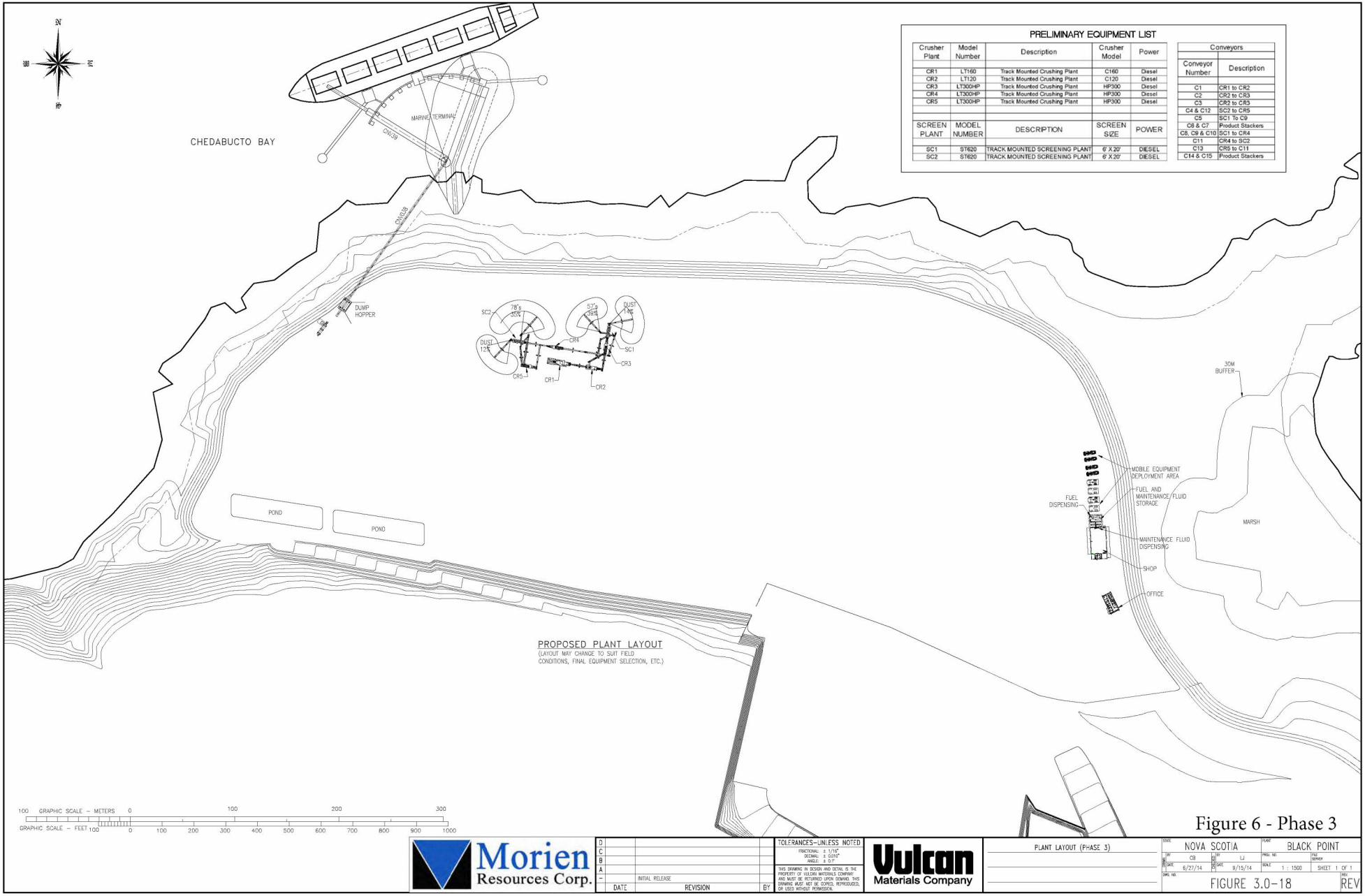


Figure 5 - Phase 2



PRELIMINARY EQUIPMENT LIST

Crusher Plant	Model Number	Description	Crusher Model	Power
CR1	LT160	Track Mounted Crushing Plant	C160	Diesel
CR2	LT120	Track Mounted Crushing Plant	C120	Diesel
CR3	LT300HP	Track Mounted Crushing Plant	HP300	Diesel
CR4	LT300HP	Track Mounted Crushing Plant	HP300	Diesel
CR5	LT300HP	Track Mounted Crushing Plant	HP300	Diesel

SCREEN PLANT	MODEL NUMBER	DESCRIPTION	SCREEN SIZE	POWER
SC1	ST620	TRACK MOUNTED SCREENING PLANT	6' X 20'	DIESEL
SC2	ST620	TRACK MOUNTED SCREENING PLANT	6' X 20'	DIESEL

Conveyors	
Conveyor Number	Description
C1	CR1 to CR2
C2	CR2 to CR3
C3	CR2 to CR5
C4 & C12	SC2 to CR5
C5	SC1 To C9
C6 & C7	Product Stackers
C8, C9 & C10	SC1 to CR4
C11	CR4 to SC2
C13	CR5 to C11
C14 & C15	Product Stackers

Figure 6 - Phase 3

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REV	DATE	REVISION	BY
D			
C			
B			
A		INITIAL RELEASE	

TOLERANCES–UNLESS NOTED
FRACTIONAL: ± 1/16"
DECIMAL: ± 0.010"
ANGLE: ± 0.5°

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PLANT LAYOUT (PHASE 3)

NOVA SCOTIA — BLACK POINT

DRN	CB	BY	LJ
DES		CHECKED	
DATE	6/27/14	DATE	9/15/14
PROJ. NO.		FILE NUMBER	
SCALE	1 : 1500	SHEET	1 OF 1
DWG. NO.	FIGURE 3.0-18	REV	

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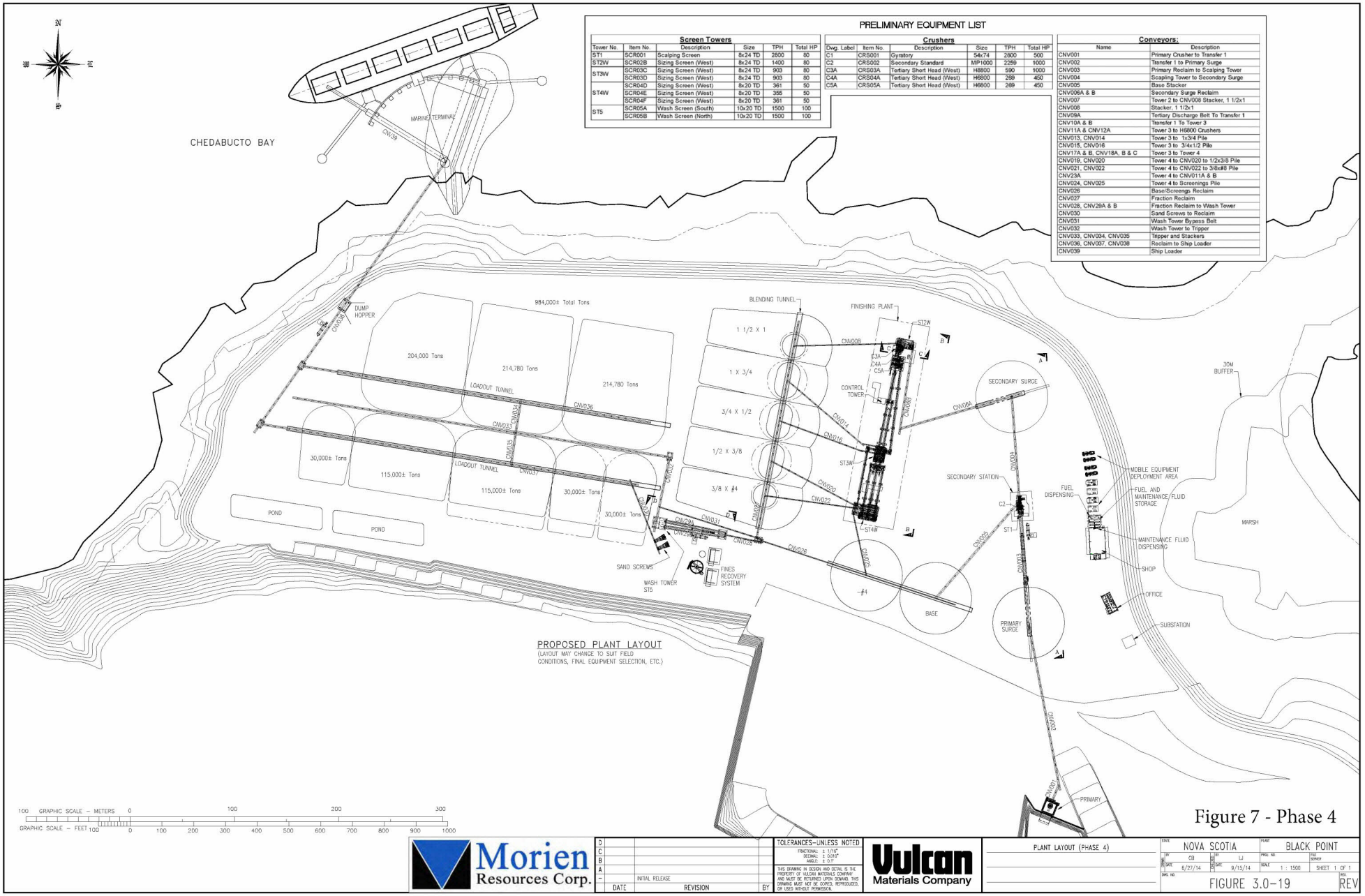

PROPOSED PLANT LAYOUT
(LAYOUT MAY CHANGE TO SUIT FIELD CONDITIONS, FINAL EQUIPMENT SELECTION, ETC.)

PRELIMINARY EQUIPMENT LIST

Screen Towers

Tower No.	Item No.	Description	Size	TPH	Total HP
ST1	SCR001	Scalping Screen	8x24 TD	2800	60
ST2W	SCR02B	Sizing Screen (West)	8x24 TD	1400	80
ST3W	SCR03C	Sizing Screen (West)	8x24 TD	903	80
	SCR03D	Sizing Screen (West)	8x24 TD	903	80
ST4W	SCR04D	Sizing Screen (West)	8x20 TD	361	50
	SCR04E	Sizing Screen (West)	8x20 TD	355	50
	SCR04F	Sizing Screen (West)	8x20 TD	361	50
ST5	SCR05A	Wash Screen (South)	10x20 TD	1500	100
	SCR05B	Wash Screen (North)	10x20 TD	1500	100

Crushers

Dwg. Label	Item No.	Description	Size	TPH	Total HP
C1	CRS001	Gyratory	54x74	2800	500
C2	CRS002	Secondary Standard	MP1000	2259	1000
C3A	CRS03A	Tertiary Short Head (West)	H8800	590	1000
C4A	CRS04A	Tertiary Short Head (West)	H6800	269	450
C5A	CRS05A	Tertiary Short Head (West)	H6800	269	450

Conveyors:

Name	Description
CNV001	Primary Crusher to Transfer 1
CNV002	Transfer 1 to Primary Surge
CNV003	Primary Reclaim to Scalping Tower
CNV004	Scalping Tower to Secondary Surge
CNV005	Base Stacker
CNV006A & B	Secondary Surge Reclaim
CNV007	Tower 2 to CNV008 Stacker, 1 1/2x1
CNV008	Stacker, 1 1/2x1
CNV09A	Tertiary Discharge Belt To Transfer 1
CNV10A & B	Transfer 1 To Tower 3
CNV11A & CNV12A	Tower 3 to H6800 Crushers
CNV013, CNV014	Tower 3 to 1x3/4 Pile
CNV015, CNV016	Tower 3 to 3/4x1/2 Pile
CNV17A & B, CNV18A, B & C	Tower 3 to Tower 4
CNV019, CNV020	Tower 4 to CNV020 to 1/2x3/8 Pile
CNV021, CNV022	Tower 4 to CNV022 to 3/8x#8 Pile
CNV23A	Tower 4 to CNV011A & B
CNV024, CNV025	Tower 4 to Screenings Pile
CNV026	Base/Screengs Reclaim
CNV027	Fraction Reclaim
CNV028, CNV29A & B	Fraction Reclaim to Wash Tower
CNV030	Sand Screws to Reclaim
CNV031	Wash Tower Bypass Belt
CNV032	Wash Tower to Tripper
CNV033, CNV034, CNV035	Tripper and Stackers
CNV036, CNV037, CNV038	Reclaim to Ship Loader
CNV039	Ship Loader

GRAPHIC SCALE – METERS 100 0 100 200 300
GRAPHIC SCALE – FEET 100 0 100 200 300 400 500 600 700 800 900 1000

Figure 7 - Phase 4

Morien Resources Corp.

D			
C			
B			
A			
–	INITIAL RELEASE		
	DATE	REVISION	BY

TOLERANCES–UNLESS NOTED
FRACTIONAL: ± 1/16"
DECIMAL: ± 0.010"
ANGLE: ± 0.1°

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Vulcan Materials Company

PLANT LAYOUT (PHASE 4)

NOVA SCOTIA — BLACK POINT

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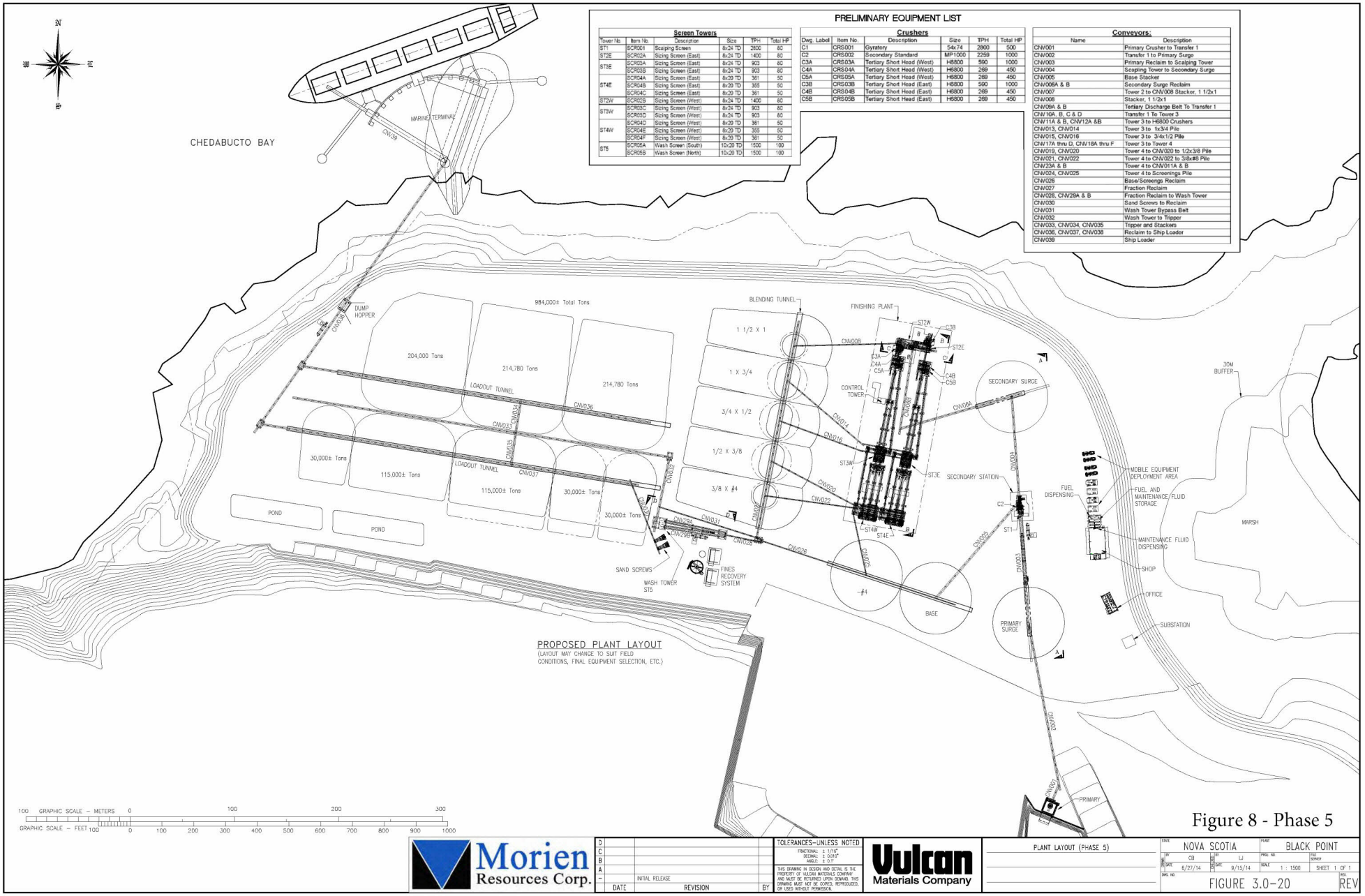
DATE	6/27/14	DATE	9/15/14

SCALE 1 : 1500 SHEET 1 OF 1

DWG. NO. FIGURE 3.0–19 REV

C 1340-044



PRELIMINARY EQUIPMENT LIST

Screen Towers

Tower No.	Item No.	Description	Size	TPH	Total HP
ST1	SCR001	Scalping Screen	8x24 TD	2600	60
ST2E	SCR02A	Sizing Screen (East)	8x24 TD	1400	60
ST3E	SCR03A	Sizing Screen (East)	8x24 TD	903	60
	SCR03B	Sizing Screen (East)	8x24 TD	903	60
ST4E	SCR04A	Sizing Screen (East)	8x20 TD	361	50
	SCR04B	Sizing Screen (East)	8x20 TD	355	50
	SCR04C	Sizing Screen (East)	8x20 TD	361	50
ST2W	SCR02B	Sizing Screen (West)	8x24 TD	1400	60
ST3W	SCR03C	Sizing Screen (West)	8x24 TD	903	60
	SCR03D	Sizing Screen (West)	8x24 TD	903	60
ST4W	SCR04D	Sizing Screen (West)	8x20 TD	361	50
	SCR04E	Sizing Screen (West)	8x20 TD	355	50
	SCR04F	Sizing Screen (West)	8x20 TD	361	50
ST5	SCR05A	Wash Screen (South)	10x20 TD	1500	100
	SCR05B	Wash Screen (North)	10x20 TD	1500	100

Crushers

Dwg. Label	Item No.	Description	Size	TPH	Total HP
C1	CRS001	Gyratory	54x74	2800	500
C2	CRS002	Secondary Standard	MP1000	2259	1000
C3A	CRS03A	Tertiary Short Head (West)	H8800	590	1000
C4A	CRS04A	Tertiary Short Head (West)	H6800	269	450
C5A	CRS05A	Tertiary Short Head (West)	H6800	269	450
C3B	CRS03B	Tertiary Short Head (East)	H8800	590	1000
C4B	CRS04B	Tertiary Short Head (East)	H6800	269	450
C5B	CRS05B	Tertiary Short Head (East)	H6800	269	450

Conveyors:

Name	Description
CNV001	Primary Crusher to Transfer 1
CNV002	Transfer 1 to Primary Surge
CNV003	Primary Reclaim to Scalping Tower
CNV004	Scalping Tower to Secondary Surge
CNV005	Base Stacker
CNV006A & B	Secondary Surge Reclaim
CNV007	Tower 2 to CNV008 Stacker, 1 1/2x1
CNV008	Stacker, 1 1/2x1
CNV09A & B	Tertiary Discharge Belt To Transfer 1
CNV 10A, B, C & D	Transfer 1 To Tower 3
CNV11A & B, CNV12A &B	Tower 3 to H6800 Crushers
CNV013, CNV014	Tower 3 to 1x3/4 Pile
CNV015, CNV016	Tower 3 to 3/4x1/2 Pile
CNV17A thru D, CNV18A thru F	Tower 3 to Tower 4
CNV019, CNV020	Tower 4 to CNV020 to 1/2x3/8 Pile
CNV021, CNV022	Tower 4 to CNV022 to 3/8x#8 Pile
CNV23A & B	Tower 4 to CNV011A & B
CNV024, CNV025	Tower 4 to Screenings Pile
CNV026	Base/Screengs Reclaim
CNV027	Fraction Reclaim
CNV028, CNV28A & B	Fraction Reclaim to Wash Tower
CNV030	Sand Screws to Reclaim
CNV031	Wash Tower Bypass Belt
CNV032	Wash Tower to Tripper
CNV033, CNV034, CNV035	Tripper and Stackers
CNV036, CNV037, CNV038	Reclaim to Ship Loader
CNV039	Ship Loader

Figure 8 - Phase 5

Morien Resources Corp.

D			
C			
B			
A			
–	INITIAL RELEASE		
	DATE	REVISION	BY

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PLANT LAYOUT (PHASE 5)

STATE: NOVA SCOTIA | PLANT: BLACK POINT
DRAWN: CB | BY: LJ | PROJ. NO.
CHECKED | DATE: 6/27/14 | DATE: 9/15/14 | SCALE: 1 : 1500 | SHEET 1 OF 1
DWG. NO.: FIGURE 3.0-20 | REV

C 1340-045

2.3.5 Marine Terminal

A rubble mound with conveyors and related infrastructure installed on a stone breakwater constructed of coarse rock will be built as the marine terminal. Caissons and mooring dolphins will be used for berthing the ship. Preliminary engineering drawings for the terminal are shown in **Figure 9 to Figure 12**. The major components of the terminal are:

- Three breasting caissons used for berthing the ship.
- Two mooring dolphins.
- Eleven slewing rail piers that support the slewing rail, which in turn allows the shiploader to move in an arc.
- One slewing rail caisson to support the slewing rail.
- Shiploader pivot point caisson, which provides the lateral stability of the shiploader.
- Rubble fill with an access road for maintenance.
- The shiploader arm that delivers aggregate product to the ship.

The shiploader is a telescoping system approximately 136 m long when fully extended. It will have a loading capacity approaching 5,000 TPH. The rubble mound portion of the terminal will be approximately 160 m in length. It will be constructed with a clean rock-filled base, armour stone protection on all sides and include a crushed stone surface. This structure will have a seafloor footprint of approximately 11,078 m^2 which includes the combined seafloor surface area occupied by the rubble fill, caissons and dolphins.

2.4 Project Activities

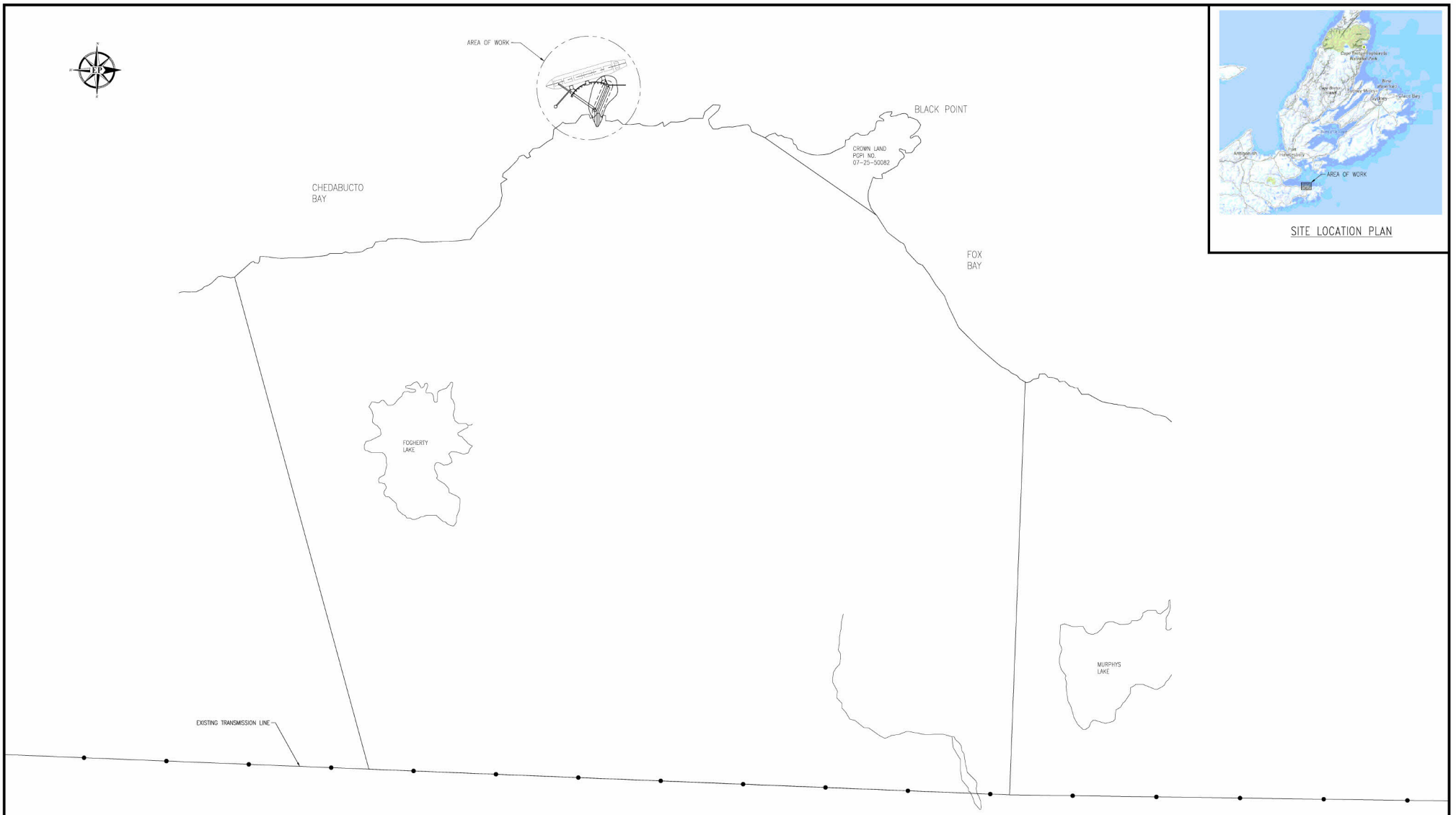
2.4.1 Site Preparation, Cut and Fill

Site preparation will begin with clearing of vegetation and removal/stockpiling of organic material and overburden on the 28 ha plant site and administrative area. Following this, this area will require cut and fill to provide a level surface to construct the processing plant.

A cut or excavation of approximately 600,000 m^3 and a fill of 835,000 m^3 will be needed to level the area prior to construction. The plant and administrative area will be designed with 1 meter of cross slope drainage which will direct all storm water to two sedimentation ponds. The site preparation and construction phase of the plant site and administrative area is anticipated to occur over a 36 month period.

2.4.2 Marine Terminal Construction

The marine terminal will be constructed from shore using fill and rock (i.e. rip-rap) sourced from the site. Typical construction support includes cranes to lift in reinforcing steel, concrete trucks and pumps and lights for night time activity. The completion of each caisson, once sunk, will take approximately one month. The slewing rail piers will be supported by piles which will be installed from a barge. There will be approximately eleven piers which are expected to have four piles each.



SITE LOCATION PLAN

SITE LAYOUT PLAN

SCALE: 1:5000

1:5000

NOTE:
(LAYOUT MAY CHANGE TO SUIT FIELD CONDITIONS, FINAL EQUIPMENT SELECTION, ETC.)

Morien Resources Corp.

EASTPOINT ENGINEERING

	DATE	REVISION	BY
D			
C			
B			
A	2014/08/28	ISSUED FOR PERMIT	BT

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ANGLE: ± 0.1°

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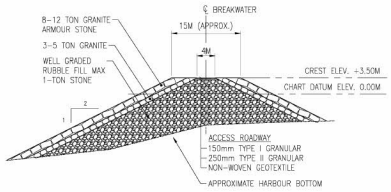
SITE LAYOUT PLAN
MARINE TERMINAL
EASTPOINT DRAWING NUMBER S001

STATE: NOVA SCOTIA
PLANT: BLACK POINT
BY: QHS
CHKD: BT
PROJ. NO.: 55126
FILE SERVER: EASTPOINT
DATE: 2014/08/05
APD: DATE: 2014/08/28
SCALE: AS NOTED
SHEET 1 OF 4
DWG. NO.: FIGURE 9
REV: A

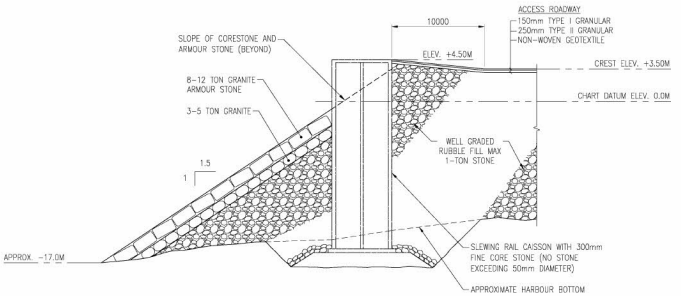
C 1340-047

AREA OF IMPACT AT SEA FLOOR	
RUBBLE MOUND	7916M²
BREASTING CAISSONS (3)	1120M²
MOORING DOLPHIN (2)	1050M²
SLEWING RAIL AND PIER	992M²

PLAN – GENERAL ARRANGEMENT
SCALE: 1:750
1:750



A S002 SECTION – TYPICAL RUBBLE MOUND
SCALE: 1:500
1:500



B S002 SECTION – RUBBLE MOUND AT CAISSON
SCALE: 1:250
1:250

NOTE:
(LAYOUT MAY CHANGE TO SUIT FIELD CONDITIONS, FINAL EQUIPMENT SELECTION, ETC.)

Morien Resources Corp. | EASTPOINT ENGINEERING

	DATE	REVISION	BY
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A	2014/08/28	ISSUED FOR PERMIT	BT

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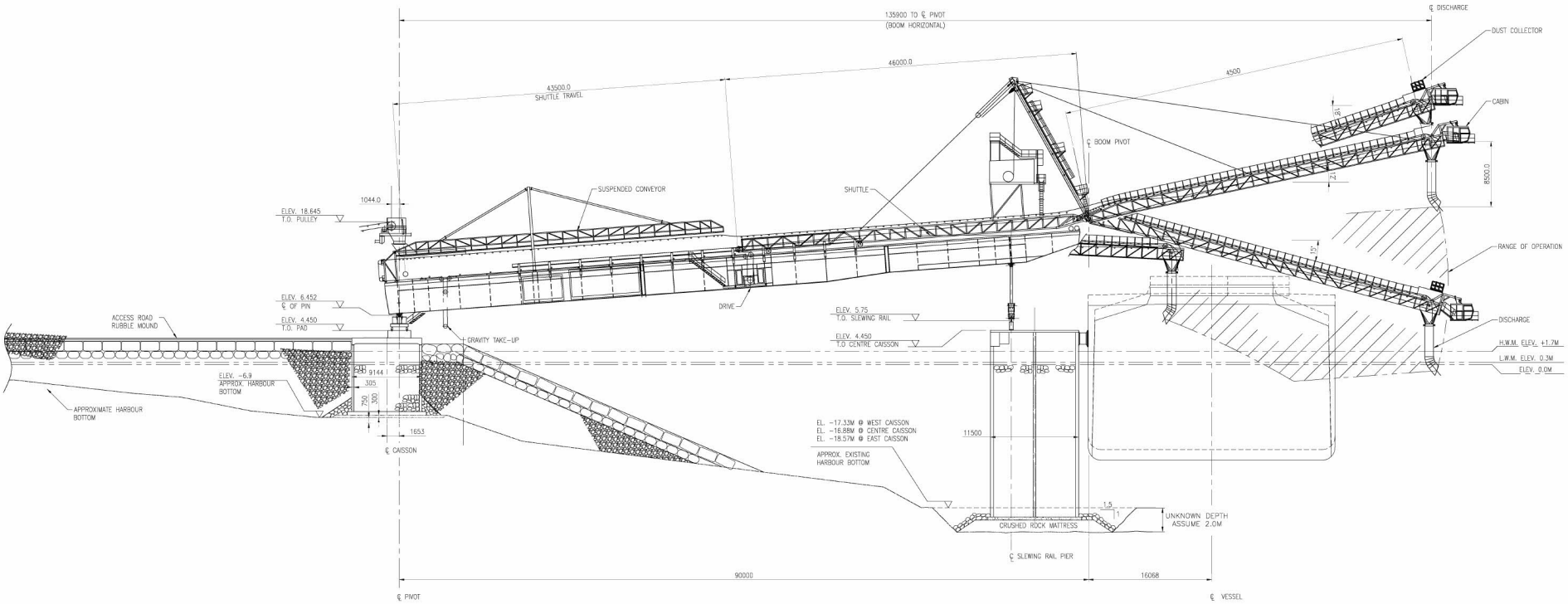
GENERAL ARRANGEMENT

EASTPOINT DRAWING NUMBER S002

STATE: NOVA SCOTIA | PLANT: BLACK POINT
DESIGN BY: QHS | DRAWN BY: BT | PROJ. NO.: 55126 | FILE SERVER: EASTPOINT
DATE: 2014/08/08 | DATE: 2014/08/28 | SCALE: AS NOTED | SHEET 2 OF 4
DWG. NO.: FIGURE 10 | REV: A

C 1340-048



B S002 SECTION
SCALE: 1:250

1:250

5 0 5 10 15 M

NOTE:
(LAYOUT MAY CHANGE TO SUIT FIELD CONDITIONS, FINAL EQUIPMENT SELECTION, ETC.)

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EASTPOINT ENGINEERING

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C			
B			
A	2014/08/28	ISSUED FOR PERMIT	BT
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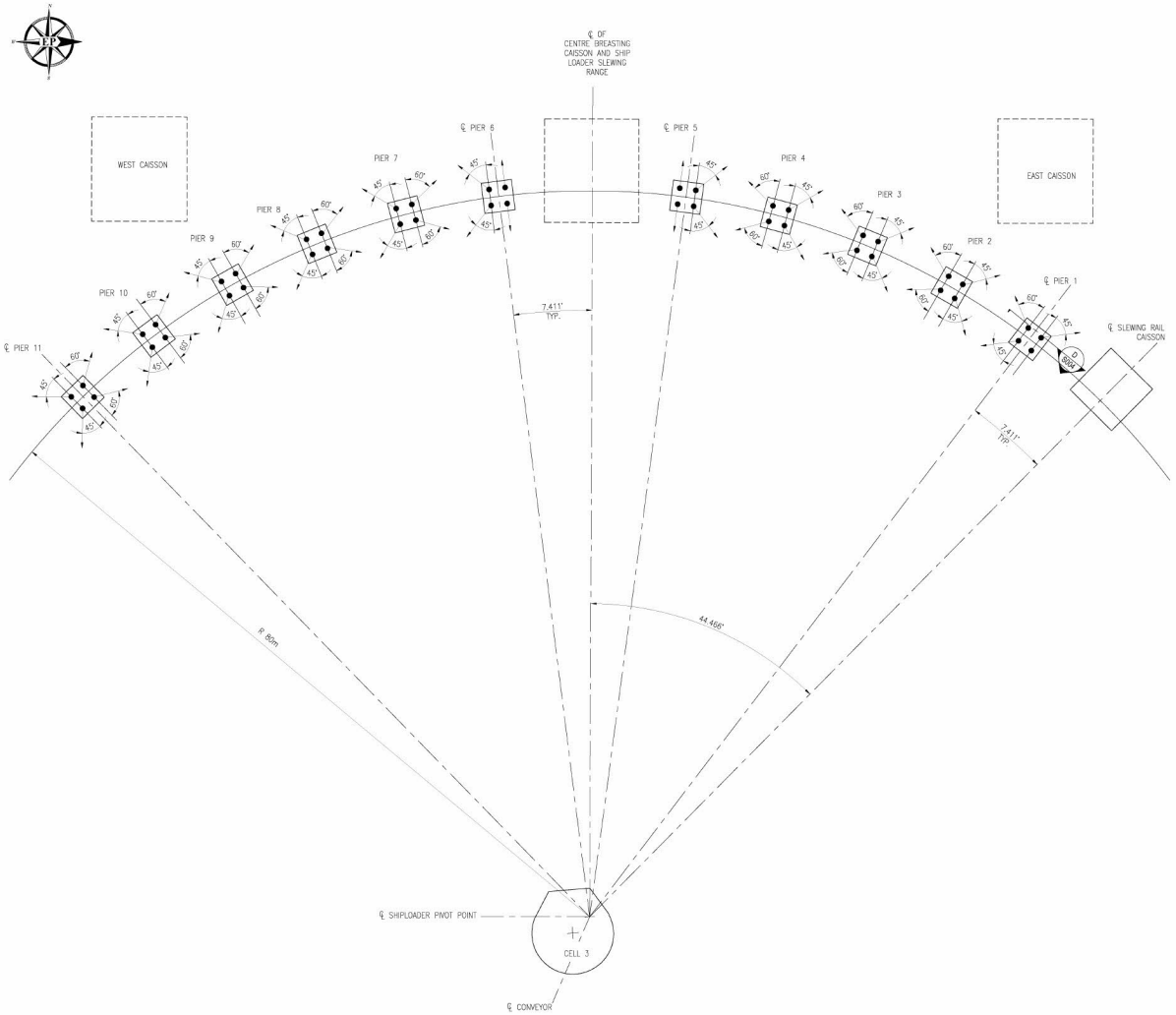
SECTION VIEW

EASTPOINT DRAWING NUMBER S003

STATE NOVA SCOTIA
PLANT BLACK POINT
BY QHS
CHK BT
PROJ. NO. 55126
FILE SERVER EASTPOINT
DATE 2014/08/05
DATE 2014/08/28
SCALE AS NOTED
SHEET 3 OF 4
DWG. NO. FIGURE 11
REV A

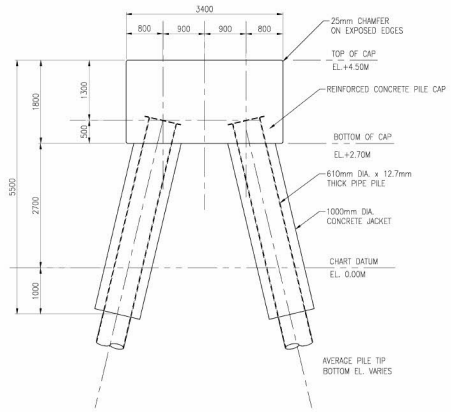
C 1340-049



PLAN – SLEWING RAIL PIER LAYOUT

SCALE: 1:250

1:250



D S004 SECTION – TYPICAL SLEWING RAIL PIER

SCALE: 1:50

NOTE:

(LAYOUT MAY CHANGE TO SUIT FIELD CONDITIONS, FINAL EQUIPMENT SELECTION, ETC.)

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EASTPOINT ENGINEERING

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SLEWING RAIL PIER LAYOUT PLAN AND SECTION

EASTPOINT DRAWING NUMBER S004

STATE	NOVA SCOTIA	PLANT	BLACK POINT
DESIGN BY	QHS	DRAWN BY	BT
PROJ. NO.	55126	FILE SERVER	EASTPOINT
DATE	2014/09/05	DATE	2014/08/28
SCALE	AS NOTED	SHEET	4 OF 4
DWG. NO.	FIGURE 12	REV	A

C 1340-050

The piles will be installed using pile driving hammers and churn drills and will be anchored in the bedrock. At this time, no dredging appears to be required. Silt curtains and acoustic blankets will be considered during installation, as needed. All marine construction will be completed using conventional marine construction techniques.

Prefabricated steel for the slewing rail and the shiploader will be delivered to the site via barge. Installation will be conducted utilizing cranes and work barges. The loadout conveyor (equipped with aggregate spill containment) will extend from the onshore loadout system to the shiploader. Any piles required for the loadout conveyor in the nearshore area would be located in the rubble fill.

2.4.3 Quarrying

The site will be developed as an open pit quarry using conventional surface mining methods. The mining cycle will include four basic actions:

- Loosening and stockpiling of the vegetation, overburden, and loose rock by dozer and/or track hoe equipment;
- Drilling and blasting to establish benches, haul roads, and sumps for stormwater management;
- Loading of loosened rock into haul trucks by track-mounted and/or rubber tired loading equipment; and
- Transportation of the quarried rock by haul trucks to a discharge point at the edge of the quarry for feed to the primary crusher.

It is anticipated that blasting will occur 30 days per year during the initial project phases, and increase to a maximum of about 200 days per year at full operation. A typical production shot will have less than 100 drill holes each drilled approximately 15 to 17 m deep. Shots utilized for quarry development such as haul roads and sumps will have variable depths generally from 3 to 10 meters.

Freshly mined rock will be transported to and reduced in size by a primary crusher located on a bench on the east side of the quarry. The crushed material will then be transported via conveyor to the processing plant.

2.4.4 Processing Plant Operation

Phase 1

Blasted material will be trucked to the mobile plant and dumped adjacent to the primary module. A loader will then feed the material into the plant. The coarse fill material will be stockpiled by conveyor.

Phase 2

Operation of this plant will be identical to that of the Phase 1 plant. The fine graded fill material will be stockpiled by conveyor and no washing of aggregate will occur during Phase 1 or Phase 2. All material produced will be a base or crusher run product.

Phase 3

Operation of the Phase 3 plant will be similar to that of the earlier phases. In this plant, various products will be stockpiled via conveyor and trucked to the marine terminal. The conveyor feeding the ship loader will include a loadout hopper that can be filled with a plant loader.

Phase 4

In this plant, blasted material will be trucked to the primary crusher where it will be dumped into the primary hopper. There it will be crushed and conveyed to a primary surge pile located near the "secondary" where it will be fed into the plant. As the material is processed with further crushing and screening, it will be conveyed to product piles that are located over "reclaim" tunnels, that is, tunnels equipped with conveyor systems that allow the products to be moved. Products can then be reclaimed to the wash tower for rinsing or bypassed around it. Material will then be stockpiled over the loadout reclaim tunnels that will convey product to the marine terminal.

Phase 5

As noted above, this plant will upgrade the tertiary portion of the Phase 4 plant by installing a parallel tertiary processing circuit. Production through the finishing plant will be increased to 2,800 TPH. Processing and loadout of the material will be identical to the Phase 4 plant but with a higher capacity. The parallel circuit will be identical to the original tertiary to minimize design time and costs.

2.4.5 Ship Loading

The shiploader will load aggregate into the holds of ships (up to 70,000 tonnes) and barges that will transport the material to the end markets. Aggregate loading onto the ships will be via conveyors and will approach 5,000 TPH once the full load-out system is completed. It is estimated that it will take approximately 18 to 24 hours to load the largest ships and that approximately 90-100 ships will be loaded per year once the plant reaches peak production.

2.4.6 Decommissioning

The Proponent will the lease the property from the MODG for the life of the quarry, estimated to be sometime after 2070. The land will be returned to the MODG following the completion of operations, equipment decommissioning, removal of plant and marine terminal infrastructure, and the acceptance of site decommissioning and reclamation activities.

In accordance with the requirements of the provincial Pit and Quarry Guidelines (NSEL 1999), the Proponent will prepare a written plan approved by NSE to provide for partial or total abandonment and rehabilitation of the site. It is anticipated that the plan will include an initial rehabilitation plan, progressive rehabilitation measures and / or a final rehabilitation plan. The Proponent will also post interim and final security bonds for the quarry, as required by the Pit and Quarry Guidelines and the *Approval and Notification Procedure Regulations*.

The rehabilitation plan will be developed for the Project site and submitted to regulators for review as part of the provincial Part V Industrial Approval application. The plan will include short-term and long-term reclamation efforts as well as details of the proposed final reclamation plan such as topography, maximum slopes, re-vegetation plans, and potential future land uses once the quarry operation is complete.

All equipment and related infrastructure including the processing plant, machinery and equipment will be removed from the site, provided this is requested by the Municipality who may

wish to keep certain infrastructure on site. The plant site and administrative areas will be graded to allow for future commercial, industrial, recreational, or residential land use, or to allow for restoration of the area to existing conditions to provide wildlife habitat. The pit will be allowed to fill with fresh water to an elevation near sea level.

To avoid disturbance of the marine environment and for potential future use, the rubble mound, mooring dolphins, caissons, slewing rails, and buoys will likely be left in place. The shiploader arm and ancillary mechanical equipment including suspended conveyors, dust collectors and drive belts will be removed from the Project site.

2.5 Project Schedule

Table 2 provides a generalized project schedule that presents the major construction and operational milestones.

Table 2:
Generalized Project Schedule

Year	Activity Undertaken or Anticipated
2010-11	Baseline ecological studies initiated
	Initial engagement with the public, regulatory agencies and First Nations
2012-2013	Properties assembled by the MODG (beginning in 2007-2008)
2014	Environmental Assessment Initiated • Consultation and engagement undertaken: • Meetings and site visits with First Nations representatives • Consultation and site visits with Regulatory Agencies • Meetings with residents and local fishermen • Open Houses, presentations, and meetings of the Citizen's Liaison Committee (CLC) • Submission of the draft EIS for review by the CEA Agency and NSE
2015	Submission of the Environmental Impact Statement report Completion of the environmental assessment
2016	Permits and Approvals
Early 2017	Updated Market Evaluation
2017-2018	Establishment of Sales Yards Receipt of Aggregate by Vessel from Black Point
2018-2021	Construction and Equipment Testing (Limited Production)
2021	Commence Full Scale Operations
2070+	Closure and Decommissioning

C 1340-053

3.0 SCOPE OF THE PROJECT AND THE ASSESSMENT

3.1 Scope of the Assessment

3.1.1 Scope of the Project to be Assessed

The Project is a proposed aggregate quarry comprising the construction, operation and decommissioning of an open pit, processing plant and marine terminal located on a property leased from the Municipality of the District of Guysborough (MODG). The scope of the Project to be assessed under CEAA, 2012 and the Nova Scotia *Environmental Assessment Regulations* includes the following components and activities:

- The stock piles, overburden storage and waste rock;
- The open pit quarry;
- Water supply needs and water management;
- Drilling and blasting activities;
- Solid and hazardous waste and sewage management treatment and systems;
- The processing of extracted materials;
- Noise and dust management;
- Access and power sources and infrastructure;
- The nature and geotechnical properties of geological materials;
- Navigation activities in Canadian waters;
- The construction, operation, maintenance, foreseeable modifications, closure, decommissioning and restoration of the sites and facilities;
- The time of year, frequency, and duration of all project activities; and
- Wharf and port infrastructure and facilities.

No facilities for the manufacture and storage of explosives will be present on site and no capital and maintenance dredging work are expected to be required at this time; these items are excluded from the Project scope.

3.1.2 Factors to be Considered

This EIS considers the factors listed in subsection 19(1) of CEAA, 2012 as well as section 79 of the *Species at Risk Act* and section 9.1 of the CEA Agency's Guidelines issued for this Project. This includes consideration of the environmental effects of the Project, the significance of effects, public and First Nation comments, mitigation measures, follow up monitoring programs the purpose of the Project, alternative means of undertaking the Project and the effects of the environment on the Project.

3.1.3 Scope of the Factors to be Considered

As provided in Section 5(1) of CEAA, 2012, the environmental effects that are to be considered regarding an "act or thing, a physical activity, a designated project or a project" are:

- *(a) a change that may be caused to the following components of the environment that are within the legislative authority of Parliament:*
  - *(i) fish and fish habitat as defined in subsection 2(1) of the* Fisheries Act*,*
  - *(ii) aquatic species as defined in subsection 2(1) of the* Species at Risk Act*,*
  - *(iii) migratory birds as defined in subsection 2(1) of the* Migratory Birds Convention Act, 1994*, and*
  - *(iv) any other component of the environment that is set out in Schedule 2;*
- *(b) a change that may be caused to the environment that would occur*
  - *(i) on federal lands,*
  - *(ii) in a province other than the one in which the act or thing is done or where the physical activity, the designated project or the project is being carried out, or*
  - *(iii) outside Canada; and*
- *(c) with respect to aboriginal peoples, an effect occurring in Canada of any change that may be caused to the environment on*
  - *(i) health and socio-economic conditions,*
  - *(ii) physical and cultural heritage,*
  - *(iii) the current use of lands and resources for traditional purposes, or*
  - *(iv) any structure, site or thing that is of historical, archaeological, paleontological or architectural significance*

Under Section 5(1) of CEAA, 2012, additional factors must be considered when the Project requires a federal authority to exercise a power or perform a duty or function conferred on it under any Act of Parliament other than CEAA, 2012. In this case, authorizations, approvals and/or permits are required from Fisheries and Oceans Canada and Transport Canada (as a minimum) and so the following environmental effects are also taken into account:

- *(a) a change, other than those referred to in paragraphs (1)(a) and (b), that may be caused to the environment and that is directly linked or necessarily incidental to a federal authority's exercise of a power or performance of a duty or function that would permit the carrying out, in whole or in part, of the physical activity, the designated project or the project; and*
- *(b) an effect, other than those referred to in paragraph (1)(c), of any change referred to in paragraph (a) on*
  - *(i) health and socio-economic conditions,*

- *(ii) physical and cultural heritage, or*
- *(iii) any structure, site or thing that is of historical, archaeological, paleontological or architectural significance*

Given this, the scope of the assessment also includes:

- Federal powers, duties or functions that may permit the carrying out of the project or associated activities;
- The environmental and other regulatory approvals and legislation applicable to the project at the federal, provincial, regional and municipal levels;
- Government policies, resource management, planning or study initiatives pertinent to the project;
- Treaties or self-government agreements with Aboriginal groups that are pertinent to the project;
- Relevant municipal planning strategies, land use bylaws, land use zoning, community plans and development permitting processes; and
- The regional, provincial and/or national objectives, standards or guidelines that have been used to assist in the evaluation of any predicted environmental effects.

3.2 Environmental Assessment Methods

3.2.1 Overview of Approach

The goal of applying a defined environmental assessment methodology is to carefully examine the Project and related activities to ensure they will not cause "serious or irreversible harm to the environment, especially with respect to environmental functions and integrity, system tolerance and resilience, and/or the human health of current or future generations" (CEA Agency 2014).

To establish the appropriate scope of an environmental assessment, it is standard practice to limit the assessment to those environmental components that are valued or of interest for ecological, scientific, cultural, regulatory and/or economic reasons. These components are referred to as Valued Components (VCs).

Once the existing condition for each VC is known, the environmental assessment:

1. Predicts the Project-related environmental effects or impacts and evaluates the scope and scale of these effects;
2. Describes a number of mitigation measures and practices that the Proponent will use to avoid, minimize, eliminate, mitigate, or compensate for the effects;
3. Assesses the cumulative effects from other probable future projects; and
4. Determines the residual effects remaining after mitigation and assesses the significance of these effects on each VC.

C 1340-056

3.2.2 Identification of VCs

An internal issues-scoping exercise was undertaken to identify the VCs of both general and project-specific interest. For the Black Point Quarry Project, provisional VCs were identified through:

- Discussions with federal and provincial regulatory agencies;
- A review of the EIS Guidelines prepared for this Project;
- A review of applicable provincial and federal regulation;
- Discussions with government scientific authorities;
- Previous environmental studies conducted on site;
- Comments raised through various public meetings and outreach events;
- A review of information submitted in support of nearby and similar environmental assessments; and
- The professional experience of the Project team.

Based on this methodology, the following VCs were selected for assessment:

1. Air Quality and Climate Change
2. Noise
3. Ambient Light
4. Geology, Soil & Sediment Quality
5. Groundwater Resources
6. Marine and Surface Water Resources
7. Terrestrial Ecosystems, Habitat & Vegetation
8. Wetlands
9. Terrestrial Wildlife
10. Freshwater Species and Habitat
11. Marine Species and Habitat
12. Species at Risk
13. Local Economy, Land and Resource Use
14. Tourism and Recreation
15. Commercial Fisheries
16. Archaeological and Heritage Resources
17. Aboriginal Land and Resource Use

3.2.3 Boundaries

Temporal boundaries represent the duration over which the Project activities interact with each VC. In general, the temporal boundaries are (a) the construction period, and (b) the operating life of the Project, through to decommissioning and reclamation.

Spatial boundaries are those geographic limits that help define the scale and range of the interactions between the Project and each VC. The following spatial boundaries are used for this assessment.

1. The **Project Area** is confined to all territory within the limits of the Project property boundary;

2. The **Affected Area** is the area which could potentially be affected by Project components or activities immediately beyond the PA. The Affected Area is similar to the area directly adjacent the Project property but can be larger depending on the component being considered.

The extent to which the Affected Area is within the spatial boundaries of the Project is VC-specific and dependent on biological and physical considerations. For most VCs the Affected Area is generally within two kilometers of the Project Property limit.

3. The **Study Area**: the Study Area is defined by considering all Project-environment interactions, including diffuse or longer range effects such as noise and light, which can only be modeled at this time. It may include, for example, the waters of Chedabucto Bay south of the shipping lanes where the Project-related marine activities and interactions will occur; for other VCs the SA may include the MODG where the majority of the social and economic effects can be expected.

Technical boundaries represent limits to the Project team's ability to asses a VC, pathway or receptor. A technical boundary is a theoretical or actual limitation on the ability to measure, assess, and/or monitor potential environmental effects.

Administrative boundaries are those limits that originate through regulatory, public policy or economic reasons. Where applicable, administrative boundaries are described in each VC chapter.

4.0 ALTERNATIVE MEANS OF UNDERTAKING THE PROJECT

Section 19(1)g of CEAA, 2012 requires that federal environmental assessment consider alternative means of undertaking a project and the consequent environmental effects of such alternative scenarios.

Table 3 summarizes the alternatives assessment.

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Table 3:
Summary of the Alternative Means of Undertaking the Project

Project Component	Alternative Means	Technical Feasibility	Economic Feasibility	Environmental Effects	Preferred Option
Quarry Location	Black Point Site	Technically Feasible	Economically Feasible	A number of environmental effects are associated with any quarry development; no significant residual environmental effects are anticipated at the Black Point site.	Yes
	Other Nova Scotia Sites	Not Technically Feasible considering the range and specificity of the geographical and resource requirements	Not Economically Feasible based on the Proponent's analysis and given the high-bulk low-cost nature of the aggregate resource	Not assessed since no feasible alternative site was identified	No
Rock Extraction Method	Drilling and Blasting	Technically Feasible	Economically Feasible	Environmental effects are similar in both alternatives: will result in noise and dust impacts	Yes
	Ripping	Not Technically Feasible considering the hardness and density of the granite resource	Not Economically Feasible	Environmental effects are similar in both alternatives: will result in noise and dust impacts	No
Development and Transportation	Rock Face Open Pit	Technically Feasible	Economically Feasible	Environmental effects are largely similar under both mining options	Yes
	Glory Hole Open Pit	Not Technically Feasible primarily due to worker safety considerations	Economically Feasible but additional infrastructure would significantly increase production costs	Potential social (human health) effects are greater in the glory hole scenario due to increased worker exposure to accidents and malfunctions	No
	Transport via Ship from Dedicated Terminal	Technically Feasible	Economically Feasible	Environmental effects relate primarily to Local Economy, Land and Resource Use; shipping related effects are similar in both scenarios.	Yes
	Truck Transport to an Existing Terminal Followed by Transport via Ship (e.g., Auld's Cove)	Technically Feasible	Not Economically Feasible due to truck transportation costs, which would eliminate profitability	Significantly more environmental and economic impacts due to truck traffic through rural and residential areas. Increased air and noise emissions in this scenario.	No

Marine Terminal Location	Eastern Location	Technically Feasible	Economically Feasible	Environmental effects are similar under both alternatives. The VCs Marine Species and Habitat and Commercial Fisheries and Aquaculture would be affected in a similar manner at both terminal locations.	Yes
	Western Location	Not Technically Feasible due to shallow water depths	Economically Feasible	As above; this location is also slightly more sheltered from winds originating to the northeast.	No
Marine Terminal Construction	Rubble Mound Wharf	Technically Feasible and permits the secure storage of acid generating rock; more operationally efficient since it permits vehicular access to ship mooring points for maintenance	Economically Feasible; less expensive to design, build and maintain	Both approaches would affect Marine Species/Habitat and Commercial Fisheries to approximately the same degree. Rubble Mound Wharf occupies more seafloor than the Concrete Caisson Wharf but the rubble would eventually act as lobster habitat.	Yes
	Concrete Caisson Wharf	Technically Feasible but less stable in severe weather; more dangerous to maintain since boat access would be needed.	Economically Feasible	Concrete Caisson Wharf occupies less seafloor than the Rubble Mound Wharf but would shade the seafloor, negatively affecting habitat quality and use.	No
Stockpile Locations	Western End Opposite the Marine Terminal	Technically Feasible	Economically Feasible: this location is both operationally and economically more practical.	In both alternatives, several wetlands would be lost	Yes
	Eastern End near Wetland 2	Technically Feasible although it greatly increases the complexity of operation and may introduce occupational health and safety risks	Not Economically Feasible: this location requires a complete reconfiguration of processing plant and a much longer conveyor system to deliver aggregate to the marine terminal.	In addition to wetland loss, Wetland 2 is potentially exposed to runoff from the stockpiles in this alternative	No
Waste Management	Collection tank for septic wastes with transport and treatment at the Canso	Technically Feasible and practical	Economically Feasible and cost effective	Minimal impact to Groundwater Resources and Marine and Surface Water Resources.	Yes

	municipal waste water treatment facility				
	Other septic treatment systems: conventional septic tank and leach field, raised bed systems, rotating biological contactors, peat-based treatment systems, constructed wetlands, and recirculating sand filtration	Not Technically Feasible due to lack of soil cover (conventional leach field): Technically Feasible but poor operational records when applied to operations at this scale (non-conventional treatment systems).	Economically more expensive to design, purchase, operate and maintain	Varying long term impacts can be expected to Groundwater Resources and Marine and Surface Water Resources through treated effluent discharge.	No
	"Crusher fines" storage outside of the quarry	Technically Feasible	Economically Feasible but more expensive considering the increased transport distance to the storage site and the greater number of times the materials would be handled	Increased risk of accidental discharge with potential negative effects on Marine and Surface Water Resources, Terrestrial Ecosystems, Habitat & Vegetation, Wetlands, and Terrestrial Wildlife. Similar anticipated effects (i.e., minimal) on Groundwater Resources in both alternatives. Increased handling and transport increases impacts to air quality.	No
	"Crusher fines" storage within the quarry	Technically Feasible	Economically Feasible	No risk of accidental discharge to the environment (potentially affecting Marine and Surface Water Resources, Terrestrial Ecosystems, Habitat & Vegetation, Wetlands, and Terrestrial Wildlife	Yes
Electrical Supply	Tie-in to the existing electrical transmission line	Technically Feasible	Economically Feasible; more expensive over the short term but costs are recovered over the longer term.	Environmental effects associated with habitat and vegetation loss within the right of way are minimized by using the same right of way for the access road.	Yes
	Use of multiple on-site generators	Technically Feasible	Economically Feasible but more expensive over the long term due to fuel, lubricant and transport costs, as well as maintenance and operating costs	Increased risks of fire and fuel spills given the generators' fuel requirements; increased impacts to ambient noise levels; increased GHG emissions	No

5.0 PUBLIC AND ABORIGINAL ENGAGEMENT

The Proponent implemented a comprehensive consultation program with the following objectives:

- to identify issues and concerns of interest to the affected communities, stakeholder groups and residents;
- to assist in judging the nature and intensity of Project benefits or impacts;
- to solicit local information and expert opinions; and
- to fulfil regulatory requirements.

5.1 Public Engagement

The Proponent has informed stakeholders of the Project, explained the planning and regulatory processes, advertised consultation and engagement opportunities and solicited input into the Project Description and the EIS report. Engagement tools and techniques that have been applied during the public consultation program include:

1. a Project-specific website – www.blackpointquarry.ca
2. a stakeholder database including email and mailing lists used for email outreach to interested residents and others;
3. an open house event, public information sessions and public presentations;
4. public notices regarding key milestones and Community Liaison Committee membership;
5. interviews with provincial and local media outlets;
6. a Project newsletter distributed via mail drops, newspaper inserts and email;
7. the Community Liaison Committee (CLC);
8. government agency briefings (federal, provincial and local); and
9. other stakeholder group meetings and door-to-door introductions to residents.

5.1.1 Stakeholder Consultation Activities

To date, eleven outreach communications have been provided to people and organizations on the mailing list (Table 4).

Table 4:
Stakeholder Outreach Communications

Date	Item	Distribution Method	Approximate Total Distribution
April-09-14	Open House Announcement	Ad in the Guysborough Journal	1,200 people; newsstands, subscribers, businesses
April-14-14	Morien Press Release re: Vulcan and the Project	Newswire / Press Release	>900 Canadian news outlets
April-17-14	Open House Announcement	Canada Post Mail Drop	3,000 households; does not incl farms, business, apartments
April-22-14	Display Boards, Vulcan Presentation Booklets	Hand-outs at the Open House	200+ attendees
April-30-14	CLC Member Solicitation	Ad in the Guysborough Journal	1,200 people; newsstands, subscribers, businesses

July-07-14	Project Fact Sheet	Canada Post Mail Drop	3,000 households; does not incl farms, business, apartments
July-30-14	Summer 2014 Newsletter	Pamphlet in the Guysborough Journal	1,200 people; newsstands, subscribers, businesses
August-27-14	CLC Member List	Ad in the Guysborough Journal	1,200 people; newsstands, subscribers, businesses
Dec-19-14	Frequently Asked Questions	Canada Post Mail Drop	3,000 households not including farms, business, apartments
Jan-13-15	GCIFA Endorsement	Newswire / Press Release	>900 Canadian news outlets
Feb-4-15	Winter 2015 Newsletter	Canada Post Mail Drop	3,000 households not including farms, business, apartments

The first Open House was held at the Queensport Fire Hall in Guysborough on April 22, 2014. The goal of the Open House was to inform the community about the Black Point Project and the environmental assessment process, and describe anticipated Project timelines. A second Open House has been tentatively scheduled for mid-March, 2015.

The Proponent has been asked by several media outlets to provide comment or updates on the Project. The Proponent was interviewed on ten occasions since April 2014.

The Summer 2014 Black Point Quarry Project Newsletter was distributed on July 30, 2014. The Winter 2015 newsletter was distributed on February 4, 2014. The Newsletters were emailed to the Project stakeholder mailing list and was distributed by Canada Post to residents in Guysborough County. Copies are available on the Project website.

In mid-2014, the Proponent established a Community Liaison Committee consisting of eight local representatives to help document community concerns and distribute updates regarding the Project. The CLC has met on two occasions to date, in August and in October, 2014. The next CLC meeting is tentatively scheduled for mid-March, 2015.

The Black Point Quarry Project team has been consulting with government officials and regulators (municipal, provincial, and federal) on an ongoing basis. The objective of these consultations is to provide information and updates on the Project and the environmental assessment, and also to receive input and guidance as appropriate.

Additionally, several presentations have been given to various groups interested in the Project. These community presentations are provided in Table 5.

Table 5:
Community Presentations

Presentation Topic	Group	Date
Black Point Marine Aggregate Quarry Update	Mining Society of Nova Scotia	June 6, 2014
Introduction to Vulcan Materials and the Project	Strait of Canso Superport Days	July 10, 2014
Project Introduction and Jobs in the Mining Industry	Fanning Academy, Grades 9-12	October 16, 2014
Geology Presentation	Fanning Academy, 4th grade	October 16, 2014
Project Introduction and Jobs in the Mining Industry	Guysborough Academy, Grades 9-12	October 28, 2014
Geology Presentation	Guysborough Academy, Middle	October 28, 2014

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	School	
Introduction to Vulcan Materials and the Project	Geology Matters Conference, NS Department of Natural Resources	November 13, 2014
Introduction to Vulcan Materials and the Project	Strait Area Chamber of Commerce	December 2, 2014

The Proponent has met with representatives of the Guysborough County Inshore Fishermen's Association (GCIFA) on three occasions since April, 2014 and has met local fishermen individually and in groups on at least four occasions.

To ensure the residents bordering the proposed Project had the opportunity to learn about the Project, pose questions, express concerns. Proponent representatives went door-to-door along Half Island Cove Road, Upper Fox Island and Fox Island Main in July, 2014. In total, 17 of 25 addresses were visited and face-to-face meetings held. Of the 8 unvisited residences, 4 occupants were not home while 4 addresses were not occupied (i.e., for sale or apparently abandoned).

5.1.2 Stakeholder Questions and Comments

Stakeholder issues have been formally compiled since January 2014 and are generally grouped by stakeholder group: local residents in the immediate Project vicinity, people in the commercial fishing industry, Aboriginal groups, and other interested stakeholders. Issues and concerns can be summarized by the following themes:

1. Questions regarding the training and skill requirements, technical operation and timing of the Project;

2. General concerns regarding environmental effects in the terrestrial environment, typically related to property values, noise, dust and water quality; and

3. Questions and concerns respecting Project effects to the commercial fishing industry, typically regarding siltation, shipping routes, fishermen displacement and the loss of fishing grounds, effects of the marine terminal and Project operation (including blasting) on the behaviour of commercial species and the possibility of invasive species imported in vessel bilge water.

Specific questions are concerns by stakeholder group are documented in Section 11 of the EIS. A log of meetings held and questions raised is presented in Appendix M Attachment 4 of the EIS.

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5.2 Aboriginal Engagement

The Proponent has undertaken several measures to identify the concerns of Mi'kmaq communities, through their designated representatives, about potential environmental effects of the Project, and to promote First Nation involvement in the Project.

The Proponent has addressed early engagement with the Aboriginal community in Nova Scotia as a priority and has developed an Aboriginal Community Engagement Strategy, which commenced several years prior to the filing of the Project Description in February 2014. The premise of the engagement strategy is that, through effective engagement, the Proponent can establish an effective relationship with Aboriginal communities and organizations.

The Proponent's objectives were to:

- inform Aboriginal communities about its proposal;
- solicit information on the Aboriginal issues and concerns with respect to the proposed Project; and
- identify ways and means for Aboriginal engagement in the planning process and approaches to a mutually beneficial Project implementation.

5.2.1 Aboriginal Organizations

Based upon a preliminary assessment of the Project location and the known activity of Mi'kmaq communities in Nova Scotia, several communities and Mi'kmaq organizations were identified as potentially affected and/or having a direct interest in the Black Point Quarry Project. These communities and organizations are listed in Table 6.

Table 6:
Key Mi'kmaq Communities and Groups

Category	Communities/Organizations
Mi'kmaq communities	Paqtnkek First Nation
	Millbrook First Nation
	Sipekne'katik First Nation
Mi'kmaq organizations	Assembly of NS Mi'kmaq Chiefs Kwilmu'kw Maw-Klusuaqn (KMK) Negotiations Office
	KMK Benefits Committee Sipekne'katik Negotiations Office
Provincial government organizations	Nova Scotia Office of Aboriginal Affairs

5.2.2 Aboriginal Consultation Activities

The engagement activities undertaken to date are listed in Table 7. In addition, invitations to all Public meetings/Open House events were sent to representatives of the Mi'kmaq communities identified in Table 6.

Table 7:
Mi'kmaq Engagement Activities

Mi'kmaq Community Engagement Activities	Date
Face to Face Contacts with Chiefs	
Paqtnkek	Oct 12, 2010 (initial meeting with Chief)
Millbrook	Mar 21, 2011 (initial meeting with Band Manager) May 7, 2014
Sipekne'katik	Jun 18, 2014 Aug 12, 2014 (site visit)
Presentations / Meetings with Communities	
Sipekne'katik Band Council	Jun 17, 2014 Aug 11, 2014 Aug 12, 2014 (site visit)
Presentation at regional Tribal Council/Provincial Tribal Organization Meetings	
KMK staff	Oct 13, 2011 (initial meeting with CEAA) Nov 21, 2011 Sept 20, 2013 (with CEAA) Mar 11, 2014 May 27, 2014 Jun 18, 2014 (site Visit)
KMK - Benefits Committee	Sep 10, 2014
Assembly of Nova Scotia Chiefs	Through KMK
Site Visits	
J. Walsh, M. Nevin	18 June, 2014
J. Copage, I. Knockwood, J. MacDonald	August 12, 2014
Chief W. Marshall, K. Prosper	October 27, 2014

5.2.3 Aboriginal Questions and Comments

Issues and concerns identified during the Aboriginal engagement process are summarized in Table 8. Based on discussions during these engagement sessions, there is a general understanding between The Proponent and Mi'kmaq communities that the engagement process will continue to facilitate open dialogue on matters related to Mi'kmaq interest regarding environment and economic development.

Table 8:
Comments and Issues Raised by Mi'kmaq Communities

Subject Area	Comments/Concerns/ Suggestions	Study Team Responses/Actions
Opportunities (Economics, Training, Other)	Seeking engagement in accordance with Proponents Guidelines, issued by the NS Government	Initiated communication with Chiefs and KMK; made commitments in a draft MOU pertaining to development of long-term relationship and provision of Project benefits.
	Potential for collaboration and employment	Negotiation of a collaborative benefits agreement.
	Potential for training and skills development	Including training in negotiation of benefits agreement.
	Potential for support for KMK operations	MOU includes negotiation of support to facilitate development of benefits agreement.
Planning Process	MEK Study	MEKS updated and submitted for review.
	Environmental protection	Providing opportunity for direct review of the EA document (made presentation and provide means to facilitate

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Subject Area	Comments/Concerns/ Suggestions	Study Team Responses/Actions
		feedback).
Review of EIS Guidelines/KMK meetings	Request internal review of MEKS	Agree. A copy of the MEKS has been provided for review and comment.
	Concerns for fish, fish habitat, and Mi'kmaq fisheries	A MEK Study has been prepared as part of the EA process. This includes a discussion of potential effects on fishing. The Proponent's engagement program with Mi'kmaq communities has addressed potential project-related effects and establishes commitments for effects management and communication.
	Identified concerns for archaeological assessment	A MEK Study and archaeological assessments have been prepared as part of the EA process. This includes a discussion of potential effects on archaeological sites. The Proponent's engagement program with Mi'kmaq communities also addresses potential project-related effects and establishes commitments for archaeological fieldwork and documentation. In addition the Proponent has committed to a separate site visit being undertaken with a qualified Mi'kmaq archaeologist prior to project implementation
	Kwilmu'kw Maw-klusuaqn Negotiation Office may coordinate Mi'kmaq representation in CLC.	The Proponent has established a CLC and invited Mi'kmaq community to be represented; the Sipekne'katik band is represented.
	Identified expectations for impact benefits agreement.	The Proponent has commenced and will continue to engage Mi'kmaq communities in the Project's planning and development process. As such the Proponent is in the process of negotiating with the Kwilmu'kw Maw-klusuaqn Negotiation Office a comprehensive Cooperation Agreement.
Consultation and Engagement	Crown responsibilities and activities regarding consultation with Mi'kmaq communities about the Project.	Maintaining direct dialogue with Mi'kmaq organizations and communities without prejudice. Maintaining arm's length discussions with Office of Aboriginal Affairs.
	Distinction between Crown Consultation and Proponent Engagement.	Proponent is ensuring Project staff is not directly involved in negotiations between NS Government and First Nations negotiators.

The Proponent is in negotiations to conclude a memorandum of understanding (MOU) with the Assembly of Nova Scotia Chiefs through the KMK Benefits office and a separate MOU is being negotiated with the Sipekne'katik First Nation. The purpose and focus of these MOUs is to guide ongoing discussions regarding collaborative benefits agreements between the Project and Mi'kmaq communities. Discussions have been ongoing since spring, 2014 and are proceeding in an open and constructive manner.

6.0 SUMMARY OF THE ENVIRONMENTAL EFFECTS ASSESSMENT

6.1 Air Quality and Climate Change

Air Quality is identified as a VC since air quality concerns associated with the generation of dust have been raised by community residents and First Nations. Air quality is also a pathway to the food chain via the transport of dust and deposition of contaminants on vegetation and surface water. Air quality within the quarry is of interest to provincial workplace health and safety regulators.

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6.1.1 Potential Environmental Effects

The construction and operation of the facility will result in dust emissions (total particulate matter [TPM], total suspended particulate [TSP], particulate matter up to particle size 10 microns [PM_{10}] and particulate matter up to particle size 2.5 microns [$PM_{2.5}$]). The sources of dust emissions associated with the Project include:

- crushers
- screens
- material loading/unloading
- material conveyors and transfer
- wind erosion of material storage piles and exposed areas
- blasting
- overburden removal, and
- vehicle traffic (haul roads).

Fuel combustion in mobile and fixed equipment, vehicles, and ships will result in emissions of criteria air contaminants including sulphur dioxide, nitrogen oxides, volatile organic compounds, carbon monoxide, and particulate matter. Fuel combustion will be a source of Project greenhouse gas emissions, which include carbon dioxide, methane, and nitrous oxide.

In order to quantify air contaminant dispersion during quarry operations, including those from vessel emissions, a detailed air dispersion modelling study was undertaken. The air dispersion modelling results demonstrate that even under worse case scenarios, Project-related air contaminants at the nearest residences are far below the maximum acceptable concentrations established by provincial and federal regulation. In particular, the predicted 1-hour and 24- hour maximum, and the annual average concentrations for nitrogen dioxide (NO2), sulphur dioxide (SO2), and particulate matter (including TSP, PM10 and PM2.5), as well as the 1-hour and the 8-hour maximum concentrations for carbon monoxide (CO) were found to be at least 50% below their respective objectives. This in turn demonstrates that air impacts at federal lands further from the property will be negligible.

The details of the air quality assessment are provided in Section 7.1 of the EIS report.

6.2 Noise

Activities such as blasting and aggregate processing will produce noise and have the potential to alter the ambient noise conditions of the local area. Noise concerns have been raised by residents living to the east and west of the Property. Changes to ambient noise may also affect a variety of wildlife, migratory birds and Species at Risk (SAR) through driving them out of the area and/or other effects on their behaviour.

Construction of the marine terminal will likely result in temporary increases to noise in the marine environment, which may in turn affect nearby marine biota. Noise may alter the behaviour patterns of certain marine species, which may in turn affect these species at different times of their life cycles. Shipping associated with the marine terminal will add to the noise already present in the marine environment.

6.2.1 Potential Environmental Effects

Under the worst case scenario, the predicted noise levels at the nearest residences during the daytime and evening range from 47 dBA to 55 dBA, complying with the most stringent noise limit of 55 dBA. Quarry production noise is generally characterised by low-frequency "rumbling" noise that does not vary much with time. Quarry noise will be audible at a "moderate to quiet" level in nearby residential areas.

The predicted noise levels at the nearest residences during night-time range from 25 dBA to 41 dBA, complying with the night-time limit of 55 dBA. The night-time noise level would not be expected to disturb the sleep of most people in the long term.

The minimum blasting distance to the nearest residence (800 m) is respected in all directions from the Property boundary.

6.3 Ambient Light

The Project site is currently undeveloped and night time ambient light conditions are low. Changes to ambient light conditions have the potential to negatively affect wildlife, including birds, in the immediate area. Increases in night time light levels may also be perceived as a nuisance by local residents.

6.3.1 Potential Environmental Effects

Ambient light levels will increase during the construction of the processing plant, associated infrastructure and the marine terminal. Other lighting introduced to the site will come from vehicle headlights moving around the site as well as entering and exiting the site at the intersection with Route 16.

The topography blocks views of the quarry from the south and so there will be no significant light trespass on any buildings along Route 16. From the west, the topography prevents direct line of sight view to the quarry, processing plant and marine terminal, except for viewers standing directly on the coast and those who may look toward Black Point from the east side of Gaulman Point. From these vantage points, the marine terminal and stockpiles will be visible, but the quarry will be largely concealed behind a vegetated coastal buffer.

To the east, direct line of sight viewers are located on the east side of Indian Cove along Fox Island Cove Road. Black Point can also be seen from the beach at Indian Cove, located 3.5 km east of the proposed processing plant. From this direction, much of the processing plant, quarry and marine terminal is expected to be shielded from view by Black Point itself (which will remain forested), as well as a 30 m wide vegetated buffer left along the coast. It is likely the tallest components of the processing plant (conveyers, tops of stockpiles, and lighting fixtures) may be visible from these eastern viewpoints.

At night, many nocturnal animals use moonlight and starlight to forage for food and detect predators. Objects in the night sky may be used as aids to navigation for migrating birds. Patterns of light and darkness are also used to regulate circadian cycles; to control the behavior of diurnal, nocturnal and crepuscular animals[1]; to determine day length; and as a directional cue

[1] Diurnal animals are most active during the day; nocturnal animals are most active at night; crepuscular animals are most active at dusk and dawn.

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for navigation. Lighting needed to illuminate working areas and for navigational purposes at the marine terminal can have an adverse effect on migrating birds. Birds that enter these illuminated areas can become confused possibly resulting in collisions and mortality.

6.4 Geology, Soil and Sediment Quality

Geology, Soil and Sediment quality was identified as a VC primarily due to the anticipated disturbance of potentially acid generating rock during site levelling for the processing plant, as well as concerns expressed by fishermen with respect to the discharge of sediment-laden water from the Project site and the consequent effects on lobster and their habitat.

6.4.1 Potential Environmental Effects

The granite rock that will be quarried for aggregate is not acid generating. In contrast, Halifax Formation sedimentary rocks that underlay a small portion of the site near the coast (approximately 11.8 ha) may generate acid and/or leach metals when exposed to oxygen. This water may negatively affect the nearshore marine environment if allowed to drain to Chedabucto Bay.

Discharge or runoff of sediment-laden water during construction and operation may have harmful effects on nearby lobster habitat or lobster life stages.

6.5 Groundwater Resources

Groundwater extracted from dug and drilled wells is used for drinking water purposes by the nearest residents living to the east, west and south of the Project site. A total of 23 residences are located in the vicinity of the Project (within 2 to 3.5 km); of these, 17 employ dug wells while 6 employ drilled wells. No water wells are installed in the granite rock that will be quarried.

Groundwater quality and quantity also contributes to the health and sustainability of local ecological systems.

6.5.1 Potential Environmental Effects

The Project will remove granite from within the Property boundaries, ultimately creating a pit approximately 130 m deep. Once pit development begins, surface precipitation that originally landed on the granite and flowed laterally to help recharge nearby wetlands and lakes will be redirected into the pit, negatively affecting these ecological features.

With respect to potential Project effects on the surface water aquifers that support dug wells, no Project-related impacts are expected. This is because these aquifers are fed by surface precipitation falling within the subcatchments that host the wells and not by precipitation falling on areas that will be developed for the Project. For those who use drilled bedrock wells to obtain potable groundwater, Project-related impacts to potable groundwater supply and quality will be negligible because:

1. There is no potable groundwater wells drilled in the granite.

2. Drilled wells within the highly fractured metasedimentary rocks access a chemically different groundwater than the one present within the granite. These aquifers are not only chemically different, they are structurally different. While a certain connectivity can be expected, the

fact that the water chemistry is different indicates that the connectivity is minimal and slow to occur.

3. Even at full pit build out, a thick barrier of granite (over 400 m wide) will remain between the pit wall and nearest metasedimentary bedrock where drilled wells are located (even further away). This thick barrier helps to isolate Project-related effects within the granite from affecting the aquifer tapped by wells in the metasedimentary bedrock.

4. The nearest drilled groundwater well is located 815 m from the pit boundary, far outside of the maximum potential drawdown cone resulting from the pit (400 m); the next nearest drilled well is more than 2.5 km from the pit boundary. The sheer distance provides a significant measure of security for drilled wells in the vicinity of the Project.

5. Because the groundwater movement within the granite is expected to be limited, no groundwater dewatering will be needed to prevent groundwater inflow into the pit (inflows will be simply collected in the sump). The lack of active dewatering wells means that the cone of influence is limited to the zone caused by passive drainage into the pit.

6.6 Marine and Surface Water Resources

Surface Water Resources are considered to be a VC because they sustain aquatic ecosystems and support terrestrial ecosystems, convey stormwater, and can either recharge groundwater resources or drain excess groundwater away from an area. Marine water quality is fundamental to healthy marine ecosystems and is critical to the long term success and sustainability of the commercial fishery. No terrestrial fish habitat is present on the site due to the natural acidity of the water.

6.6.1 Potential Environmental Effects

The Project may impact upon the baseline hydrological regime by increasing or decreasing flows to, or water levels within surface water resources. This in turn may impact upon established aquatic ecosystems, or (during extreme events) additional runoff may increase the risk of flooding within the downstream environment. Additionally, the development may impact upon surface water quality through accidental spills or uncontrolled erosion, which may in turn affect established aquatic ecosystems. Downstream flow to Reynolds Brook, located 1.0 km south of the Property, is expected to be reduced by up to 18% at full quarry build out. This may have negative effects on fish populations (if present) during periods of low flow, or alternatively, may improve water quality by reducing inflows of low pH surface water.

Marine water quality may be negatively affected by sediment laden water in the form of discharge or stormwater runoff. Acid rock drainage generated from the disturbance of Halifax Formation rocks may also affect marine water quality.

6.7 Terrestrial Ecosystems, Habitat and Vegetation

Terrestrial ecosystems, habitat and vegetation express local and regional biodiversity and support ecological resilience. These features form the basis upon which local wildlife populations depend. First Nations have expressed concerns with respect to their continuing ability to harvest terrestrial resources within the Project and adjacent areas, as well as the overall effect of Project activities on ecological resources in general.

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6.7.1 Potential Environmental Effects

Terrestrial ecosystems and habitat will be permanently diminished or destroyed, and vegetation will be lost during the course of building and operating the Project. Indirect impairments to ecosystems and habitat may occur through Project-related activities such as water use, accidental spills, and dust emissions.

6.8 Wetlands

Wetlands are highly productive and diverse ecosystems that perform a number of biophysical and ecological functions. They may provide habitat or refuges for a diversity of species (including SAR), attenuate storm flows, recharge groundwater and provide discharge to downstream receptors during dry periods.

6.8.1 Potential Environmental Effects

Over the 50 year life of the Project, development will directly affect a number of wetlands on the Project site, and may indirectly affect others through effects to surface and groundwater flows or from inputs from accidental hydrocarbon spills or quarry dust. Those wetlands directly affected will be permanently destroyed or diminished. These effects will not be felt at once, but rather progressively as the quarry expands over its 50 year production life.

6.9 Terrestrial Wildlife

Terrestrial wildlife species have ecological, aesthetic and recreational importance to the public and First Nations, primarily as a food source and as an economic and recreational resource. They also have inherent value as wild species and critical components of larger ecosystems.

6.9.1 Potential Environmental Effects

Project development will impair or eliminate the productive capacity of some terrestrial habitat within the Project footprint. Other indirect interactions (airborne dust, emissions, noise, vibration, light, water use) may affect species and habitat adjacent to the Project.

The main impact on landbirds will be the loss of nesting and foraging habitat. Vegetation clearing and grubbing activities may also cause destruction of nests and nestlings or eggs if conducted during the breeding season. In addition to habitat loss, construction noise (including blasting) may have deleterious effects on animals in and near the Project area.

No evidence of breeding shorebirds was reported during the field surveys. Disturbance due to construction noise (including blasting) is expected to have minor impacts on breeding, migrating and/or wintering shorebirds, depending on when the activities take place.

Waterfowl along the marine shoreline and inland ponds and lakes may be disturbed by noise from blasting and other construction activities. Seabirds nest on a number of offshore islands and other inaccessible coastal areas, notably the Country Island Complex, the nearest point of which is approximately 13 km from the Project site. Minor disturbance of foraging terns from blasting and other construction noise is possible; however, the distance from the colony makes it unlikely that Roseate Terns will forage in the waters near the Project. Large gulls and Common and Arctic Terns nesting on Fox Island and Half Island, both approximately 3 km from the Project site, could potentially be disturbed by blasting noise. However, this distance is

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greater than the 1 km buffer recommended by Environment Canada for high-disturbance activities such as drilling and blasting.

Habitat removal and fragmentation will result in displacement of mammals from within the Project footprint. Clearing and construction activities are expected to slightly reduce the available area used by terrestrial mammals and interrupt local movement to and from adjacent areas of suitable habitat. Project related noise (including blasting) may cause mammals in immediately adjacent areas to flee temporarily.

The loss of ponds, wetlands and riparian areas in the Project area will result in habitat loss for local amphibians and turtles, and increased sedimentation from dust generated by construction may further impact aquatic habitats. Snakes may utilize much of the Project area, and will be impacted by habitat loss as well as increased fragmentation which may inhibit movement between areas of suitable habitat.

Some loss of odonate (dragonfly and damselfly) breeding and feeding habitat is expected from the loss of wetlands, ponds and riparian areas within the Project area. Dust from construction activities may contribute to sediment loading in watercourses, potentially altering aquatic habitats. Lepidopterans (moths and butterflies) will be most affected by the loss of larval food plants, which varies from species to species; adults are highly mobile and therefore able to avoid areas impacted by Project activities.

6.10 Freshwater Species and Habitats

Fish and fish habitat are valued for their ecological services as a renewable resource base, and for their economic, cultural, spiritual and ceremonial benefits. As noted above, the watercourses and lakes on the Property do not contain fish due to acidic conditions. Nevertheless, other freshwater species and habitat are important biological components of larger ecological systems and are valued by the public and First Nations.

6.10.1 Potential Environmental Effects

Project activities will remove some freshwater habitat and may indirectly affect other areas. Once quarrying ceases and the pit fills with water, the Project will ultimately create more freshwater fish habitat than currently exists on the site.

6.11 Marine Species and Habitats

Marine species and habitats are valued for their aesthetic, cultural, ecological and economic attributes by First Nations and the public at large. Marine SAR are of interest to scientists, regulators and public due to their inherent biological and cultural value and are protected under federal provincial legislation. The marine habitat in Chedabucto Bay supports productive and diverse fisheries. A number of fish species reside within the Bay, and additional species migrate from nearby water bodies to feed and spawn. Marine mammals associated with Chedabucto Bay typically include of seals, whales and porpoise.

6.11.1 Potential Environmental Effects

The majority of the effects to marine species and habitat are associated with the construction and operation of the marine terminal since the construction of this feature will remove marine habitat. Construction of the marine terminal will permanently destroy approximately 1.1 ha of sea bottom habitat even as new habitat is created by the terminal foundations. To offset this habitat loss, habitat creation nearby is required by DFO. Transport of aggregate via seagoing

vessels will impact upon the marine environment through noise associated with vessel passage and potentially through accidental spills or other incidents at sea.

Potential environmental effects on marine sediment quality are described in Section 6.4 while potential effects on marine water quality are described in Section 6.6. Potential environmental effects to commercial fisheries are described in Section 6.15. Potential environmental impacts to marine SAR are described in Section 6.12.

6.12 Species at Risk

Species at Risk are identified as a VC due to their ecological role, scientific value and cultural attributes. Species at Risk may be regulated at the federal level, the provincial levels, or both. No critical habitat for any species at risk was identified on the Property.

6.12.1 Potential Environmental Effects

The direct loss of habitat used by terrestrial or marine SAR is the primary concern of this VC, although SAR may be indirectly affected through noise, light and general activity at the Property.

Two vascular plant species of conservation concern (SOCC) are known to occur within the Project footprint. Four lichen SOCC were identified on the Project site. For most terrestrial fauna SAR/SOCC (including the one mammal, fourteen bird, and one odonate), potential effects are predicted to be similar to those for terrestrial fauna as a whole (Section 6.7).

Mainland Moose

The mainland Nova Scotia population of Eastern Moose, which is listed as Endangered under the *Nova Scotia Endangered Species Act (NSESA)*, could potentially be affected by the Project through:

- Loss of habitat (foraging, wintering, calving);
- Habitat fragmentation;
- Disruption of migratory routes;
- Mortality due to vehicle collisions;
- Increased poaching levels in area due to increased traffic;
- Noise disturbance; and
- Exposure to runoff from hazardous materials/contaminated soils.

Rusty Blackbird

To date, a total of fourteen bird SOCC have been reported from the Project site. Of these, a single species, the Rusty Blackbird is a SAR. This bird, which is also listed as Endangered under the *NSESA*, could potentially be affected through:

- Loss of habitat (foraging, nesting);
- Habitat fragmentation;
- Disturbance from construction noise (including blasting); and
- Exposure to runoff from hazardous materials/contaminated soils.

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No terrestrial herpetile SAR or SOCC are known or suspected to occur on the Black Point site. A single invertebrate SOCC species, a dragonfly known as the Spot-winged Glider was detected on the site in 2010. No freshwater flora or fauna SAR or SOCC are known or suspected to occur on the Black Point site.

Several marine fish, mammal, and reptile SAR and/or SOCC have the potential to occur within the marine footprint and immediate vicinity of the Black Point Project site. Potential effects on marine fauna SAR and SOCC are predicted to be similar to those for marine fauna as a whole, which are discussed in detail in Section 6.11.

6.13 Local Economy, Land and Resource Use

Positive economic effects of the Project will benefit local residents, local businesses in the service sector and government at the municipal and provincial levels. Improvements in the regional economy can positively affect the population size and demographics as workers move to the area, purchase real estate, goods and services, and raise families. Real estate values can also be affected by a vibrant regional economy.

The Project will require a temporary labour force during construction and a smaller but significant labour force over the long term operation of the Project. In addition to direct hires, the Project will generate employment and economic activity through contracting for goods and services.

Current on-site land uses (trapping, local tourism) will be replaced by quarrying and associated activities. Existing and planned land uses on adjacent properties or within the Affected Area may be impacted through changes to the visual or acoustic environments.

6.13.1 Potential Environmental Effects

The positive economic impacts are principally related to long term employment opportunities which typically result in amplified demand for goods and services, as well as improved tax revenues for municipal, provincial and federal governments.

One of the primary effects of the Project is to change the use of the Property from an undeveloped piece of land used occasionally for trapping and recreational activities (ATV passage and fishing in the nearshore), to a quarry that will be operated on a continuous basis, and where these current activities will be limited or no longer practical. Despite these land use changes, the current zoning reflects a long term municipal vision to promote economic development and so is compatible with the goals and objectives of the community.

6.14 Tourism and Recreation

Residents and tourists alike utilize the local terrestrial and marine landscapes for outdoor activities such as camping, hiking, fishing, boating, off-road motoring, and hunting. Tourism and recreational activities, as well as the infrastructure associated with these activities, such as accommodation, marinas, recreation centres and parks, make up the Tourism and Recreation VC.

6.14.1 Potential Environmental Effects

The presence of a quarry may influence perceptions regarding noise and changes in the visual character of the coastal landscape, resulting in changes to resource use patterns by tourists. The Project may result in restrictions to currently accessible beaches and headlands within the

property footprint but not to nearby beaches such as Gaulmans Point and the beach at Indian Cove. Additionally, there will be little to no impact to the visual site lines from Marine Drive as the entrance area will be groomed, and the surrounding trees are anticipated to remain during the life of the Project. In addition, the quarry will be topographically lower than Marine Drive.

The quarry development has the potential to affect the tourism and recreation through a decrease in wilderness/nature oriented recreation and tourism within the Project Area and vicinity due to marine vessel traffic and actual or perceived noise, dust and light from the quarry. This in turn may negatively affect revenue at local campgrounds, rental accommodations and other service providers. The quarry may also result in an increase in expenditures on tourism services through increased discretionary spending by people hired at the Project.

6.15 Commercial Fisheries

Marine commercial fisheries represent an important, sustainable resource of historical, cultural, social and economic value to local communities and First Nations. As noted, there are no *freshwater* commercial or recreational fisheries on the Property. At the same time, aquaculture is not currently practiced along the south shore of Chedabucto Bay.

The primary species harvested on a commercial basis in Chedabucto Bay south of the established shipping lanes are:

- Lobster;
- Shrimp;
- Herring, Mackerel and Squid
- Snow Crab;
- Tuna; and
- Scallop

Sea urchin, rock crab, marine plants and eels are reportedly not fished on a commercial basis at this time, although local fishermen do have licenses that permit the harvest of these species. Mackerel is the primary salt-water recreational species in the area, but catch and release recreational Bluefin tuna fishing is also popular.

6.15.1 Potential Environmental Effects

The presence and use of the marine terminal will result in limitations to lobster harvesting in the immediate area and, as a result, potential displacement into other areas of those who currently fish in the nearshore at the Black Point site. This limitation will occur for two reasons: (1) the construction of the marine terminal will remove approximately 1.0 ha of lobster habitat that is currently available for commercial exploitation, and (2) fishermen will likely steer clear of the active marine terminal for safety and out of concern for gear losses.

Potential sediment-laden water runoff from terrestrial construction activities and consequent negative effects to water quality may displace fish from the immediate near shore but is unlikely to result in their death.

The transit of empty and loaded aggregate transport vessels has the potential to interfere with other commercial fishing activities that occur in deeper water between the established shipping

lanes and the south shore of Chedabucto Bay. In addition to interference with on-going fishing, noise associated with this increased traffic may displace fish from the immediate area.

The added ship traffic may require fishermen who frequent deeper water to avoid preferred fishing grounds to accommodate Project-related ship traffic.

Accidental fuel spill or other discharges to the aquatic environment can alter water quality and physical habitat, which in turn can negatively affect life-cycle stages of commercially important species and their food supply. Accidental aggregate spills will not likely affect the commercial fishery since this material has already been washed to remove fine-grained sediment.

No underwater blasting will be required. Blasting on land is not expected to result in significant effects since blasting charges can be minimized to meet guidelines that are designed to be protective of aquatic species.

No impact is expected to the fixed berth mackerel, herring and squid trap fisheries since these berths are considerably removed from the Project site. A possible exception to this are the two mackerel traps located in Indian Cove approximately 4.0 km east of the marine terminal. Concerns have been raised by local fishermen that the marine terminal will divert mackerel from their normal coastal-hugging route that brings them into Indian Cove where the traps are located. Instead, the terminal may encourage the fish to remain offshore and travel directly from Black Point to Fox Island, rather than entering Indian Cove.

6.16 Archeological and Heritage Resources

Archaeological and Heritage Resources were identified in the EIS Guidelines as a potential VC as concerns have been raised regarding the possible existence of these resources during the public outreach phase of the environmental assessment.

A 2011 Archaeological Resource Assessment survey did not identify any archaeological or heritage resources, but potential post-European contact house foundations were identified on the Property near the coast during the 2014 Archaeological Resource Assessment.

6.16.1 Potential Environmental Effects

Although 30 m buffer zones will be left undisturbed along the coastline (thereby protecting some of these finds), much of the coastal zone inside this buffer will be built upon, thus potentially disturbing, destroying or covering over some of these resources.

6.17 Aboriginal Land and Resource Use

Aboriginal culture in the form of traditional land and resource use is practiced on a regular basis in many Nova Scotia Aboriginal communities. Traditional hunting, fishing, and plant harvesting practices are deeply rooted and highly valued in these communities. Consideration of Aboriginal interests is legislated by federal and provincial laws and listed in the EIS Guidelines issued for this Project.

6.17.1 Potential Environmental Effects

Based on the information compiled through the MEKS and findings during site visits conducted with Mi'kmaq Elders, harvesters, Chiefs, and organizational representatives, there is currently no direct Mi'kmaq use of the Project site for subsistence harvesting of food or furbearing

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animals. Several Mi'kmaq communities are currently fishing marine species for livelihood purposes along the eastern shore. Of these, only the Waycobah shrimp trap fishery is operating in proximity to the Project. The Waycobah band holds the only Mi'kmaq shrimp trap license in the south side of Chedabucto Bay however this license is currently being fished by non-aboriginal license holders on behalf of the Band. No Mi'kmaq fishermen currently deploy lobster traps in the Project vicinity although they, like other LFA 31 license holders, have the right to fish anywhere within LFA 31.Potential Environmental Effects

As noted in the Mi'kmaq Ecological Knowledge Study completed for this Project, development effects may include:

1. potential disturbance of hitherto unidentified archaeological resources during the construction of the infrastructure as well as the quarry operation itself.

2. likely permanent loss of wildlife and plant resources which have been traditionally harvested within the immediate project footprint. This loss may result from the physical removal or displacement of specimens or restriction of access to potential harvesting areas.

3. potential harm or dispersing of wildlife due to noise resulting from increased human presence, traffic, blasting, and general mining activities.

4. potential disturbance or contamination of vegetation, wetlands and water bodies as a result of settlement of dust and other airborne pollutants associated with the Project. This can significantly depreciate the quality of local food and medicinal plants for human consumption as well as the quality of animal browse and water/wetland habitat.

5. potential degradation of the local marine and shoreline habitats surrounding the shipping terminal due to dust contamination, the potential for accidental aggregate spillage during loading, and possible contamination resulting from petroleum products associated with cargo vessels. However, based on the current information (section 6.17) it is concluded that the Project will not likely have a direct significant impact on Mi'kmaq livelihood fishing: the shipping route near the marine terminal has been modified to avoid preferred shrimping grounds.

6.18 Accidents and Malfunctions

The assessment of potential environmental effects resulting from accidents and malfunctions employs risk based approach that involves:

1. Identification of hazards associated with the Project infrastructure and activities to be undertaken on-site or off-site.
2. Identification of potential environmental effects or the anticipated consequences of the identified hazards by completing a qualitative risk assessment aimed and providing some perspective on the hazards and their consequences by rating the likelihood of the adverse environmental effects. This rating represents the overall assessment of significance for the potential adverse environmental effects of accidents and malfunctions.

Those hazards with the greatest potential to result in environmental effects are:

- **Structural Failures:** These include quarry pit slope failure, aggregate stockpile slope failure, processing plant/marine terminal infrastructure failure and sediment pond failure;

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- **Accidents:** These include an explosives accident, marine spills, transportation accidents (including vehicle and marine collisions), hydrocarbon spills on land or in the water; and,

- **Other Malfunctions:** These include unspecified health and safety incidents, wildlife encounters and forest fires.

Each potential accident and malfunction was assessed according to likelihood of the event and given a risk rating from "negligible" to "high". Environmental effects are assigned a magnitude rating from "low" to "extreme". The combination of the likelihood of an event and the magnitude of its environmental effects is determined by plotting these ratings on the matrix. Increased risk is associated with accidents and malfunctions having a greater *likelihood* of occurrence and greater *magnitude* of effects. Accidents and malfunctions with an overall combined rating of greater than or equal to 4 are not considered to be significant events or consequences. The results are summarized in Table 9. The results indicate that all accidents and malfunctions described above have ratings ranging from 5 to 8. These events and their environmental effects are therefore considered not significant.

Table 9:
Summary of Accidents and Malfunctions Assessment

Malfunction/Accident	Key VCs Potentially Affected	Risk Rating	Magnitude Rating	Overall Rating 1 = Maximum 9 = Minimum
Quarry Pit Slope Failure	Human Health and Safety	Negligible	High	7
Stockpile Slope Failure	Human Health and Safely Surface Water Resources Terrestrial Habitat and Vegetation	Negligible	Moderate	8
Sedimentation Pond Failure	Marine and Surface Water Resources Terrestrial Habitat and Vegetation Marine Species and Habitat Species at Risk	Very Low	Low	8
Processing Plant Infrastructure Failure	Marine and Surface Water Resources Marine Species and Habitat Species at Risk	Very Low	Moderate	7
Marine Terminal Infrastructure Failure	Marine and Surface Water Resources Marine Species and Habitat Species at Risk	Very Low	Moderate	7
Terrestrial Spill	Human Health and Safely Geology, Soil & Sediment Groundwater Resources Wetlands	Low	Moderate	7
Vessel Accident/Collisions	Human Health and Safely Marine Species and Habitat Species at Risk Local Economy Commercial Fisheries	Very Low	Very High	5
Explosives Accident	Human Health and Safely Marine and Surface Water Resources Terrestrial Habitat and Vegetation Terrestrial Wildlife Marine Species and Habitat	Negligible	Moderate	8

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Malfunction/Accident	Key VCs Potentially Affected	Risk Rating	Magnitude Rating	Overall Rating 1 = Maximum 9 = Minimum
	Species at Risk			
Marine Spill	Human Health and Safely Marine and Surface Water Resources Marine Species and Habitat Species at Risk Local Economy Commercial Fisheries	Very Low	Very High	6
Illegal Ballast Discharge	Marine and Surface Water Resources Marine Species and Habitat Species at Risk Local Economy Commercial Fisheries	Low	High	5
Transportation Accident	Human Health and Safely Terrestrial Habitat and Vegetation Terrestrial Wildlife	Low	Moderate	8
Forest / Site Fire	Human Health and Safely Air Quality Terrestrial Habitat and Vegetation Terrestrial Wildlife Tourism and Recreation Aboriginal Land and Resources Use	Negligible	High	7

6.19 Effects of the Environment on the Project

The natural environment has the potential to adversely interact with the Project through meteorological, climatological and seismological events. These events may include:

- Drought or extreme precipitation events leading to flooding;
- Extreme (high/low) temperatures;
- Rapid or increasing number of freeze/thaw events;
- Severe wind storms including hurricanes;
- Extreme marine conditions (high waves plus extreme winds);
- Ice storms and hail events;
- Late season sea ice; and
- Earthquakes.

The Project is located on a relatively exposed southern coastline exposed to northerly winds and considerable wave action. Initial designs have considered prevailing historical conditions, including extreme events, as well the anticipated effects of climate change on key weather variables. As the Project moves into the detailed design stage, additional consideration will be given to the effects of the environment on the Project.

In addition to design factors, potential adverse effects on the Project due to the environment will be mitigated through the monitoring and/or contingency planning. Therefore, the effects of the environment on the Project are anticipated to be not significant.

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6.20 Cumulative Effects

Cumulative environmental effects are residual Project effects combined with the environmental effects of past, present, and future projects. For this assessment, the descriptions of the existing environment and of the current condition of each VC already include the effects of current projects occurring within or outside of the Project Area. The cumulative effects assessment thus focuses on the effects of other future projects and activities.

With respect to identifying potential cumulative effects:

1. there must be a measurable environmental effect of the project being proposed;
2. the environmental effect must be demonstrated to interact cumulatively with the environmental effects from other projects or activities; and
3. it must be known that the other projects or activities have been, or will be, carried out and are not hypothetical. That is, there must be some *probability* the cumulative environmental effect will occur rather than simply a *possibility*.

Based on these parameters, four projects were identified as potentially contributing cumulative effects to the Black Point Quarry Project:

Chedabucto Aggregates Quarry Expansion (Halfway Cove, Guysborough Co.)

Chedabucto Aggregates Limited in September 2014 indicated they will register the Chedabucto Aggregates Quarry Expansion for environmental assessment. The project is located approximately 13 km southeast of Guysborough. The proposed expansion is scheduled for 2015; production levels and operations are not expected to increase as a result of the proposed expansion.

Goldboro Liquefied Natural Gas Project (Goldboro, Guysborough Co.)

Pieridae Energy proposes to construct a natural gas liquefaction plant and marine terminal in Goldboro, Guysborough County. On March 21, 2014 the project was approved with conditions and the project is currently in the Front End Engineering and Design phase.

Maher Melford Container Terminal (Melford, Guysborough Co)

Melford International Terminal is proposing to develop a 315-acre container terminal and intermodal rail facility in Melford on the Strait of Canso. In late 2014 the Nova Scotia Minister of the Environment authorized an extension for the commencement of project work: the Proponent must, on or before October 23, 2016, commence work on the project unless granted an extension by the Minister.

Bear Head Liquefied Natural Gas Project (Port Hawkesbury, Cape Breton)

The Bear Head project near Port Hawkesbury received EA approval in 2004. Construction on the LNG facility began in 2005, but later ceased. In July 2014, the company Liquefied Natural Gas Ltd. announced it has purchased the project. In November 2014, Liquefied Natural Gas Ltd. announced plans to double the capacity of the proposed liquefaction and export terminal from 4 mtpa to 8 mtpa. A final investment decision on the Bear Head project is expected in late 2015 to 2016 and the facility could be in commercial operation in late 2018 to 2019.

In order to identify potential overlapping projects and systematically assess the likely cumulative effects for each VC, the Project team:

1. Researched the status of future planned or anticipated projects that could overlap in time or space with the Project; and

2. Defined the spatial and temporal boundaries that would be used to assess the degree and significance of the overlap (i.e., the cumulative effect) for each VC.

All VCs were examined for the potential to contribute to cumulative effects. Once future projects were identified, the infrastructure and activities associated with these projects were reviewed to determine the likelihood that potential effects on VCs at these projects would overlap in space with the VCs assessed for the Black Point Project. If an effect was likely, then these effects were further examined as to their potential to overlap in time (temporal overlap) with Black Point effects.

Chedabucto Aggregates quarry is located approximately 17 km west of Black Point. Given the distance from the Project Area and the limited scale of quarrying activities associated with the expansion, no overlap in space between the environmental effects produced at Chedabucto Aggregates and the Black Point Project is expected. Therefore, no cumulative effects are anticipated.

The Goldboro LNG project is located on Nova Scotia's eastern shore, approximately 45 km southwest the Black Point Project. The project is associated with a number of residual environmental effects but most of these effects are not considered to be significant. The project's GHG emissions could be regionally significant when combined with other large, regional GHG emitters, but the Black Point Project is not a significant GHG producer. Vessel traffic to the Goldboro marine terminal will remain many kilometres from Chedabucto Bay. Under these circumstances, there is no overlap in space between the effects produced at Goldboro and those expected at Black Point. Given this, no cumulative effects are anticipated.

Given their relative proximity and location with respect to the Black Point Project site, certain aspects of the Bear Head LNG and the Maher Melford Container Terminal projects are expected to overlap in space and time with VCs retained for the Black Point Project. These VCs include:

- Shipping and Navigation
- Local Economy, Land and Resource Use

With respect to Shipping and Navigation, the vessels used to transport aggregate will not be operated by Proponent crews and so mitigation of potential vessel collisions is, to a large extent, outside of the control of the Proponent. Nevertheless, the Proponent will review the safety and environmental records of shipping contractors prior to engaging them, with the aim of employing only the most reputable firms.

Marine traffic within Chedabucto Bay managed by the Canadian Coast Guard and the Proponent will communicate with the MCTS to the extent requested or required during adverse weather conditions. To the extent applicable, the Proponent will also

- Comply with the Eastern Canada Vessel Traffic Services Zone Regulations of the *Canada Shipping Act*;

- Comply with navigational and operational requirements of Atlantic Pilotage Authority and Coast Guard; and
- As needed, provide marine vessel volumes and schedules to marine management operators responsible for traffic movement; and

With respect to Local Economy, Land and Resource Use the Proponent is committed to meeting with local schools, trade unions and other organizations to describe labour and skill requirements, and to employ a procurement policy that favors local labour markets and suppliers.

Taking into account the basic mitigation measures described above, the residual adverse cumulative effects expected with respect to Shipping and Navigation are predicted to be insignificant. Cumulative effects to the Local Economy, Land and Resource Use are expected to be positive and potentially significant over the medium to long term.

6.21 Changes and Effects of Changes Under Federal Jurisdiction

As noted in Section 3.1.3, this section summarizes changes to components of the environment within federal jurisdiction; changes to the environment that would occur on federal or transboundary lands; changes to the environment that are directly linked or necessarily incidental to federal decisions; effects of changes to the environment on Aboriginal peoples; and the effects of changes to the environment that are directly linked or necessarily incidental to federal decisions.

Changes to Components Within Federal Jurisdiction

- Changes are expected to freshwater fish habitat in Reynolds Brook where reductions in flow of up to 18% may be expected in the brook section above Hendsbee Lake. Water quality improvements may also occur due to the reduced inflows of low pH water.
- Changes are expected to marine fish and fish habitat, including marine plants due to the construction of the marine terminal and the transit of marine vessels to and from the terminal.
- Changes to migratory bird behaviour and risk of mortality may occur due to light and noise associated with the Project.

Changes to the Environment Occurring on Federal or Transboundary lands;

The marine components of the Project, especially aggregate shipping, have the potential to result in changes to the environment on federal submerged lands and federal waters. No changes are anticipated on federally owned or federally managed terrestrial lands.

Changes to the Environment that are Directly Linked or Necessarily Incidental to Federal Decisions

A *Navigation Protection Act* approval and *Fisheries Act* authorisation will be required to construct the marine terminal. As a result of these approvals, changes in the marine environment may include effects on marine fish and fish habitat and commercial lobster and shrimp fishing.

Effects of Changes to the Environment on Aboriginal Peoples

The site is not currently visited for resource harvesting and there are currently no FSC fisheries at the Project site. Changes to the environment will not negatively affect health and socio-economic conditions (positive economic benefits may be realised), physical and cultural heritage, the current use of lands and resources for traditional purposes, or any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

Effects of Changes to the Environment Directly Linked or Necessarily Incidental to Federal Decisions

As noted a *Navigation Protection Act* approval and *Fisheries Act* authorisation will be required to construct the marine terminal. The marine terminal is not expected to result in adverse effects to heath, physical and cultural heritage, or any structure, site or thing that is of historical, archaeological, paleontological or architectural significance. In contrast, effects on socio-economic conditions may result from the terminal's effect on the commercial fisheries through:

- Change in risk of fish injury or death; and
- Change in fish or other habitat quality and use;

These potential changes are expected to be temporary and confined to the area around the marine terminal and to the designated shipping routes between the terminal and the main shipping lanes in Chedabucto Bay. With the implementation of the proposed Fisheries Offset Plan, these effects are not expected to significantly alter the socio-economic conditions for commercial or Aboriginal fishermen.

7.0 MITIGATION AND MONITORING MEASURES

The Proponent has committed to a number of mitigation measures to limit or eliminate adverse environmental effects and monitoring programs to verify predictions made in the environmental assessment. Table 10 summarizes the mitigation measures on a VC by VC basis, and lists the proposed follow and monitoring programs.

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Table 10:
Proposed Mitigation Measures and Monitoring Programs

VC	Mitigation	Monitoring

Air Quality and Climate Change (7.1)	• Regular maintenance of all equipment and emission control devices.
	• The use of wet suppression and/or dust collection systems on crushers, screens, and conveyor transfer points. Some parts of the process due to high moisture content of the stone will not need water sprays or additional dust control.
	• The application of water to the access and haul roads and aggregate stockpiles as needed.
	• Use of qualified blasting contractors with blast design plans that incorporate dust emission controls.
	• Construction of the haul roads using material with low silt content.
	• Use of a binder substance within the dust suppression application (e.g. calcium chloride) during drier periods of the year to aid in keeping the roads moist for longer periods of time, when necessary..
	• Use adaptive management to adjust dust control measures and/or operating conditions to account for changing conditions that affect dust control. Some of the control measures that will be implemented based on management determination of need include:
	  ○ Increase in watering frequency of haul roads and stock piles.
	  ○ Application of dust suppressants to the haul and access roads.
	  ○ Reduction in allowable speed on haul and access roads.
	  ○ Restriction or suspension of operation of part or all of the processing plant until dust can be controlled.
	  ○ Suspension or modification of overburden handling activities.
	  ○ Addition or modification of dust suppression systems to address specific points where dust is being generated, including spray nozzle additions and/or modifications.
	  ○ Modify operation and dust controls during high wind events (>30 km/h) to control dust, if it cannot be controlled suspend operation until it can.
	• Utilize multi-passenger vehicles to transport crew when possible.
	• Use high quality, ultra-low sulphur diesel fuels or standard unleaded gasoline for mobile equipment at the operation. (Note: Ships will not be refuelled at the site; vessel fuel type is not within the Proponent's control).
	• Reduce idling and shut off equipment when parked unless it is required to operate due to safety considerations, inspection requirements or maintenance activity.
		• Daily dust and weather monitoring as described in the Environmental Management Plan.
		• Regular individual worker / workplace health and safety testing.
		• Agency-requested ambient air quality testing or monitoring as required.
		• Implementation of a complaints log / response protocol at the site office.

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VC	Mitigation	Monitoring
	• Turn off equipment that is idling and not in use. • Utilize drill rig that has dust suppression incorporated into its design. • Apply water to shot rock pile as needed to reduce emissions from loading and conveyance of material to the process. • Ships must comply with International Marine Organization limits on NO_X, VOC, and SO_2 but enforcement is the responsibility of Transport Canada. • Optimize load times to limit auxiliary engine idling on ships at dock.	
Noise and Vibration (7.2)	• Procure equipment that meets best practices in terms of noise emissions. • Place as much distance as possible between the plant or equipment and residences. • Maximize shielding from quarry walls, buildings and stockpiles as noise barriers. • Use natural landforms as noise barriers. • Include in tenders, subcontractor agreements and work method statements clauses that assure the minimization of noise and compliance with directions from management to minimize noise. • Regularly train workers and contractors to use equipment in ways that minimize noise. • Ensure that site managers periodically check the site, nearby residences and other sensitive receptors for noise problems. • Procure equipment that meets US EPA Category IV air emission standards for off-road diesel equipment which tend to generate less noise than older equipment. • Equipment that operates in the quarry pit should stay in the pit to the extent possible so that the pit walls attenuate the noise levels. • Locate product stockpiles and other structures to the extent possible to attenuate the noise from the processing equipment. • Restrict operating hours for the quarry and processing plants to 16-hours per day so that noise levels are reduced during night time. • Restrict blasting to daytime hours and weekdays • Keep truck drivers informed of designated vehicle routes, parking locations, acceptable delivery hours and other relevant practices (e.g. minimizing the use of engine brakes and engine idling). • Minimize the use of reversing alarms by designing the site layout to avoid reversing. • Provide information/advance notification to neighbors before and during construction through media such as letterbox drops or meetings; • Upon request, residents will be alerted to upcoming production shots (blasts) via automated telephone notifications ("robo-calls"). <u>Night-time Mitigation Measures</u> • Minimize the need for reversing alarms.	• As required by the NSE Pit and Quarry Guidelines, all blasts will be monitored to establish concussion and vibration levels. This is consistent with the Proponent's standard operating practices at all quarries. • As required by NSE, sound level monitoring will be undertaken at the property boundary or elsewhere as directed during daytime, evening and night-time to verify compliance with the Pit and Quarry guidelines. • As part of the workplace health and safety program, noise monitors will be attached to workers on a regular basis to measure and monitor noise exposure over an eight hour shift.

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VC	Mitigation	Monitoring
	• Avoid metal-to-metal contact on equipment. • Ensure that periods of respite are provided in the case of unavoidable maximum noise level events.	
Ambient Light (7.3)	• Use full cut off luminaires where no light is emitted above the horizontal plane, where practical and where they don't comprise worker safety. • Use only the lights needed to meet local lighting objectives. • Where practical Minimize glare by keeping the main beam angle less than 70 degrees. • Use floodlights with asymmetric beams where possible. • Direct the site lighting away from residential properties. • Where possible position lights as far away from site boundaries as practical. • Where possible, keep lighting at low heights to reduce the chance of illuminating migrating birds. • Pole mounted lighting will be pointed downward and shielded from the top and sides. • To the extent possible, low intensity lighting will be used rather than high intensity lighting. • Lights placed on the outside of the quarry work areas will be kept as low as possible and correctly aimed to prevent lighting non-essential areas. • Lights for the marine terminal will be chosen and aimed to prevent where possible light shining directly into the water. • Marine terminal lighting will be controlled so that minimal lighting will be used when the terminal is not in operation. • If lighting is required at the perimeter of the site it will be aimed inward to prevent off site light trespass. • Temporary lighting used during construction will be focussed on the intended work area and will be shielded to minimize spillage. • To reduce night time ambient lighting effects, operations will be routinely monitored so that lighting can be switched off by work area when it is not needed. • Consideration will be given to using light sources such as directional LEDs to give a better spread of lighting and reduce the overall intensity of the lighting systems. • Consideration will be given to selecting lights that have a lesser effect on the wildlife to help reduce lighting effects on nocturnal species.	• Routine site monitoring as described in the Environmental Management Plan will include maintaining records of bird mortality so developing issues related to lighting can be identified. • The Environmental Management Plan will include instructions on implementing the protocol "*Best practices for stranded birds encountered offshore Atlantic Canada*" (EC 2014e) for responding to avian strandings related to activities in the marine environment. • Nightly site inspections will reveal opportunities for light reduction
Geology, Soil & Sediment Quality (7.4)	• Standard mitigation measures to manage acid generating rock, including the control and containment of drainage and the management of excavated rock as per NSE regulation. • Sloping of the processing plant area to the south to collect surface water within the sedimentation ponds, prevent discharge to the ocean. • Environmental Management Plan that describes standard ARD control measures. The	• The acid generating potential of bedrock will be assessed at the beginning of construction as per the Nova Scotia *Sulphide Bearing Material Disposal Regulations*. • Discharge will be monitored through a Surface Water Monitoring Program elaborated within the Environmental Management Plan.

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VC	Mitigation	Monitoring
	Environmental Management Plan will incorporate an Erosion and Sediment Control Plan to ensure drainage is properly managed and control structures inspected and a Stormwater Management Plan that describes the construction and operation drainage swales and stormwater management ponds.	
Groundwater Resources (7.5)	• Since no impacts to groundwater users are expected, no mitigation is proposed • To mitigate reductions in groundwater flows that supply nearby wetlands, implement a Wetland Compensation Plan for wetlands damaged due to the Project.	• The groundwater wells will be monitored as part of the Groundwater Monitoring Program elaborated within the Environmental Management Plan.
Marine and Surface Water Resources (7.6)	• Sedimentation ponds will be used near the processing plant while the quarry pit will employ sumps to collect water inflows. • Topographic controls (sloping the ground to the south) will ensure that overflow, should it occur, will collect against the south cliff and in the pit, rather than be permitted to discharge directly to the ocean. • Double walled and or/fully bermed fuel and chemical storage reservoirs will be used. • The Environmental Management Plan will include a discrete Erosion and Sediment Control Plan to ensure drainage is properly managed and control structures inspected and a Stormwater Management Plan that describes the construction and operation drainage swales and stormwater management ponds. • The EMP will also include an Emergency Response and Spill Contingency Plan combined with incident prevention and emergency response training to minimize the risk of accidental spills and to rapidly react to any incident that may occur. The Emergency Response and Spill Contingency Plan will include spill dispersion modelling in the marine environment to aid in rapid and effect emergency response. • The Proponent will contract with a local emergency response consultant to ensure that additional resources and expertise are available in the event of an accidental spill in the marine environment. • To mitigate reductions in surface water flows that supply nearby wetlands, implement a Wetland Compensation Plan for wetlands damaged due to the Project.	• Discharge will be monitored through a Surface Water Monitoring Program elaborated within the Environmental Management Plan. • The success of the Wetland Compensation Plan will be monitored over time as determined in collaboration with NSE; other water features not directly included in the Plan will be inspected to detect hydrological changes potentially caused by the Project – these inspections will be outlined in the Plan.
Terrestrial Ecosystems, Habitat and Vegetation (7.7)	• A general set of environmental mitigation measures will be defined in the Environmental Management Plan which will include an Erosion and Sediment Control Plan, a Stormwater Management Plan and an Emergency Response and Spill Contingency Plan. • Minimize the Project footprint. • Mark Project boundaries to prevent accidental impacts outside the work area. • Remove/ and salvage topsoil; store separately and reuse for site restoration.	• The Environmental Management Plan will establish monitoring/inspection plans to ensure protective mitigation measures are implemented and effective. • Daily inspection and record keeping will be described in the EMP.

VC	Mitigation	Monitoring
	• Dust-prevention and abatement measures outlined above will also protect local flora and habitats. • Stabilize and rehabilitate areas of disturbance. • Use local native vegetation in restoration; consideration will be given to the preferential use of vegetation types of interest to the Mi'kmaq. • Vegetation management will be conducted by mechanical cutting (e.g., mower, brush cutter); • Mitigation measures for the protection of watercourses (see Section 7.6 and 7.10) will help to protect terrestrial and freshwater aquatic vegetation and habitats.	
Wetlands (7.8)	• Mitigation developed for surface water quality will also protect wetlands (Sections 7.6). • Mitigation against the potential effects of spills, malfunctions and accidents are described in Section 7.18. • Wetlands will be avoided to the extent feasible during Project planning. • Where wetlands cannot be avoided, the Project footprint in the wetland area will be minimized. • A wetland alteration permit will be obtained from NSE prior to construction. • Where a permanent loss of wetland function is identified, a **Wetland Compensation Plan** will be developed, subject to approval by NSE. • Maintain a 30 m buffer around all undisturbed wetlands. • Where the access road cuts across diffuse natural drainage paths culverts or drainage swales of sufficient size will be installed to maintain water flow at pre-construction levels. • To the extent feasible, clean site runoff will be managed so that the amount of water entering adjacent wetlands is similar to pre-construction levels. • Runoff collected along the roads will not be allowed to enter directly into wetlands, but shall be directed into vegetation buffers around wetlands. • Integration of existing/remnant wetlands into the quarry's stormwater management system will be considered in the **Stormwater Management Plan** and in the **Environmental Management Plan**. • Implement **Erosion and Sediment Control Plan.** • Uncontaminated drainage will be directed away from areas under construction. • Vegetation management in or near wetlands will be conducted by cutting (i.e., no use of herbicides). • Dust-prevention and abatement measures outlined above will also protect wetlands.	• Efficacy of the erosion and sediment control measures will be monitored as outlined in the **Environmental Management Plan**. • Monitoring of new or enhanced wetlands will be undertaken as per the **Wetland Compensation Plan.** • Other water features not directly included in the Plan will be inspected to detect hydrological changes potentially caused by the Project – these inspections will be outlined in the Plan.
Terrestrial Wildlife (7.9)	• Minimize the Project footprint. • Implement dust-prevention and dust abatement measures described above. • Implement a **Wetland Compensation Plan.** • Instruct workers to maintain good housekeeping practices and not leave out any food or garbage to avoid attracting wildlife.	• Routine site monitoring as described in the Environmental Management Plan will include maintaining records of bird mortality so developing issues related to lighting can be identified. • The Environmental Management Plan will include provisions describing specific management actions for at risk species (e.g.,

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VC	Mitigation	Monitoring
	• To minimize impacts on nesting landbirds, clearing will take place outside of the breeding season for most bird species (April 1 to September 1). If some clearing is necessary during the breeding season the Proponent will assess if the work can be undertaken without contravention of the *Migratory Birds Convention Act* and a contingency plan developed in consultation with CWS in order to maintain compliance with the *Act*. • If an Osprey, Bald Eagle or Northern Goshawk nest is found, even outside of the breeding season, a buffer zone will be placed around the nest and clearing will only occur outside of the buffer zone. • To discourage ground-nesting or burrow-nesting species, no large piles or patches of bare soil will be left uncovered or un-vegetated during the breeding season. • Should any ground- or burrow-nesting species initiate breeding activities on stockpiles or exposed areas, the Proponent will establish a 20 m buffer around the nest location and contact EC-CWS for further advice. • Noise suppression equipment such as mufflers on mobile equipment and fixed/portable engines will be maintained in original OEM working condition • The duration of noise disturbance will be minimized. • Lighting will be restricted to areas where it is necessary. • To minimize interference of nesting activities, workers will be asked to refrain from entering undisturbed habitat areas where no work is done. • In the event that impacts on migratory birds are detected during construction, further mitigation will be developed in consultation with NSDNR and EC. • Standard mitigation measures for noise (including blasting), as outlined in Section 7.2, will minimize impacts on terrestrial fauna. • As recommended by EC, ships en route will maintain a minimum distance of at least 300 m from any colony or island occupied by seabirds and waterbirds. • To minimize the risk to migrant birds, the minimum amount of pilot warning and obstruction avoidance lighting will be used on tall structures. • Lighting for the safety of the employees should be shielded to shine down and only to where it is needed, without compromising safety. • Street and parking lot lighting should also be shielded so that little escapes into the sky and it falls where it is required. • The protocol "*Best practices for stranded birds encountered offshore Atlantic Canada*" (EC 2014e) will be used for stranded seabirds. • White lights will be preferred for use on towers or high structures at night, as recommended by the US Fish and Wildlife Service (2003). Solid red or flashing red lights will be avoided as they appear	Mainland Moose, ground- or burrow-nesting species)

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VC	Mitigation	Monitoring
	to attract nocturnal migrants more than white flashing lights. • The operation of exterior decorative lights such as spotlights and floodlights, whose function are to highlight features of buildings or to illuminate an entire building, will be avoided unless safety is a factor. • High intensity lights, including floodlights, will be turned off at night outside of working hours, if possible, especially during the spring and fall migration period. • Where feasible, tinted or frosted glass windows will be used in buildings to reduce bird mortality from collisions.	
Freshwater Species and Habitat (7.10)	• As described in the **Erosion and Sediment Control Plan**, erosion control measures will be implemented to ensure that discharge water quality meets all relevant regulatory standards prior to discharge to receiving environment. • As described in the **Stormwater Management Plan**, stormwater will be collected in the pit and in ponds near the processing plant to ensure that uncontrolled runoff will not occur. • Overburden stockpiles, fuel and chemical storage facilities, and construction equipment will be located a minimum of 30 m from any pre-development water body. • Flagging tape will be used to delineate temporary work areas and control construction access near retained wetlands and water bodies to protect natural substrates and vegetation contributing to habitat and bank stability; • An **Emergency Response Spill Contingency Plan** will be prepared to prevent and manage the effects of any malfunctions and accidents.	• Fish habitat assessment and determination of presence/absence is proposed for Reynolds Brook above Hendsbee Lake. If fish are present, then a modest monitoring program is proposed for such time as quarry development begins to divert water away from its natural drainage to the south. This is not expected to occur before year 10 of quarry development. During construction and operation monitoring will focus on: • Condition and location of erosion and sediment control structures; • Water quality testing of stormwater discharge as outlined in the **Surface Water Monitoring Program**; • Ensuring overburden stockpiles, fuel and chemical storage facilities, and construction equipment are a minimum of 30m from any natural water body.

Marine Species and Habitat (7.11)	• An **Environmental Management Plan** will describe the following preventative and mitigation measures:
	  ○ Application of appropriate timing windows for all in-water work.
	  ○ Implementation of terrestrial erosion and sediment control measures.
	  ○ Use of surface water monitoring to ensure that quality meets all relevant regulatory standards prior to discharge to receiving environment.
	• Install overburden stockpiles, fuel and chemical storage facilities a minimum of 30 m from Chedabucto Bay.
	• Implement an Emergency Response and Spill Contingency Plan for Accidents and Malfunctions.
	• If effects from blasting vibrations exceed the DFO thresholds, then a site specific standard to protect fish and an appropriately scaled fish and fish habitat offset plan will be implemented.
		• **Fisheries Offset Program** and associated monitoring for effectiveness.
		• Concussion and ground vibration monitoring during each blast to ensure limits established by DFO for the marine environment are respected.

VC	Mitigation	Monitoring
	• Control ballast water release via "*Ballast Water Control and Management Regulations*" and the requirements as per the International Convention for the control and Management of Ship's Ballast Water and Sediments. • Equip the ship loader with aggregate spill containment features. • Implement a Fisheries Offset Program to recreate fish habitat that has suffered "serious harm".	
Species at Risk (SAR) and of Conservation Concern (SOCC) (7.12)	• Mitigation for potential effects on SAR and SOCC are similar to recommendations for terrestrial or marine fauna as a whole. Standard mitigation measures such as minimization of Project footprint, dust control, emissions control, and monitoring of air quality targets as detailed in Sections 7.7 and 7.1 will be sufficient to protect many SAR and SOCC, if present. • Standard handling and storage procedures for hazardous material, as well as procedures for handling and disposal of contaminated soils (outlined in Section 7.18), will adequately mitigate the potential for exposure of Moose and bird SAR/SOCC to any hazardous materials or contaminated soils. • Strict reporting policies for any suspected hunting activities will help to minimize any potential Moose poaching in the Project area. • Imposing a 50 km/hr speed limit will reduce the potential for vehicle-moose collisions. It will also decrease encounters between humans and Moose. • Exposed soils and soil stockpiles will be adequately covered or vegetated to deter Common Nighthawks from nesting on them. • Should Common Nighthawks initiate breeding, the Proponent will establish a 20 m buffer around the location once identified, and contact CWS for further advice.	• Mainland Moose surveys (presence/absence and use) will be performed annually for up to three years after construction is initiated. • Regular inspections for Common Nighthawk nests.
Local Economy, Land and Resource Use (7.13)	• Recreational users will be notified of restricted access by signage at the entrance to the construction site. • Vessels will not be refuelled at the marine terminal and fuel used at the quarry will be kept in double hulled reservoirs or will be placed within secondary containment and will be protected against collision. This helps to minimize the risk of accidents at the terminal. • Navigational safety mitigation measures and emergency response planning measures are presented in Section 7.18.3. • As part of the Environmental Management Plan, implement an Emergency Response and Spill Contingency Plan in advance of any accident or malfunction causing a spill in the marine environment. • The Proponent will contract with a local emergency response organisation to ensure supplementary emergency resources are available if needed.	• None proposed
Tourism and	• Recreational users will be notified of restricted access by signage at the entrance to the	• None proposed

VC	Mitigation	Monitoring
Recreation (7.14)	construction site. • Vessels will not be refuelled at the marine terminal and fuel used at the quarry will be kept in double hulled reservoirs protected against collision. This helps to minimize the risk of accidents at the terminal. • Navigational safety mitigation measures and emergency response planning measures are presented in Section 7.18.3. • As part of the Environmental Management Plan, implement an Emergency Response and Spill Contingency Plan in advance of any accident or malfunction causing a spill in the marine environment. • The Proponent will contract with a local emergency response organisation to ensure supplementary emergency resources are available if needed.	
Commercial Fisheries (7.15)	• Minimize the impact of construction in the marine environment during and after lobster fishing season to the extent possible. For example: standard construction best management practices and mitigation measures to control onshore sediment release to the marine environment will be implemented (Section 7.6 and Section 7.11). • The quarry site office will be manned 24 hrs/day so that fishermen can telephone to receive information regarding vessel arrival and departures. The phone number can also be used to report loss or damage to gear caused by Project-related vessel traffic. • Construction and regular use of the marine terminal will require a safety exclusion zone around the terminal. Loss of these fishing grounds will be mitigated through the creation of new lobster habitat as described in the Fisheries Offset Program to be established in collaboration with local fishermen and DFO. • Routine communication with potentially affected Mi'kmaq will occur through the CLC to which they have been invited to sit as members or through other means as established by both parties.	• Monitoring terminal operations and fishing access in response to concerns expressed by local fishing community, as needed; • Monitoring of the effectiveness of the marine Fisheries Offset Program for a minimum of three years during and after marine terminal construction until it can be demonstrated that the program objectives have been met.
Archaeological/ Heritage Resources (7.16)	• Prior to construction, implement a Cultural Resource Management Plan to guide site personnel in the event that archaeological and heritage resources are identified during construction. The Plan specifies a notification procedure if remains are found, and will describe specific preservation measures as needed. • These mitigation measures would be approved by the Minister of the Department of Communities, Culture and Heritage before site construction could begin. • Exploratory excavation will likely be required in those areas that may be disturbed during Project construction.	• Follow up pre-construction excavation to investigate heritage resources that will be lost during project construction • Monitor construction activities near known or suspected cultural resources.
Mi'kmaq Land and Resource Use	• While there is currently no Mi'Kmaq harvesting on the site or in waters immediately adjacent, it is intended that the non-hazardous portions of the Project site and adjacent waters will be accessible	• Monitoring of progress and implementation of MOU and any other agreements reached with other First Nation communities.

VC	Mitigation	Monitoring
(7.17)	to Mi'kmaq for harvesting for flora and fauna for food, social and ceremonial purposes, to the extent this is not precluded by safety consideration • Any future potential Project impacts (environmental, social and economic) on these harvesting activities will be a matter of the formal and regular meetings with the Mi'kmaq community representatives. • In the event that archaeological remains are excavated, recommended guidelines as directed by the Nova Scotia Communities, Culture, and Heritage Coordinator of Special Places will be employed. Should evidence of aboriginal archeological remains be uncovered all activity will cease until Mi'kmaq archaeological experts have had an opportunity to examine the site and determine appropriate action.	• Mi'kmaq resource harvesting activities will be reviewed with Mi'kmaq representatives at the Community Liaison Committee meetings.

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8.0 PROPOSED SIGNIFICANCE DETERMINATION

Thresholds are used to define a level beyond which a residual environmental effect (i.e., an effect that remains after the application of mitigation measures) would be considered significant or unacceptable. These thresholds are based on applicable regulation, if available, or on standards, resource management objectives, or the preservation of ecological sustainability. VC-specific significance thresholds defined for the Black Point Project are given in Table 11, which also demonstrates that no significant residual environmental effects are expected.

Table 11:
Residual Adverse Effects, Significance Thresholds and Significance

VC and Residual Adverse Effects	Threshold for Determination of Significance	Significance of Residual Adverse Effect
Air Quality and Climate Change		
Fugitive dust emissions from site preparation, quarrying, crushing, stockpiling, vehicle traffic and off loading	An exceedance of the Nova Scotia or CCME ambient air quality standards at a residential or commercial location outside the property boundary, where the exceedance is due to emissions from the operation and the event occurs more than twice in the period of time that the standard is based	Not Significant
Emissions of fuel combustion products from site vehicles and generators	As above	Not Significant
Noise (Terrestrial)		
Ambient noise perceived by residents living around the site during construction (road building, vehicle traffic, blasting, crushing, marine terminal construction)	An exceedance of the maximum noise or vibration limits listed in the *Pit and Quarry Guidelines* at or beyond the property boundary, where the exceedance is due to noise from the operation and the event occurs more than twice in the period of time that the standard is based.	Not Significant
Ambient noise perceived by residents living around the site during operation (blasting, loading, crushing, screening, offloading)	As above	Not Significant
Ambient Light		
Increased ambient light from the Project construction and operation, including operation of the marine terminal	Direct light trespass that according to the affected resident regularly interferes with the use and enjoyment of nearby residential properties on a permanent basis.	Not Significant
Attraction or disturbance of nocturnal wildlife and/or migrating birds	Evidence of unacceptable levels of bird mortality associated with Project lighting (mortality or injury of ten or more migratory birds in a single event, or of any number of species at risk birds).	Not Significant
Geology, Soil and Sediment Quality		
Surface water discharge to the marine environment	An accidental release of low pH, acid rock drainage to the marine environment.	Not Significant
As above	An accidental release of total suspended solids in	Not Significant

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VC and Residual Adverse Effects	Threshold for Determination of Significance	Significance of Residual Adverse Effect
	excess of the maximum values listed in the CCME (1999) Water Quality Guidelines for the Protection of Aquatic Life (Marine) and/or the Nova Scotia Pit and Quarry Guidelines (NSEL 1999).	
Groundwater Resources		
Reduction in groundwater recharge to offsite surface water features; changes to groundwater quality	A decrease in groundwater supply to Adjacent Areas by 20% and/or an impairment in water quality such that groundwater discharge to surface waterbodies no longer meets Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (CCME 1999 as updated).	Not Significant
Marine and Surface Water Resources		
Changes to surface water quality	Discharge from the site exceeds the liquid effluent discharge standards in the *Pit and Quarry Guidelines* (NSEL 1999) or criteria listed in the CCME *Canadian Water Quality Guidelines for the Protection of Aquatic Life*, both freshwater and marine (CCME 1999).	Not Significant
Effects on Reynolds Brook and Murphys Lake from diversion of surface and groundwater into the pit over time	A predicted change in the mean annual runoff within any off-site watercourse, or flow into any water body which changes by 20%. A predicted change in peak flow of water discharged from the site which will measurably increase the risk of flooding to downstream watercourses	Not Significant
Terrestrial Ecosystems		
Habitat loss / plant mortality	A decline in abundance and/or a change in distribution beyond which natural recruitment would not return the population to its pre-project level within several (3-5) generations.	Not Significant
Wetlands		
Progressive habitat loss due to Project construction and operation over 50 years	An effect that is likely to cause a permanent net loss of wetland function as established during the wetland evaluation.	Not Significant following compensation
Changes to wetland hydrology and water quality resulting in habitat loss	As above.	Not Significant
Terrestrial Wildlife		
Habitat loss / fragmentation	An effect that causes a decline in abundance and/ or a change in distribution beyond which natural	Not Significant

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VC and Residual Adverse Effects	Threshold for Determination of Significance	Significance of Residual Adverse Effect
	recruitment would not return the population to its pre-project level within several (three to five) generations	
Wildlife disturbance	As above	Not Significant
Disturbance of seabirds and waterfowl	As above	Not Significant
Freshwater Species and Habitat		
Effects on Reynolds Brook from diversion of surface and groundwater into the pit over time	A permanent, irreplaceable loss of Freshwater Species and Habitat that are part of or support a commercial, recreational or Aboriginal fishery.	Not Significant
Marine Species and Habitat		
Temporary noise and vibration effects to marine biota	1. Adverse and irreversible changes to critical habitats; 2. Serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish species that support such a fishery; 3. Permanent impairment of the ecological functioning of the biotic community; and/or 4. Increased ecological risk to a level that long term effects to the health of aquatic biota is predicted.	Not Significant
Permanent loss of habitat resulting from the construction and operation of the marine terminal	As above	Not Significant following Offset
Species at Risk (SAR)		
Terrestrial Flora and Fauna SAR/SOCC - Clearing and site preparation will result in habitat loss and fragmentation and SOCC plant mortality	An effect that causes a decline in abundance and/ or a change in distribution beyond which natural recruitment would not return the population to its pre-project level within several generations and/or an adverse effect that causes a net loss of habitat function	Not Significant
Terrestrial Fauna SAR/SOCC - Change in behavior as a result of noise and light (including blasting).	As above	Not Significant
Marine SAR/SOCC - Loss of fish habitat due to construction of marine terminal	As above	Not Significant

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VC and Residual Adverse Effects	Threshold for Determination of Significance	Significance of Residual Adverse Effect
Marine SAR/SOCC - Disturbance and potential change in behavior due to noise from ship traffic, pile driving and blasting	As above	Not Significant
Economy, Land and Resource Use		
Change in land use from occasional recreational/trapping to quarry, with resulting limitations on these activities	Pervasive change in land use patterns within the Study Area that adversely affects a community's use of that land and/or is inconsistent with a designated land use established through a municipal planning process.	Not Significant
Tourism and Recreation		
A decrease in wilderness/nature oriented recreation and tourism within the Project Area and vicinity due to vessel traffic and actual or perceived noise, dust and light	A permanent and widespread change in tourism or recreational activities such that people are no longer able to undertake these activities within the municipality and/or that result in a significant loss of tourism related revenue to local businesses.	Not Significant
Commercial Fisheries		
Temporary loss of lobster fishing grounds due to the marine terminal construction and operation and, as a result, displacement of fishermen into other areas	1. An uncompensated loss of habitat of those fish species that are used for, or support commercial, recreational and/or Aboriginal fisheries; or 2. A sustained decrease in earnings from a fishery due to lower catch quantity and/or quality, or increased fishing costs (i.e., due to longer travel times, loss of gear, additional license fees, etc).	Not Significant following Offset
Archaeological and Heritage Resources		
None anticipated	An uncontrolled disturbance to, or destruction of, any historical resource considered by the First Nations, provincial regulators or local residents to be of major importance.	Not Significant
Aboriginal Land and Resource Use		
Loss of future opportunities to harvest traditional terrestrial resources on portions of the property (there is currently no harvesting on the site)	Loss of fishing employment/income that could not be replaced within a reasonable time, loss of food resources not present in reasonable proximity to communities, or permanent loss of cultural relationship with the lands, flora and fauna.	Not Significant
Harm to or dispersion of local	As above	Not Significant

VC and Residual Adverse Effects	Threshold for Determination of Significance	Significance of Residual Adverse Effect
wildlife; Potential depreciation of the quality of local food and medicinal plants; Potential degradation of the local marine and shoreline habitats		

8.1 Conclusions of the Proponent

As progressively described within this EIS, a series of Project-environment interactions can be expected during the construction, operation and decommissioning of the Black Point Quarry Project. These interactions and their resulting effects on the environment are entirely consistent with and typical of environmental impacts of natural resource development projects in Nova Scotia and elsewhere in Canada. For many reasons the Project site is well suited for a quarry operation. The large, chemically stable granite resource is not used as a potable water supply, the nearest residential property are not situated at the property boundary but rather hundreds or thousands of meters away, the quarry face is directed across open water rather than toward residential development, the resource is located near a deep water, ice free shipping route to a major commercial market, prime fishing areas can be avoided or in the case of lobster habitat occupied by the marine terminal, can be recreated in the immediate vicinity, etc.

Given these considerations and a number of others, the Proponent concludes that the Project is not likely to result in any significant adverse residual environmental effects. In contrast, the Black Point Quarry Project is expected to result in long term direct and indirect employment opportunities, in addition to other positive economic benefits for the local, regional and provincial economies.

9.0 ACRONYM LIST

asl: above sea level

CEA Agency: Canadian Environmental Assessment Agency

CLC: Community Liaison Committee

dBA: A-weight decibels

EIS: Environmental Impact Statement

GCIFA: Guysborough County Inshore Fishermen's Association

ha: hectares

km: kilometers

KMK: Kwilmu'kw Maw-Klusuaqn Negotiations Office

m: meters

MODG: Municipality of the District of Guysborough

MOU: memorandum of understanding

MT: million metric tonnes

NSESA: Nova Scotia Endangered Species Act

PM_{10}: particulate matter up to particle size 10 microns

$PM_{2.5}$: particulate matter up to particle size 2.5 microns

SAR species at risk

SOCC: species of conservation concern

TPH: tonnes per hour

TPM: total particulate matter

TSP: total suspended particulate

VCs: Valued Components

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Whitehorse, YT Y1A 1N2
Canada
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Unit 44, 5022 49 Street
Yellowknife, NT X1A 3R8
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Black Point Quarry Project
Municipality of the District of Guysborough, NS

Environmental Impact Statement

PART 1 Sections 1-5

Vulcan Materials Company

February 2015

C 1340-104

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1.0 PROJECT INTRODUCTION

1.1 Report Organization

This Environmental Impact Statement (EIS) is organized to reflect the process by which the environmental assessment was conducted. The EIS begins with an introduction to the Project and Proponent. This is followed by a description of the regulatory framework within which the Project will be assessed, a detailed description of the construction, operation, and decommissioning of the Project, a description of alternatives that were considered during Project planning, and a description of the environmental effects methodology that was used.

These sections are followed by a description of the biophysical environment in which the Project will be constructed and operated. Information from these sections is then used to assess the effects of the Project on the biophysical and human environments and identify measures that will be taken to limit or eliminate those effects. Monitoring programs that will help determine the accuracy of the predicted residual impacts are also presented.

A separate section describes the public, First Nation and stakeholder engagement programs that have been, and will continue to be, undertaken. The report closes with a summary describing the effects of the Project on the environment, the effects of the environment on the Project and the cumulative effects from other anticipated developments in the region. In more detail:

Section 1.0 Project Introduction introduces the Project and Proponent and provides background information on the Project. Project location, scope and schedule are presented. Project activities are described in a general way.

Section 2.0 Regulatory Framework describes the primary federal and provincial laws and regulations that mandate and guide the environmental assessment process, as well as the principal laws, regulations and policies that the Project is subject to.

Section 3.0 Project Description provides a comprehensive description of the Project during all phases of development. It lists the project components and structures, outlines the layout of the various facilities and infrastructure, describes site operations and lists emissions and discharges during construction, operation and decommissioning.

Section 4.0 Alternatives to the Project describes alternative means of carrying out the Project that were considered during Project planning, and why the current version of the Project is preferred.

Section 5.0 Environmental Effects Assessment Methodology describes the assessment methodology employed for the EIS. The methodology outlines how each "Valued Component" or VC was chosen, lists probable project-environment interactions, and describes the size of the different study areas selected for the EIS.

Section 6.0 Existing Environment describes the physical, terrestrial, marine and socio-economic characteristics of the study areas. A total of thirteen subject categories are described, ranging from surface and groundwater resources, through marine and terrestrial habitat to First

Nation interests, shipping, and commercial fisheries. This section provides the background or context to Project development.

Section 7.0 Environmental Effects Assessment provides the results of the environmental effects assessment for each VC selected in Section 5.0. Mitigation measures that will be applied to limit or eliminate project effects on the human and ecological environments are also described, and any residual effects or impacts are listed.

Section 8.0 Effects of the Environment on the Project describes the possible effects of severe weather, climate change, and other events on the Project.

Section 9.0 Cumulative Effects considers other anticipated projects in the region and describes how effects from each of these other projects may combine to cause more intense or more regional effects than the Black Point Project alone.

Section 10.0 Proposed Compliance and Effects Monitoring Programs summarizes information first presented in the Effects Assessment (Section 7.0) into a single location so that all proposed follow-up monitoring programs can be reviewed together. The monitoring programs are intended to verify the nature and scope of the predicted impacts, or the lack of impacts, during Project construction and operation.

Section 11.0 Consultation and Engagement Programs lists and describes the various outreach efforts the Proponent has made to the different stakeholder communities over the course of the environmental assessment.

Section 12.0 Assessment Summary and Conclusion summarizes the findings of the EIS, and includes a discussion of residual Project-related effects on the environment, probable effects of the environment on the Project and cumulative effects.

A series of technical reports and other supporting information are contained in the appendices.

1.2 Project Overview

Vulcan Materials Company (Vulcan), a U.S.-based aggregate producer and Morien Resources Corporation (Morien), a Nova Scotia-based resource development company, have jointly prepared this Environmental Impact Statement (EIS), which outlines the proposed development, operation, and decommissioning and abandonment of a hard rock quarry and marine terminal at Black Point in Guysborough County, Nova Scotia (**Figure 1.0-1**). Black Point Aggregates Inc., a wholly owned subsidiary of Vulcan Materials Company, is the named Proponent of the Project. Following the environmental assessment process, Black Point Aggregates Inc. will develop and operate the quarry and marine terminal.

The anticipated average annual production rate will exceed 1.0 million tonnes (MT) with a peak production rate of 7.5 MT per year, should market conditions warrant this production rate. The Project is anticipated to have capital costs on the order of US$80-$110 million and will be a significant employer in Guysborough County throughout the expected 50+ year lifespan of the quarry. The total property is 354.5 ha; the finished quarry will occupy approximately 180 ha while the processing plant, administration and stockpile areas together will occupy approximately 28 ha.

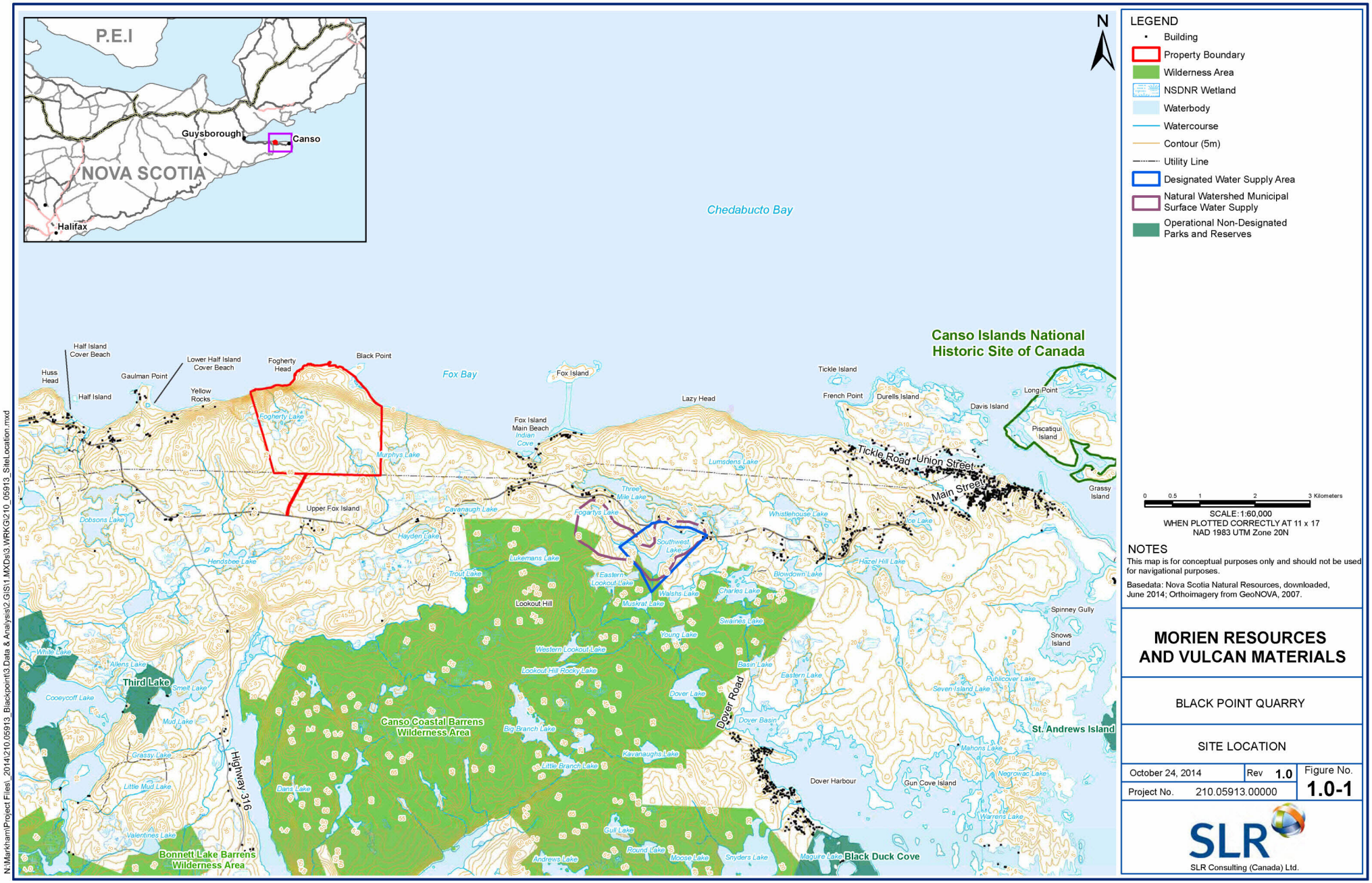
This EIS has been prepared to obtain approval pursuant to the federal *Canadian Environmental Assessment Act, 2012* and, at the same time, approval for a Class I undertaking pursuant to the provincial *Environmental Assessment Regulations* made under the Nova Scotia *Environment Act*.

The site for the proposed Project was selected primarily due to the quantity and superior quality of granite rock, combined with thin to non-existent overburden. Rock reserves in the proposed quarry are estimated at more than 400 MT. Also, the proposed quarry is adjacent to deep water, which is sheltered and ice-free. This enables the construction and safe operation of a deep water marine terminal for aggregate shipment. Aggregate from the quarry will be transported in bulk carrier ships, as large as Panamax-sized (up to 70,000 deadweight tonnage or DWT), to ports along the eastern and Gulf coast markets of the U.S.

Electrical power for buildings and equipment (pumps, conveyors, crushers, screens, and ship loading) will be supplied through a tie-in to the existing Nova Scotia Power Inc. (NSPI) electrical transmission line that forms the southern Property boundary. A single pole, 2.5 km long high voltage transmission line (20 m wide right of way) will bring power to the site. A transformer sub-station will be required to reduce the voltage for the quarry.

Other utilities will include domestic water supply and sewage management or disposal system to facilitate the needs of on-site workers. Entrance to the quarry will be via an access road to be constructed from provincial Route 16 (Marine Drive).

At this time, no public funding is being sought to undertake this Project.



LEGEND

- Building
- Property Boundary
- Wilderness Area
- NSDNR Wetland
- Waterbody
- Watercourse
- Contour (5m)
- Utility Line
- Designated Water Supply Area
- Natural Watershed Municipal Surface Water Supply
- Operational Non-Designated Parks and Reserves

0 0.5 1 2 3 Kilometers

SCALE: 1:60,000
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

MORIEN RESOURCES AND VULCAN MATERIALS

BLACK POINT QUARRY

SITE LOCATION

October 24, 2014	Rev 1.0	Figure No. 1.0-1
Project No. 210.05913.00000		

SLR Consulting (Canada) Ltd.

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C 1340-112

1.3 Project Location

The lands to be developed are owned by the Municipality of the District of Guysborough (MODG) and will be leased to the Proponent. The property is currently undeveloped and is zoned Industrial Heavy I-2 (pers. comm. D. Torrey, 2014). Permitted uses for this zoning includes, among other activities, "rock quarry operation or open-pit mines from which rocks or minerals are extracted" (MODG 2013). The approximate center of the Project site is located at:

45º21'13.25"N

61º08'56.15"W

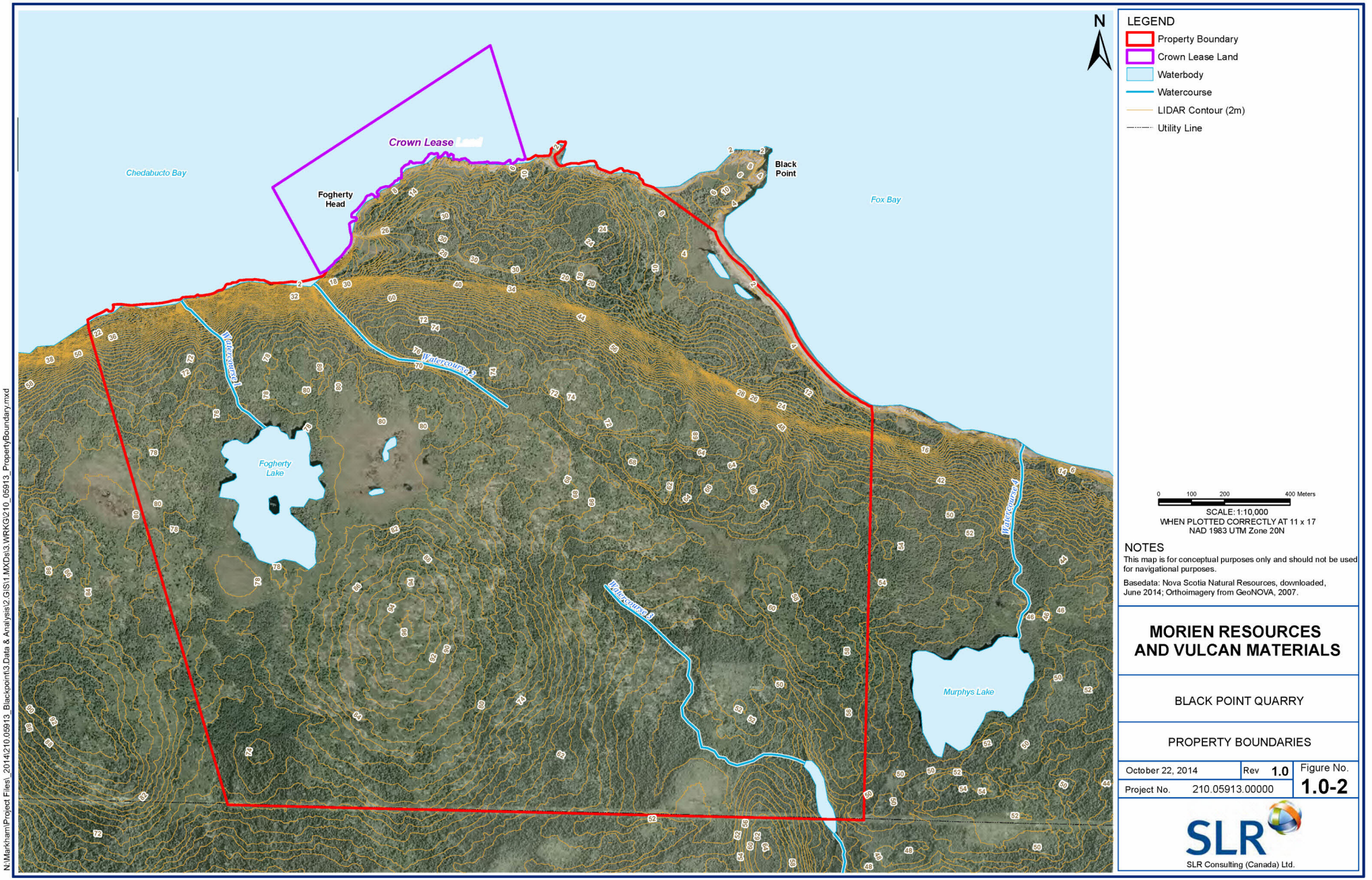
The municipal land designated for the Project consists of properties assembled through a land exchange with the Province and through expropriation of private lands. The property reference numbers are provided in Table 1.1.

Table 1.1:
Black Point Quarry Property Identification Numbers

Assembled Through Land Exchange w/ Province	Assembled Through Expropriation
1: 35212521	7: 35044056
2: 35212497	8: 35214014
3: 35212505	9: 35214022
4: 35213990	10: 35093210
5: 35212513	
6: 35212539	

The generalized property boundaries are shown on **Figures 1.0-1** and **1.0-2**. Table 1.2 provides coordinates for the four corners of the proposed Project area and the submerged Crown Land Lease that will host the marine terminal. The submerged Crown Land Lease has not yet been granted. The land parcel that includes Black Point itself is Crown land; this parcel is not included in the Project.

The provincial Crown Land in the marine environment needed for the marine terminal has not been previously used as a marine terminal and has not been so designated by the MODG. The Proponent has worked with the MODG and has made application to the Nova Scotia Department of Natural Resources (NSDNR) to lease a portion of the seabed extending from the ordinary high water mark north approximately 300 m to allow for construction and operation of the terminal, shown on **Figure 1.0-3.**


N
Crown Lease Land
Chedabucto Bay
Fogherty Head
Black Point
Fox Bay
Watercourse 1
Watercourse 2
Watercourse 3
Watercourse 4
Fogherty Lake
Murphys Lake
LEGEND
Property Boundary
Crown Lease Land
Waterbody
Watercourse
LIDAR Contour (2m)
Utility Line
0 100 200 400 Meters
SCALE: 1:10,000
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N
NOTES
This map is for conceptual purposes only and should not be used for navigational purposes.
Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.
MORIEN RESOURCES AND VULCAN MATERIALS
BLACK POINT QUARRY
PROPERTY BOUNDARIES
October 22, 2014
Rev 1.0
Figure No. 1.0-2
Project No. 210.05913.00000
SLR Consulting (Canada) Ltd.
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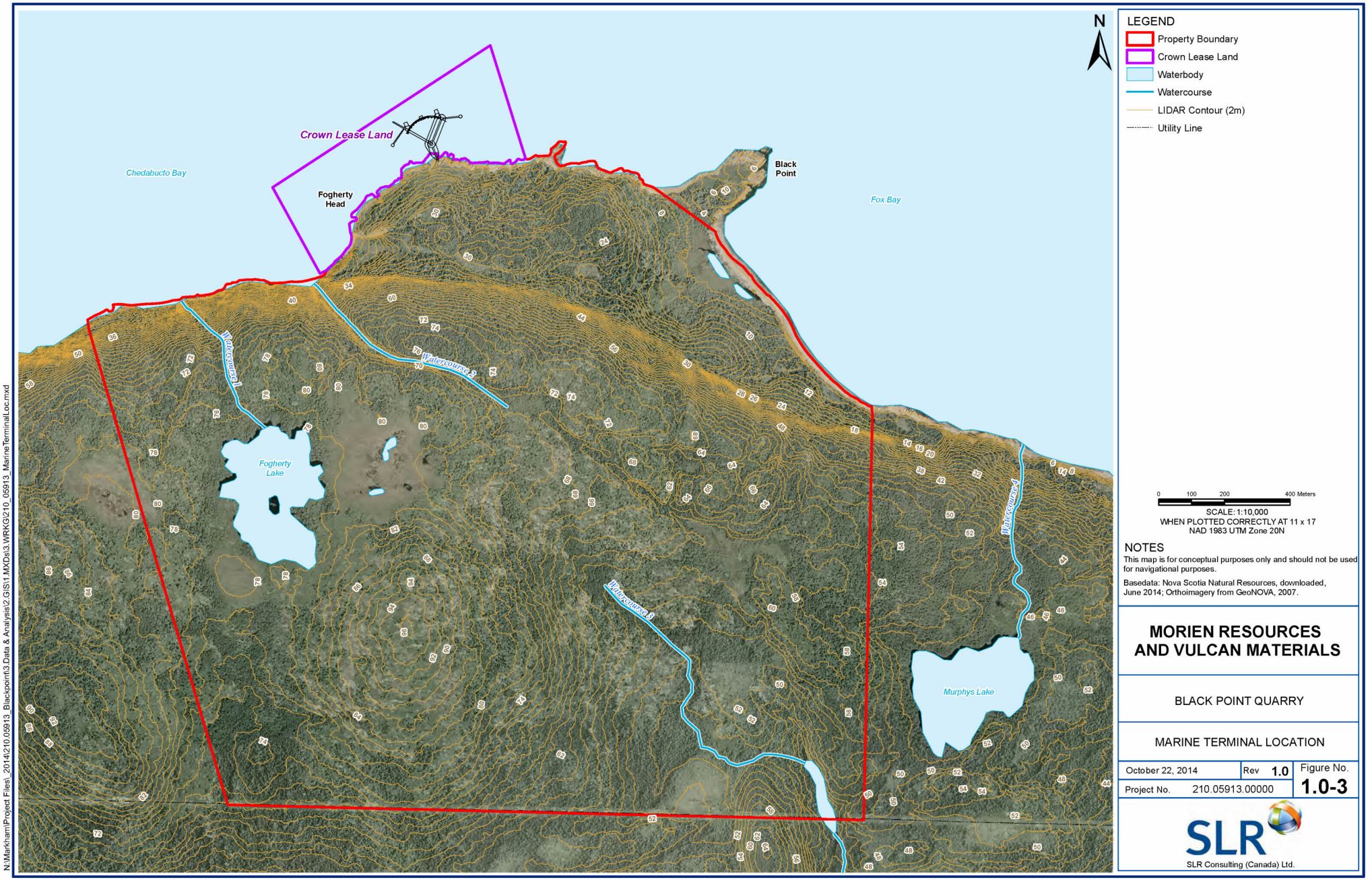
C 1340-114

Table 1.2:
Proposed Boundary Coordinates

Boundary Location	Easting	Northing
Terrestrial Property		
North West Corner	643573.480	5023895.438
South West Corner	644005.711	5022431.120
South East Corner	645930.498	5022389.912
North East Corner	645955.893	5023627.756
Submerged Crown Land Lease		
North West Corner	644130.37	5024312.49
South West Corner	644275.16	5024050.04
South East Corner	644900.62	5024394.53
North East Corner	644791.83	5024744.29



LEGEND

- Property Boundary
- Crown Lease Land
- Waterbody
- Watercourse
- LIDAR Contour (2m)
- Utility Line

0 100 200 400 Meters

SCALE: 1:10,000
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

MORIEN RESOURCES AND VULCAN MATERIALS

BLACK POINT QUARRY

MARINE TERMINAL LOCATION

October 22, 2014	Rev 1.0	Figure No. 1.0-3
Project No. 210.05913.00000		

SLR Consulting (Canada) Ltd.

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C 1340-116

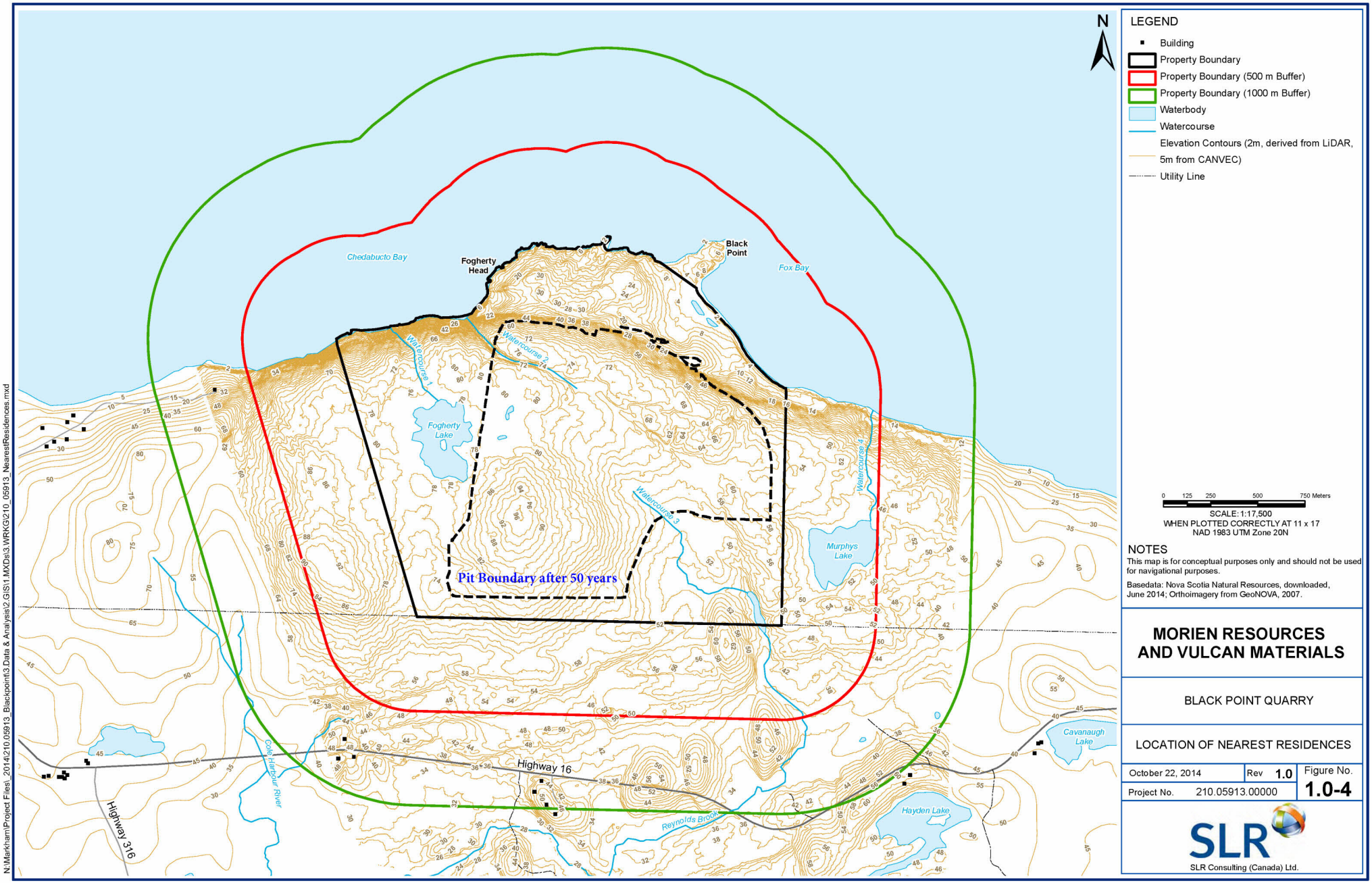
1.4 Geographical Setting

The quarry is proposed for a 354.5 ha property located on the south shore of Chedabucto Bay approximately 4.0 km east of Fox Island in Guysborough County, Nova Scotia. The Project is bound to the north by Chedabucto Bay and to the south by a 69 kV power transmission line. No terrestrial federal lands will be used to undertake this project. The nearest federal lands are the Canso Islands National Historic Site of Canada (which includes the Grassy Island Forts site) located approximately 10 km due east of Black Point (**Figure 1.0-1**).

Although the marine terminal will be constructed within the limits of a provincial seabed Crown Land Lease, aggregate shipping will occur on "federal lands" as defined in CEAA 2012 (S.2b). Federal land in this context refers that portion of the ocean claimed by Canada.

The Project site is located on an undulating granite hill with minimal soil cover and overburden. The hill, which has a maximum elevation of approximately 96 m above sea level (asl), is sloped to the north where a cliff is present. The site levels off abruptly at approximately 22 m asl where it gradually grades to the rocky coast. The regional geology consists of Ordovician age metamorphosed sediments of the Halifax and Goldenville formations, intruded by Devonian age granites (Erdene 2011). The granite is the rock that will be quarried and crushed to produce aggregate.

All blasting will occur more than 900 m away from any residential structures. There are no hospitals, retirement hospices, schools or day care centres located within 5 km of the site. Provincial Route 16 (Marine Drive) runs parallel to the southern boundary of the Project site and is located approximately 750 m south of the site. Residential development in the vicinity of the Project is relatively rare, with no residential structures within 500 m of the property line and fewer than seven within 1.0 km of the property boundary (**Figure 1.0-4**). The nearest residence (an abandoned trailer home, for sale as of September 2014) is approximately 700 m west of the property boundary along Half Island Cove Road. A cluster of three residences is located along Route 16 approximately 750 m southwest of the property boundary. In fact, the quarry will not occupy the entire property; quarrying will stop 95 m inside the eastern property boundary, 125 m inside the southern property boundary and 225 m inside the western property boundary (**Figure 1.0-4**).



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LEGEND

- Building
- Property Boundary
- Property Boundary (500 m Buffer)
- Property Boundary (1000 m Buffer)
- Waterbody
- Watercourse
- Elevation Contours (2m, derived from LiDAR, 5m from CANVEC)
- Utility Line

0 125 250 500 750 Meters

SCALE: 1:17,500
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

MORIEN RESOURCES AND VULCAN MATERIALS

BLACK POINT QUARRY

LOCATION OF NEAREST RESIDENCES

October 22, 2014	Rev 1.0	Figure No. 1.0-4
Project No. 210.05913.00000		

SLR Consulting (Canada) Ltd.

C 1340-118

1.5 Ecological Overview

The 354.5 ha property measures approximately 2.75 km from east to west and is generally less than 2.0 km wide from north to south. Much of the terrain at higher elevations consists of exposed bedrock interspersed with thin, patchy vegetation and stunted trees. Vegetation and tree cover thicken at lower elevations on the flanks of the exposed granite dome. The massive granite rock limits infiltration of rainwater and snowmelt, resulting in a number of wetlands distributed across the property at lower elevations. In these areas (e.g., around Fogherty Lake) and extending north to the coast, wetlands mixed with mature black and red spruce forest dominate the landscape.

There are three unnamed watercourses on the site, including the outflow from Fogherty Lake, the only lake on the Black Point property (**Figure 1.0-4**). The watercourses are narrow, shallow and do not contain fish. One stream is ephemeral. Fogherty Lake is approximately 6.8 ha in surface area, but is relatively shallow and is strongly acidic. Water in the lake is dark brown and visibility is limited. Nearby Murphys Lake (6.0 ha in area) located east of the Black Point Property is also acidic and is ringed by wetlands.

A number of habitat types are encountered within the Project site. Most of the area is covered by a mosaic of barren vegetation, tall shrub barren, and some coniferous forest. There are also patches of mixed forest, and wetlands such as treed bog, open bog, fen, and swamp scattered throughout the Project site. A variety of other habitat types are also present, including beaches, coastal barren headlands, coastal cliffs, regenerating forests, and lakes.

NSDNR's Restricted and Limited Land Use map shows the following features in proximity to the proposed Project (**Figure 1.0-1**).

- Three private beaches protected under the Beaches Protection Act
  - Lower Half Island Cove 1.5 km west
  - Half Island Cove 2.7 km west
  - Fox Island Main 2.55 km east

- Two Wilderness Areas
  - the Bonnet Lake Barrens Wilderness Area (6.9 km southwest)
  - the Canso Coastal Barrens Wilderness Area (1.7 km south and east);

- A Designated Water Supply Area
  - Walsh or Wilkins Lake 4.5 km south and east;

- A Natural Watershed Municipal Surface Water Supply
  - Located 3.65 km south and east; and,

- Third Lake Operational Non-Designated Parks and Reserve
  - Located 4.2 km south and west.

1.6 Participants in the Environmental Assessment

1.6.1 Proponent

Table 1.3:
Project Proponent Contact Information

Project:	Black Point Quarry Project
Proponent:	Black Point Aggregates Inc.
Postal Address:	1200 Urban Center Drive Birmingham, Alabama USA 35242
Contact Name:	Mr. Frank Lieth, Vice-President
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1.6.2 Corporate Information

As noted, the Proponent Black Point Aggregates Inc. is a wholly owned subsidiary of Vulcan Materials Company (Vulcan). Vulcan is a publically traded company with stock listing on the New York Stock Exchange under the symbol VMC. The corporate office for Vulcan is located in Birmingham, Alabama. Company governance is overseen by the Company's Board of Directors, which is majority controlled by non-Vulcan affiliated directors.

The President and Chief Executive Officer is Mr. J. Thomas Hill, who also serves on the Board of Directors. The company has a talented and experienced management team that oversees the company's 340+ facilities located in 20 states, Mexico and the Bahamas. Vulcan employs a local management model that organizes the operations into geography- and market-based regions. Each region has a management team responsible for providing direction and management oversight to the operations.

Vulcan has extensive corporate policies and procedures that apply to the company's operations and employees. These policies and procedures ensure consistency across the company with respect to the expectations, responsibilities and operation of various functional areas (e.g., accounting and finance, legal, human resources, etc.). The Safety, Health and Environmental Policy (SHE Policy) specifically addresses the company's commitment and direction regarding SHE issues. The SHE Policy is described in Section 1.6.3.

The Black Point Project will be subject to the same liability protection measures that are provided for other Vulcan operations. The primary liability protection measures are described below:

- Liability protection begins with minimizing the risk of an incident that could create liability. Risk is minimized by incorporating best management and proactive oversight procedures in the design, construction and operation of a project; such measures include:
    - Incorporation of safety protection measures in facility design such as equipment guarding, safe means of access to equipment, benching in quarry pit, etc; and implementation of Vulcan's safety management system to ensure that safe work procedures are followed to minimize the risk of employee injury during equipment maintenance and other work activities;
    - Implementation of Vulcan's Occupational Health and Safety Program that ensures that the employees are protected from work place exposures that could impact their health. The two areas of primary focus in a quarry setting are the control of worker exposure to noise and dust. The employee noise exposure limit applicable to the Black Point operation is 85 dB(A) for an 8-hour work shift. The work place employee exposure limit for crystalline silica exposures is 25 ug/m^3 for an 8 hours work shift.
    - Implementation of environmental control measures including dust control systems, containment systems for fuel storage tanks, water treatment systems, site drainage control and implementation of storm water management controls, and other measures that reduce the risk of environmental incidents that could create liability.
    - Training and supervision to ensure employees know how to do their jobs safely, and that they have the knowledge and experience to recognize and react to risks before an incident occurs. Vulcan will provide extensive training to all Black Point employees.
    - Work place and equipment inspections to identify conditions that could result in an incident so these conditions can be modified before an incident occurs. The Black Point Project site will be routinely inspected by plant employees and supervisors to ensure that issues are identified and addressed.

- The Black Point operation will maintain an Emergency Response and Spill Contingency Plan that the employees will be trained to implement in the event of an incident. The plan will outline the steps to be taken, responsibilities of key personnel, notification procedures for alerting emergency response agencies and regulatory agencies, and other measures to be implemented in the case of an emergency or major incident. The Black Point operation will coordinate with local response agencies on response procedures. Supplementary to this Plan, any additional response documents and plans specified by Canadian or Provincial regulations will be prepared and maintained as required.

- The Corporate Risk Management department at Vulcan's head office in Birmingham, Alabama is responsible for management of liabilities associated with the various business units, including any liabilities that arise due to the Black Point operation. Vulcan is self-insured for losses related to workers' compensation up to $2,000,000 (US) per occurrence and automotive and general/product liability up to $3,000,000 (US) per occurrence. Vulcan has excess coverage on a per occurrence basis beyond these retention levels. Additionally,

Vulcan maintains insurance coverage for excess liabilities that could arise and that are beyond the level that Vulcan desires to cover through the self-insurance process.

1.6.3 Safety Health and Environmental Policy

As approved by the Board, Vulcan's SHE policy applies companywide, including all subsidiaries. It affirms that Vulcan will be a responsible steward with respect to the safety, health and environmental impact of the company's operations and products. Accordingly, Vulcan will:

- Strive to produce products safely and make concern for public health and the protection of the environment integral parts of Vulcan's operations.
- Endeavor to provide employees with a safe and healthy working environment.
- Reduce waste, conserve energy and recycle materials, to the extent practicable, and dispose of, or treat, waste responsibly.
- Provide education, training and leadership to employees to enable and motivate them to understand and comply with applicable law and these policies.
- Conduct reviews of safety, health and environmental practice at Vulcan facilities to verify compliance with applicable laws and regulations and to identify and correct operational practices that might impair safety, health or environmental quality at such facilities or in the neighborhoods in which we operate.
- Promote responsible stewardship of the company's products with carriers, distributors and customers.
- Promote the adoption of, and adherence to, sound safety, health and environmental practices by on-site contractors and tenants, directing where appropriate that contractors and tenants take corrective actions.
- Advocate the development of reasonable, scientifically sound and cost-effective safety, health and environmental laws and regulations that are based on realistic assessments of risk.
- Support and encourage the development of sound safety, health and environmental standards and practices in the industries in which Vulcan participates.

Vulcan is recognized as a leader in the Safety, Health and Environmental areas and maintains this leadership with a focus on continuous improvement.

As an operating facility within Vulcan Materials, the Black Point operation will be subject to Vulcan's internal policies and procedures as well as all applicable provincial and national regulations and requirements. Vulcan will ensure that the operation maintains compliance with internal and external requirements and expectations by providing training and direction to the site management team and employees, communicating expectations, and then checking through audits and inspections that all requirements and obligations are met. Vulcan understands the importance of providing a safe workplace, protecting our employees from work

place health hazards, being responsible members of the community and good neighbors, and of protecting the environment.

The company has an internal audit department that performs independent audits of the company operations, business units, and personnel for compliance with company policy and procedure. In addition, in the Safety, Health and Environmental (SHE) Audit Policy mandates periodic audits of each operation and of the operating regions.

1.6.4 Environmental Consultants

Table 1.4:
Environmental Consultant Contact Information

Name	SLR Consulting (Canada) Ltd.
Postal Address	115 Joseph Zatzman Drive Dartmouth, NS B3B 1N3
Contact Name	Russell Dmytriw, M.Sc., P.Geo
Telephone	902-499-1190
Fax	902-420-9703
Email	rdmytriw@slrconsulting.com

Table 1.5 lists the key personnel responsible for completing the background studies and the EIS report

Table 1.5:
Names and Qualifications of the Report Authors

Name	Qualifications	Affiliation	Role
Russell Dmytriw	M.Sc., P.Geo.	SLR Consulting	EIS Project Manager
Steven Usher	P. Eng., P.Geo	SLR Consulting	Hydrogeology
Gordon Wichert	Ph.D, Biologist	SLR Consulting	Aquatic Biology
Paul Klimczak	M.Sc., Hydrologist	SLR Consulting	Hydrology
Briony Croft	Ph.D., MIEAust., CPEng.	SLR Consulting	Noise and Vibrations
Gillian Hatcher	M.A.Sc.	Stantec	Air Quality
Maureen Cameron-MacMillan	M.Sc. Biologist	AMEC	Bird Surveys/Ecology
Scott Burley	M.Sc. Biologist	AMEC	Wetlands/Terrestrial Habitats
Chris Milley	Senior Environmental Consultant	AMEC	First Nations

1.6.5 Aboriginal Groups

A review of outstanding specific land claims was undertaken during the preparation of the Mi'kmaq Ecological Knowledge Study for the Black Point Quarry Project (Mi'kma'ki All Points Services 2013). At the time there were no specific land claims pending within the Project area. This does preclude future land claims in the area.

The nearest mainland First Nation (Mi'kmaq) community is Paqtnkek First Nation located in Afton, NS. Paqtnkek First Nation is 66 km north of Queensport in Antigonish County, mid-way between the Canso Causeway and the Town of Antigonish.

In addition to Paqtnkek, some members from the Millbrook and Sipekne'katik First Nations have been involved in the resource harvesting in the lands and waters near the Project area, and as a result are familiar with the region. Two other Mi'kmaq communities, Pictou Landing and Potoltek, are also in relatively close proximity to the Project Site (i.e., <150 km away).

The Assembly of Nova Scotia Mi'kmaq Chiefs is a key Aboriginal group, which has also participated in the environmental assessment process.

1.6.6 Community and Environmental Organisations

A number of community and environmental groups have expressed an interest in the Project, either through direct contact with the Proponent or though submissions made to the CEA Agency and NSE during the course of the environmental assessment. The Proponent's outreach efforts to these and other groups are described in Section 11. Table 1.6 lists the community and environmental organisations associated with the Project.

Table 1.6:
Environmental and Community Organisations

	Organization
1	Chedabucto Education Centre/Guysborough Academy
2	Guysborough Memorial Hospital Foundation
3	Chedabucto Lifestyle Center
4	Guysborough County Adult Learning Association
5	Guysborough County Food Bank
6	Canso Lions Club
7	With A Little Help Society (W.A.L.H.S.)
8	Queensport Volunteer Fire Department
9	Out of the Fog Lighthouse Museum
10	Guysborough Amateur Athletic Association
11	Canso Library
12	Cyril Ward Memorial Library
13	Guysborough Waterfront Association
14	Ecology Action Centre
15	Guysborough County Inshore Fishermen's Association
16	Sierra Club Atlantic
17	Strait Area Chamber of Commerce
18	Mining Association of Nova Scotia

1.7 Project Schedule

Table 1.7 provides a generalized schedule that presents the major construction and operational milestones.

Table 1.7:
Generalized Project Schedule

Year	Activity Undertaken or Anticipated
2010-11	Baseline ecological studies initiated
	Initial engagement with the public, regulatory agencies and Mi'kmaq
2012-2013	Properties assembled by the MODG (beginning in 2007-2008)
2014	Environmental Assessment Initiated • Consultation and engagement undertaken: • Meetings and site visits with Mi'kmaq representatives • Consultation and site visits with Regulatory Agencies • Meetings with residents and local fishermen • Open Houses, presentations, and meetings of the Citizen's Liaison Committee (CLC) • Submission of the draft EIS for review by the CEA Agency and NSE
2015	Submission of the Environmental Impact Statement report Completion of the environmental assessment
2016	Permits and Approvals
Early 2017	Updated Market Evaluation
2017-2018	Establishment of Sales Yards Receipt of Aggregate by Vessel from Black Point
2018-2021	Construction and Equipment Testing (Limited Production)
2021	Commence Full Scale Operations
2070+	Closure and Decommissioning

1.8 Purpose of the Project

The purpose of the Black Point Quarry Project is to supply construction aggregate to markets predominantly on the eastern and Gulf coasts of the United States and possibly to markets in eastern and central Canada. Construction aggregates are composed primarily of crushed stone (the product from Black Point), natural sand and gravel. These resources are needed for the development and maintenance of modern infrastructure. Although construction aggregates have numerous end uses, their general application is in the production of building materials such as concrete and asphalt. In general concrete is about 80% aggregate and asphalt is about 94% aggregate.

While natural materials used to produce construction aggregates (stone, sand and gravel primarily) are relatively abundant, these resources must be located in areas that are geographically accessible. In addition, the rights and permits to recover the resources must be obtainable, and there must be sufficient market capacity to support the planned production of the mining operation. Finally, aggregates must meet strict quality requirements related to the chemical and physical characteristics of the rock. Most rocks do not meet these geographic conditions and quality specifications and cannot qualify as viable construction aggregate resources.

In the U.S. market, the majority (80% or more) of aggregates are transported by truck from the quarry to the consumer. This form of transport is expensive and limits the typical aggregate operation to a market radius of about 80 km from the quarry. Coastal markets within the US are increasingly using high volume modes of transportation such as rail and ship to minimize costs. The south eastern U.S. aggregate market is a prime target for bulk vessel transported aggregate due in part to the geologic absence of suitable aggregate resources in coastal areas. For example, the Martin Marietta Materials quarry at Aulds Cove, NS shipped nearly 300 vessels of crushed stone to Florida ports between 2004 and 2009 (ACS 2009).

1.9 Benefits of the Project

The benefits of the Black Point Quarry Project to Canadians and Nova Scotians are numerous. The revenue generated from the Project will provide economic benefit to the people and governments of Guysborough County and Nova Scotia through taxes paid, dollars invested into goods and services directly by the Project Proponent, and indirect dollars that will go into local businesses and services from employees and contractors working on the Project and at the quarry. Specifically, the investment will be in the US$80-$110MM range. The construction and site development phases of the Project will generate between 120-150 direct and indirect jobs. Once operational, there will be 50-60 full time jobs associated with the operations. Based on experience at other Vulcan quarries, the annual operating expenses are estimated to be in the range of US$9-$15MM which is spent on wages, fuel, electricity, operating parts and maintenance. Additionally, numerous local vendors, service providers and consultants would be engaged in activities at the quarry.

Additional benefits that the environmental assessment process has generated since the Project was proposed revolve around the increased levels of consultation the community, the Mi'kmaw, and local fishermen. The dialogue that has occurred to date has been driven by a genuine interest to harmoniously coexist with the Project's Guysborough County neighbours, but is also mandated in the assessment process and facilitated by open comment periods. Exchanges with these groups, numerous site visits, and presentations at schools and business forums have improved the quality of information presented in the EIS report and established a baseline example for future interactions over the life of the Project.

Examples of changes to the Project and critical information incorporated into the EIS through community dialogue include:

<u>Fisheries</u>

- Over the course of multiple consultation events, the Proponent's proposed vessel approach routes between the marine terminal and the main shipping lane in Chedabucto Bay were reviewed and critiqued by local area fishermen. This process resulted in the selection and

modification of a preferred route intended to avoid preferred fishing grounds to the extent possible[1].

- Several potential fisheries offset project locations were identified during meetings with local fishermen. These include areas immediately west of the Project and well as in Indian Cove.
- Mackerel and shrimp migration patterns in the immediate area nearshore environment to the marine terminal are best understood by the fishermen. Mitigation measures will take that input into account.
- Lobster spawning concerns and considerations relative to blasting in the nearshore terrestrial environment were issues that the fisherman wanted more information about and assurances that no impact will occur. The Proponent provided the fisherman with academic studies related to blasting in the nearshore environment and utilized the same information to generate blasting setbacks as reported in this EIS report.

The Mi'kmaw

- The constructive and open dialogue encouraged during meetings, presentations and site visits have generated a mutual awareness and understanding of the needs and intentions of the other, which will survive the duration of the environmental assessment process.
- The Mi'kmaw have been made aware of the anticipated benefits of the Project, the potential environmental impacts and proposed mitigation measures aimed at minimizing those impacts as well as the sustainable practices and environmental track record of the Proponent.
- The Proponent has learned a great deal with respect to Mi'kmaq history, culture, and land use rights in Nova Scotia. The Proponent has also been made aware of type and number of Mi'kmaq labor and vendor resources who desire training and employment, which the Project will need during construction and operation.

Local Community

- Several meetings and presentations were used to describe mining processes and quarry-specific vocations to interested students to help prepare them for Project related employment opportunities.
- Meetings were also used to describe background environmental conditions including residential water quality results, wetland function and the results of biological surveys.

The baseline environmental testing and monitoring at the site add to the scientific understanding and background data held by the Province. This background information contributes to a knowledge base that ultimately helps to increase public ecological awareness and promote conservation.

[1] The local fishermen selected a preferred route (one of two presented) then requested further modifications to the preferred route, which were incorporated to establish a final route shown on Figure 3.0-29.

2.0 REGULATORY FRAMEWORK

2.1 Federal

The Black Point Quarry Project is proposed within a framework of federal and provincial laws and municipal by-laws. These laws describe the environmental assessment process, the permits required for operation and construction, and the conditions under which the Project will be operated. The Project is also subject to a number of guidelines, policies and standards that are applied during the design, construction and operation of the Project. Governing legislation is listed in **Table 2-1** while the key laws are described in more detail below.

2.1.1 Canadian Environmental Assessment Act (CEAA 2012)

The *Canadian Environmental Assessment Act, 2012 (CEAA 2012)* regulates the federal government's environmental assessment process. Section 8 of *CEAA 2012* requires that the Proponent of a "designated project" provide the Canadian Environmental Assessment Agency (CEA Agency) with a Project Description so that the federal Minister of the Environment can determine whether an environmental assessment is required. Designated project types are listed in the *Regulations Designating Physical Activities.* The Black Point Quarry Project includes two activities (or project types) listed in the *Regulations* and is therefore subject to a federal environmental assessment:

16(g) the construction, operation, decommissioning and abandonment of a **new stone quarry** or sand or gravel pit with a production capacity of 3,500,000 tonnes per year or more;

24(c) the construction, operation, decommissioning and abandonment of a **new marine terminal** designed to handle ships larger than 25,000 DWT unless the terminal is located on lands that are routinely and have been historically used as a marine terminal or that are designated for such use in a land-use plan that has been the subject of public consultation.

The CEA Agency both leads and coordinates agency review of and response to the Proponent's EIS report.

2.1.2 Canadian Environmental Protection Act 1999

The *Canadian Environmental Protection Act 1999* (CEPA 1999) is aimed at the prevention and management of risks posed by toxic and other harmful substances. CEPA 1999 also manages environmental and human health impacts of marine pollution, disposal at sea, certain atmospheric emissions, hazardous wastes, environmental emergencies and other sources of pollution.

With respect to marine pollution, CEPA 1999 provides the authority to issue non-regulatory objectives, guidelines and codes of practice to prevent marine pollution from land-based sources. It also prohibits the disposal of wastes at sea within Canadian jurisdiction and by Canadian ships in international waters unless a permit is obtained. Dredging is not currently anticipated at the Black Point Project; should this change, a permit allowing disposal at sea of dredged materials would be required.

2.1.3 Fisheries Act

The recently amended *Fisheries Act* protects the sustainability and productivity of recreational, commercial and Aboriginal fisheries. Among other things, the amendments re-emphasize the Proponent's responsibility to avoid harm to fish and fish habitat through the application of appropriate design and mitigation measures.

People are prohibited from harming fish in section 35(1) *No person shall carry on any work, undertaking or activity that results in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery,* except if the work or activity is authorized by or carried on in accordance with the regulations made under the *Act*. This prohibition is supported by definitions of commercial, recreational and Aboriginal fisheries in the *Act*, as well as a definition of "serious harm to fish", which is the *death of fish or any permanent alteration to, or destruction of, fish habitat.*

In addition, Section 36(3) of the *Fisheries Act* prohibits discharge or deposit of "a deleterious substance in water frequented by fish" unless allowed by regulation.

In consequence of this regulation, DFO authorization may be required to construct the marine terminal. In contrast, no freshwater fishery is present due to the low pH of Fogherty Lake and the freshwater streams on the site, and so no DFO authorization is required for the terrestrial components of the Project.

2.1.4 Migratory Birds Convention Act, 1994

The *Migratory Birds Convention Act* (MBCA) protects migratory bird species and states that no person shall disturb, destroy or take a nest, egg, nest shelter, eider duck shelter or duck box of a migratory bird without a permit. Section 5.1 of the Migratory Birds Convention Act prohibits the deposit of substances harmful to migratory birds:

"5.1 (1) No person or vessel shall deposit a substance that is harmful to migratory birds, or permit such a substance to be deposited, in waters or an area frequented by migratory birds or in a place from which the substance may enter such waters or such an area.

(2) No person or vessel shall deposit a substance or permit a substance to be deposited in any place if the substance, in combination with one or more substances, results in a substance — in waters or an area frequented by migratory birds or in a place from which it may enter such waters or such an area — that is harmful to migratory birds.".

2.1.5 Species at Risk Act

The *Species at Risk Act* (SARA) protects wildlife species from becoming extinct through prohibitions against killing, harming, harassing, capturing or taking species at risk, and against destroying their critical habitats. Management of species at risk and species of special concern (as identified by the Committee on the Status of Endangered Wildlife in Canada [COSEWIC]) is accomplished by providing for the recovery of species at risk and by ensuring through sound management that species of special concern do not become endangered or threatened. In the aquatic environment, DFO is responsible for freshwater and marine species at risk, while Environment Canada (EC) is responsible for all other species at risk.

2.1.6 Canada Shipping Act, 2001

The *Canada Shipping Act, 2001* governs safety in marine transportation, recreational boating and the protection of the marine environment. It applies to Canadian vessels operating in all waters and to all vessels operating in Canadian waters. The *Vessel Pollution and Dangerous Chemicals Regulations for* lists prohibited ship-source discharges including: oil, noxious liquid substances and dangerous chemicals, sewage, garbage and air anti-fouling systems. Regulations under the Act are also meant to prevent and respond to marine spills from vessels and require vessels to manage ballast water to reduce the potential for invasive (non-native) organisms (*Ballast Water Control and Management Regulations*).

2.1.7 Oceans Act

The *Oceans Act* sets out Canada's role with respect to oceans management, specifying the need to integrate marine conservation with development activities to maintain healthy ecosystems. The *Act* is implemented through three programs: the Marine Protected Areas Program (a national system of marine protected areas, including designating areas for special protection), the Integrated Management Program (leading, facilitating and implementing plans for the integrated management of all activities or measures in or affecting estuaries, coastal and marine waters), and the Marine Ecosystem Health Program (establishing marine environmental quality guidelines).

2.1.8 Navigation Protection Act

The Navigation Protection Act (NPA) protects the public's right to navigation and marine safety in Canadian waters. Administered by Transport Canada, the NPA requires approval for any works that may affect navigation on navigable waters in Canada. Given this, the construction of the marine terminal will require approval under Section 6(1) of the NPA.

In addition to these laws, the follow legislation also applies to the Black Point Quarry Project:

- The *Marine Transportation Security Act* provides regulatory measures for marine and port security.

- The *Pilotage Act* the General Pilotage Regulations and the Atlantic Pilotage Authority Regulations establish pilotage authority and requirements within areas where local ship pilots are required by law to assist the masters (captains) of incoming vessels. The Black Point marine terminal is situated within a Compulsory Pilotage Area administered by the Atlantic Pilotage Authority.

2.2 Provincial

2.2.1 Environmental Assessment

Provincial environmental assessments are regulated under Nova Scotia's *Environment Act* and *Environmental Assessment Regulations*. Projects subject to environmental assessment are divided into two classes, Class I and Class II. As a quarry larger than 4 ha and an undertaking that may disrupt wetlands in excess of 2 ha, the proposed Project is considered to be a Class 1 Undertaking, which requires the submission of an Environmental Assessment Registration Document. Further requirements for the provincial environmental assessment process have

been established in the Guide to Preparing an EA Registration Document for Pit and Quarry Developments in Nova Scotia (NSE 2009a).

Many of the provincial permits required for this Project, including the primary operating permit - the Industrial Approval - originate from stipulations in the provincial *Activities Designation Regulations* made under Section 66 of the *Environment Act*. The *Activities Designation Regulations* provide permitting guidance to watercourse alterations and wetland alterations, groundwater surface water withdrawal, and construction of infrastructure in the marine environment.

The application for Industrial Approval, like other permit applications, is made once environmental assessment approval has been received. The Industrial Approval defines specific operational conditions and limitations, including dust, noise, surface water and groundwater discharge criteria and follow-up monitoring plans.

2.2.2 Harmonization

CEAA 2012 also allows the federal Minister of Environment to enter into agreements with provincial and territorial governments relating to the environmental assessments of projects where both federal and provincial governments have an interest. For this project, the CEA Agency and NSE have determined a harmonized federal/provincial environmental assessment process is achievable. A Federal-Provincial Environmental Assessment Agreement has been established to define the roles and responsibilities of the different departments, establish a timeline for the review process, and ensure the federal and provincial requirements are coordinated. This Agreement stipulates that a single environmental assessment report will address the interests of both federal and provincial government departments and agencies.

2.2.3 Resource Management Initiatives

There are a number of government initiatives and resource management policies that have implications to the Black Point Project design and operation. Most important are those wildlife conservation and management policies applicable to Species at Risk. In addition, a number of commercial fishery resource management initiatives have been implemented by DFO and the Guysborough County Inshore Fisheries Association (GCIFA).

Once a species is listed under the provincial *Endangered Species Act,* a Recovery Plan is developed for those species designated Endangered and Threatened and a Management Plan is developed for Vulnerable designated species.

The Mainland Moose Recovery Plan is once such policy (NSDNR 2007a). Nova Scotia's Mainland Moose population was first listed as provincially endangered in 2003. The Recovery Plan defines the recovery goal, objectives, strategies, and actions that have been developed to protect, conserve, and recover this species in Nova Scotia. The objectives of the Plan are to: 1) maintain and enhance the current population and distribution; 2) mitigate threats that limit recovery; 3) initiate research to address knowledge gaps; and 4) maintain and enhance habitat. The Plan indicates that these objectives will be achieved through research, monitoring, management, education and stewardship. Since Mainland Moose have been identified on the Black Point Quarry property and the Project is expected to impact this species, the Proponent has integrated the objectives and recovery approaches within the design and long term monitoring objectives of the Project (Section 7.12).

Funding for research aimed an understanding conservation options for three recently listed bat species has also been allocated by the province (not related to the Black Point Project), although a specific recovery plan has not been developed for these species. Bat populations have suffered severely from a fungal infection termed white-nose syndrome, which has led to catastrophic population declines in eastern North America.

DFO has developed Integrated Fisheries Management Plans (IFMPs) to manage and guide the sustainable management of commercial fisheries resources (DFO 2014a). Among other things the plans establish fishing seasons and fishing quotas. Within the Maritimes Region (where the Project is situated) IFMPs are in place for:

- Lobster
- Herring
- Atlantic Seal (various species)
- Atlantic Mackerel
- Bluefin Tuna
- Atlantic Swordfish and Other Tunas
- Canadian Atlantic Herring
- Canadian Atlantic Swordfish and Other Tunas
- Shrimp – Scotian Shelf

The use of these IFMPs to guide commercial fisheries in Chedabucto Bay is described in Section 6.10.

The *National Framework for Canada's Network of Marine Protected Areas* seeks to establish a network of marine protected areas (MPAs) in Canadian waters. The overarching objective of the *Framework* is to provide long-term protection of marine biodiversity, ecosystem function and special natural features. To achieve this objective, the *Framework* provides guidance for Canadian MPA network planning and design and states that MPA networks should identify Ecologically or Biologically Significant Areas (EBSAs). To this end, the Canso Ledges EBSA, which includes the Project site, was identified in 2012 (DFO 2012a).

2.2.4 Permits and Authorizations

In addition to the above-described environmental assessment requirements, the Project will also require a number of federal and provincial regulatory permits and approvals prior to proceeding. These permits are typically issued after the successful completion of the environmental assessment. The *key* environmental permits anticipated are listed in **Table 2.1.**

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Table 2.1:
Anticipated Key Permitting Requirements

Regulatory Requirement	Approval/Permit	Sections	Project Activity/Trigger	Responsible Agency
FEDERAL				
CEAA 2012	Assessment	S. 16(g), 24(c)	Construction of a stone quarry of greater than 2.5 MT capacity; construction of a marine terminal hosting vessels larger than 25000DWT	CEA Agency
Fisheries Act and Regulations	Authorization	S. 35(1)	Marine terminal construction; prohibits deposit of a deleterious substance in waters frequented by fish	Fisheries and Oceans Canada
Navigation Protection Act	NPA Approval	S. 6 (1)	Marine terminal construction, installation of watercourse crossings	Transport Canada
Transportation of Dangerous Goods Act	NA	NA	The movement of dangerous good to, from and within the site must comply with applicable regulations under the Act	Transport Canada
Migratory Birds Convention Act	NA	S. 5 and 5.1	The Proponent will comply with the Migratory Birds Convention Act and associated regulations, including prohibitions against harming migratory birds to depositing substances which may hard these birds	Environment Canada
Canada Shipping Act (Ballast Water Control and Management Regulations)	NA	NA	Code of practice for shipping operations	Transport Canada
National Building Code of Canada	Approval	NA	Building occupation	MODG
PROVINCIAL				
Environmental Assessment Regulation under the NS Environment Act	Approval/Release	32	Prohibits work on an undertaking without an approval	Nova Scotia Environment
Activities Designation Regulations under the NS Environment Act	Water Approval	S. 5(1) various	Water withdrawal, alteration of water bodies and/or wetlands associated with quarry development	Nova Scotia Environment
Activities Designation Regulations NS Environment Act	Part V Industrial Approval	S. 13(f)	Quarry development and operation	Nova Scotia Environment
Activities Designation Regulations under the NS Environment Act	Permits	various	Wharf construction, chemical storage tank in excess of 2000L, wastewater treatment system	Nova Scotia Environment

Regulatory Requirement	Approval/Permit	Sections	Project Activity/Trigger	Responsible Agency
			construction, etc.	
Petroleum Management Regulation	Registration	S. 11(1)	Underground and aboveground petroleum storage tanks of 2000L or greater	Nova Scotia Environment
Air Quality Regulation	NA	Schedule A	Establishes ambient air quality criteria	Nova Scotia Environment
Dangerous Goods Management Regulation	Approval	S. 6(1)	Requires written approval to store dangerous waste goods	NSDNR
Beaches Act and Beaches Regulations	Permit	S. 7	Authorizes construction activities below the ordinary high water mark	NSDNR
Special Places Protection Act and Regulations	Permit	S. 8(1)	Authorizes an Archaeological Resources Impact Assessment	NS Department of Communities, Culture and Heritage
Nova Scotia Wildlife Act and Regulations	Permit	50(1)	Prohibits the taking, hunting or killing or possession of eagles, osprey, falcons, hawks, owls or any protected wildlife	NSDNR
Nova Scotia Endangered Species Act	Permit	S. 14	Prohibits harm to or interference with an endangered or threatened species and their habitat. The permit authorizes activities that would otherwise be prohibited	NSDNR
Crown Lands Act and Regulations	Crown Land Lease for Submerged Lands		Governs the use of lands owned by the Province. A Lease is required for use of the seabed to construct the marine terminal	NSDNR

As the Project is currently planned, no explosives will be stored or manufactured on site and no dredging will be required.

2.3 Municipal

The Municipality of the District of Guysborough employs a Land Use By-Law to manage development within the municipality. Aggregate quarries are permitted in lands zoned Industrial Heavy (I-2) but these projects must obtain a development permit prior to construction. Applications must be accompanied by site plans showing lot dimensions, structures and buildings, location of watercourses, and other information. Building permits will also be required prior to construction.

2.4 Policies and Guidelines

There are a number of federal and provincial policies, guidelines, standards and codes of practice that will apply to the construction and operation of the Black Point Project. Table 2.2 lists these documents.

Table 2.2:
Federal and Provincial Policies and Guidelines

Federal

1. Canadian Council of Ministers of the Environment (CCME) Canadian Environmental Quality Guidelines (CCME 1999a).
2. CCME Canadian Environmental Quality Guidelines, Water: Aquatic Life (Freshwater and Marine) (CCME 1999b).
3. CCME Canadian Environmental Quality Guidelines, Sediment Quality Guidelines (SQGs) for Protection of Aquatic Life (CCME 2001).
4. CCME Canadian Environmental Quality Guidelines, Soil: Commercial/Industrial Sites (CCME 1999c).
5. CCME Canada-Wide Standards for Particulate Matter (PM) and Ozone (CCME 2010)
6. National Fire Code of Canada.
7. Useful Information for Environmental Assessments (Health Canada 2010).
8. Guidelines to Avoid Disturbance to Seabird and Waterbird Colonies in Canada (EC 2013a).
9. Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters (DFO 1998).
10. Operational Policy Statement Assessing Cumulative Environmental Effects Under The Canadian Environmental Assessment Act (CEA Agency 2013a).
11. Canadian Environmental Protection Act (EC 1999).
12. Changes to the Fisheries Act (DFO 2013b).
13. Atlantic Canada Wastewater Guidelines Manual for Collection, Treatment and Disposal (EC 2006).
14. Guide for Reporting to the National Pollutant Release Inventory (NPRI) 2012/2013 (EC 2013b).
15. Applications For Authorization under Paragraph 35 (2)(b) of the Fisheries Act Regulations (Government of Canada 2013a).
16. Fisheries Productivity Investment Policy: A Proponent's Guide to Offsetting (DFO 2013c).
17. Fisheries Protection Policy Statement (DFO 2013a).
18. National Guidelines for Monitoring Dredged and Excavated Material at Ocean Disposal Sites (EC 1998).
19. Aboriginal Consultation and Accommodation: Updated Guidelines for Federal Officials to Fulfil the Duty to Consult (GC 2013b).
20. Addressing "Purpose of" and "Alternative Means" under the Canadian Environmental Assessment Act, 2012 (CEAA Agency 2013b).
21. Federal Policy on Wetland Conservation (GC 1991)

Provincial

1. Guideline for Environmental Noise Measurement and Assessment (NSEL 1990).
2. Guidelines for the Management of Contaminated Sites in Nova Scotia (NSEL 1996).
3. Nova Scotia Climate Change Action Plan (NSE Guidelines) (NSE 2009c).
4. Guide to Considering Climate Change in Environmental Assessment (NSE 2011a).
5. Guide to Consider Climate Change in Project Development in NS (NSE 2011b).
6. Guide to Addressing Wildlife Species and Habitat in an EA registration document (NSE 2009a).
7. Nova Scotia Wetland Conservation Policy (NSE 2011c).
8. From Strategy to Action, An Action Plan for the Path We Share, A Natural Resources Strategy for NS (NSDNR 2011a).
9. The Path We Share: A Natural Resources Strategy for NS 2011-2020 (NSDNR 2011b).
10. Water for Life: Nova Scotia's Water Resource Management Strategy (NSE 2010).

11. Nova Scotia Standard Specifications. Highway Construction and Maintenance (NSTPW 1997).
12. Sediment and Erosion Control Handbook (NSE 1988).
13. Watercourse Alteration Protection; Erosion Protection; Wharves; Pipe Culverts; Arch or Open Bottom Box Culverts (NSE 2013).
14. Generic Environmental Protection Plan for Construction of 100 Series Highways (NSTPW 2007).
15. Guide to Preparing an EA Registration Document for Pit and Quarry Developments in Nova Scotia. (NSE 2009b).
16. A Proponents Guide to Environmental Assessment. Nova Scotia Department of Environment (NSE) 2001.
17. Nova Scotia Standards for Construction and Installation for Petroleum Storage Tank Systems (NSEL 1997).
18. Guidelines for Monitoring Public Drinking Water Supplies (NSEL 2005).
19. Storm Drainage Works Approval Policy (NSEL 2002).
20. Pit and Quarry Guidelines (NSEL 1999).
21. Proponent's Guide: Engagement with the Mi'kmaq of Nova Scotia (Government of Nova Scotia 2009).
22. Guidelines for the Development on Slates in Nova Scotia (NSE 1991).

2.5 First Nations

As noted in Section 1.6.5 a review of outstanding specific claims was undertaken during the preparation of the Mi'kmaq Ecological Knowledge Study undertaken for this project. At the time there were no specific claims pending within the Project area. This does preclude future land claims in the area. To the best of the Proponent's knowledge, there are no treaty or self-government agreements with the Mi'kmaq that are pertinent to the project and/or the environmental assessment.

3.0 PROJECT DESCRIPTION

3.1 OVERVIEW OF PROJECT COMPONENTS AND SITE LAYOUT

The Black Point Quarry Project consists of aggregate production (drilling, blasting, processing, and stockpiling), along with the construction and operation of a marine terminal in Chedabucto Bay adjacent to the quarry.

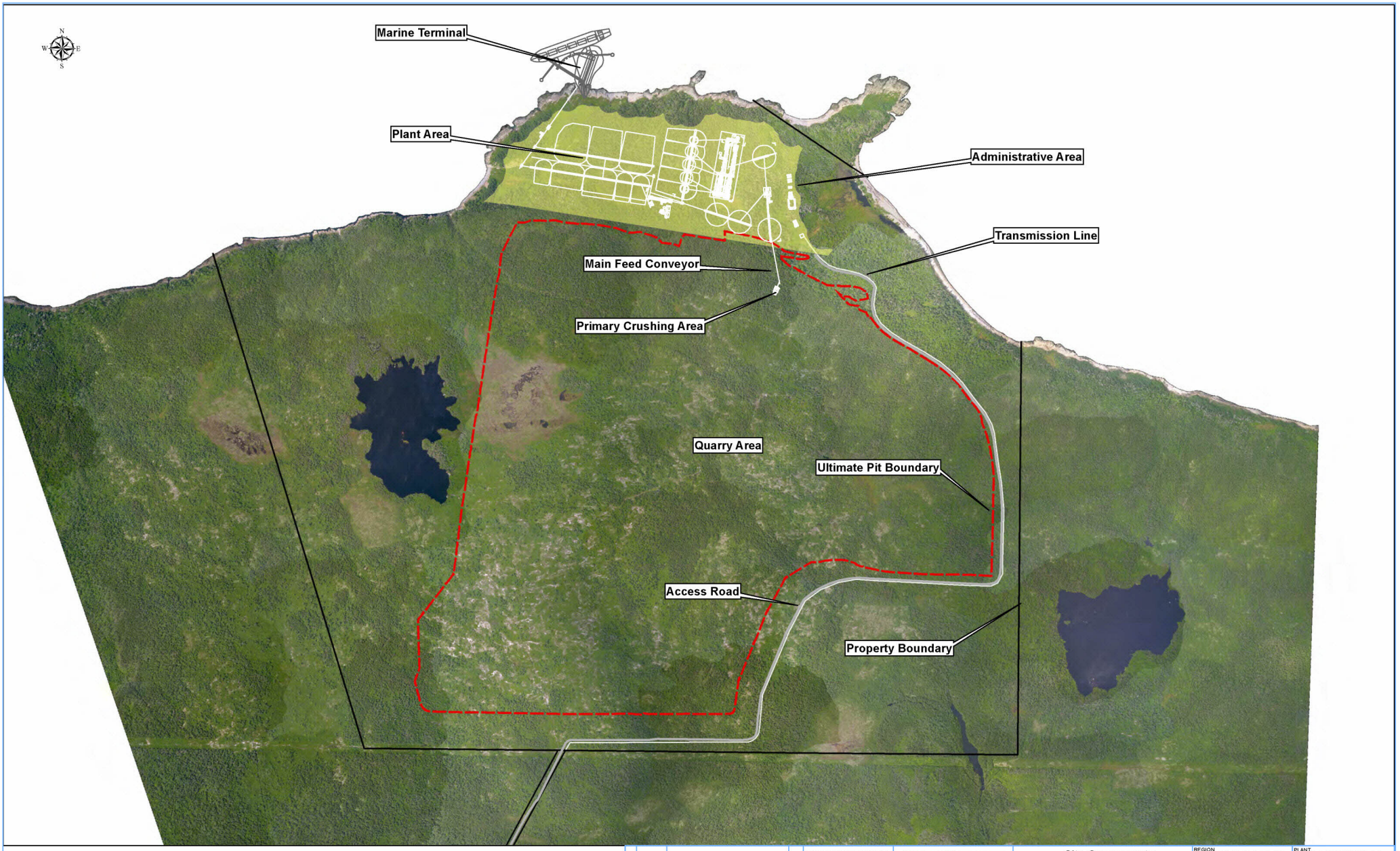
The anticipated average annual production rate will exceed 1.0 million metric tonnes (MT) with an anticipated peak annual production of 7.5 MT depending on prevailing market conditions. Estimated rock reserves in the proposed quarry area are upwards of 400 MT. Quarry operations are expected to take place over an approximate 50+ year period, depending on the demand for aggregate and annual production volumes.

The anticipated processing plant schedule will be 24 hr/day with two 8-hr operating shifts plus one 8 hour maintenance shift, 7 days/week. The plant will operate for nine months of the year weather permitting. The quarry will also operate for nine months of the year. When a ship is present, the marine operations will run 24 hr/day, up to 7 days per week, anytime during the year to accommodate shipping schedules and the time needed to load ships.

The primary components associated with the Project include:

- An unpaved access road from provincial Route 16 into the quarry;
- The quarry and primary crushing area;
- Main feed conveyer from the primary crusher to the processing plant;
- The processing (finishing) plant consisting of secondary and tertiary processing (crushing and washing) and a stockpile laydown area;
- Modular buildings that comprise the administration complex; and,
- A 160 m long marine terminal and load-out facility.

The locations of the primary project components are depicted in **Figure 3.0-1.**



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DATE | REVISION | BY | ISSUE DATE:

Vulcan Materials Company

Site Components

REGION: NOVA SCOTIA
DWN BY: CKR | DATE: 01/16/2015 | CHK BY:
JOB NO: | SCALE: 1 in = 250 m
PATH:

PLANT: BLACK POINT
DWG. NO.
Figure 3.0-1

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3.1.1 Access Road

A single private access road to the quarry site, processing plant, and marine terminal will be constructed prior to mining. Vehicular access will be primarily by construction workers during the construction phase and by employees and delivery/service vehicles once the site is operational. The access road will be a 10 m wide unpaved road north from Route 16 along the centerline of easement EA-1 to the southern property boundary, a distance of approximately 800 m (**Figure 3.0-1**). From the southern property boundary, the road will be extended easterly and northerly approximately 2.5 km to access the processing area and marine terminal. The access road will remain inside a 30 m wide buffer around the periphery of the property and, to the extent possible, will be constructed a minimum of 30 m from wetlands.

The access road will be designed to accommodate the anticipated load and size of Project-related vehicles. The intersection of Route 16 and the access road will be designed to meet Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR) standards. Where possible fill materials required for access road construction will be obtained from within the property. No bridges will be required. Culverts will be installed across any watercourses along the access road in accordance with NSE standards and permit requirements. At this time, only one culvert appears to be needed.

3.1.2 Open Pit Quarry

The site will be developed as an open pit quarry using conventional surface mining methods. The mining cycle will include the following basic actions:

- Loosening and stockpiling of the vegetation, overburden, and loose rock by dozer and/or track hoe equipment;
- Drilling and blasting to establish benches, haul roads, and sumps for stormwater management;
- Loading of loosened rock into haul trucks by track-mounted and/or rubber tired loading equipment; and
- Transportation of the quarried rock by haul trucks to a discharge point at the edge of the quarry for feed to the primary crusher.

Figures 3.0-2 through 3.0-12 show the development of the quarry over time, and list the milestones for each project phase. In general, mining will commence on the north end of the property beginning at the top of the granite hill near the northeast corner of the site. The quarry will be developed initially in a westerly direction before proceeding in a southerly direction to a final grade at or near elevation -30 m asl (i.e., 30 m below sea level). The final quarry footprint will comprise approximately 180 ha.

Overburden will be removed only as necessary to facilitate access to granite reserves. All overburden will be stored on-site for use in the reclamation process or partially used for construction of on-site berms, impoundments and haul roads. The storage locations include the screening berm along the southern portion of the access road and within the open pit. Once the

vegetation and overburden have been removed, drilling and blasting will be used to mine material and establish benches along the rock face.

Holes will be drilled into the rock to receive the explosives used for blasting. In general, the rock will be blasted along specific drill patterns that will maximize rock breakage and minimize wasted energy. It is anticipated that blasting will occur 30 days per year during the initial project phases, and increase to a maximum of about 200 days per year at full operation. All blasting activities will be conducted by a licensed contractor. Blasting will not be undertaken on Sundays or statutory holidays.

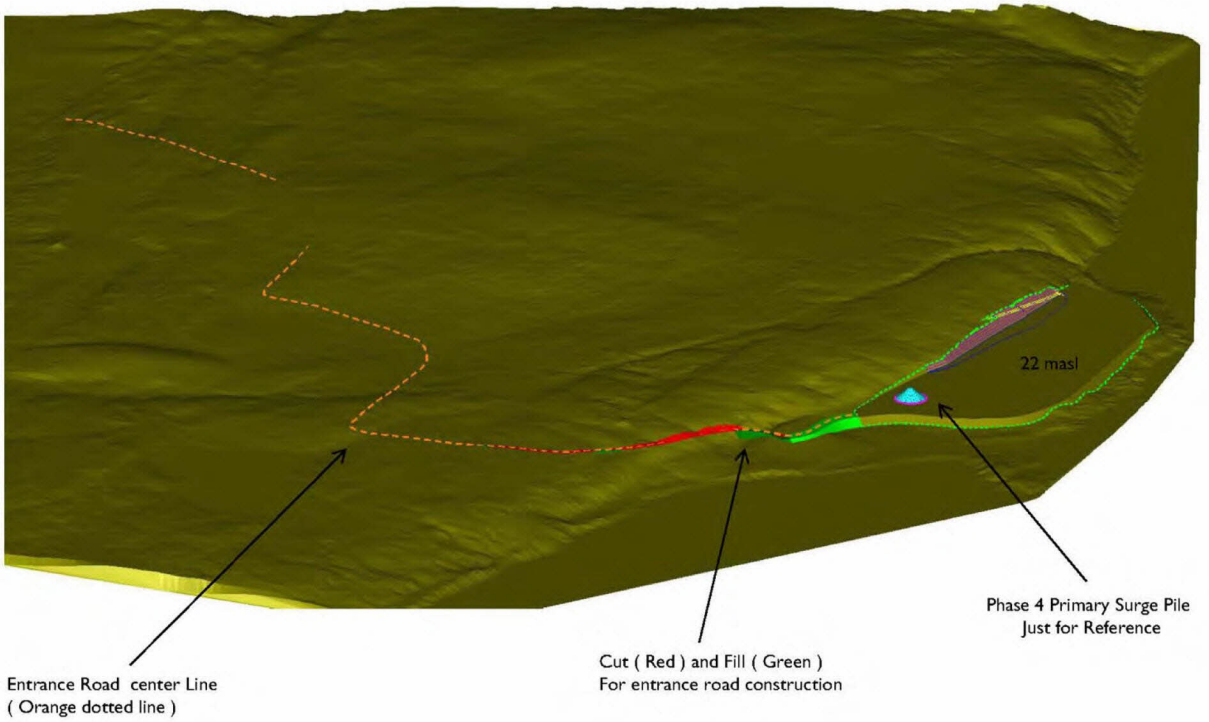
Freshly mined rock will be transported to and reduced in size by a primary crusher located on a bench on the east side of the quarry (see **Figure 3.0-1** for location). The crushed material will then be transported via conveyor to the processing plant (see Section 3.1.3 for a detailed description of processing).

As quarry development progresses, essential milestones will be established to ensure sufficient access to reserves to meet production requirements. The preliminary milestones include:

- Access road and plant pad development;
- Establish haul ramp from plant pad to an elevation of 52 m asl (primary dump elevation);
- Locate primary crushing station;
- Construction of up to a 16.9 million gallon (64,000 m^3) temporary sump;
- Establish haul ramp down to an elevation of 22 m asl to prepare for construction of main pit sump; and
- Construction of up to a 102 million gallon (386,000 m^3) permanent sump.

During the initial phases, the materials mined will be utilized during the plant development and construction.

Pre-Mining : Plant Pad and Entrance Road Construction



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Vulcan Materials Company

Pre-Mining

REGION NOVA SCOTIA

DWN BH DATE 10/22/2014 CHK BY

JOB NO. SCALE No Scale

PATH

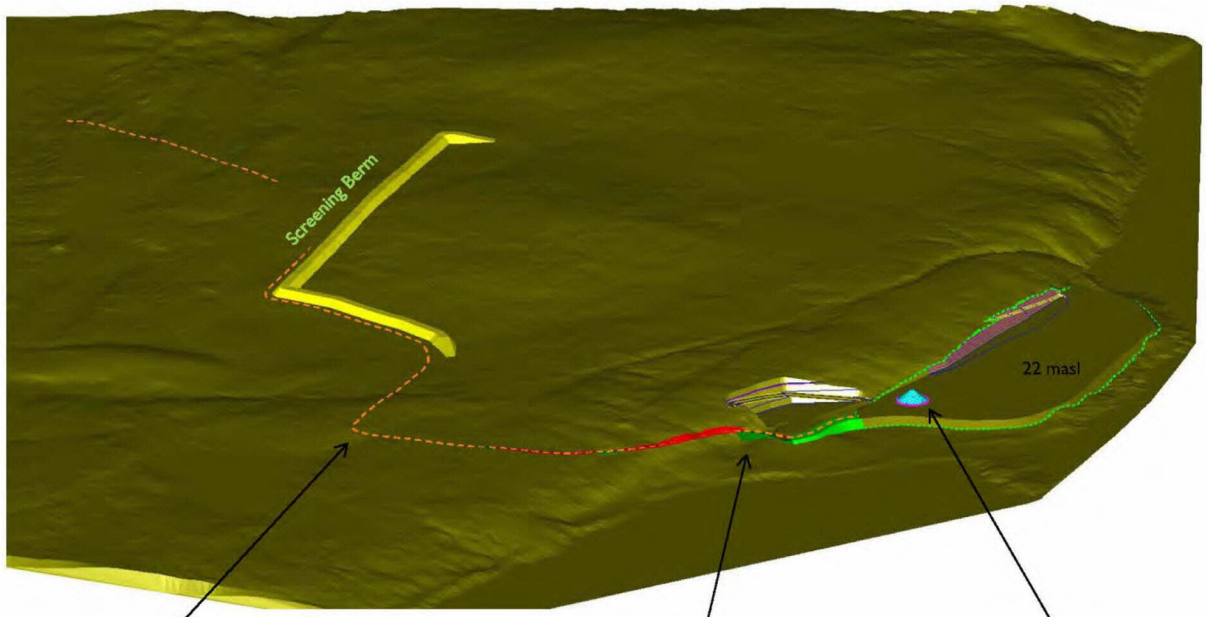
PLANT BLACK POINT

DWG. NO. Figure 3.0-2

End Of Year 1

Milestones:

- Establish haul ramp from pad 22 masl to 52 masl
- Perimeter screening berm begins
  - End of Yr 3 construction shown here



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End of Year 1

REGION NOVA SCOTIA | PLANT BLACK POINT

DWN BH | DATE 10/22/2014 | CHK BY

JOB NO. | SCALE No scale

PATH

DWG. NO. Figure 3.0-3

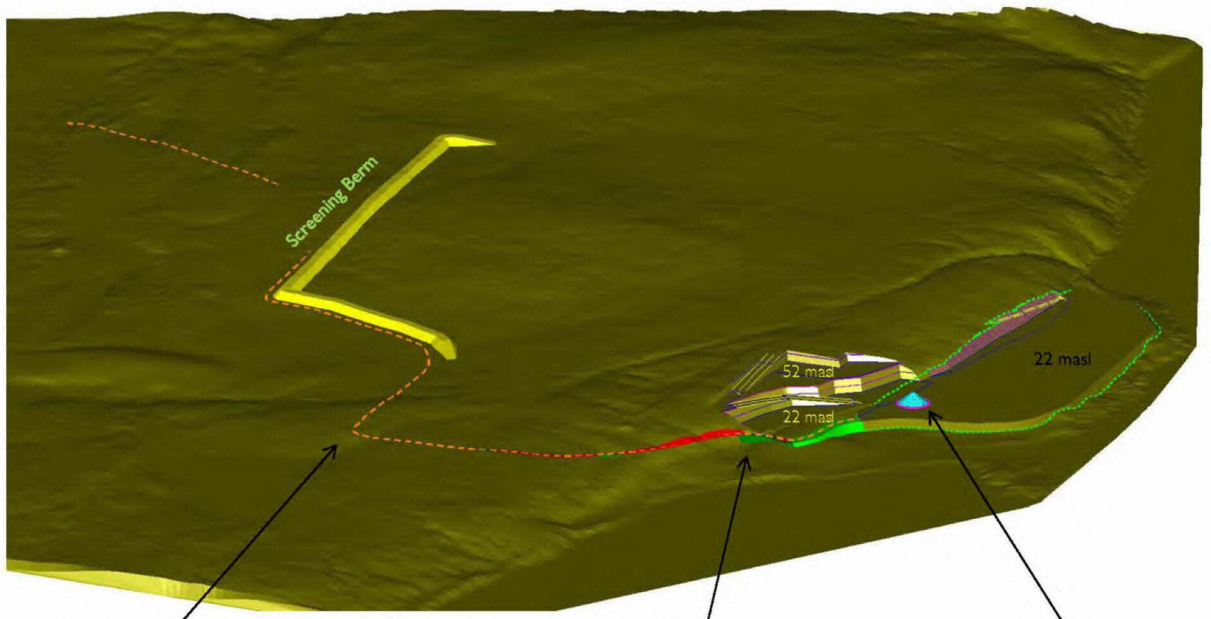
PLOTTED: | LAST UPDATE:

DATE | REVISION | BY | ISSUE DATE:

End Of Year 2

Milestones:

- Primary Station area completed (dump and base)
- Ready for first pit sump construction
- Begin mining ridge to West
- Perimeter screening berm construction continues



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End of Year 2

REGION NOVA SCOTIA | PLANT BLACK POINT

DWN BY BH | DATE 10/22/2014 | CHK BY

JOB NO. | SCALE No scale

PATH

DWG. NO. Figure 3.0-4

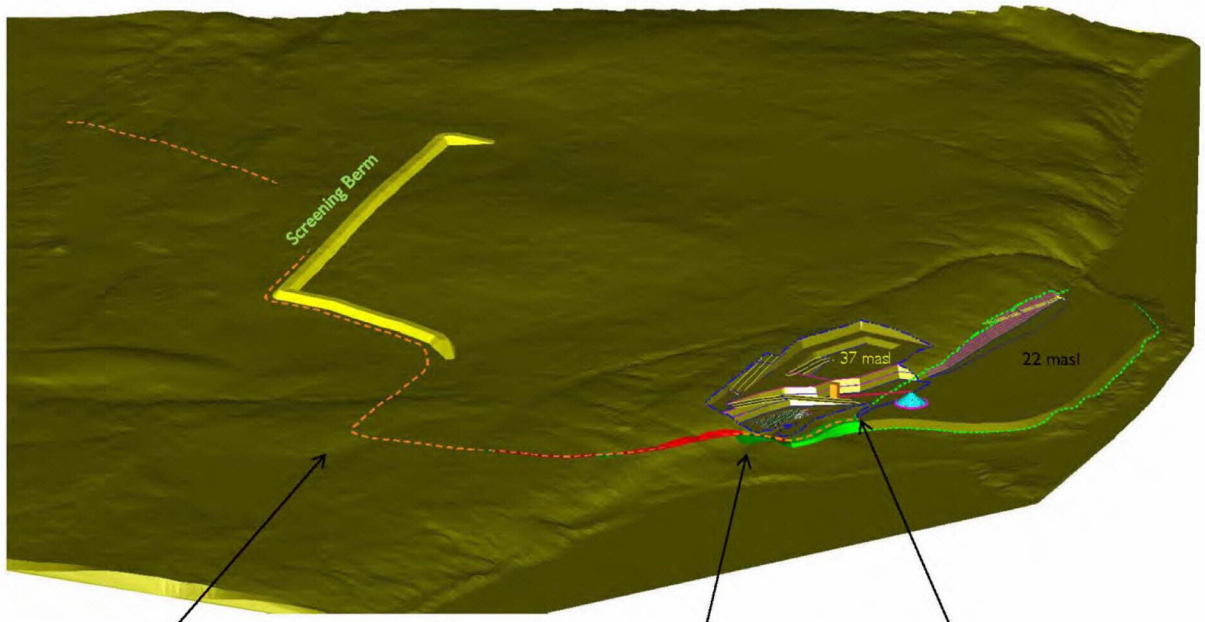
PLOTTED: | LAST UPDATE:

DATE | REVISION | BY | ISSUE DATE:

End Of Year 3

Milestones:

- First pit sump construction complete
  - 16.9 M gallon capacity
- Continue mining ridge to West
- Perimeter screening berm nearing completion
- Establish haul ramp down to 37 masl
  - Mining to get ready for main pit sump



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End of Year 3

REGION NOVA SCOTIA

PLANT BLACK POINT

DWG. NO. Figure 3.0-5

PLOTTED: LAST UPDATE:

DATE REVISION BY ISSUE DATE:

DWN BH DATE 08/02/2012 CHK BY

JOB NO. SCALE No scale

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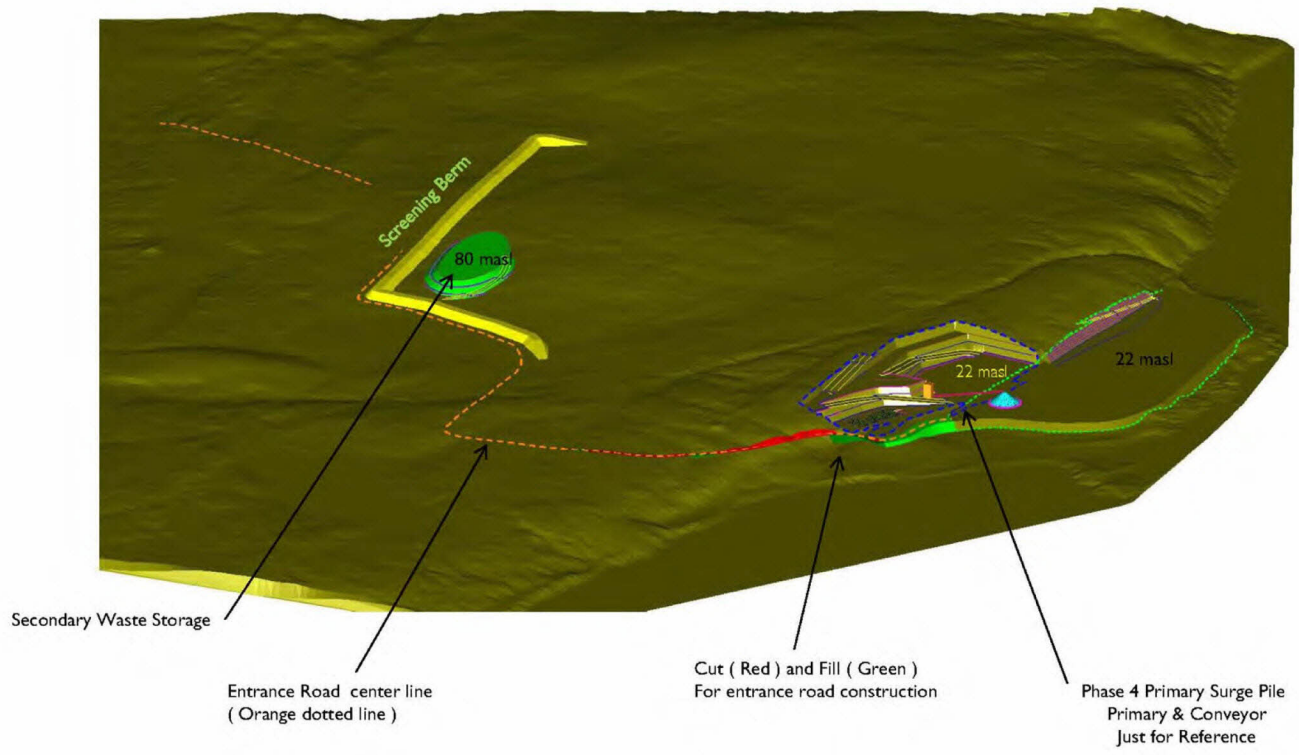
End Of Year 4

Milestones:

- Establish haul ramp down to 22 masl along ridge
- Main pit sump area is ready for construction
- Secondary waste storage pile begins



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End of Year 4

REGION NOVA SCOTIA

PLANT BLACK POINT

DWG. NO. Figure 3.0-6

DRWN BH DATE 10/22/2014 CHK BY

JOB NO. SCALE No scale

PATH

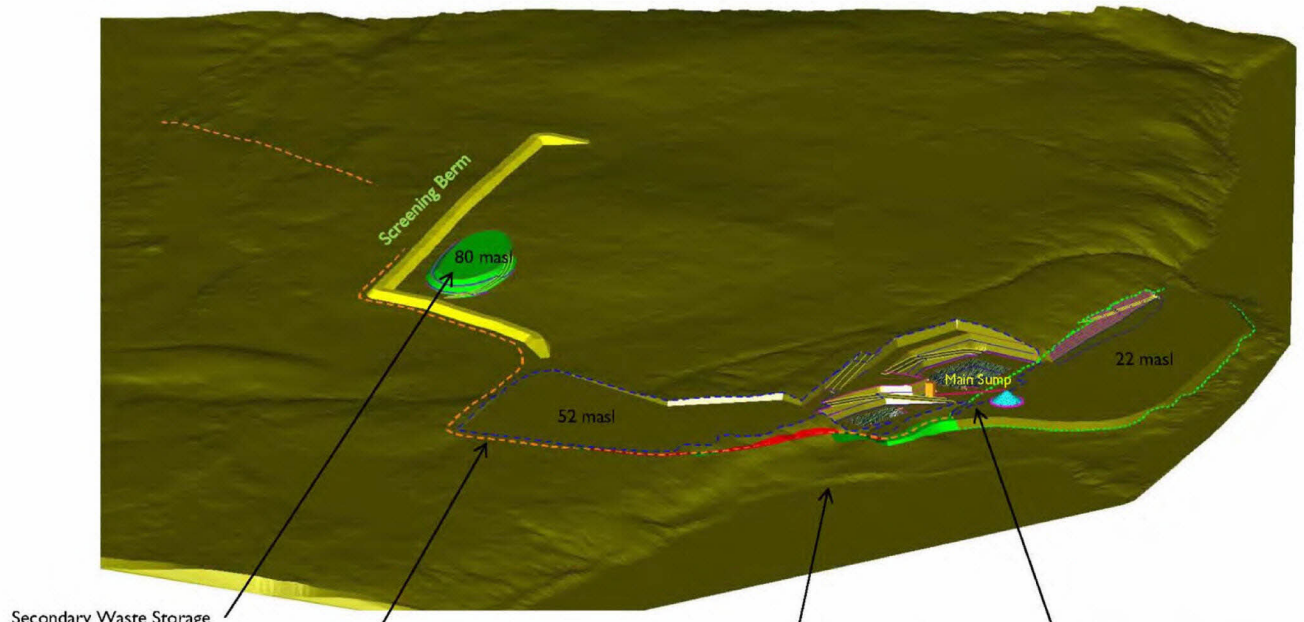
PLOTTED: LAST UPDATE:

DATE REVISION BY ISSUE DATE:

End Of Year 5 11.8 MM Tons Mined

Milestones:

- Main pit sump is complete
  - 102 M gallon capacity
- Area for initial waste pad completed
- Secondary waste pile completed



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End of Year 5

REGION NOVA SCOTIA | PLANT BLACK POINT

DWN BH | DATE 10/22/2014 | CHK BY

JOB NO. | SCALE No scale

PATH

DWG. NO. Figure 3.0-7

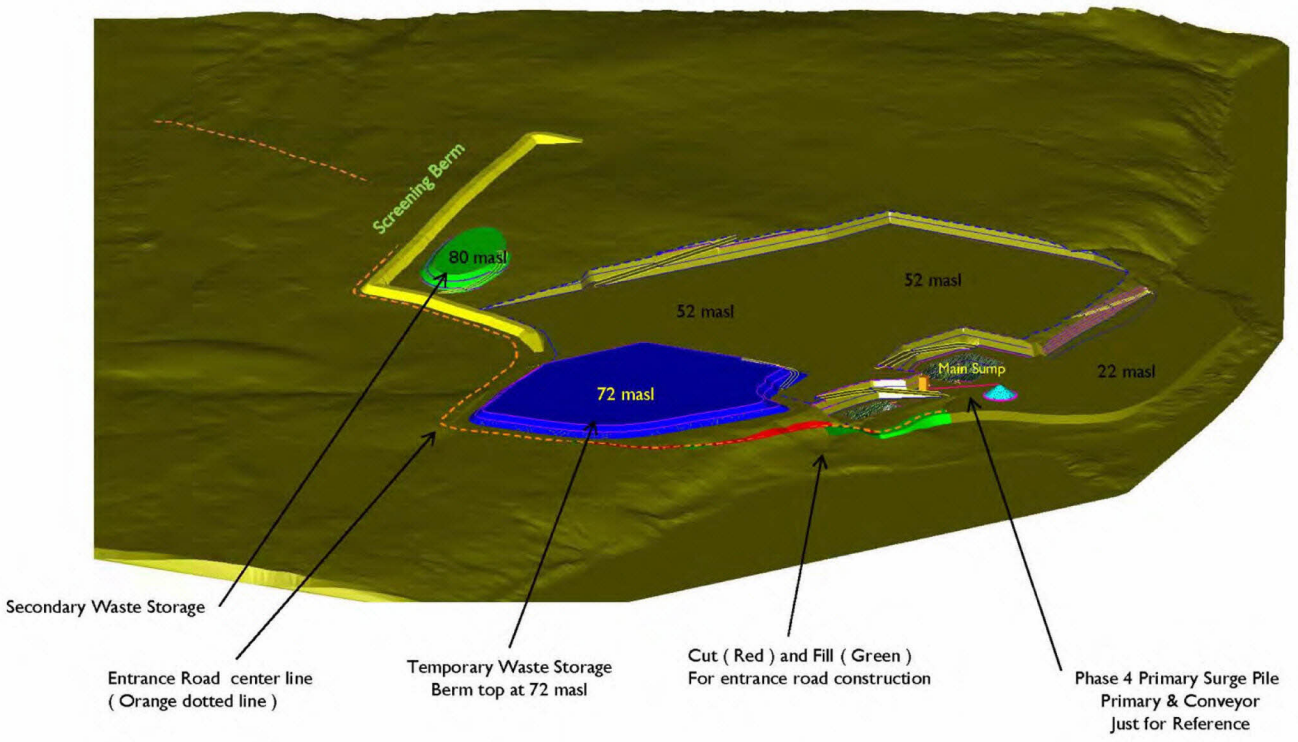
PLOTTED: | LAST UPDATE:

DATE | REVISION | BY | ISSUE DATE:

Milestones:

- Temporary Storage area for waste complete to 72 masl

48.9 MM Tons Mined



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48.9 MM Tons Mined

REGION NOVA SCOTIA | PLANT BLACK POINT

DWN BY BH | DATE 10/22/2014 | CHK BY

JOB NO. | SCALE No scale

PATH

DWG. NO. Figure 3.0-8

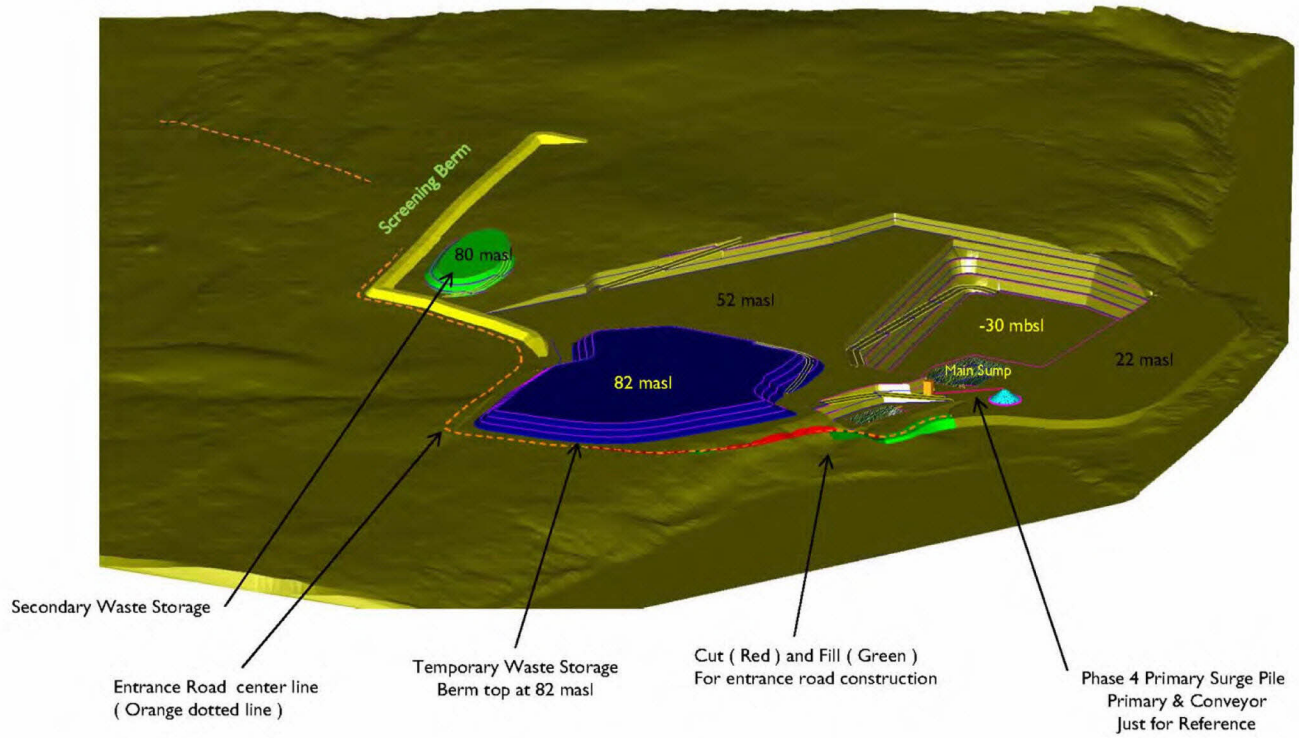
PLOTTED: | LAST UPDATE:

DATE | REVISION | BY | ISSUE DATE:

99.6 MM Tons Mined

Milestones:

- Lowest point in pit -30 mbsl
- Ready for initial in pit waste disposal
- Waste berm foot print expanded and tops out at 82 masl
  - Three 10 m lifts



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99.6 MM Tons Mined

REGION NOVA SCOTIA | PLANT BLACK POINT

DWN BH | DATE 10/22/2014 | CHK BY

JOB NO. | SCALE No scale

PATH

DWG. NO. Figure 3.0-9

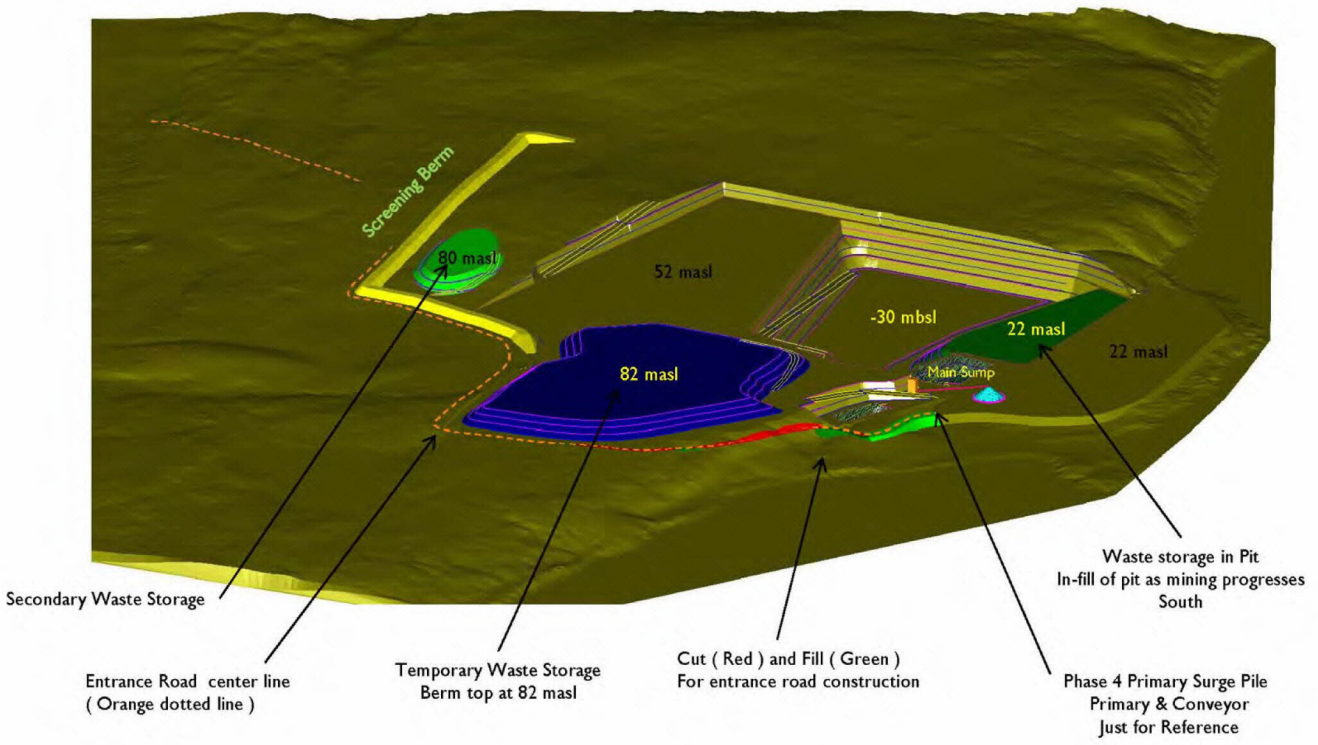
PLOTTED: | LAST UPDATE:

DATE | REVISION | BY | ISSUE DATE:

150.2 MM Tons Mined

Milestones:

- Lowest point in pit at -30 mbsl
- Ready for additional in pit waste disposal



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150.2 MM Tons Mined

REGION NOVA SCOTIA

DWN BH DATE 10/22/2014 CHK BY

JOB NO. SCALE No scale

PATH

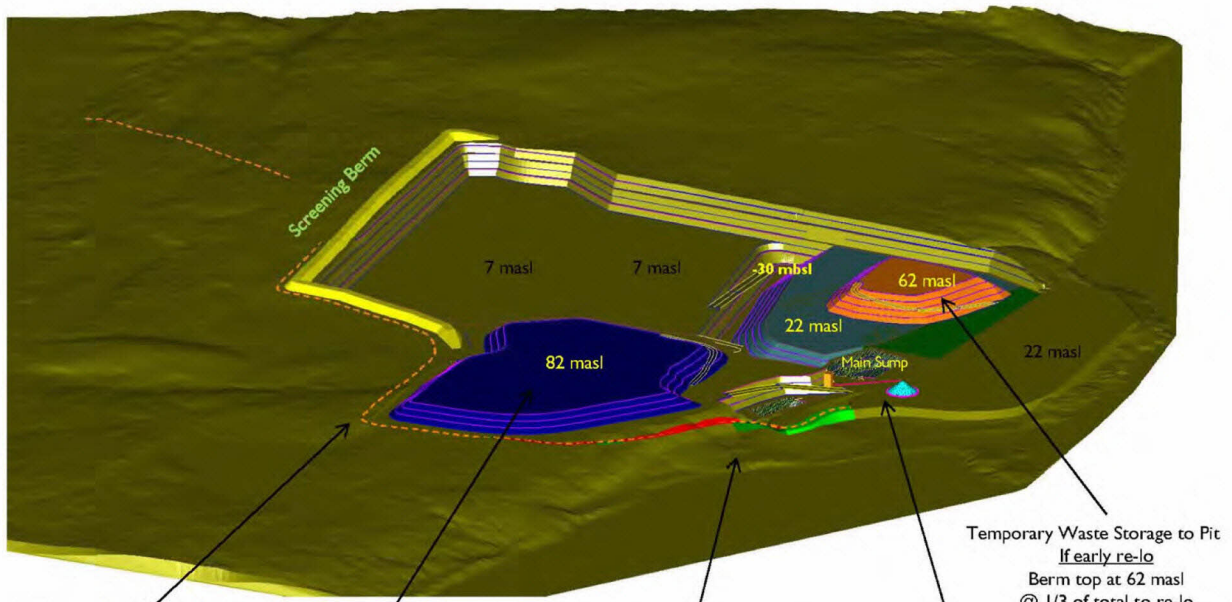
PLANT BLACK POINT

DWG. NO. Figure 3.0-10

251.4 MM Tons Mined

Milestones:

- South expansion complete to 7 masl
- Secondary waste storage relocated to pit
- Temporary waste storage relocation to pit begins
  - Option for early movement shown
- Lowest point in pit -30 mbsl



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251.4 MM Tons Mined

REGION NOVA SCOTIA

PLANT BLACK POINT

DWG. NO. Figure 3.0-11

DRWN BH DATE 08/02/2012 CHK BY

JOB NO. SCALE No scale

PATH

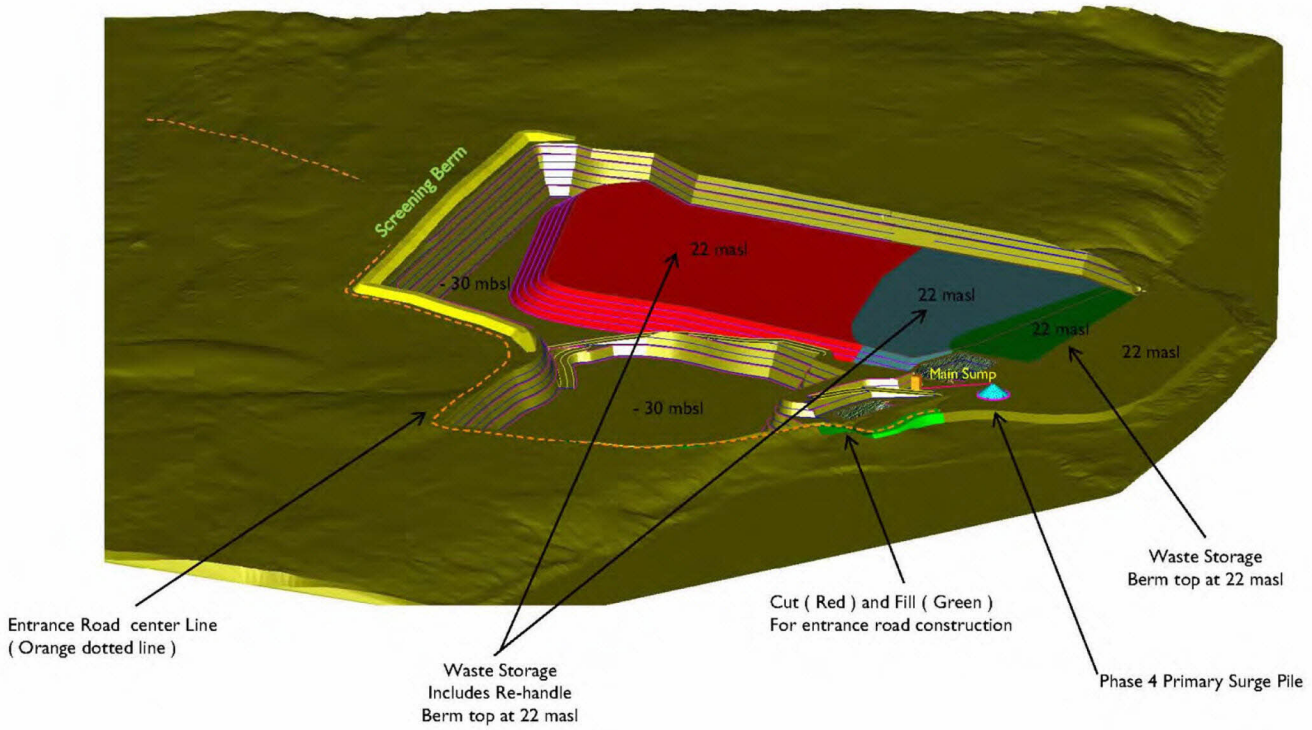
PLOTTED: LAST UPDATE:

DATE REVISION BY ISSUE DATE:

403.3 MM Tons Mined

Milestones:

- Entire pit developed to -30 mbsl
- Main pit mined out to -30 mbsl
- Temporary Waste Storage is 100 % relocated to main pit
- See previous slide for alternative to in pit waste



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403.3 MM Tons Mined

REGION NOVA SCOTIA

DWN BH DATE 10/22/2014 CHK BY

JOB NO. SCALE No scale

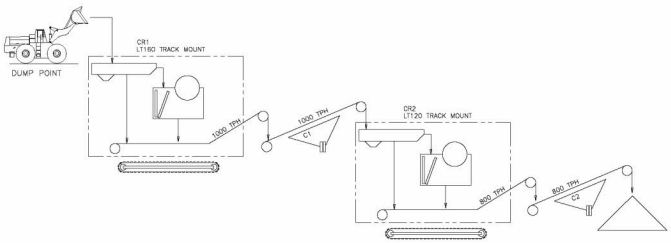
PATH

PLANT BLACK POINT

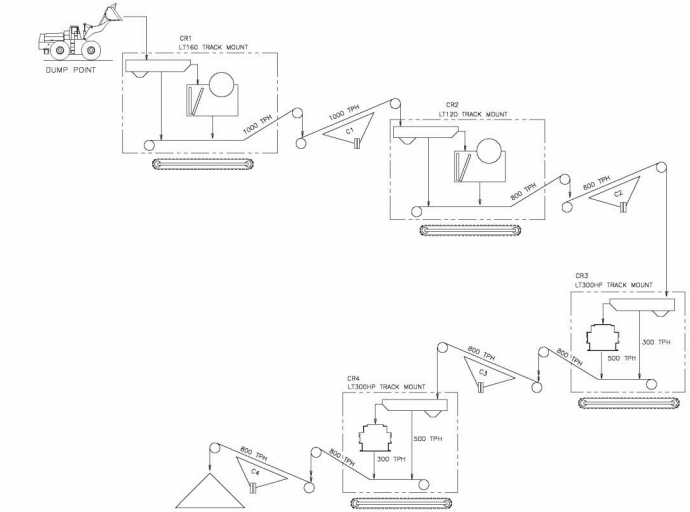
DWG. NO. Figure 3.0-12

3.1.3 Processing Plant

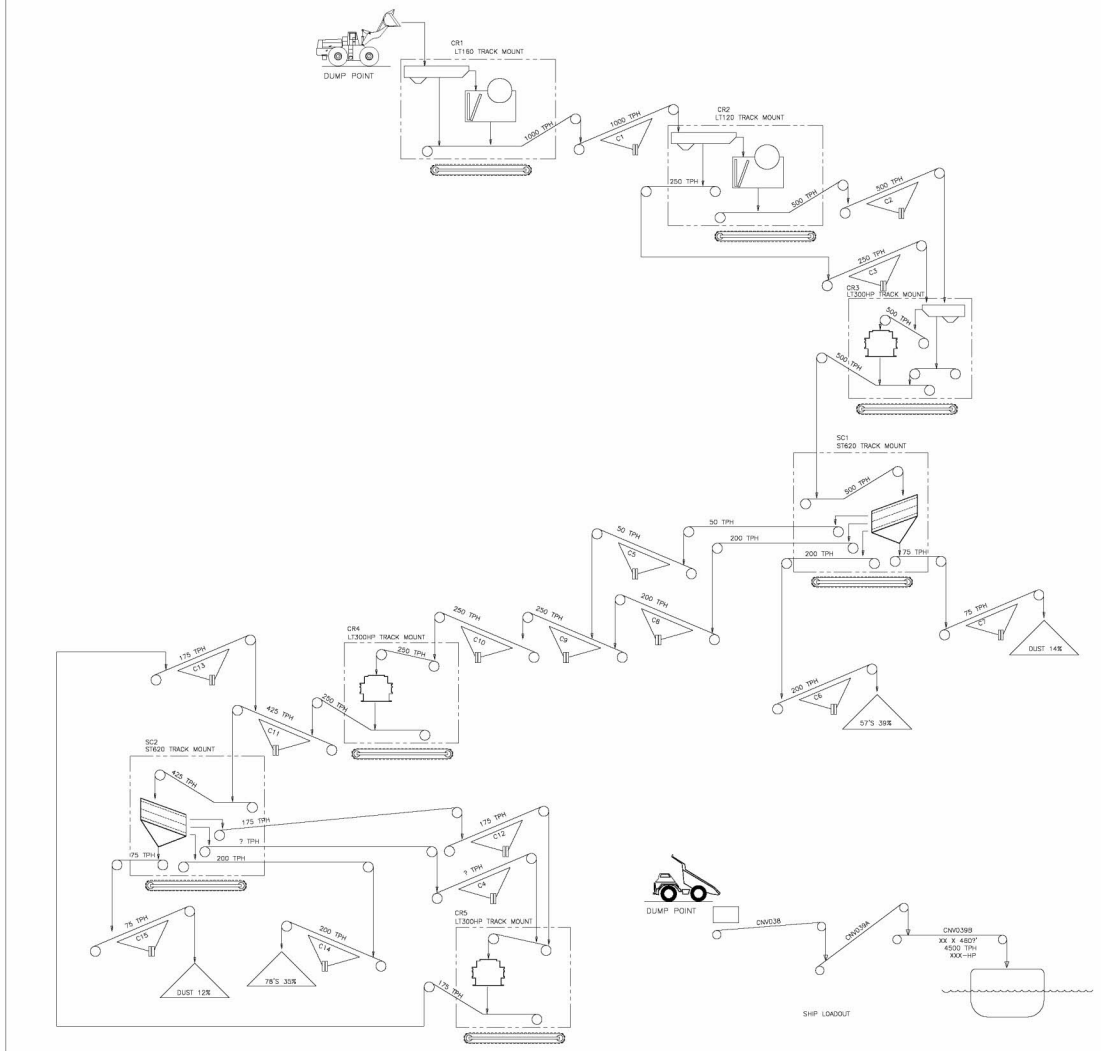
Based upon the preliminary design, there will be five phases of the processing plant ranging from an initial portable circuit utilized for site development to a large fixed plant capable of producing an anticipated peak production of 7.5 MT. Process flow diagrams for each phase are included as **Figures 3.0-13, 3.0-14 and 3.0-15**. A description of each phase is given below.



PHASE #1 FLOW



PHASE #2 FLOW



PHASE #3 FLOW

PROPOSED FLOW CHARTS

PRELIMINARY FLOW CHARTS BASED ON THE EQUIPMENT SHOWN ON PLANT LAYOUTS FIGURES 3-16, 3-17 & 3-18

Morien Resources Corp.

DATE	REVISION	BY
D		
C		
B		
A		
–	INITIAL RELEASE	

TOLERANCES–UNLESS NOTED
FRACTIONAL: ± 1/16"
DECIMAL: ± 0.010"
ANGLE: ± 5.°

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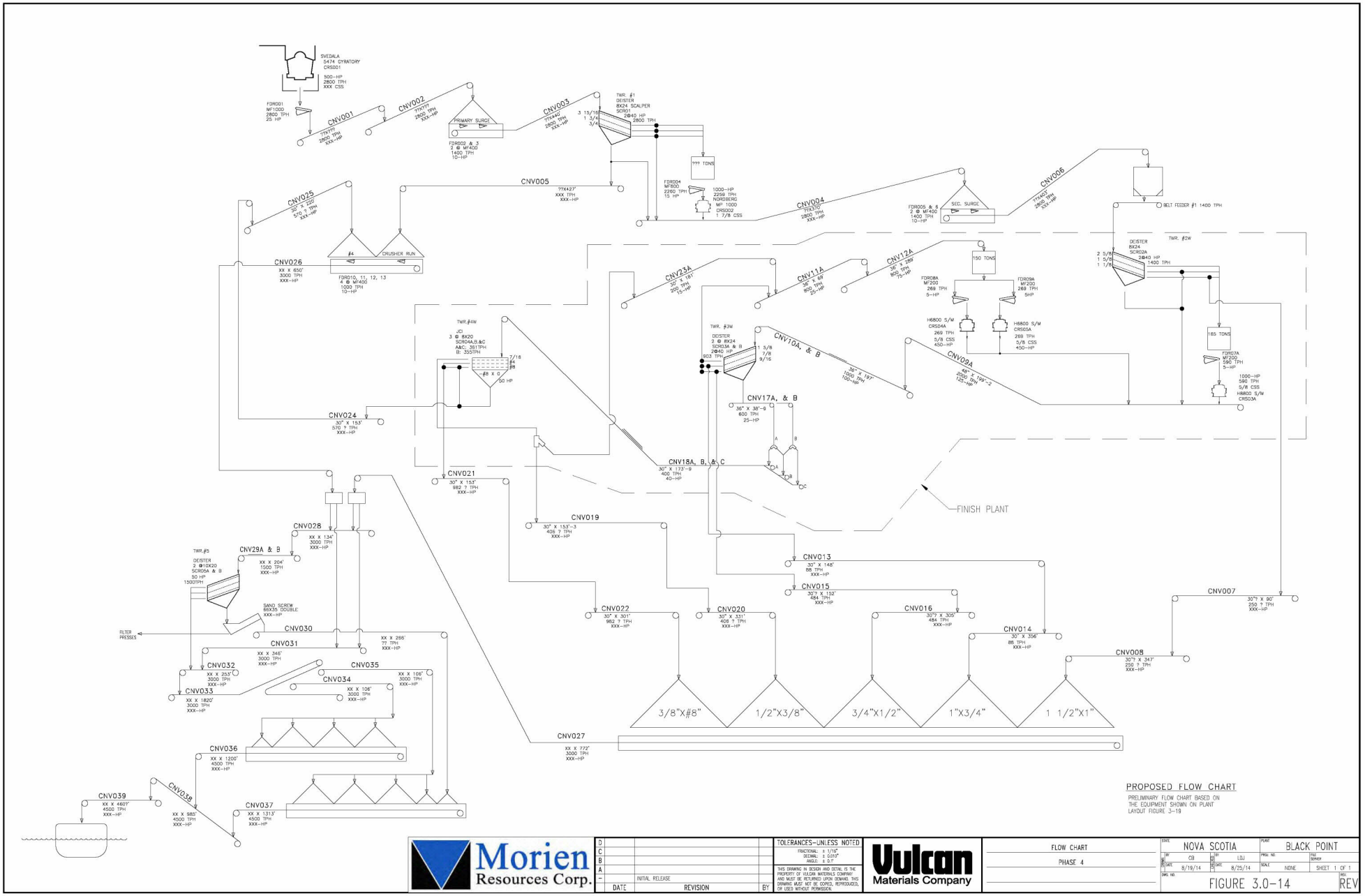
FLOW CHART
PHASES 1, 2 & 3

STATE: NOVA SCOTIA
PLANT: BLACK POINT
DRAWN BY: CB
CHECKED BY: LDJ
DATE: 8/26/14
APPROVED BY:
DATE: 8/25/14
PROJ. NO.
FILE NUMBER
SCALE: NONE
SHEET 1 OF 1
DWG. NO.
FIGURE 3.0-13
REV

C 1340-155



PROPOSED FLOW CHART

PRELIMINARY FLOW CHART BASED ON THE EQUIPMENT SHOWN ON PLANT LAYOUT FIGURE 3-19

Morien Resources Corp.

D			
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B			
A			
–	INITIAL RELEASE		
	DATE	REVISION	BY

TOLERANCES-UNLESS NOTED
FRACTIONAL: ± 1/16"
DECIMAL: ± 0.010"
ANGLE: ± 5.°

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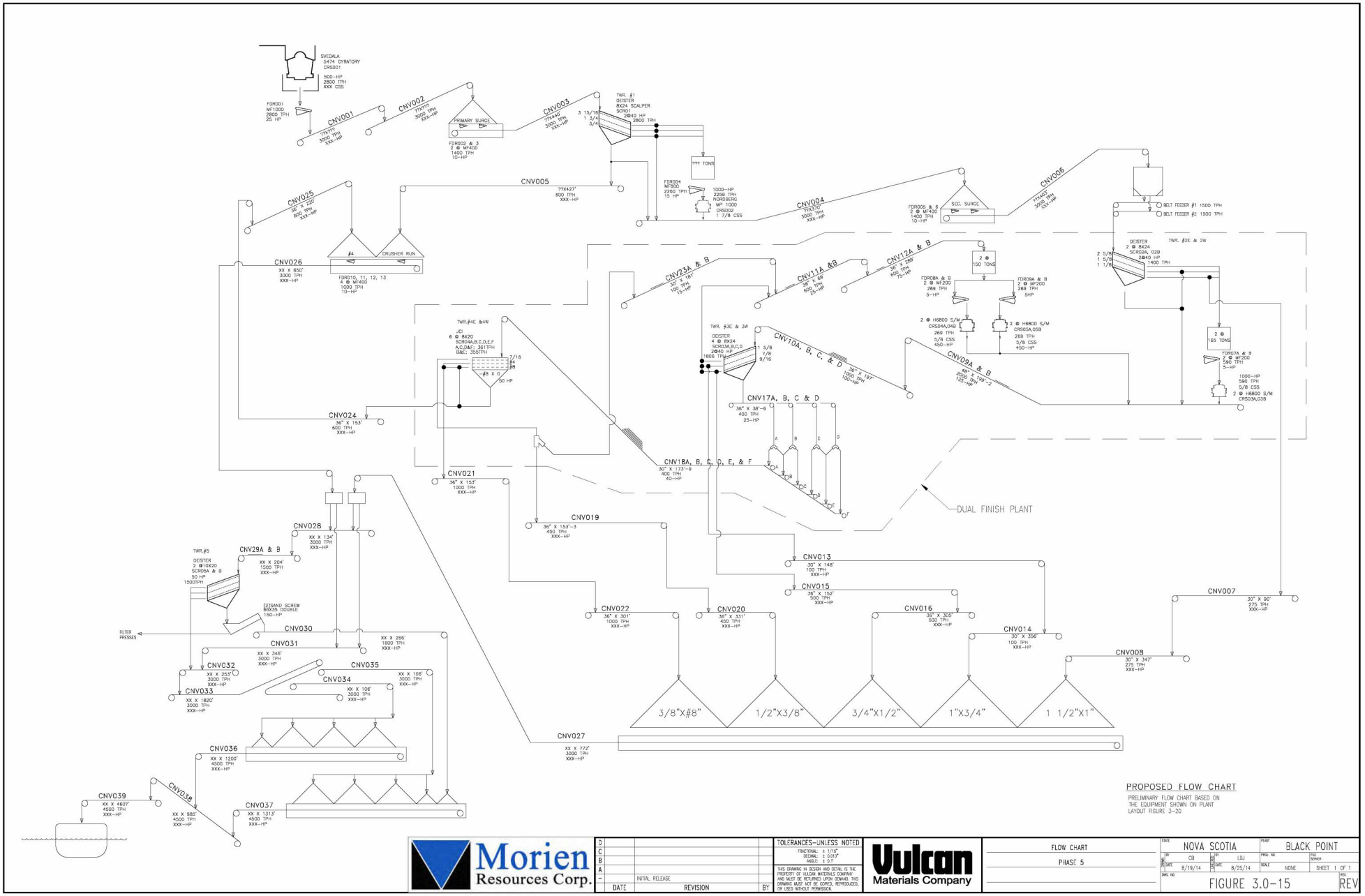
FLOW CHART
PHASE 4

STATE	NOVA SCOTIA	PLANT	BLACK POINT
DRAWN BY	CB	CHECKED BY	LDJ
DRAWN DATE	8/19/14	CHECKED DATE	8/25/14
PROJ. NO.		FILE NUMBER	
SCALE	NONE	SHEET	1 OF 1
DWG. NO.	FIGURE 3.0-14	REV.	REV

C 1340-156



PROPOSED FLOW CHART

PRELIMINARY FLOW CHART BASED ON THE EQUIPMENT SHOWN ON PLANT LAYOUT FIGURE 3-20

Morien Resources Corp.

D			
C			
B			
A			
–	INITIAL RELEASE		
	DATE	REVISION	BY

TOLERANCES-UNLESS NOTED
FRACTIONAL: ± 1/16"
DECIMAL: ± 0.010"
ANGLE: ± 5.°

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Vulcan Materials Company

FLOW CHART
PHASE 5

STATE: NOVA SCOTIA
PLANT: BLACK POINT
DRAWN BY: CB
CHECKED BY: LDJ
DATE: 8/19/14
APPROVED BY:
DATE: 8/25/14
PROJ. NO.
FILE NUMBER
SCALE: NONE
SHEET 1 OF 1
DWG. NO.
FIGURE 3.0-15
REV

C 1340-157

Phase 1, Figure 3.0-16

Major components:

- Two portable track mounted primary crushing plants that include vibrating grizzly feeders.
- Conveyors.

A small portable or mobile plant with a capacity up to 1,000 tons per hour (TPH) will be utilized for initial plant site development. This plant will produce a coarse fill material for site development needs (i.e., road, berm and platform construction). Power for the plant will be provided by diesel powered generators with capacities of either 200 kW or 525 kW depending on whether electricity is available to power the non-motive portion of the plant.

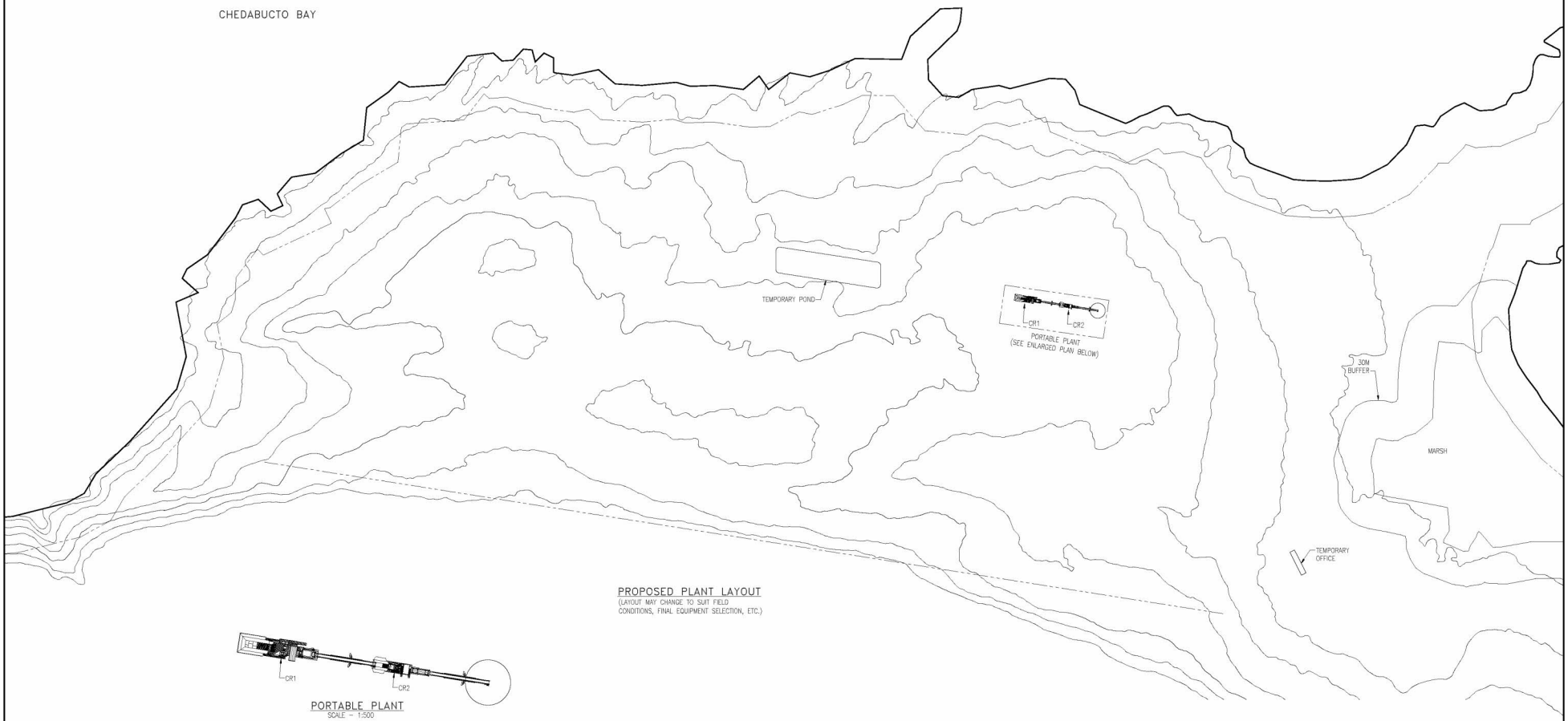
During development of the plant site situated on the lower coastal platform, the grade will be sloped away from the coast and wetlands and toward stormwater retention basins first located near the center of the coastal platform (Figures 3.0-16) and in later phases situated at the foot the cliff (**Figures 3.0-17 and 3.0-18**). These basins are designed to retain stormwater to allow for clarification prior to discharge the marine environment, if needed.

In this plant, blasted material will be trucked to the mobile plant and dumped adjacent to the primary module. A loader will then feed the material into the processing plant. The coarse fill material will be stockpiled by conveyor.

PRELIMINARY EQUIPMENT LIST

Crusher Plant	Model Number	Description	Crusher Model	Power
CR1	LT160	Track Mounted Crushing Plant	C160	Diesel
CR2	LT120	Track Mounted Crushing Plant	C120	Diesel

Conveyors	
Conveyor Number	Description
C1	CR1 to CR2
C2	Product Stacker



PROPOSED PLANT LAYOUT
(LAYOUT MAY CHANGE TO SUIT FIELD CONDITIONS, FINAL EQUIPMENT SELECTION, ETC.)

PORTABLE PLANT
SCALE – 1:500

GRAPHIC SCALE – METERS 100 0 100 200 300

GRAPHIC SCALE – FEET 100 0 100 200 300 400 500 600 700 800 900 1000

Morien Resources Corp.

D			
C			
B			
A			
–	INITIAL RELEASE		
	DATE	REVISION	BY

TOLERANCES–UNLESS NOTED
FRACTIONAL: ± 1/16"
DECIMAL: ± 0.015"
ANGLE: ± 0.1°

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Vulcan Materials Company

PLANT LAYOUT (PHASE 1)

STATE: NOVA SCOTIA
PLANT: BLACK POINT
BY: CB
CHECKED BY: LJ
PROJ. NO.
FILE NUMBER
DRAWN DATE: 6/27/14
CHECKED DATE: 9/15/14
SCALE: 1 : 1500
SHEET 1 OF 1
DWG. NO.
FIGURE 3.0-16
REV

C 1340-159

Phase 2, Figure 3.0-17

Major components:

- Phase 1 equipment described above.
- Two portable track mounted secondary crushing plants that include vibrating feeders.
- Conveyors.

In the second phase plant, two additional track mounted crushing modules will be added to the Phase 1 equipment; the modules will have a similar capacity to that described for Phase 1. This plant will produce a fine graded fill material for final site development needs. Power for this plant will be provided by diesel powered generators built into the track mounted crushing units.

During final development of the site, the grade will be sloped away from the coast and wetlands and toward a permanent stormwater retention basin built against the cliff. This will prevent uncontrolled stormwater discharges to the marine environment.

Marine terminal construction is expected to begin during Phase 2 as described in Section 3.2.6.

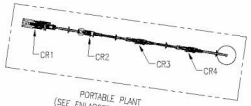
Operation of this plant will be identical to that of the Phase 1 plant. The fine graded fill material will be stockpiled by conveyor and no washing of aggregate will occur during Phase 1 or Phase 2. All material produced will be a base or crusher run product.

PRELIMINARY EQUIPMENT LIST

Crusher Plant	Model Number	Description	Crusher Model	Power
CR1	LT160	Track Mounted Crushing Plant	C160	Diesel
CR2	LT120	Track Mounted Crushing Plant	C120	Diesel
CR3	LT300HP	Track Mounted Crushing Plant	HP300	Diesel
CR4	LT300HP	Track Mounted Crushing Plant	HP300	Diesel

Conveyors	
Conveyor Number	Description
C1	CR1 to CR2
C2	CR2 to CR3
C3	CR3 to CR4
C4	Product Stacker

CHEDABUCTO BAY



PORTABLE PLANT
(SEE ENLARGED PLAN BELOW)

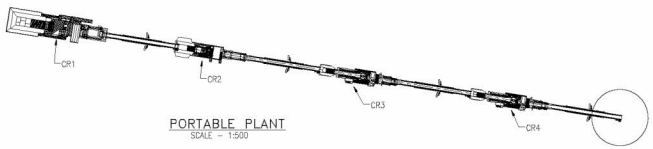
POND

30M BUFFER

MARSH

TEMPORARY OFFICE

PROPOSED PLANT LAYOUT
(LAYOUT MAY CHANGE TO SUIT FIELD CONDITIONS, FINAL EQUIPMENT SELECTION, ETC.)



PORTABLE PLANT
SCALE – 1:500

100 GRAPHIC SCALE – METERS 0 100 200 300

GRAPHIC SCALE – FEET 100 0 100 200 300 400 500 600 700 800 900 1000

Morien Resources Corp.

D			
C			
B			
A			
–	INITIAL RELEASE		
	DATE	REVISION	BY

TOLERANCES–UNLESS NOTED
FRACTIONAL: ± 1/16"
DECIMAL: ± 0.015"
ANGLE: ± 0.5°

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PLANT LAYOUT (PHASE 2)

STATE: NOVA SCOTIA
PLANT: BLACK POINT
DRAWN BY: CB
CHECKED BY: LJ
DRAWING DATE: 6/27/14
REVISION DATE: 9/15/14
PROJ. NO.
FILE NUMBER
SCALE: 1 : 1500
SHEET 1 OF 1
DWG. NO.
FIGURE 3.0-17
REV

C 1340-161

Phase 3, Figure 3.0-18

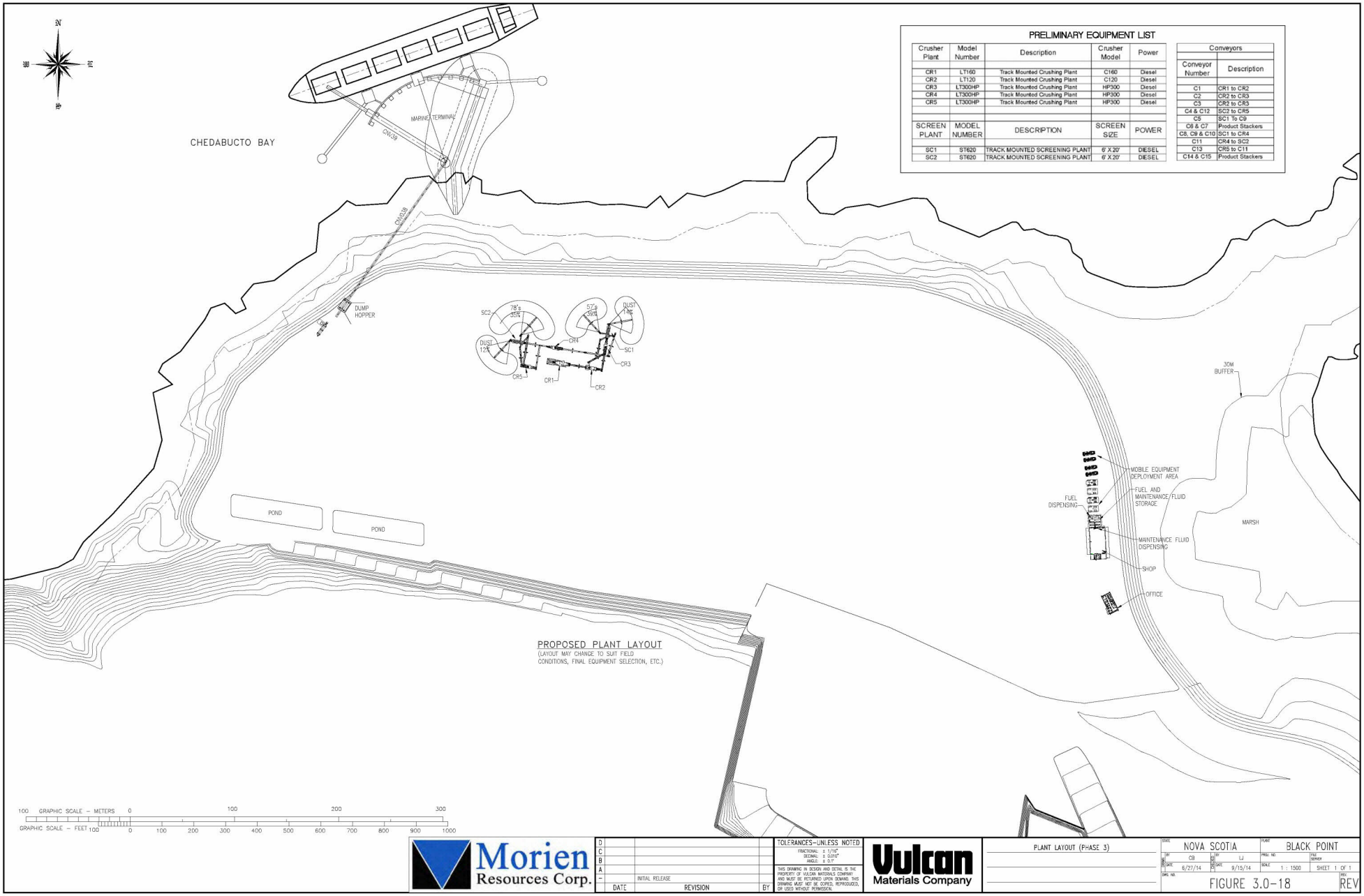
Major components:

- Phase 2 equipment described above.
- Two additional portable track mounted screening plants.
- One track mounted tertiary crushing plant with a belt feeder.
- Conveyors.

After the processing plant site has been developed, additional mobile units will be added to begin production to meet the initial sales demand. Power for the additional units will be supplied by diesel powered generators with combined capacity of 260 kW in addition to the existing generators identified as in Phases 1 and 2. Production during Phase 3 is expected to be approximately 500 TPH. This plant will be replaced by a larger fixed plant over time as the sales demand dictates. This approach is intended to save capital during the early years of the Project.

Operation of the Phase 3 plant will be similar to that of the earlier phases. In this plant, various products will be stockpiled via conveyor and trucked to the marine terminal. The conveyor feeding the ship loader will include a loadout hopper that can be charged with a plant loader.

The portable plant will be located in a portion of the plant site that will allow construction of the Phase 4 plant.



PRELIMINARY EQUIPMENT LIST

Crusher Plant	Model Number	Description	Crusher Model	Power
CR1	LT160	Track Mounted Crushing Plant	C160	Diesel
CR2	LT120	Track Mounted Crushing Plant	C120	Diesel
CR3	LT300HP	Track Mounted Crushing Plant	HP300	Diesel
CR4	LT300HP	Track Mounted Crushing Plant	HP300	Diesel
CR5	LT300HP	Track Mounted Crushing Plant	HP300	Diesel

SCREEN PLANT	MODEL NUMBER	DESCRIPTION	SCREEN SIZE	POWER
SC1	ST620	TRACK MOUNTED SCREENING PLANT	6' X 20'	DIESEL
SC2	ST620	TRACK MOUNTED SCREENING PLANT	6' X 20'	DIESEL

Conveyors	
Conveyor Number	Description
C1	CR1 to CR2
C2	CR2 to CR3
C3	CR2 to CR5
C4 & C12	SC2 to CR5
C5	SC1 To C9
C6 & C7	Product Stackers
C8, C9 & C10	SC1 to CR4
C11	CR4 to SC2
C13	CR5 to C11
C14 & C15	Product Stackers

Morien Resources Corp.

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C			
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DECIMAL: ± 0.010"
ANGLE: ± 0.1°

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PLANT LAYOUT (PHASE 3)

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PLANT: BLACK POINT
DRAWN: CB
CHECKED: LJ
PROJ. NO.
FILE NUMBER
DATE: 6/27/14
DATE: 9/15/14
SCALE: 1 : 1500
SHEET 1 OF 1
DWG. NO.: FIGURE 3.0-18
REV

C 1340-163

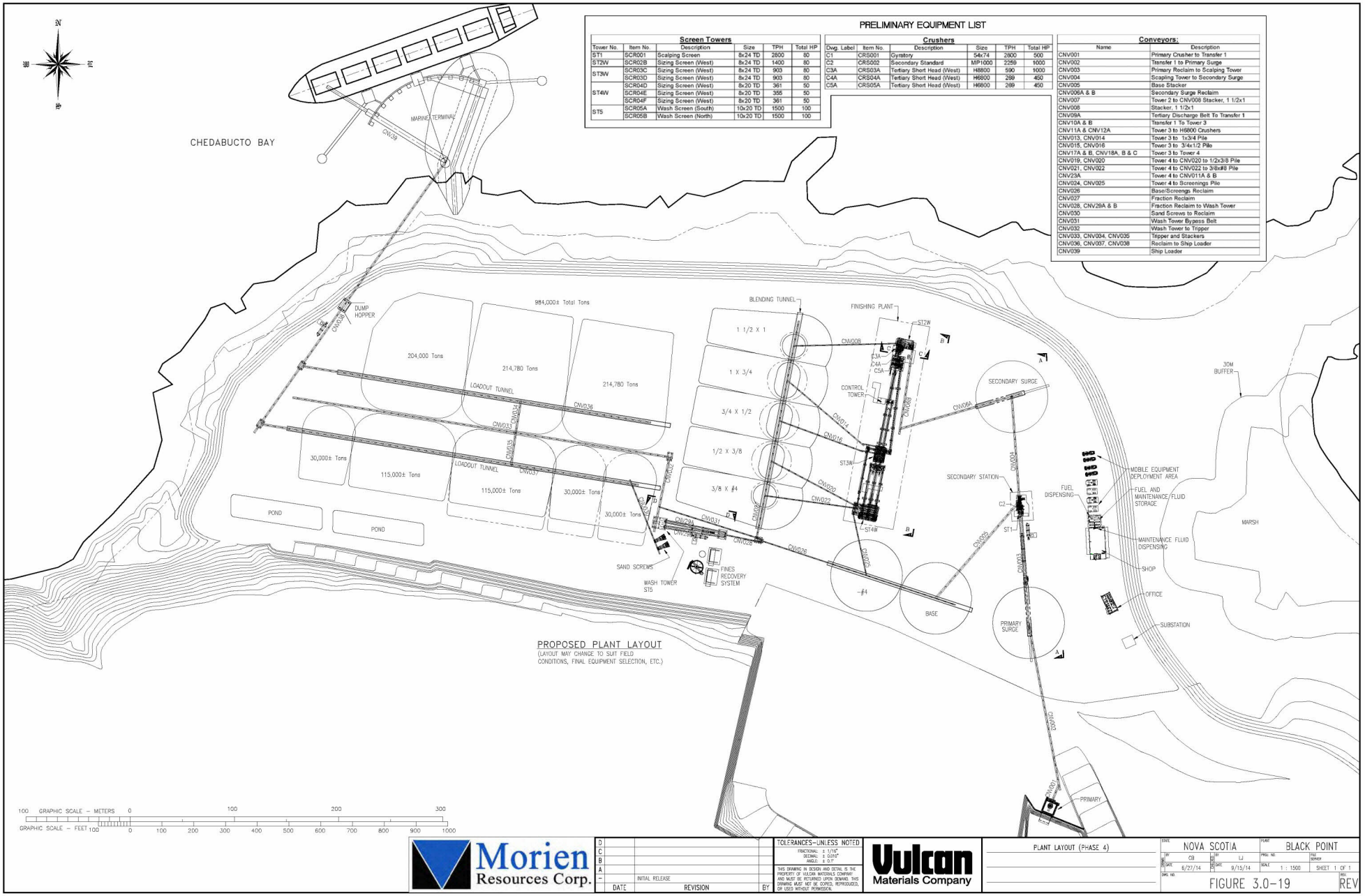
Phase 4, Figure 3-19

Major components:

- Primary gyratory crusher.
- Primary surge reclaim tunnel.
- Scalping screen.
- Secondary cone crusher.
- Secondary surge reclaim tunnel.
- Six sizing screens.
- Three tertiary cone crushers.
- Conveyors.
- Vibratory feeders.
- Base/screenings reclaim tunnel.
- Fractionated products reclaim tunnel.
- Two wash screens.
- Fines recovery system.
- Two sand screws.
- Two loadout reclaim tunnels.
- Marine terminal.

When the sales demand dictates a higher production rate, the mobile plant will be replaced by a larger fixed plant. The plant will have a flexible design that will allow it to be expanded as the market demand increases. The initial fixed plant will have the capability to produce up to 1,400 TPH through the tertiary plant.

In this plant, blasted material will be trucked to the primary crusher where it will be dumped into the primary hopper. There it will be crushed and conveyed to a primary surge pile located near the "secondary" where it will be fed into the plant. As the material is processed with further crushing and screening, it will be conveyed to product piles that are located over "reclaim" tunnels, that is, tunnels equipped with conveyor systems that allow the products to be moved. Products can then be reclaimed to the wash tower for rinsing or bypassed around it. Material will then be stockpiled over the loadout reclaim tunnels that will convey product to the marine terminal.



PRELIMINARY EQUIPMENT LIST

Screen Towers

Tower No.	Item No.	Description	Size	TPH	Total HP
ST1	SCR001	Scalping Screen	8x24 TD	2800	60
ST2W	SCR02B	Sizing Screen (West)	8x24 TD	1400	80
ST3W	SCR03C	Sizing Screen (West)	8x24 TD	903	80
	SCR03D	Sizing Screen (West)	8x24 TD	903	80
ST4W	SCR04D	Sizing Screen (West)	8x20 TD	361	50
	SCR04E	Sizing Screen (West)	8x20 TD	355	50
	SCR04F	Sizing Screen (West)	8x20 TD	361	50
ST5	SCR05A	Wash Screen (South)	10x20 TD	1500	100
	SCR05B	Wash Screen (North)	10x20 TD	1500	100

Crushers

Dwg. Label	Item No.	Description	Size	TPH	Total HP
C1	CRS001	Gyratory	54x74	2800	500
C2	CRS002	Secondary Standard	MP1000	2259	1000
C3A	CRS03A	Tertiary Short Head (West)	H8800	590	1000
C4A	CRS04A	Tertiary Short Head (West)	H6800	269	450
C5A	CRS05A	Tertiary Short Head (West)	H6800	269	450

Conveyors:

Name	Description
CNV001	Primary Crusher to Transfer 1
CNV002	Transfer 1 to Primary Surge
CNV003	Primary Reclaim to Scalping Tower
CNV004	Scapling Tower to Secondary Surge
CNV005	Base Stacker
CNV006A & B	Secondary Surge Reclaim
CNV007	Tower 2 to CNV008 Stacker, 1 1/2x1
CNV008	Stacker, 1 1/2x1
CNV09A	Tertiary Discharge Belt To Transfer 1
CNV10A & B	Transfer 1 To Tower 3
CNV11A & CNV12A	Tower 3 to H6800 Crushers
CNV013, CNV014	Tower 3 to 1x3/4 Pile
CNV015, CNV016	Tower 3 to 3/4x1/2 Pile
CNV17A & B, CNV18A, B & C	Tower 3 to Tower 4
CNV019, CNV020	Tower 4 to CNV020 to 1/2x3/8 Pile
CNV021, CNV022	Tower 4 to CNV022 to 3/8x#8 Pile
CNV23A	Tower 4 to CNV011A & B
CNV024, CNV025	Tower 4 to Screenings Pile
CNV026	Base/Screengs Reclaim
CNV027	Fraction Reclaim
CNV028, CNV29A & B	Fraction Reclaim to Wash Tower
CNV030	Sand Screws to Reclaim
CNV031	Wash Tower Bypass Belt
CNV032	Wash Tower to Tripper
CNV033, CNV034, CNV035	Tripper and Stackers
CNV036, CNV037, CNV038	Reclaim to Ship Loader
CNV039	Ship Loader

Morien Resources Corp.

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PLANT LAYOUT (PHASE 4)

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PLANT: BLACK POINT
DRAWN: CB
CHECKED: LJ
DATE: 6/27/14
DATE: 9/15/14
PROJ. NO.
FILE NUMBER
SCALE: 1 : 1500
SHEET 1 OF 1
DWG. NO.
FIGURE 3.0–19
REV

C 1340-165

The plant layout is designed in consideration of safe operational needs along with best practices developed over many years. The plant will be designed to minimize airborne dust emissions by utilizing built-in wet suppression for dust control. All structures will be designed according to appropriate building codes and engineering standards. Electrical power for the plant will be provided via Nova Scotia Power Inc. as described in Section 3.1.6.

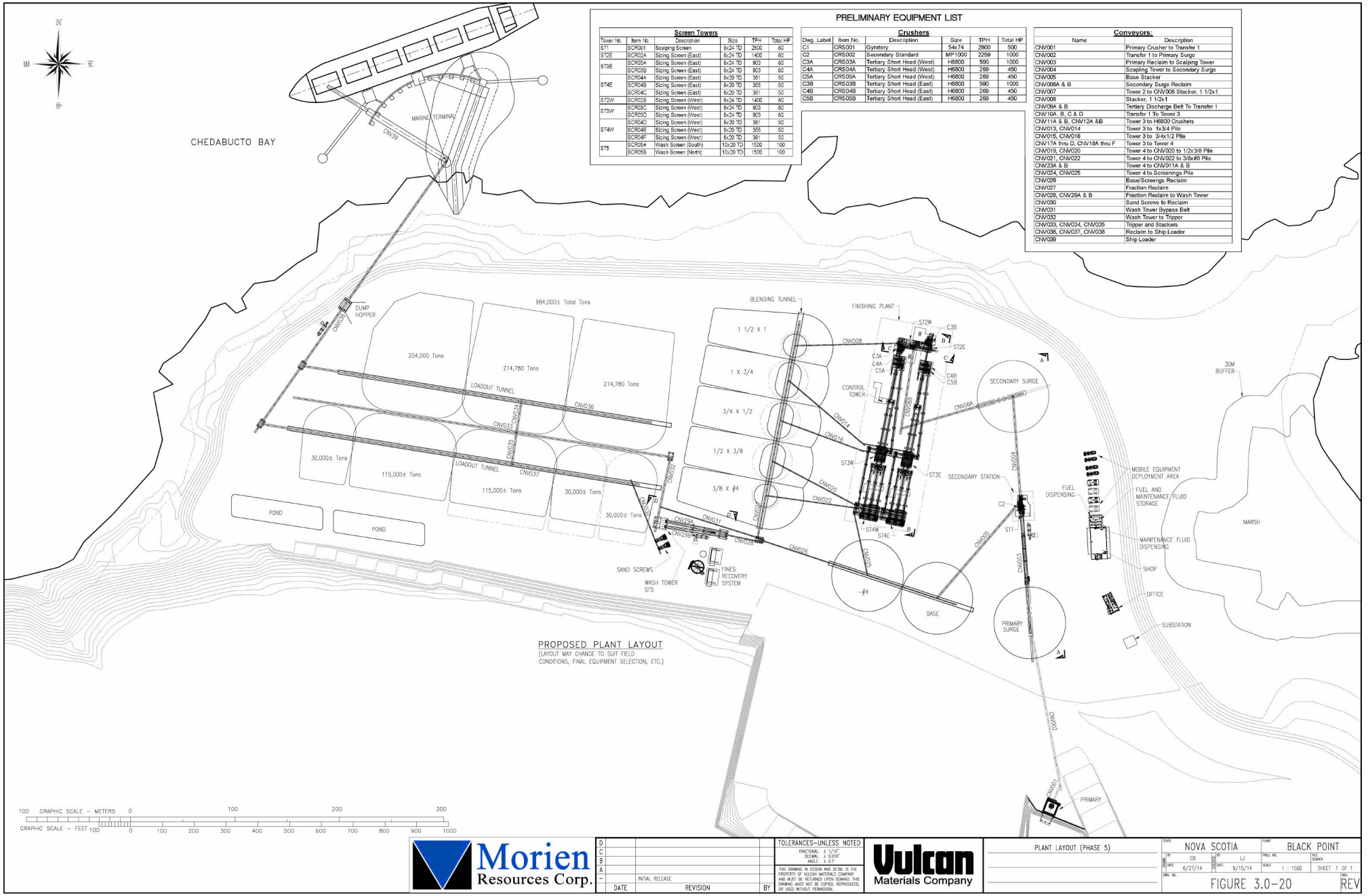
Phase 5, Figure 3-20

Major components:

- Phase 4 equipment described above.
- Six sizing screens.
- Three tertiary cone crushers.
- Conveyors.
- Vibratory feeders.

As the sales demand increases and production rates approach the limit of the initial fixed plant, the final phase will be initiated. This plant will upgrade the tertiary portion of the Phase 4 plant by installing a parallel tertiary processing circuit. Figure **3.0-21** provides plant elevations for the Phase 4 and 5 plants. Production through the finishing plant will be increased to 2,800 TPH.

Processing and loadout of the material will be identical to the Phase 4 plant but with a higher capacity. The parallel circuit will be identical to the original tertiary to minimize design time and costs. The layout will be located to minimize any operational disruptions due to the expansion.



PRELIMINARY EQUIPMENT LIST

Screen Towers

Tower No.	Item No.	Description	Size	TPH	Total HP
ST1	SCR01	Scalping Screen	8x24 TD	2800	800
ST2E	SCR02A	Sizing Screen (East)	8x24 TD	1400	80
ST3E	SCR03A	Sizing Screen (East)	8x24 TD	903	80
	SCR03B	Sizing Screen (East)	8x24 TD	903	80
ST4E	SCR04A	Sizing Screen (East)	8x20 TD	361	50
	SCR04B	Sizing Screen (East)	8x20 TD	355	50
	SCR04C	Sizing Screen (East)	8x20 TD	361	50
ST2W	SCR02B	Sizing Screen (West)	8x24 TD	1400	80
ST3W	SCR03C	Sizing Screen (West)	8x24 TD	903	80
	SCR03D	Sizing Screen (West)	8x24 TD	903	80
ST4W	SCR04D	Sizing Screen (West)	8x20 TD	361	50
	SCR04E	Sizing Screen (West)	8x20 TD	355	50
	SCR04F	Sizing Screen (West)	8x20 TD	361	50
ST5	SCR05A	Wash Screen (South)	10x20 TD	1500	100
	SCR05B	Wash Screen (North)	10x20 TD	1500	100

Crushers

Dwg. Label	Item No.	Description	Size	TPH	Total HP
C1	CRS001	Gyratory	54x74	2800	500
C2	CRS002	Secondary Standard	MP1000	2259	1000
C3A	CRS03A	Tertiary Short Head (West)	H8800	590	1000
C4A	CRS04A	Tertiary Short Head (West)	H6800	269	450
C5A	CRS05A	Tertiary Short Head (West)	H6800	269	450
C3B	CRS03B	Tertiary Short Head (East)	H8800	590	1000
C4B	CRS04B	Tertiary Short Head (East)	H6800	269	450
C5B	CRS05B	Tertiary Short Head (East)	H6800	269	450

Conveyors:

Name	Description
CNV001	Primary Crusher to Transfer 1
CNV002	Transfer 1 to Primary Surge
CNV003	Primary Reclaim to Scalping Tower
CNV004	Scapling Tower to Secondary Surge
CNV005	Base Stacker
CNV006A & B	Secondary Surge Reclaim
CNV007	Tower 2 to CNV008 Stacker, 1 1/2x1
CNV008	Stacker, 1 1/2x1
CNV08A & B	Tertiary Discharge Belt To Transfer 1
CNV10A, B, C & D	Transfer 1 To Tower 3
CNV11A & B, CNV12A &B	Tower 3 to H6800 Crushers
CNV013, CNV014	Tower 3 to 1x3/4 Pile
CNV015, CNV016	Tower 3 to 3/4x1/2 Pile
CNV17A thru D, CNV18A thru F	Tower 3 to Tower 4
CNV019, CNV020	Tower 4 to CNV020 to 1/2x3/8 Pile
CNV021, CNV022	Tower 4 to CNV022 to 3/8x#8 Pile
CNV23A & B	Tower 4 to CNV011A & B
CNV024, CNV025	Tower 4 to Screenings Pile
CNV026	Base/Screengs Reclaim
CNV027	Fraction Reclaim
CNV028, CNV29A & B	Fraction Reclaim to Wash Tower
CNV030	Sand Screws to Reclaim
CNV031	Wash Tower Bypass Belt
CNV032	Wash Tower to Tripper
CNV033, CNV034, CNV035	Tripper and Stackers
CNV036, CNV037, CNV038	Reclaim to Ship Loader
CNV039	Ship Loader

PROPOSED PLANT LAYOUT

(LAYOUT MAY CHANGE TO SUIT FIELD CONDITIONS, FINAL EQUIPMENT SELECTION, ETC.)

GRAPHIC SCALE – METERS 100 0 100 200 300

GRAPHIC SCALE – FEET 100 0 100 200 300 400 500 600 700 800 900 1000

Morien Resources Corp.

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C			
B			
A			
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DECIMAL: ± 0.010"
ANGLE: ± 0.1°

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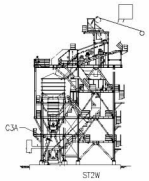
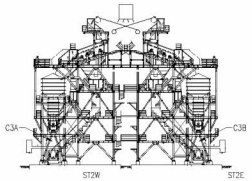
PLANT LAYOUT (PHASE 5)

STATE: NOVA SCOTIA
PLANT: BLACK POINT
DRAWN: CB
DESIGNED: LJ
PROJ. NO.
REF. SERVER
DATE: 6/27/14
DATE: 9/15/14
SCALE: 1 : 1500
SHEET 1 OF 1
DWG. NO.
FIGURE 3.0–20
REV

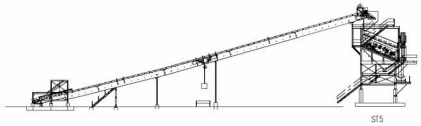
C 1340-167



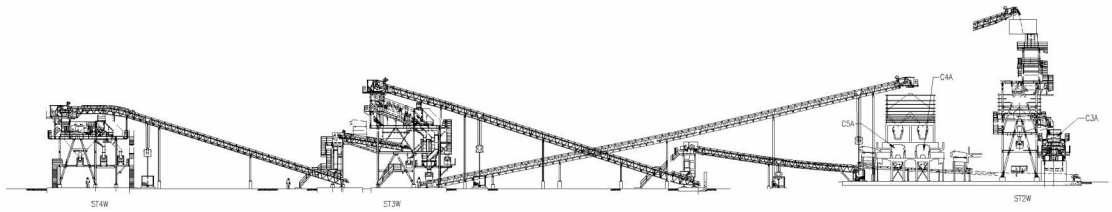
ELEVATION "C–C"
PHASE #4



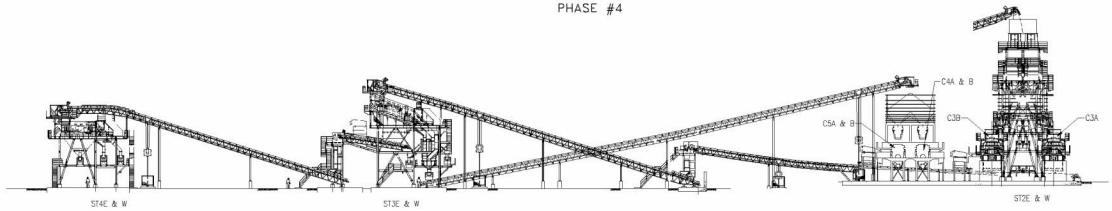
ELEVATION "C–C"
PHASE #5



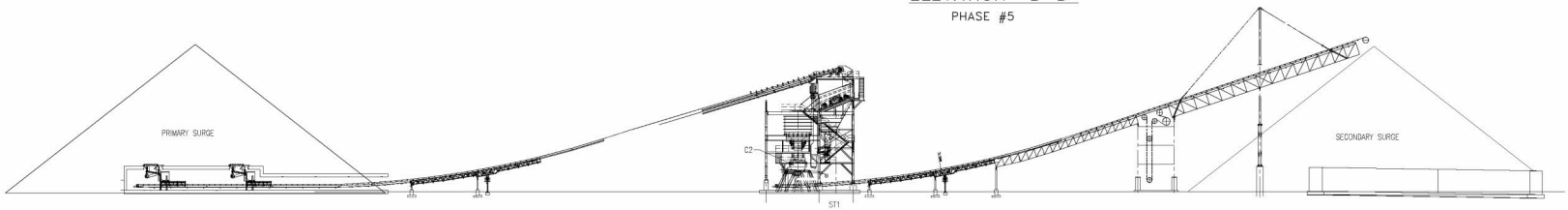
ELEVATION "D–D"



ELEVATION "B–B"
PHASE #4



ELEVATION "B–B"
PHASE #5



ELEVATION "A–A"

PROPOSED PLANT ELEVATIONS

PRELIMINARY ELEVATIONS TO ILLUSTRATE
THE EQUIPMENT SHOWN ON PLANT LAYOUTS
FIGURES 3–19 & 3–20

0 GRAPHIC SCALE – METERS 100

0 GRAPHIC SCALE – FEET 100

Morien Resources Corp.

D			
C			
B			
A			
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PLANT ELEVATIONS
PHASES 4 & 5

STATE: NOVA SCOTIA
PLANT: BLACK POINT
DRAWN BY: CB
CHECKED BY: LJ
DATE: 8/19/14
DATE: 9/15/14
SCALE: 1 : 400
SHEET 1 OF 1
DWG. NO.
FIGURE 3.0-21
REV

C 1340-168

3.1.4 Stockpiles, Overburden and Crusher Fines

The processing plant site is approximately 28 ha in size and occupies the northern section of the 354.5 ha Project site along Chedabucto Bay (**Figure 3.0-1**). This area will be used for processing (e.g. secondary and tertiary crushing, screening, washing and conveying), as well as stockpiling aggregate products, equipment, fuel and material storage, ship loading and administrative buildings.

The area will contain two ponds beginning in Phase 3, located on the western edge of the plant site against the cliff. Each pond will be sized to hold approximately 6,100 m^3. One of the ponds will be dedicated to stormwater retention and will be dry most of the time, while the other will be used to supply process water for washing and dust control. During Phase 1, temporary ponds will be utilized as required to manage stormwater. In Phase 2, one of the permanent ponds will be constructed and dedicated to stormwater retention.

This portion of the site will include two surge piles, various aggregate product piles (fractionated, screenings and base material) and approximately 1,000,000 tons of product ready for shipment. The plant layout and water system will be designed to minimize airborne dust emissions by employing wet suppression for dust control.

Storage locations of overburden and organic materials will be selected as part of the detailed site engineering. For the purposes of the EIS, overburden storage is shown in a screening berm along the southern property boundary and in various designed piles inside the pit boundary (see **Figures 3.0-2 through 3.0-12**).

3.1.5 Administrative Buildings

Approximately 2.5 ha will be dedicated for an administrative area and will be located on the eastern edge of the plant site (**Figure 3.0-18**). In this area, two buildings (modular or fixed) will be erected. One will contain offices and the administrative functions while the other will contain facilities for on-site workers such as a locker/shower room, washroom, first aid station, lunchroom, quality control laboratory and shop. This area will also include a site to store fuel and other maintenance fluids. Mobile equipment will be parked adjacent to the shop.

3.1.6 Transmission Line Tie In

Electrical power will be required for buildings and the operation of equipment (pumps, conveyors, crushers, screens and ship loading). Electrical demand will vary over the life of the Project. During Phases 1 and 2, a 200 amp service will be sufficient to provide power for the buildings. Diesel powered generators will provide the power for the processing plant and equipment during this time. The 200 amp electrical service is expected to be provided from a 25 KV high voltage distribution line running along Route 16 and operated by NSPI. The line will be routed adjacent to the entrance road with a pole mounted transformer located near the temporary office as shown on **Figures 3.0-16 and 3.0-17**. Due to the line location along the disturbed portion of the entrance road, no additional environmental effects are anticipated.

Once sales demand dictates a larger plant, a tie-in will be made to the 69 KV high voltage line that runs along the southern boundary of the Project site. This line will also be routed adjacent to the entrance road and will terminate at the substation as shown on **Figure 3.0-19**. Again, the

line will be routed along the disturbed portion of the entrance road so no additional environmental effects will result. All power to the plant will be routed underground from the substation and these lines will remain within the Project property. The transformer sub-station will be required to reduce the voltage for the quarry. The peak electrical power demand for the site is estimated to be between 10,000 and 12,000 horsepower (i.e., 5.0 to 6.0 MW). Following discussions with NSPI, the tie-in to the high voltage line and the sub-station are expected to be provided and owned by NSPI. Temporary diesel powered generators may be needed until such time as the sub-station and transmission link are complete.

3.1.7 Marine Terminal

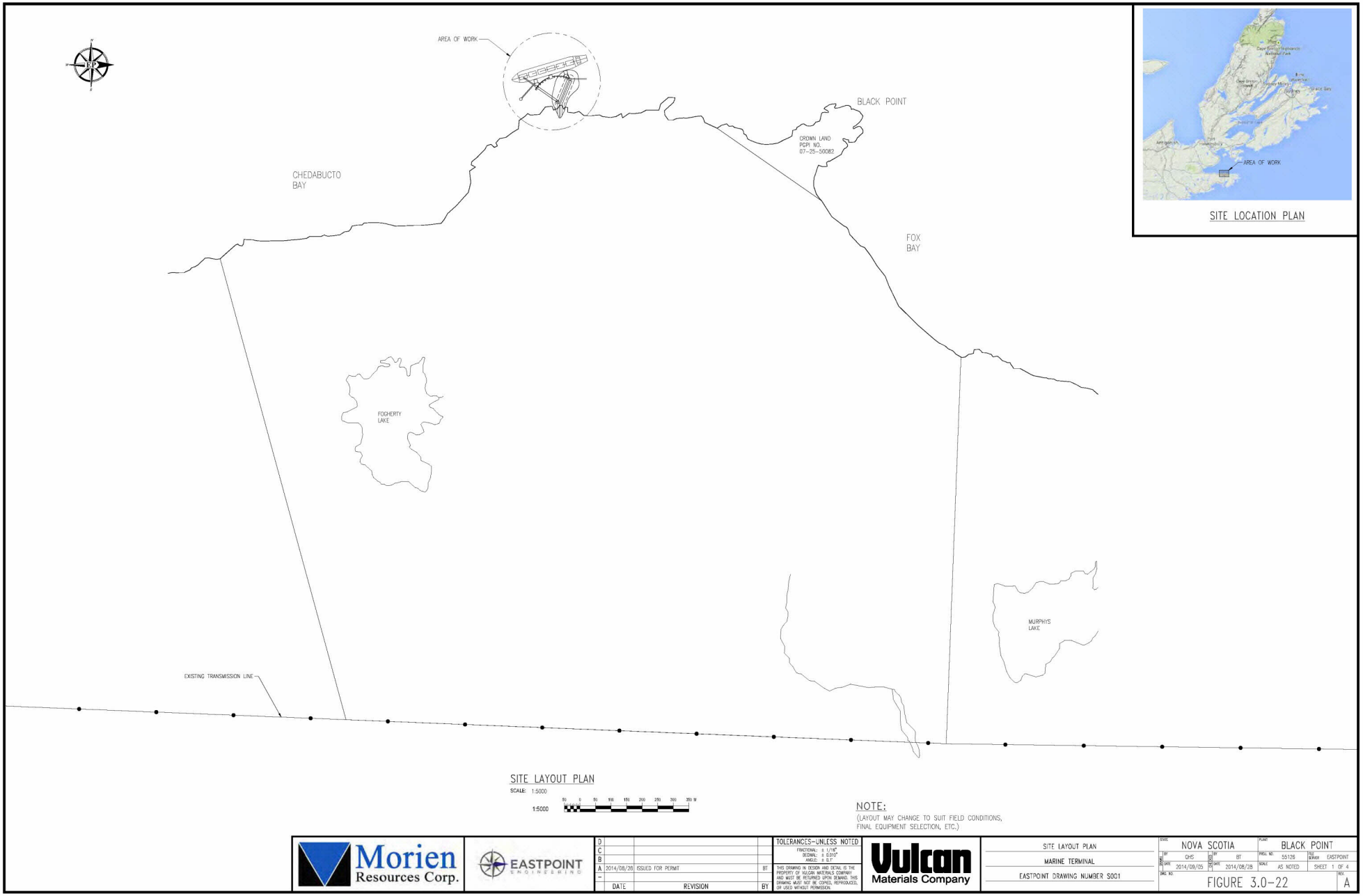
Based upon preliminary engineering, a rubble mound approach (where conveyors and related infrastructure are installed on a stone breakwater constructed of coarse rock extending from the shore) will be utilized in the design of the marine terminal. Caissons and mooring dolphins will be used for berthing the ship. The rubble mound will comprise the primary structural element of the terminal and will provide stability for the shiploader during operations as well as a means of egress for maintenance. Preliminary engineering drawings for the terminal are shown in **Figure 3.0-22 through Figure 3.0-25**. The major components of the facility are:

- Three breasting caissons used for berthing the ship.
- Two mooring dolphins.
- Eleven slewing rail piers that support the slewing rail, which in turn allows the shiploader to move in an arc.
- One slewing rail caisson to support the slewing rail.
- Shiploader pivot point caisson, which provides the lateral stability of the shiploader.
- Rubble fill with an access road for maintenance.
- The shiploader arm that delivers aggregate product to the ship.

The shiploader is a telescoping system approximately 136 m long when fully extended. It is capable of loading vessels up to 70,000 deadweight tons (DWT) without warping (shifting) the vessel. The shiploader transports material from the land based conveyor into the ship and will have a loading capacity approaching 5,000 TPH. Lighting will be shielded to direct light down onto the conveyor during night operations. Navigational lighting will be provided as required by Transport Canada.

The rubble mound portion of the terminal will be approximately 160 m in length as shown in **Figure 3.0-24**. It will be constructed with a clean rock-filled base, armour stone protection on all sides and include a crushed stone surface. This structure will have a seafloor footprint of approximately 11,078 m^2 which includes the combined seafloor surface area occupied by the rubble fill, caissons and dolphins. The dolphins and piles will be designed and constructed to withstand the horizontal loads associated with the berthing of vessels as well as the environmental loads (wind, waves, etc.) present.

Shipping will be contracted to a third party and no waste disposal, deck washing or fuelling will occur at the marine terminal.



SITE LOCATION PLAN

SITE LAYOUT PLAN

SCALE: 1:5000

1:5000

NOTE:

(LAYOUT MAY CHANGE TO SUIT FIELD CONDITIONS, FINAL EQUIPMENT SELECTION, ETC.)

Morien Resources Corp.

EASTPOINT ENGINEERING

	DATE	REVISION	BY
D			
C			
B			
A	2014/08/28	ISSUED FOR PERMIT	BT

TOLERANCES-UNLESS NOTED
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DECIMAL: ± 0.010"
ANGLE: ± 0.1°

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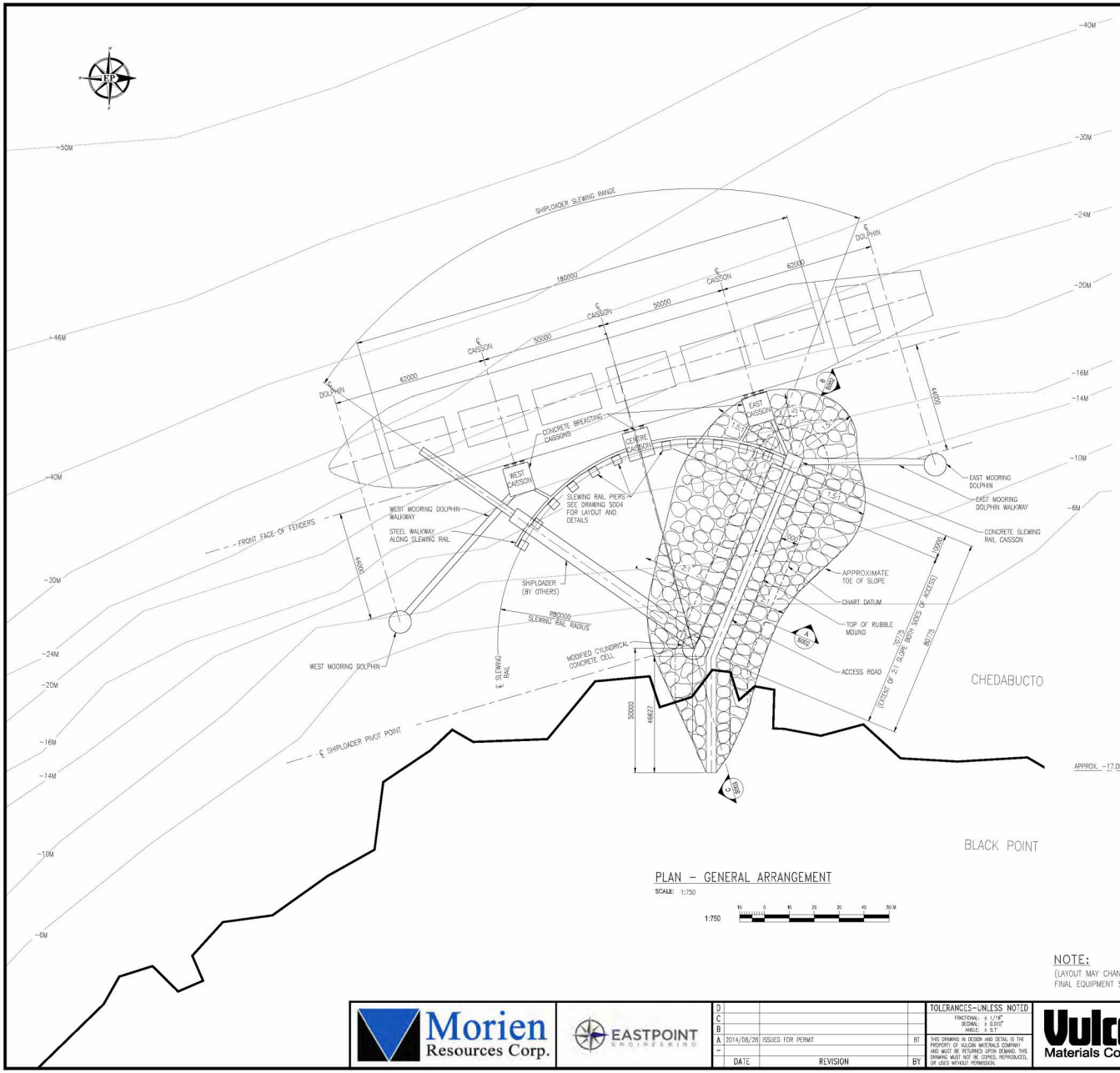
SITE LAYOUT PLAN
MARINE TERMINAL
EASTPOINT DRAWING NUMBER S001

STATE: NOVA SCOTIA
PLANT: BLACK POINT
DRAWN BY: QHS DATE: 2014/09/05
CHECKED BY: BT DATE: 2014/08/28
PROJ. NO.: 55126
FILE NUMBER: EASTPOINT
SCALE: AS NOTED
SHEET 1 OF 4
DWG. NO.: FIGURE 3.0-22
REV.: A

C 1340-171

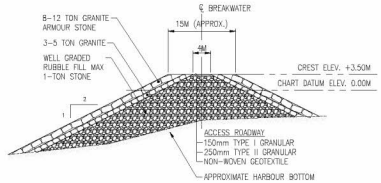


PLAN – GENERAL ARRANGEMENT

SCALE: 1:750

1:750

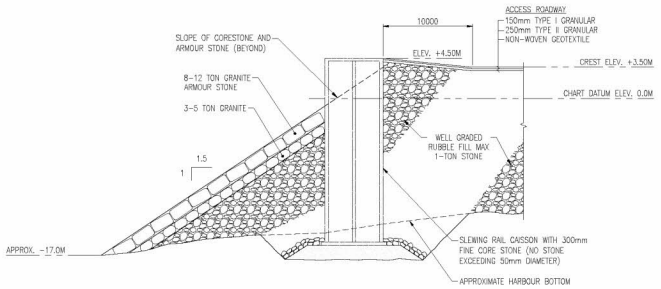
AREA OF IMPACT AT SEA FLOOR	
RUBBLE MOUND	7916M²
BREASTING CAISSONS (3)	1120M²
MOORING DOLPHIN (2)	1050M²
SLEWING RAIL AND PIER	992M²



A S002 SECTION – TYPICAL RUBBLE MOUND

SCALE: 1:500

1:500



B S002 SECTION – RUBBLE MOUND AT CAISSON

SCALE: 1:250

1:250

NOTE:

(LAYOUT MAY CHANGE TO SUIT FIELD CONDITIONS, FINAL EQUIPMENT SELECTION, ETC.)

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EASTPOINT ENGINEERING

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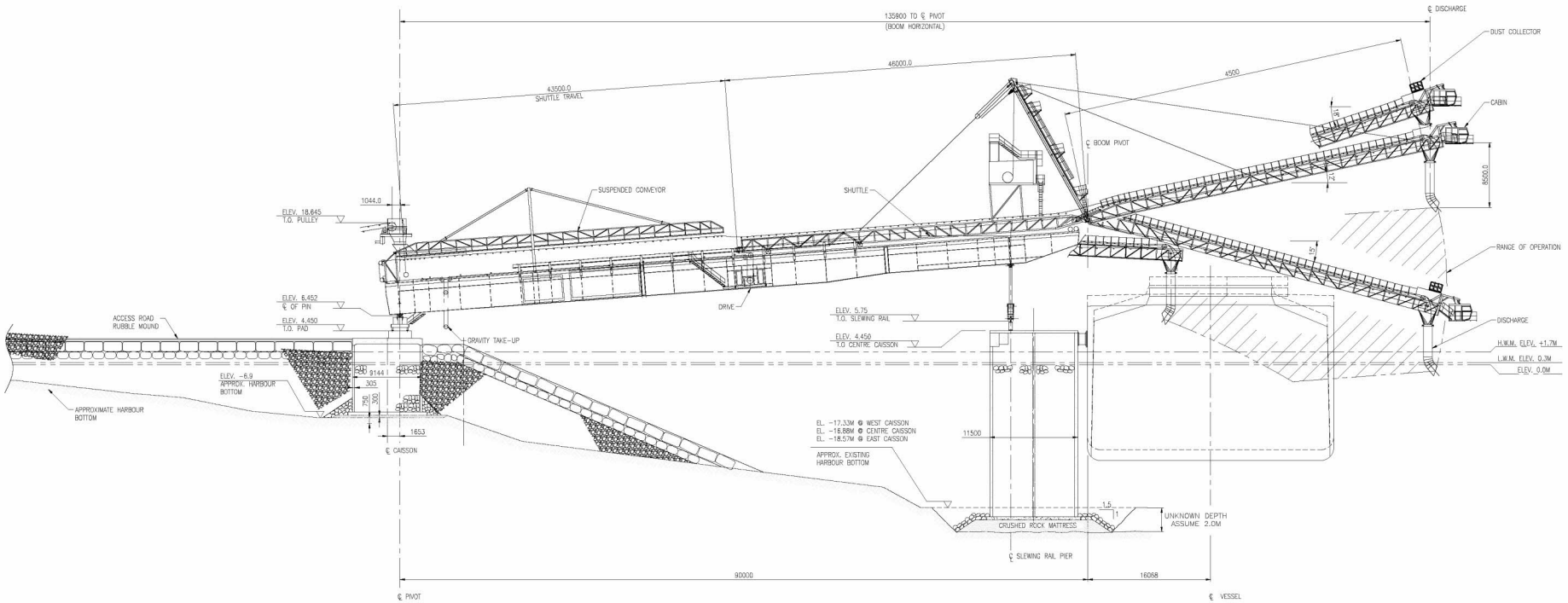
GENERAL ARRANGEMENT

EASTPOINT DRAWING NUMBER S002

STATE: NOVA SCOTIA
PLANT: BLACK POINT
DRAWN: BY QHS DATE 2014/09/08
CHECKED: BY BT DATE 2014/08/28
PROJ. NO. 55126
SCALE: AS NOTED
DES'D BY: EASTPOINT
SHEET 2 OF 4
DWG. NO. FIGURE 3.0-23
REV. A

C 1340-172



B
5002

SECTION

SCALE: 1:250

1:250

5 0 5 10 15 M

NOTE:
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EASTPOINT ENGINEERING

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C			
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A	2014/08/28	ISSUED FOR PERMIT	BT

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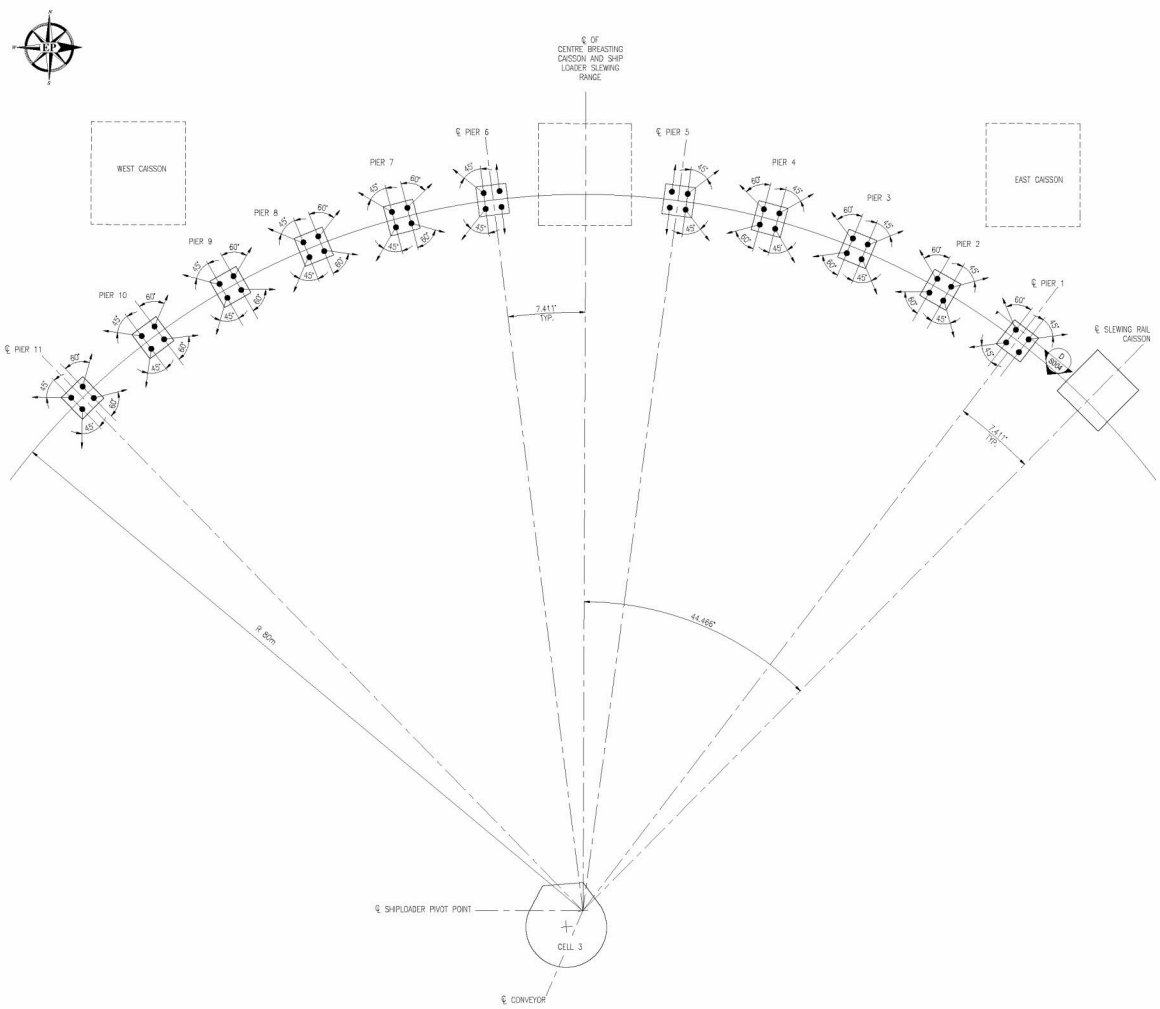
SECTION VIEW

EASTPOINT DRAWING NUMBER S003

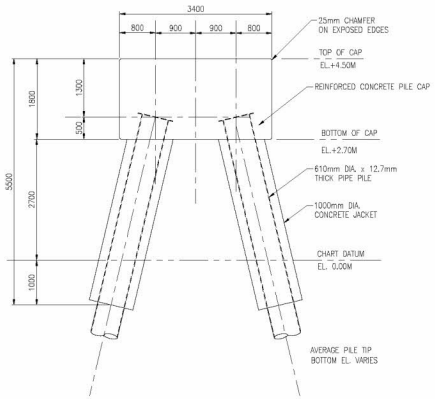
STATE: NOVA SCOTIA
PLANT: BLACK POINT
DRAWN BY: QHS
DATE: 2014/09/05
CHECKED BY: BT
DATE: 2014/08/28
PROJ. NO.: 55126
FILE NUMBER: EASTPOINT
SCALE: AS NOTED
SHEET 3 OF 4
DRG. NO.: FIGURE 3.0-24
REV.: A



PLAN – SLEWING RAIL PIER LAYOUT

SCALE: 1:250

1:250



D
S004 SECTION – TYPICAL SLEWING RAIL PIER

SCALE: 1:50

NOTE:

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EASTPOINT ENGINEERING

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A	2014/08/28	ISSUED FOR PERMIT	BT
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SLEWING RAIL PIER LAYOUT PLAN AND SECTION

EASTPOINT DRAWING NUMBER S004

STATE: NOVA SCOTIA
PLANT: BLACK POINT
DRAWN BY: QHS DATE: 2014/09/05
CHECKED BY: BT DATE: 2014/08/28
PROJ. NO.: 55126
FILE NUMBER: EASTPOINT
SCALE: AS NOTED
SHEET 4 OF 4
DRG. NO.: FIGURE 3.0.0–25
REV.: A

C 1340-174

3.1.8 Waste Water Treatment System (Other Utilities)

Other utilities will include domestic water supply that will be supplied by drilled groundwater wells, and a waste water or sewage disposal system to facilitate the needs of on-site workers (please see Section 3.3.7). Propane tanks may also be installed for heating or other functions.

3.2 CONSTRUCTION PHASE

3.2.1 Construction Activities

When construction begins, there will be two main activities: site preparation and plant construction (see Table 3-1). Site preparation will come first. A temporary crushing facility will be employed to produce the crushed stone needed to surface the access road and level the plant site for the site preparation. The permanent plant will be constructed as soon as sales warrant. Site preparation and construction activities are described below.

Site Preparation

- Vegetation removal and stockpiling[2];
- Entrance and infrastructure road clearing and initial construction;
- Erection of the temporary crushing facility;
- Surveying and delineating plant site, road right of ways, and protected areas buffers;
- Blasting and rock crushing to produce surfacing stone for roads and the Plant site;
- Plant site grading to create suitable plant/laydown area with controlled drainage;
- Erosion and sedimentation control installation, including stormwater management pond(s);
- Site access control including gates, and earthen and boulder berms; and
- Excavation of sanitary and process waste collection disposal system

Construction

- Employ a modular portable plant to process stone during early phases;
- Undertake blasting and crushing to produce additional surfacing stone;
- Create trenches for electrical conduits;
- Construct concrete foundations for processing plant equipment;
- Install an electrical substation and supporting power network;

[2] Vegetation removal will be undertaken on an as needed basis, rather than over the entire site at project start up. Vegetation removal will occur outside of the breeding bird season.

- Build temporary and permanent office locations;
- Pour concrete pad and containment area for petroleum products; and
- Excavate additional stormwater management pond(s)

Best Management Practices

Guidelines for construction and site grading have been created by the Province and will be employed.

- Sedimentation and Erosion Control Handbook (NSE 1988);
- Watercourse Alteration Protection; Erosion Protection; Wharves (NSE 2013b); and
- Nova Scotia Pit and Quarry Guidelines (NSEL 1999)

3.2.2 Geotechnical Investigations and ARD

The bedrock geology of the Black Point area is outlined in Section 6.1.3 of this report and in a Geological Survey of Canada report and accompanying map (Hill 1991). The proposed pit area is underlain by homogeneous biotite-muscovite granite. Analysis of this granite from a suite of samples collected from 10 drill holes distributed throughout the proposed quarry indicated very low concentrations of total sulphur (<0.01%) and these rocks are therefore considered to have non-existent potential for generating Acid Rock Drainage / Metal Leaching (ARD/ML).

In contrast, the processing plant area (the lower platform) is underlain by two rock formations: the Halifax Formation, which forms a wedge-shaped block adjacent to the prominent granite hill where the quarry will be developed, and the Goldenville Formation along the coast from Black Point to Fogarty Head. Since these rocks are known to be potentially acid generating elsewhere in Nova Scotia, the Proponent's geological staff conducted a geological mapping and sampling program in 2011 and submitted a suite of 6 representative samples of bedrock for geochemical and ARD/ML analysis (Dalton 2011). Of the 6 samples collected, only 1 sample contained significant concentrations of sulphide minerals (1.0% total sulphur) and had potential for generating ARD/ML (acid producing potential; kg/t H_2SO_4 = 28.60), although the pH of this sample was slightly alkaline (7.4 pH) suggesting the presence of carbonate minerals that have pH buffering capacity. The remaining 5 samples from the Halifax and Goldenville Formations had low sulphur concentrations (<0.19%) and have very low potential to generate ARD/ML (acid producing potential; kg/t H_2SO_4 = 0.11 – 0.43) if exposed during construction.

The site for the processing plant will be developed over Halifax and Goldenville Formation rocks to a mean height above sea level of 22 m. An assessment of the topography at the site indicates that this development will involve both the excavation of a central 11.8 hectare area of Halifax Formation rocks and the in-filling of three separate low-lying areas (1.5, 1.3 and 6.1 hectares; **Figures 3.0-26 & 3.0-27**). The first phase of development for the processing plant area will involve clearing the site of vegetation and grubbing the topsoil to expose bedrock. At that time it will be possible to assess the presence and extent of potential acid generating (PAG) rocks of the Halifax Formation by following the sampling and analysis protocols outlined in the 2009 Mine Environment Neutral Drainage (MEND) Program report entitled *Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials* and the 1995 provincial *Sulphide Bearing*

Material Disposal Regulations. Two representative samples will be collected from each hectare of probable Halifax Formation rocks and these will be submitted for analysis, using procedures in accordance with above regulations and guidelines, to determine if ARD/ML issues are present.

As noted above, the entire processing plant site will be graded and sloped such that all rainfall and drainage will migrate to the south side of the site where it will be collected in ponds. In addition, a 1 m high berm will surround the entire plant site to ensure all surface water is captured. These features will ensure that no acidic drainage will be discharged to Chedabucto Bay.

There are no freshwater streams with fish habitat in the area to be excavated to create the processing plant area, nor are there streams or freshwater fish habitat within 60 m of the site.

If ARD/ML is present, based on the testing of the material from the processing plant site, then this matter will be addressed in accordance with the 1995 *Sulphide Bearing Material Disposal Regulations*, and any appropriate protocols outlined in the 2009 Mine Environment Neutral Drainage (MEND) Program manual for handling sulphide-bearing materials. In addition, long term kinetic testing of PAG or Uncertain PAG material (excavated or disturbed) will be undertaken if needed to evaluate rates of acid generation and neutralization, potential time to onset of acid generation, and drainage chemistry and contaminant loadings in and around the plant site.

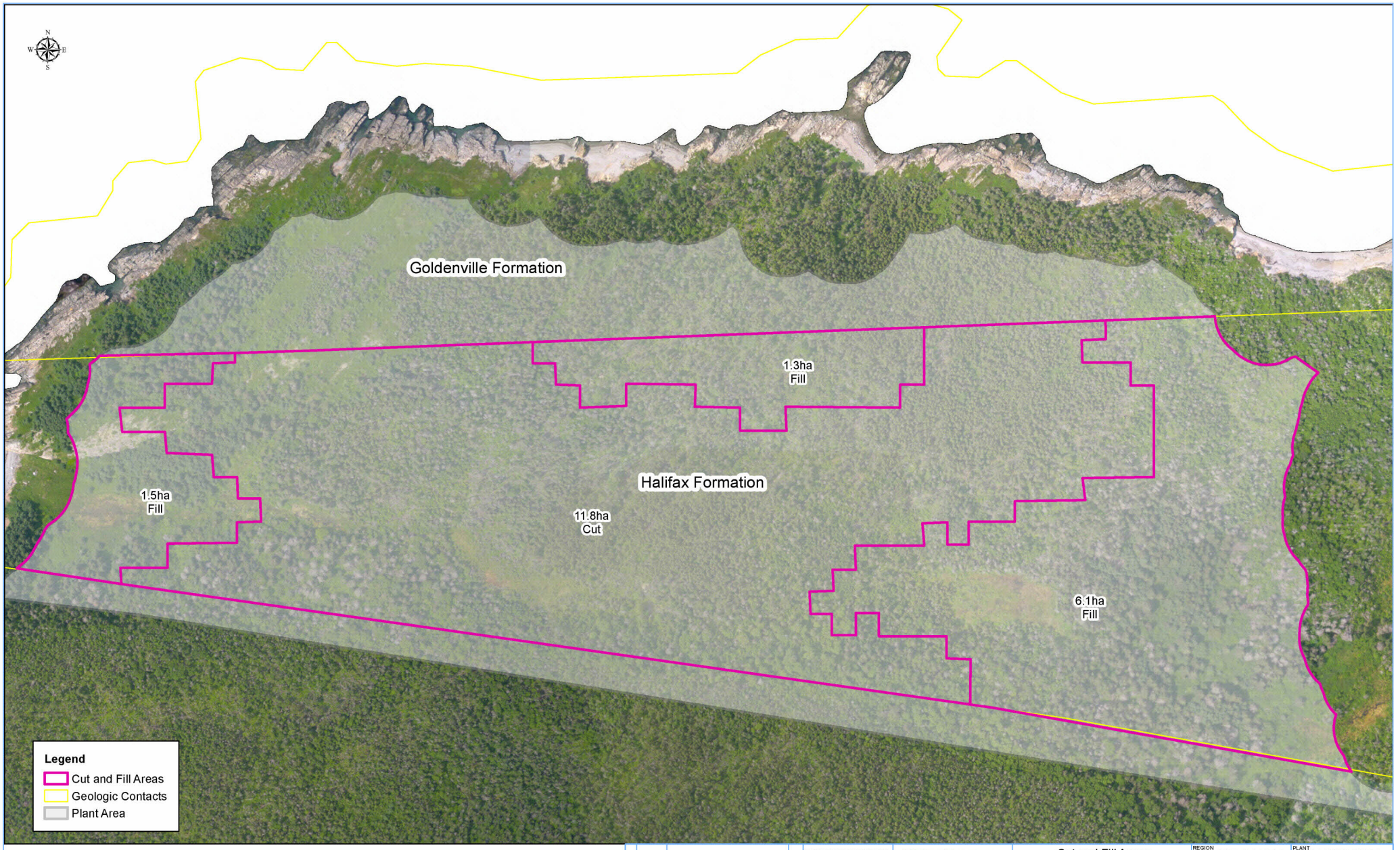
3.2.3 Site Preparation, Cut and Fill, Blasting

The site preparation and construction phase of the Project will begin with clearing of vegetation and removal of organic material and overburden for the development of the 28 ha plant site and administrative area. This area will require cut and fill activities and will be conducted as described in Section 3.2.2.

Preliminary mass balance calculations for the plant and administrative areas suggests a cut or excavation of approximately 600,000 m^3 and a fill of 835,000 m^3 will be needed to level the area prior to construction **(Figures 3.0-26 and 3.0-27).** The swell factor (i.e., the increase in volume that occurs when solid rock is broken up and excavated) has been estimated at approximately 40%. Additionally, the plant and administrative area will be designed with 1% of cross slope drainage which will direct all storm water to the two ponds described in Sections 3.1.4, and 3.3.7. Any additional required fill material will be generated using the initial mobile processing plant. The final elevation of the plant area and administrative areas will be approximately 22 masl. The site preparation and construction phase of the plant site and administrative area is anticipated to occur over a 36 month period.

As mining activities begin, vegetation and the removal of organic material and overburden will be conducted to establish a rock face at the north end of the property. A phased mining approach will be used to minimize impacts and to allow natural vegetation to remain as long as possible. With the exception of organics, materials extracted during these early development stages will primarily be used for construction of access roads, the laydown areas, and the fill for the marine terminal. Topsoil and excess overburden, if any is encountered, and crusher fines will be stockpiled (separately) and stabilized (e.g., seeded) for future use in the reclamation phase. Much of the overburden will be stored in berms on the edges of the property, thereby increasing sound and visual buffers.

To minimize the potential for erosion and sedimentation, clearing, grubbing and removal of overburden will be conducted in a progressive manner to accommodate drilling and blasting activities, such that the amount of exposed erodible soils is minimized. Clearing activities will take place outside of the breeding season for most bird species (April to September 1) to prevent the disturbance of migratory birds or their nests. If some clearing is necessary during the breeding season, the feasibility of maintaining compliance with the *Migratory Birds Convention Act* will be assessed and a contingency plan developed in consultation with CWS to ensure compliance with *Migratory Birds Convention Act* .during clearing.



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DATE | REVISION | BY | ISSUE DATE:

PLOTTED: | LAST UPDATE:

Vulcan Materials Company

Cut and Fill Areas

REGION: NOVA SCOTIA

PLANT: BLACK POINT

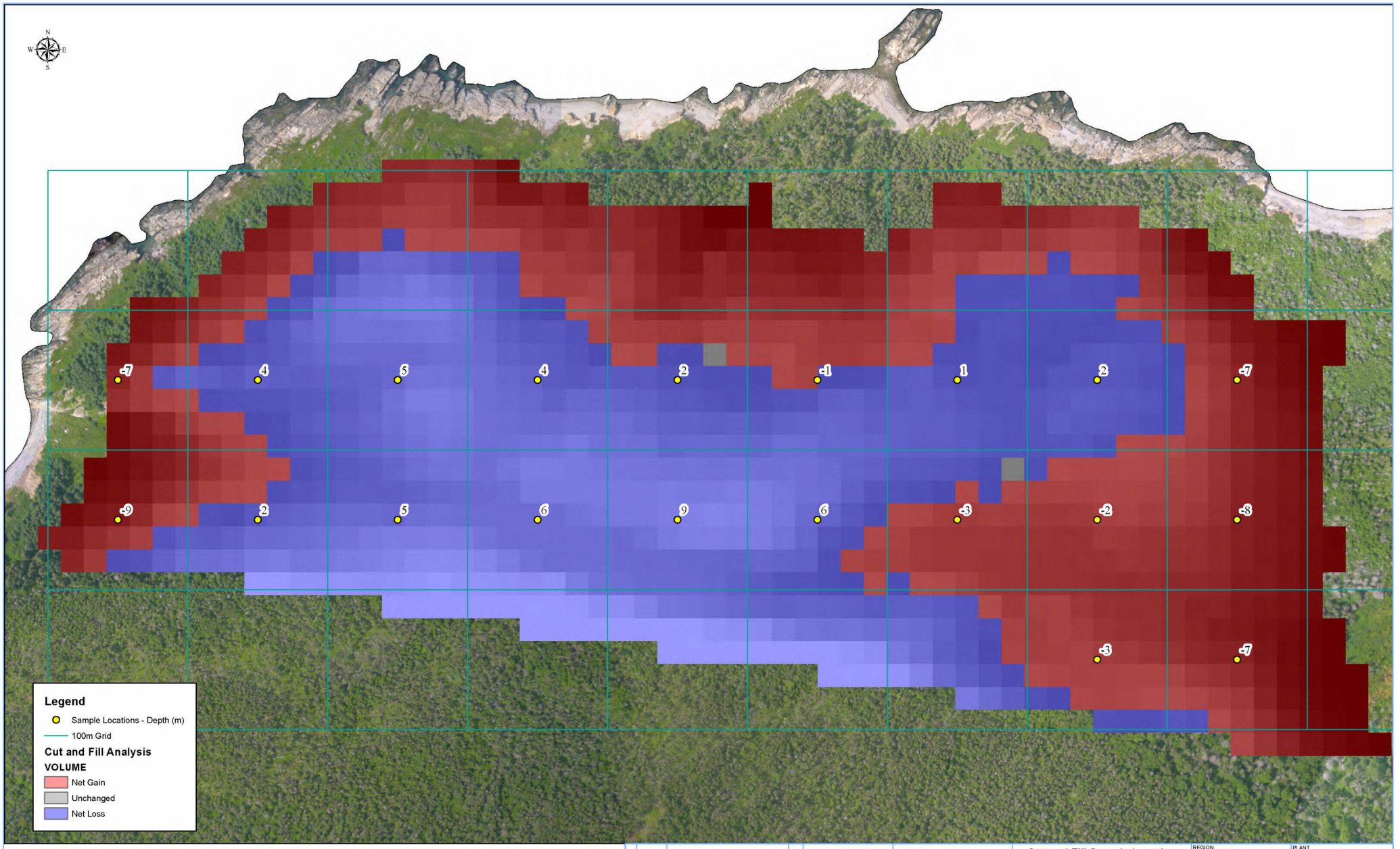
DWN BY: CKR | DATE: 10/22/2014 | CHK BY:

JOB NO: | SCALE: 1 in = 60 m

PATH:

DWG. NO. Figure 3.0-26

C 1340-179



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DATE	REVISION	BY	ISSUE DATE:

Vulcan Materials Company

Cut and Fill Sample Locations

REGION: NOVA SCOTIA
DWN BY: CKR | DATE: 10/22/2014 | CHK BY:
JOB NO: | SCALE: 1 in = 60 m
PATH:

PLANT: BLACK POINT
DWG. NO.: Figure 3.0-27

PLOTTED: | LAST UPDATE:

C 1340-180

3.2.4 Access Road and Transmission Tie-in

Access to the Project site will be made utilizing a new access road that will connect Route 16 to the plant site adjacent to Chedabucto Bay as shown on **Figure 3.0-1**. A majority of the materials necessary for the construction of the road will be extracted from the quarry site. The intersection at Route 16 and a portion of the access road will be paved to minimize dust and track-out issues on Route 16. The intersection will be designed to meet provincial highway department standards.

To the extent possible, the access road will be located so as to avoid watercourse crossings. Where this is not possible, a culvert will be installed. Installation of these structures may require a Water Approval pursuant to the provincial *Activities Designation Regulations* and will be installed between June 1st and September 30th, unless otherwise authorized. Structures will be designed to accommodate the 100 year storm.

Gradients on the access road will not exceed 10%. Similarly constructed gravel access roads within the quarry will be built to connect the land based infrastructure and the ship loading facility. All necessary erosion and sediment controls such as silt fences, temporary sedimentation ponds, and/or rip rap check dams will be installed as required during construction of the road.

During Phases 1 and 2 of the Project, either an electrical service provided by NSPI from the transmission line running adjacent to Route 16 or a diesel powered generator will be required. If necessary, the new service would access the site via the newly constructed access road. All required clearing and grubbing would be completed by the Proponent based upon NSPI requirements. As the sales demand increases, a new service will be required to provide power for the fixed plant. This is expected to be provided by NSPI from the high voltage line running along the southern boundary of the project site. All lines as well as the sub-station are expected to be installed and owned by NSPI.

3.2.5 Processing Plant and Laydown Areas

After the plant site is developed in the early phases of the project and the sales demand has increased to an appropriate level, a large fixed plant will be built. The construction period for the fixed plant will span approximately 18 months dependent upon weather. A majority of the materials necessary for construction will be extracted from the quarry site. This will involve some blasting, heavy excavation equipment, crushing and screening. Depending on the availability of concrete from nearby sources, a small concrete batch plant may be established on-site during the construction period. After site preparation, the activities will shift to installation of foundations.

Prefabrication activities will proceed off site in parallel with civil works, so that as foundations are completed phased delivery of prefabricated structures, equipment skids, subassemblies, and modules can progress. Work associated with electrical and piping needs follow once the structures are erected. Deliveries will be sequenced to support the installation, hook-up, and commissioning program. A majority of the steel structures and equipment will be shipped to the local port and trucked to the site for erection. Several mobile cranes will be utilized on-site during the construction phase.

Construction will be work packaged from the outset so that the integrity of the structures and equipment can be better managed. Construction sequencing will be strongly focused on the testing and commissioning program that brings the plant into operation on schedule. Appropriate dust and drainage control based on the avoidance of environmentally sensitive areas will be applied throughout.

A second construction phase will follow in future years as the sales demand increases. This phase will involve the construction of a second tertiary plant in parallel with the existing one. This work should be completed within approximately six months and will include similar steps as those outlined above with the exception of blasting.

3.2.6 Marine Terminal

The preferred construction approach for the marine terminal employs a fill and rock technique that results in a relatively large footprint on the seabed. A current estimate of the impact totals 11,078 m^2. Preliminary engineering drawings for the terminal are shown in **Figure 3.0-22 through Figure 3.0-25**. Additional geotechnical work will be required before the drawings are finalized. To accomplish this, a marine engineering firm will be contracted to complete borings of the seabed. This will allow the exact depth, location and integrity of the seabed to be verified.

The terminal will be constructed along the shore using fill and rock (i.e. rip-rap) material sourced from the site. At this time, blasting in the terrestrial near shore area does not appear to be required for construction of the laydown area and approach to the wharf.

The major components of the facility and the expected construction duration of each component are shown below with the total project duration expected to be between 11 and 13 months.

Component	Duration (Sequential)
Caissons	Four Months
Piers/Dolphins	Four to Six Months
Rubble Approach	Two Months
Slewing Rail and Shiploader	One Month

It is expected that slip forming (construction in place) of each caisson will take approximately one week. Installation will be a 24 hour operation until the caisson is cast to about half way between low and high tides. Typical activities include cranes to lift in reinforcing steel, concrete trucks and pumps and lights for night time activity. The completion of each caisson, once sunk, will take approximately one month. The slewing rail piers will be supported by piles which will be installed from a barge. There will be approximately eleven piers which are expected to have four piles each. The piles will be installed using pile driving hammers and churn drills and will be anchored in the bedrock. Silt curtains and acoustic blankets will be considered during installation, as needed. All marine construction will be completed using conventional marine construction techniques.

Prefabricated steel for the slewing rail and the shiploader will be delivered to the site via barge. Installation will be conducted utilizing cranes and work barges. The loadout conveyor (equipped with aggregate spill containment) will extend from the onshore loadout system to the shiploader.

Any piles required for the loadout conveyor in the nearshore area would be located in the rubble fill.

3.2.7 Construction Water Use and Water Management

The construction activities will require water primarily for site dust control. The water will be applied to the areas of the property where earthwork is occurring and to the plant haul roads to control fugitive dust emissions. The portable processing plant will also use water to control dust emissions from the initial crushing operations.

The water volumes used during the construction phase will be minimal compared to the amounts that will be needed when the quarry pit is more fully developed and the permanent processing plant is operational. The water source during construction will be runoff from precipitation captured in retention basins and pit sump. These basins and the sump will be installed early in the construction phase to control sediment runoff and to provide a water supply. In the event that sufficient water is not available at the beginning of construction then water will be procured from off-site sources. Drilled wells will also be considered as an alternative.

Wastewater generated from the construction activities will primarily be runoff from precipitation that falls on the areas disturbed during the construction (i.e., stormwater runoff). Sediment and erosion control measures including site contouring to direct runoff to the retention basins and silt fences, aggregate rock filters, and other best management practices will be employed as needed. These measures will be described in a site-specific Erosion and Sediment Control Plan.

3.2.8 Construction Related Noise

The site development and initial rock processing that will occur during the construction phase will involve activities similar to those that will occur during full facility operation. The equipment used for construction will be similar to the equipment that will be part of the site operation. Noise generated from construction is anticipated to be similar to the noise that will be generated from facility operations. Construction related noise and vibrations will be controlled primarily through attenuation (distance between the source and receptor). The noise levels from the construction activities will comply with the Pit and Quarry Guidelines established for operational sound levels (NSEL 1999). The construction sound levels will be maintained to not exceed the following levels at the boundaries of the Project site:

- 65 dBA 0700 – 1900 hours (Days);
- 60 dBA 1900 – 2300 hours (Evenings); and
- 55 dBA 2300 – 0700 hours (Nights, Sunday and statutory holidays).

Please refer to Sections 6.3 and 7.2 for additional information regarding noise.

3.2.9 Construction Related Traffic

The Black Point Project construction activities will occur within the boundaries of the Project area and will not have a significant effect on public highway traffic. The movement of equipment to the site will occur sporadically during normal working hours. The construction of the site

access road will be done in a manner that minimizes any impact to traffic on the public highway. There will be an increase in vehicles accessing the site during the peak of site construction activity and during worker shift changes. Areas within the facility boundary will be established for parking of construction employee vehicles to prevent any traffic issues associated with parking along the public highway.

Any oversize equipment delivered to the site will be done in compliance with provincial transportation requirements and if necessary protective measures such as flagmen or accompaniment by caution vehicles or police agencies will be followed.

3.2.10 Construction Schedule

A preliminary construction schedule is provided as Table 3-1. It should be noted that the schedule will be dependent on approvals, final designs, and the procurement of equipment. It is anticipated that the construction associated with site development will take approximately 2 years.

As stated previously, the site preparation and construction phase of the project will begin with the clearing of vegetation and removal of organic material and overburden for the development of the plant site. It is anticipated that these initial activities would begin early in the year. To the extent possible, clearing activities will take place outside of the breeding season for most bird species to prevent the disturbance of migratory birds or their nests. Once the site is cleared, the Phase 1 portable plant will be installed and will be utilized to produce crushed stone for rough grading. The total time needed to erect the Phase 1 plant is anticipated to be one week. As outlined in Table 3-1, the Phase 2 portable plant is expected to be added during the second year of operation. It is anticipated that this plant would be added early in the year and will be used to make a smaller diameter crushed stone used to "fine grade" the site. This plant can also be erected in approximately one week. Construction of the marine terminal should start at this time with construction expected to last approximately one year.

Once the site is complete, additional components will be added to the portable plant to produce saleable products. This addition will also have a short construction window due to the portable and modular nature of the components.

As sales demand increases, the Phase 4 plant will be constructed. It is anticipated that construction will start early in the year (Feb/Mar timeframe) with all construction completed by late fall of the same year. The final phase plant will have a construction window identical to the Phase 4 plant.

3.3 OPERATIONS PHASE

3.3.1 Quarry Operation

Please see Table 3-1 for construction to operation schedule. Quarry operations will gradually begin after site construction. Rock processing will generate aggregate and other construction materials for grading the plant area, making concrete for equipment foundations and creating the large stone blocks needed for the marine terminal rubble mound.

Following vegetation removal, drilling and blasting will be employed to loosen the granite in the ground. The blast-generated "shot rock" will be picked up by loaders and excavators and transported by off-road haul truck to the crushing plant (either temporary or permanent). Loading and hauling would occur up to 16 hours a day.

Other quarry equipment includes a rockbreaker (a jack hammer mounted on the end of an excavator), a grader for road maintenance and a water truck fitted with a water sprayer used to suppress dust on the roads and on the muck pile.

Blasting will be handled by a licensed and insured contractor, be performed during the hours of 8 AM to 6 PM, and will not occur on statutory holidays or Sundays. The blasting operator will be responsible for blast designs and methods in accordance with the *Blasting Safety Regulations* made pursuant to the Nova Scotia *Occupational Health and Safety Act,* the Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters (Wright and Hopky 1998), and in accordance with the Nova Scotia Pit and Quarry Guidelines (NSEL 1999).

Blasting is expected to occur 1 to 3 times per month for the first two to three years and increase to 10 to 15 times per month at full operation (up to 120 times per year). Blast locations and depths will be based on pit geometry. The number of drill holes in each blast will vary depending on the purpose and bench geometry. A typical production shot will have less than 100 drill holes each drilled approximately 15 to 17 m deep. Shots utilized for quarry development such as haul roads and sumps will have variable depths generally from 3 to 10 meters. Table 3-2 presents typical blasting parameters. Upon request, residents will be alerted to upcoming production shots via automated telephone notifications ("robo-calls").

Production holes will be in a staggered or square pattern and placed in no more than four rows and will be spaced approximately 3 to 5 meters apart. Typical charge weights per hole will range from 25 kg during construction to 400 kg during normal operations. The explosive charge will consist of ammonium nitrate and fuel oil (ANFO) and an appropriate concentration of waterproof emulsion. All blasting will be conducted by a third party vendor who is licensed and insured. Blasting materials will not be manufactured or stored on site.

Benches will generally be 15 meters in height, although during the initial development phases, face heights could be less. Safety benches will be established every two benches and will have a width of approximately 7.5 meters. The final slopes for the quarry will have face angles of 85 degrees with a maximum pit slope of 65 degrees. Working benches will have face angles of 70 to 75 degrees.

Haul roads within the pit will be constructed for the movement of personnel, equipment, and materials within the quarry. Haul roads will be 30 m wide and will have a maximum grade of 10%. Sump ramps will be 20 m wide with a maximum grade of 15%.

Table 3.1:
Construction to Operation Schedule

Activity	Anticipated Commencement	Anticipated Completion
EA Approval	Q4 2014	Q4 2015
Mining		
Establish Access Road	2018	2018
Site Preparation	2018	2020
Establish Haul Road to Plant	2020	2020
Primary Crusher Location Established	2021	2022
Temporary Pit Sump Developed	2022	2022
Permanent Pit Sump Developed	2022	2025
Plant		
Portable Plant		
Phase 1	2018	2019
Phase 2	2019	2020
Phase 3	2020	2022
Permanent Plant		
Phase 4	2021	2026
Phase 5	2026	2030
Marine Terminal	2018	2020
Water Management		
Best Management Practices	2018	2070+
Temporary Plant Pond	2018	2018
Plant Pond 1	2018	2018
Plant Pond 2	2018	2019

Table 3.2:
Standard Shot Design

	BLASTHOLE >250 m From Water	BLASTHOLE 150-250 m from Water	BLASTHOLE 75-150 m to water	UNITS
Hole Diameter	150 (6.0")	100 (4.0")	100 (4.0")	mm
Depth	12.2	12.2	2.2	m
Burden	4	4	4	m
Spacing	4	4	4	m
EXPLOSIVE TYPE AND IN HOLE DISTRIBUTION				
Column Charge Type	ANFO/Emulsion	ANFO/Emulsion	ANFO/Emulsion	
Product Density	1.2	1.2	1.2	g/cc
Product per meter	21.86	9.72	9.72	kg
Product per hole	266.7	118.6	21.38	kg
SHOT LAYOUT				
Max No. of Holes	100	100	Variable	
Shot Patterns	Staggered or Square	Staggered or Square	Staggered or Square	
Distance to nearest non-company structure	>925	>925	>2,260	m
Distance to water	>250	>150	>75	m

Legend

Definitions:

Burden: The distance from the borehole and the nearest free face or the distances between the boreholes measured perpendicular to the spacing

Spacing: The distance between boreholes. In bench blasting, the distance is measured parallel to the free face and perpendicular to the burden.

3.3.2 Processing Plant Operation

The type of processing plants at Black Point will vary from a small portable plant to a large fixed plant but the operations for each will be similar. Since the larger plant has a potentially greater impact, it is discussed in this section.

Blasted rock will be loaded by front-end loaders or hydraulic shovels into appropriately sized haul trucks to transport the blasted rock to the primary crusher located within or just outside the quarry boundary. This material will be dumped into the primary dump hopper where it will be fed into the primary crusher(s).

After being reduced in size at the primary crusher, the rock will be transported via conveyor to a primary surge pile located near the secondary circuit of the plant. Material will then be reclaimed (transported) from the surge pile utilizing a tunnel and conveyor and sent to the scalping screen and secondary crusher where it will be further sized and reduced. A base material (-1 ½") will be removed from the scalping screen and stockpiled by conveyor. The discharge of the screen and secondary crusher will be conveyed to a secondary surge pile.

The material in the secondary surge pile will be reclaimed by conveyor and fed into the tertiary portion of the plant. This material is routed through the remainder of the crushing and screening plant via conveyors to produce stockpiles of graded material. All stockpiles will be located over blending reclaim tunnels.

Material can be fed directly from the blending tunnels to the rinse screen(s) or a bypass conveyor around the screen(s) in various proportions to meet individual product specifications. This product will be stockpiled over tunnels that will feed the ship loadout system. The slurry generated on the rinse screen(s) will be piped to the sand screws with the overflow pumped to a clarifier and fines recovery system. The water will be reclaimed for future use.

Processing aggregate will require the operation of a variety of equipment including primary crushers (jaw or gyratory), surge piles, screens, cone crushers, reclaim tunnels, conveyors, waterlines and pumps, water clarification tank, generators and other associated mining equipment. This plant will be operated by electricity, but the portable plant may be powered by generators. Mobile equipment will likely include excavators, loaders, off-road trucks, bulldozers, water trucks, cranes, drill rigs, service vehicles, work boat, rock breaker, and barge.

Conveyors will be inter-locked and equipped with motion sensors that will stop the conveyance of material should there be an overload situation, thus preventing spillage. Routine inspection and maintenance will be conducted on all equipment.

3.3.3 Operational Water Requirements

The operational water requirements for the processing plant will vary from approximately 8.8 L/s in Phase 1 to approximately 44.7 L/s in Phase 5. During the first two phases of the project as outlined in Section 3.1.3, the only water needs will be for dust suppression, base material moisture addition and potable water. It is expected that surface water accumulating in one of the two the settling ponds will satisfy the dust suppression and base moisture addition needs. Potable water needs will be met either through the purchase of water from off-site sources or by drilling a well.

During Phase 3 of the project, additional modules will be added to the portable plant to produce saleable aggregate products. One of the modules added will be a wash plant. The wash water system will be operated as a closed loop system which recycles as much of the water as possible. This plant will have two ponds: one will collect surface water for use at the processing plant and for dust control while the other will be kept dry and used to manage and treat stormwater collected on the lower platform. Each of the two ponds is designed to allow fine sediment to settle out over their length so that the water can be reused, or if excess volume is present, discharged to the ocean. A long-armed backhoe will be utilized to remove accumulated sediment from the ponds.

In the last two phases of the project a large fixed plant will be installed. The plant will continue to have a wash water system that will be operated as a closed loop system. The slurry discharge from the wash screen(s) will be piped to a sand screw(s) to recapture the coarse fines. The overflow from the sand screw(s) will be collected and pumped to a fines collection system that will have a clarification system as well as a system to extract fines. Clean water will be returned to the pond for reuse. The fixed plant will also have other needs for this clean water such as wash down stations and sprinkler heads for area dust suppression. An instantaneous water demand of approximately 708 gallons per minute (44.7 L/s) is estimated at peak production with a majority of the water recovered from the site.

3.3.4 Offloading to Ships

The shiploader will load aggregate into the holds of ships (up to 70,000 tonnes) and possibly barges that will transport the material to the end markets. Aggregate loading onto the ships will approach 5,000 TPH once the full load-out system is completed. It is estimated that it will take approximately 18 to 24 hours to load the largest ships and that approximately 90-100 ships will be loaded per year once the plant reaches peak production.

Aggregate products will be the only material loaded at the Project site.

3.3.5 Liquid Fuel Delivery and Storage

The Black Point operation will use diesel fuel in mobile equipment throughout the life of the facility, and to power on-site generators and portable plant equipment that will be used in the initial phase of the operation. The operation will also use other liquid petroleum and non-petroleum (antifreeze) products for equipment maintenance.

The delivery of these materials to the site will be by truck from the material suppliers who routinely handle these materials. The transfer of these materials into storage tanks at the facility will be attended by the delivery driver so that any equipment or other issues that could result in a spill are identified promptly and corrected before a spill incident occurs. The diesel fuel and other liquid petroleum products will be stored on-site in above ground storage containers in proximity to the shop. At this time, it is expected that fuel storage requirements will be met with one to two diesel storage tanks each sized at 20,000 gallons (75,708 L) or less, and one 5,000 gallon (18,297 L) gasoline reservoir. Various lube oils and other maintenance related fluids will be stored in 55 gallons (205 L) or smaller drums and a series of 4 to 8 tanks with capacity of less than 1,000 gallons (3,885 L) each.

All storage tanks will be either double walled self-contained tanks or single walled tanks with secondary containment. All petroleum storage containers 205 L (55 gallons) or larger will be stored within a contained area. These materials will be stored and handled in accordance with

all relevant regulations. The fuelling area will be erected on a reinforced concrete slab or lined containment area enclosed within side curbs and with a sloping floor to contain any spills and/or leaks that may occur during fuelling.

3.3.6 Hazardous Materials Management

The hazardous materials associated with the facility will include blasting agents, waste petroleum products, and waste materials including batteries, spent parts washer fluids, used oil and anti-freeze. No pesticides or herbicides will be used on site. All of the materials stored on site will be managed to prevent spills or other releases that could impact the environment or contaminate surface water runoff. The materials will be stored in tanks and or containers in dedicated, contained areas to prevent any spills from reaching the outside environment. Hazardous materials will be handled and stored in accordance with provincial hazardous materials regulations and will be transported for off-site disposal using a licensed hazardous waste transport company. Employees will be trained on proper handling and management practices for these materials.

3.3.7 Wastewater Management

Septic Wastewater

The Project will generate sewage and greywater waste, which will require treatment either on site using a standard wastewater treatment system, or offsite at a municipal wastewater treatment facility. It is expected that during the construction and early operations phases of the project, portable sanitation units will be utilized. A permanent washroom and bathing facility may be constructed at a later date as the project advances through the operations phase.

The Project site will not have a conventional septic tank and soil absorption disposal field due to the shallow soil overlying the bedrock, which will not permit adequate treatment of the wastewater. As an alternative, it is anticipated that a large volume holding tank will be utilized during the construction phase of the project. The sewage and greywater waste would be directed to the holding tank and pumped out by truck to be hauled by a licensed septic waste transport company for offsite treatment. It is anticipated that holding tanks totalling 227 m^3 will be sufficient to collect the waste from 60 workers for two weeks, after which the tanks would be emptied and the waste transported for offsite treatment (NLDEC 2005). This volume provides for 1.5 times the maximum daily flow for two weeks[3].

A conventional raised bed septic system (where the treatment medium, typically sand, is imported onto the site) will also be considered as a possible alternative on-site treatment method. The type of raised bed system suitable for the project site would be determined at a later date following the completion of test pits that would provide technical information about the soil profile at the proposed system location. In both cases, the magnitude of waste generated will be proportional to the number of workers employed at the project site. The volume of the holding tank or size of the raised bed septic system will be based on peak employment estimates.

The treatment methods, design, construction, maintenance and management of the on-site system will take into account the regulations, guidelines, policies, and standards that have been established by the Nova Scotia Department of Environment, including Technical Guidelines for

[3] 60 persons x 180 L/person/day = 10,800 L x 14 days = 151,200 L (151 m^3 + security factor = 227 m^3)

On-Site Sewage Disposal Systems and other guidance documents (NSE 1997; NSE 2006; NSE 2007; NSE 2013).

The location of the wastewater treatment system would likely be adjacent to the office and maintenance shops shown on **Figure 3.0-20**.

Stormwater and Wash Water

Stormwater at the Black Point operation will include surface water runoff from precipitation (including snowmelt) falling on the processing and quarry areas. Within the pit, this will also include minimal groundwater inflows described in the Hydrogeological Technical Study (**Appendix A**). Wash water will consist of collected stormwater and will be used in the granite washing process to remove fines from the granite in the processing plant. This water will be collected and reused.

Stormwater and wash water from the processing area (the lower platform) will be managed by sloping the processing area so that water is directed away from the Chedabucto Bay to one of two settling ponds located along the base of the cliff at the southern edge of the lower platform. The two 6,100 m^3 settling ponds are sized to provide sufficient retention time for any suspended solids (rock fines) to settle out leaving clarified water. Stormwater retention ponds are sized to comply with NSE 1988 Erosion and Sedimentation Control Handbook guidelines, which equates to 11 days residence time for mean annual runoff through the ponds (please see the Surface Water Technical Report, **Appendix C**). The clarified water will be reused for product washing and site dust control, or tested and discharged if needed. Any excess untreated water can be pumped to the pit sump described below. Should a power failure occur, the settling ponds can be allowed to overflow, since the water will simply accumulate around the ponds rather that flow to Chedabucto Bay. This will allow containment and eventual treatment of the entire storm event.

In the quarry stormwater will be routed by sloping and shallow drainage ditches to the quarry floor for collection in the pit sump. The pit sump consists of a large excavated basin designed to retain water for reuse. Initially, the pit sump will measure approximately 45 x 60 m with a depth of 4.5 m and a volume of 12,000 m^3. The sump can be expanded proportionally as the quarry expands through Phase 3 (64,000 m^3), and Phase 5 (386,000 m^3). As is the case with the retention ponds in the processing area, the pit sump can overflow will no negative effect on operations. In the event of overflow, water would be allowed to clarify in place prior to testing and discharge to the ocean, or would be pumped to the settling ponds for clarification.

The Project is designed to allow pumping of water from the settling ponds to the quarry sump and vice versa in a closed loop recycling process to ensure sufficient wash water is present at all times. The combination of retention ponds, quarry sump and land sloping is adequate to contain a 100-year 24 hour storm event.

The water management system will be designed to provide capability for non-routine discharges of clean water from the quarry sump. Any discharge to the ocean will be required as a minimum to meet water quality standards listed in the Pit and Quarry Guidelines (NSEL 1999) as well as quality criteria stipulated in the operating permits and authorisations. These criteria will include for example total dissolved solids, pH, oil and grease, nitrates and other constituents required by the permitting agencies. The final location of the discharge point will be established during the detailed design phase but is anticipated to be in the southwest zone of the lower platform nearest to the settling ponds. The quality of any discharged water is expected to be equivalent

to or better than the highly acidic surface discharges currently received from Fogherty Lake and Murphys Lake.

3.3.8 Other Waste

The project will generate various types of waste and recyclable materials as a result of construction activity, and routine operation of the facility. The materials that will be generated include:

- Non saleable crushed granite, termed product fines, granite fines or crusher fines (crusher fines is the term used in this EIS).

- Typical "curbside" solid waste. This will include paper, plastic, cardboard, food scraps, aluminum cans, glass bottles and containers, and other trash. Much of this material will be collected in dedicated containers for recycling. Small volumes of medical waste may also be generated on occasion.

- Vehicle and equipment maintenance waste. Routine maintenance activities will generate a variety of waste materials including used antifreeze, used oil and hydraulic fluids, paint, used oil and fuel filters, spent batteries, tires, conveyor belting, miscellaneous equipment parts, scrap steel, wood pallets, light bulbs, petroleum contaminated rags and other petroleum contaminated media (pads, soil, granite fines, rags).

The Proponent's approach to waste management is to use pollution prevention techniques to minimize the amount and types of waste materials. This also reduces the amount of material shipped off-site for disposal which reduces the risk of liability associated with the off-site disposal site. All wastes will be sorted and transported to a licensed recycling facility using authorized local services in compliance with the Nova Scotia Solid-Waste Resource Management Regulations and municipal requirements. Materials that cannot be recycled will be managed using authorized landfills for disposal. All waste materials and materials awaiting shipment or pick-up will be properly stored to prevent accidental release of substances to the environment.

3.3.9 Operation Related Noise and Light

The Black Point operation will generate noise from the operation of mobile equipment, the processing plant, blasting and product loadout at the marine terminal (please see Section 6.3 for more information on anticipated noise levels).

The facility will employ a number of noise mitigation measures consistent with guidance presented in resource materials provided to the Proponent by Health Canada. These measures will both reduce noise at the source and reduce noise emanating from the facility through attenuation by design. Together, these measures will reduce noise levels outside the property boundaries. Noise reduction and mitigation measures will include:

- specification of reduced noise equipment, especially mobile equipment;
- procurement of equipment that meets US EPA Category IV air emission standards for off-road diesel equipment which tend to generate less noise than older equipment;
- confinement of most mobile equipment within the quarry pit below ground surface so the pit walls will attenuate noise levels;
- retention of natural barriers such as hillsides to the extent possible;

- placing product stockpiles and other structures to attenuate the noise from the processing equipment;
- consideration of alternative back-up alarms systems for mobile equipment;
- enclosure of the majority of the screening towers to reduce noise transmission;
- restricting operating hours for the quarry and processing plants to 16-hours per day so that noise levels are reduced during night time; and
- restricting blasting to daytime hours and weekdays.

In addition, the Proponent will periodically measure noise levels of the equipment and operation using portable dosimeters and track the levels so that increasing noise levels that could indicate equipment issues can be identified and corrective action taken. The Proponent also conducts employee noise exposure monitoring as part of the Safety and Health program. The employee noise monitoring will identify issues with work place exposure to noise that will target the source of the noise internally to minimize the risk of a noise issue outside of the facility property. The Proponent will also maintain an open communication with the community and the neighbours in the Black Point vicinity to identify any concerns with noise levels so that the issue can be addressed. All of these measures, combined with the distance of the site operations from off-site noise receptors (homes), will ensure that the site complies with the Pit and Quarry Guidelines established for operational sound levels (NSEL 1999). These Guidelines stipulate that noise levels are not to exceed the following levels at the boundaries of the Project site:

- 65 dBA 0700 – 1900 hours (Days);
- 60 dBA 1900 – 2300 hours (Evenings); and
- 55 dBA 2300 – 0700 hours (Nights, Sunday and statutory holidays).

A comprehensive noise assessment has been prepared for the facility that included measurement of background noise levels at the site and in proximity to the nearby noise receptors, and estimation and modelling of projected noise impacts associated with the operation. The results of this assessment are provided in Section 6.3.

Operational impacts on human-perceived night time light levels are anticipated to be limited. This is because the site layout and natural terrain restrict direct line-of-site visibility of the operation from the east and west. The distance of the operation from the nearest residents, combined with 30 m wide forested coastal buffers (and undeveloped Black Point itself) will help minimize any impacts. The quarry will not be visible from Route 16 due to the distance, vertical change in topography, and forested slopes.

Light will be generated from vehicles using onsite access roads and parking lots, exterior lighting, and lighting of the marine terminal. Illumination will be minimized by shielding lights to shine only where needed to ensure the safety of employees. The facility lighting will also be designed to minimize impacts by controlling the intensity of the lighting sources used and by careful placement of light sources. To the extent possible lights will be located where structures, buildings and natural barriers block transmission in the direction where neighbours are present. Lighting will be reduced to a minimum level in non-operational areas during night time hours. Any maintenance activity will take into consideration light impacts and adjust to provide the light needed to safely perform the task while trying to minimize off-site impacts. Please see Sections 6.3 and 7.3 for additional detail regarding anticipated light emissions.

3.3.10 Air Emissions

Dust emissions during all phases of the Project will be controlled with the application of water obtained from the settling ponds and water that has pooled on the quarry floor and collected in the quarry sump. Biodegradable products proven to significantly minimize fugitive dust may also be used following approval from NSE. To minimize dust emissions associated with truck traffic, conveyors will be used to transport rock from the pit to the laydown area. Processing equipment will be designed to minimize drop heights at transfer points and certain equipment will be fitted with water spray nozzles for dust control.

Combustion emissions will be generated from all phases of the Project as a result of fuel combustion in Project equipment and vehicles. Specific emissions associated with the Project include: sulphur dioxide (SO_2), nitrogen oxides (NO_X), volatile organic compounds (VOCs), carbon monoxide (CO), carbon dioxide (CO_2), and trace products of particulate matter (PM). These combustion related emissions will be minimized through the use of mobile equipment and electrical generators that meet US and Canadian Category IV emissions standards. These emissions are also minimized through the use of ultra low sulphur fuel in on-site mobile and fixed equipment. The use of conveyors will reduce trucking emissions; regular equipment maintenance and reduction of idling time will also ensure emissions are reduced.

The air quality impacts of the estimated emissions of dust particles and combustion related compounds were determined through the use of air quality dispersion modelling (Section 7.1 Air Quality and Climate Change and **Appendix O).** The modelling results were compared to federal and provincial air quality standards to assess potential Project-related impacts. The air quality assessment demonstrates that the Project emissions will not exceed applicable ambient air quality standards at any locations where off-site receptors (residences) are present.

Visible emissions monitoring will be conducted following installation and the start of operation of each crusher, screen, conveyor, and other pieces of processing equipment that is not wet. Compliance with applicable opacity standards will be confirmed and if found to be non-compliant, improvements in dust control will be implemented to achieve compliance before the equipment is returned to full operation. Daily visual observations of the operational areas including the processing plant and loadout areas, haul roads and stockpiles will be performed by site management personnel and any areas with visible dust will receive additional water applications, adjustments dust control equipment to improve effectiveness, or if the issue cannot be immediately corrected, by shutting down the equipment or area until corrective measures can be taken. The Proponent will apply adaptive management techniques and use the monitoring results to guide decision-making on an ongoing basis throughout each operating day.

The estimated annual emissions for each of the five operational phases are provided in Table 3.3. These values are maximums for peak production amounts anticipated in each phase.

Table 3.3:
Total Criteria Pollutant Emissions from Quarry and Processing Plant (tonnes/year)

Project Phase	Total Suspended Particulate (TSP)	Particulate Matter <10 microns (PM10)	Particulate Matter <2.5 micros (PM2.5)	Nitrogen Dioxide (NO2)	Carbon Monoxide (CO)	Volatile Organic Compounds (VOCs)	Sulfur Dioxide (SO2)
Phase I	6.16	1.83	0.76	30.64	24.99	3.39	1.48
Phase 2	22.78	6.31	2.70	54.12	36.15	6.12	1.60
Phase 3	47.09	14.58	2.92	77.50	62.48	8.33	2.00
Phase 4	99.84	33.42	6.19	91.76	92.15	9.87	2.00
Phase 5	114.56	37.44	7.28	105.35	109.07	11.08	2.80

(source: Vulcan Materials Company)

Greenhouse Gas Emissions

The Black Point quarry, processing plant and loadout operations will result in the direct emissions of greenhouse gases, primarily carbon dioxide (CO_2) and to a lesser extent methane (CH_4) and nitrous oxide (N_2O). These gases are combustion by-products from fuels used in mobile equipment and the diesel powered engines associated with the portable processing plant in operational Phase 1 through Phase 3. A small amount of greenhouse gases are also generated on a discontinuous basis from blasting within the quarry pit. The estimated amount of greenhouse gases generated as direct emissions by the land based operations (excluding marine terminal) are 4,793 annual tonnes of carbon dioxide equivalent (CO_2e) emissions during Phase 1. GHGs from the marine terminal are described later in this section.

The levels of greenhouse gas emissions increase proportionally as production increases, to a maximum estimated emission level (land based only) of 8,522 tonnes of CO_2e annually during Phase 5. The estimated amounts of direct greenhouse gas emissions by operating phase are presented in Table 3.4.

Table 3.4:
Tier I - Direct GHG Emissions Quarry, Processing Plant and Loadout

Project Phase	CO2 (tonnes/yr)	CH4 (tonnes/yr)	N2O (tonnes/yr)	CO2e (tonnes/yr)
Phase I	4,708.00	5.40	79.90	4,793.30
Phase 2	7,195.00	8.20	122.20	7,325.40
Phase 3	6,421.00	7.30	109.00	6,537.30
Phase 4	8,330.00	9.50	141.50	8,481.00
Phase 5	8,371.00	9.60	142.00	8,522.60

(source: Vulcan Materials Company)

The Black Point project will require approximately 9,000 kilowatts of electrical power primarily for the operation of the processing plant equipment in Phases 4 and 5. This amount of electricity generation by the electric utility will result in an indirect greenhouse gas emission rate of 1,058 tonnes of CO_2e per year during peak production in Phase V. Lesser amounts of electricity will be needed in earlier phases. The indirect emissions due to electricity utilization are resented in Table 3.5.

Table 3.5:
Tier II - Indirect GHG Emissions for Electric Power Usage

Project Phase	Maximum Electricity Demand (Horsepower)	CO2 (tonnes/yr)	CH4 (tonnes/yr)	N2O (tonnes/yr)	CO2e (tonnes/yr)
Phase I	180	15.78	0.02	0.06	15.86
Phase 2	180	15.78	0.02	0.06	15.86
Phase 3	180	15.78	0.02	0.06	15.86
Phase 4	12000	1,052.09	1.05	4.31	1,057.46
Phase 5	12000	1,052.09	1.05	4.31	1,057.46

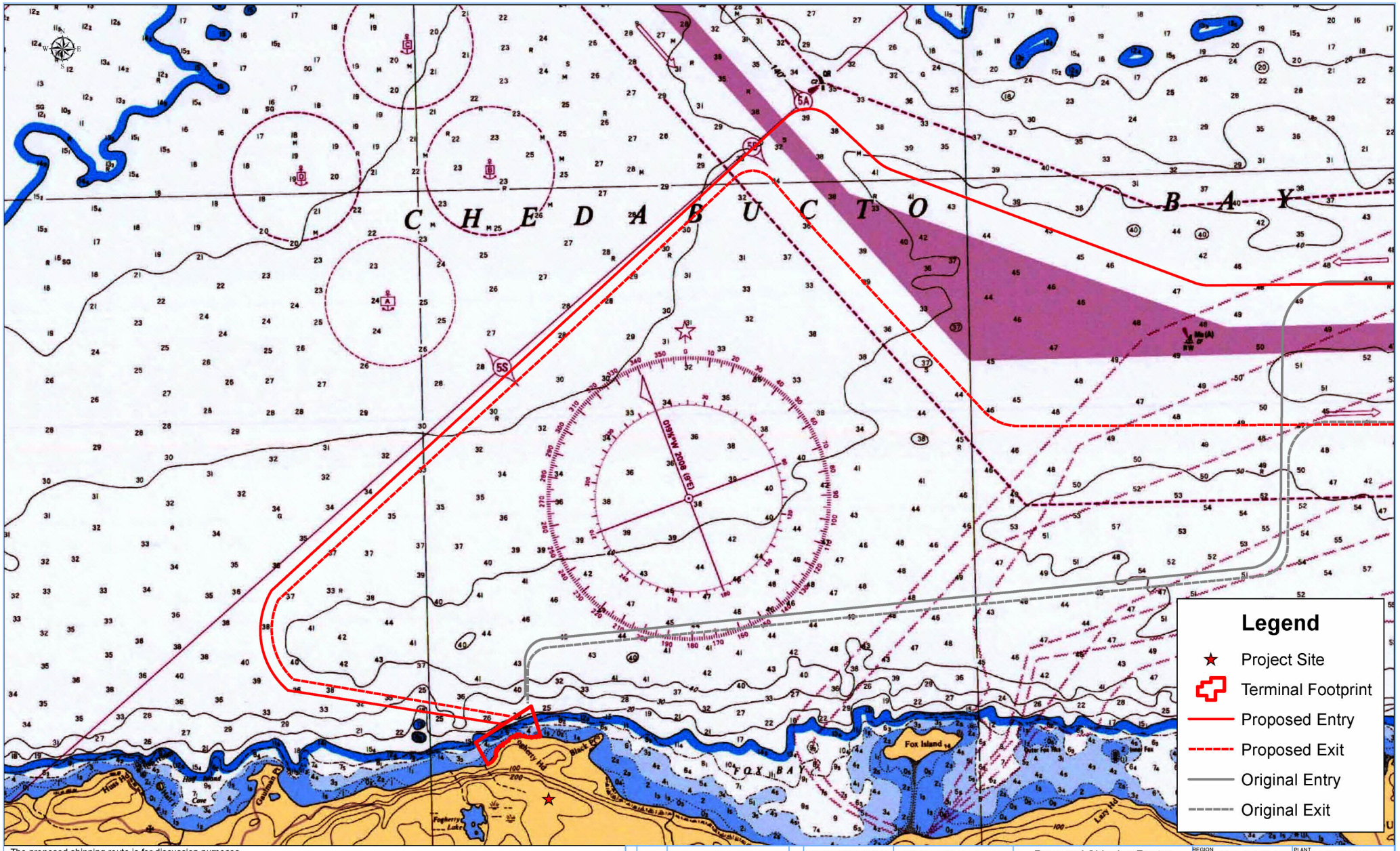
(source: Vulcan Materials Company)

3.3.11 Marine Vessel Operations

The typical vessel used to transport aggregate is a 70,000 DWT "Panamax" size ship (**Figure 3.0-28**). During the initial stages of production before the plant is operating at maximum capacity, ships will arrive at the terminal on average approximately 1 to 3 times per month. As market conditions warrant, this will increase to a maximum of 1 to 2 ships per week. Ship loading typically requires 18 to 24 hours and so a typical cycle of arrival–berthing-loading-departure requires on average one to two days. Aggregate products will be the only material off-loaded at the Project site. Shipping will typically be arranged through the customers, who will arrange for ship arrival and departure at the marine terminal.

Operating limits for the marine terminal will be established during the final marine terminal design stage. The Environmental Management Plan will define the operating limits for the vessel to remain alongside the terminal will be developed. The Plan will identify and establish limits for severe atmospheric and/or oceanographic conditions for all marine terminal activities including berthing, mooring, and aggregate loading. The vessel will vacate the berth if and when these limits are reached.

Figure 3.0-28:
"Panamax" Size Ship



The proposed shipping route is for discussion purposes.
The acutal shipping route is subject to ongoing transportation studies and government approval.

0 500 1,000 2,000 3,000 Meters

Morien Resources Corp.

Vulcan Materials Company

Proposed Shipping Routes

REGION NOVA SCOTIA

PLANT BLACK POINT

DWN BY CKR DATE 09/23/2014

SCALE 1 in = 1,000 m

DWG. NO. Figure 3.0-29

PLOTTED: LAST UPDATE:

DATE REVISION BY ISSUE DATE:

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A proposed shipping route from the inbound shipping lane to the marine terminal is shown on **Figure 3.0-29.** Two routes have been examined and after consultation with local fishermen, a preferred route was selected. It should be noted that the route used on any given voyage will depend on weather, traffic, safety, local pilot instructions and other factors. Due to the large size of vessels, speeds within Chedabucto Bay during the approach to the terminal are anticipated to be less than 2 knots. Elsewhere with the Bay, vessel speed would be at the Master's discretion under the pilot's advice. Outside of Chedabucto Bay, ships will generally travel at a speed of 14 knots.

If severe weather is forecast, the ship captain in consultation with the local pilot assigned to the vessel will determine the appropriate course of action. Ship crews will be fully trained of their responsibilities in the event of a weather-induced emergency at sea, and proper emergency response and escape equipment will be onboard at all times. If an instance of severe weather develops, the marine terminal may be used as a refuge for fishing boats or ships in the immediate area.

Ships are to adhere to all relevant laws, regulations and permits to ensure environmental compliance, and meet all regulatory standards pursuant to the *Canada Shipping Act*, including, but not limited to the:

- *Ballast Water Control and Management Regulations;*
- *Navigation Safety Regulations; and*
- *Ship Station (Radio) Regulations.*

It should be noted that no fuel tanker vessel traffic will occur as a part of the Project. There will be no bulk fuel or oil transport or transfer to or from ships while at the marine terminal and bilge water and deck wash discharge at the terminal will only occur in compliance with the federal government's *Ballast Water Control and Management Regulations*. Additional detail on bilge and ballast water management is provided in Section 6.11 Shipping and Navigation.

3.3.12 Emissions to Atmosphere from Marine Operations

The Project will result in air emissions of dust (particulates) and fuel combustion byproducts emitted by ships during transport and loading operations. The combustion related emissions will include: sulphur dioxide (SO_2), nitrogen oxides (NO_X), volatile organic compounds (VOCs), carbon monoxide (CO), carbon dioxide (CO_2), and trace products of particulate matter (PM).

Estimates of direct GHG emissions associated with ship operations and product transfer are presented in Table 3.6. The emissions estimates were prepared using factors provided in "Environment Canada GHG Emission Quantification Guidance `for Fuel Combustion" using the mobile equipment guidance for light oil fuelled ships[4]. The fuel consumption values used in to prepare the estimates were 4.6 tons per day docked and 37.1 tons per day in transit.

[4] http://www.ec.gc.ca/ges-ghg/default.asp?lang=En&n=AC2B7641-1#section5

The GHG emissions associated with the berthing of the ship during loading at the marine terminal and the emissions associated with manoeuvring within the Project operating area are presented in Table 3.6.

Table 3.6:
Tier I - Direct GHG Emissions from Vessel Operations at Marine Terminal

Project Phase	CO2 (tonnes/yr)	CH4 (tonnes/yr)	N2O (tonnes/yr)	CO2e (tonnes/yr)
Phase I	201.37	0.40	0.00	201.77
Phase 2	279.67	0.56	0.00	280.24
Phase 3	425.11	0.85	0.01	425.96
Phase 4	626.47	1.25	0.01	627.73
Phase 5	939.71	1.87	0.02	941.59

(source: Vulcan Materials Company)

The greenhouse gas emissions for roundtrip vessel travel between the Black Point project boundary and the edge of Canadian economic zone waters are provided in Table 3.7. This information is based on an estimated vessel travel distance of 500 km round trip which will vary based on the specific route each vessel navigates.

Table 3.7:
Emissions for Total Annual Vessel Haulage (To/From Canadian Economic Zone Edge)

Project Phase	CO2 (tonnes/yr)	CH4 (tonnes/yr)	N2O (tonnes/yr)	CO2e (tonnes/yr)
Phase 1	3,240.00	0.58	2.42	3,243.01
Phase 2	4,500.00	0.81	3.36	4,504.17
Phase 3	6,840.00	1.23	5.11	6,846.35
Phase 4	10,080.00	1.82	7.53	10,089.35
Phase 5	15,120.00	2.73	11.30	15,134.03

The Canadian National GHG Inventory for the 2012 calendar year shows the carbon dioxide equivalent emission levels for Nova Scotia to be 17,400 kt with 11,700 of that amount from stationary combustion sources and 5,530 for transport emission sources. The mining and oil and gas industrial category generated 201 kt of emissions.

Unlike priority pollutant air contaminants such as NOx and CO there are no ambient air quality standards for greenhouse gases. In addition, the impact of greenhouse gas emissions on the environment is cumulative in nature and is supplemented by natural processes such as volcanic eruptions. The impact of the Project's greenhouse gas emissions can be evaluated through a

comparison of the Project emission levels to both the levels of emissions in Nova Scotia in general and to the emission levels of similar industries.

The Project's total GHG emission level at the maximum generation rate during Phase 5 is estimated at 9,464 tonnes per year CO_2e. This level is roughly 0.05% of the Province's total GHG emissions for 2012 of 17,400,000. The Project GHG emission level is also roughly 4.7% of the 2012 reported emissions of the mining and oil and gas industrial category. The Project represents 0.0000283 percent of the 2012 World Wide emissions for the fuel combustion and cement production source categories.

The Project's greenhouse gas emissions will not contribute significantly to these emissions levels. The Proponent will minimize GHG emissions by purchasing heavy off-road mining equipment that meet the US EPA and Canadian Tier 4 engine standards, operating mobile equipment with fuel efficiency in mind by eliminating unnecessary idling and shutting off equipment when it is parked (unless there is a safety or maintenance reason it is running), utilizing conveyors in the process to reduce the need for mobile equipment, and through the use of ocean vessels to ship the product reducing more energy intensive ground transportation options. This last point is illustrated in Table 3.8. This table summarizes the GHG savings of shipment achieved through the use of ocean vessels versus rail and truck. The GHG emission savings are dramatic ranging from 19% to 89% per vessel shipment.

Table 3.8:
Vessel Operation GHG Analysis

CO2e Emissions Vessel Travel to Delivery Point (tonnes/trip)				GHG Emissions CO2e	
North Caroline to Virginia Area	Charleston, SC	Miami, Fl	Tampa, FL	Total By Phase	
611	683.00	1,013.00	1,283.00	Phase I	16,155.00
Alternatives Analysis				Phase II	22,437.50
Land Shipment from Vulcan Quarry to Same Market Area				Phase III	34,105.00
GHG CO2e Per Equivalent Single Vessel Shipment				Phase IV	50,260.00
752	1,505.00	8,986.00	5,354.00	Phase V	75,390.00
% GHG Reduction by Ocean Vessel Shipping (per ship trip)				Phase V Annual CO2e Savings (tonnes)	
18.8%	54.6%	88.7%	76.0%	273,147	

(source: Vulcan Materials Company)

3.4 DECOMMISSIONING PHASE

3.4.1 Transfer of Ownership and Control

The Proponent will lease the property from the MODG for the life of the quarry, estimated to be sometime after 2070. The land will be returned to the MODG following the completion of operations, equipment decommissioning, removal of plant and marine terminal infrastructure, and the acceptance of site decommissioning and reclamation activities.

A description of the site following operations and decommissioning activities and details of a conceptual rehabilitation plan are provided in the following sections.

3.4.2 Rehabilitation Plan

In accordance with the requirements of the provincial Pit and Quarry Guidelines (NSEL 1999), the Proponent will prepare a written plan approved by NSE to provide for partial or total abandonment and rehabilitation of the site. It is anticipated that the plan will include an initial rehabilitation plan, progressive rehabilitation measures and / or a final rehabilitation plan. The Proponent will also post interim and final security bonds for the quarry, as required by the Pit and Quarry Guidelines and the *Approval and Notification Procedure Regulations*.

The rehabilitation plan will be developed for the Project site and submitted to regulators for review as part of the provincial Part V Industrial Approval application. The plan will include short-term and long-term reclamation efforts as well as details of the proposed final reclamation plan such as topography, maximum slopes, re-vegetation plans, and potential future land uses once the quarry operation is complete.

All areas of the Project site affected by quarry activities including the plant site and settling ponds, marine terminal, access roads and the quarry floor will be included in the rehabilitation program. The final reclamation plan will be developed in consultation with various stakeholders such as provincial and municipal officials, non-government organizations and conservation groups, adjacent landowners, and Mi'kmaq representatives. A draft Table of Contents is given below.

Rehabilitation Plan Draft Table of Contents

1.0 Introduction

2.0 Baseline Information

3.0 Project Facilities and Areas

3.1. Open Pit

3.2. Processing Plant

3.3. Marine Terminal

3.4. Infrastructure

3.5. Water Supply, Treatment, and Discharge

4.0 Conceptual Decommissioning and Reclamation Plan

4.1. Site at Closure

4.2 General Strategies

4.2.1 End Use Objectives

4.2.2 Goals

4.2.3 Plan for Managing Surficial Materials

4.2.4 Plan for Managing Re-Vegetation

4.2.5 Plan for Water Management

4.3 Specific Strategies for Project Facilities

4.3.1 Infrastructure Removal

4.3.2 Plant Equipment

4.3.3 Mobile Equipment

4.3.4 Marine Terminal

4.3.5 Access Roads

4.3.6 Open Pit

4.3.7 Water Retention and Ponds

4.3.8 Hazardous Materials Management

5.0 Site Safety and Security

6.0 Monitoring and Maintenance

6.1. Site Maintenance

6.2. Reclamation and Vegetation Monitoring

6.3. Water Quality Monitoring

7.0 Schedule

8.0 Costs

9.0 References.

3.4.3 Site Description at Closure

The site will include the following elements at the end of operations (**Figure 3.0-30**):

- An open pit that will be flooded to create an aquatic feature with viable habitat,
- Permanent submersion of the solid granite quarry floor and associated haul roads,
- A graded area including the plant site and material storage areas,
- Engineered ponds and sumps that supplied water to the processing plant,
- Minor disturbed areas immediately adjacent to the open pit,
- Appropriate surface water drainage structures (ditches, swales) in and around the Project site, and
- Site buildings and road(s) needed for care and maintenance of the site after operations end.

3.4.4 Reclamation Objectives

The reclamation objective is to restore aquatic and terrestrial habitats to the extent possible so that indigenous flora and fauna can occupy or exploit areas recently used to support quarrying operations. The overall end use objective is to promote land uses and habitat types within the Project area that are similar to those that occurred before the Project was initiated. Other recreational or commercial land use opportunities may develop during the life span of the quarry and will be examined in coordination with the MODG and other stakeholders.

At closure, all unneeded buildings and equipment will be decommissioned and removed from the site. The water management system used during operations will be re-configured to ensure

stable site drainage and water quality that meets applicable standards for discharge. The landforms that remain after operations will be reclaimed to a variety of habitats, including upland forest, shrub-riparian, and rocky outcrop. These habitats will be most appropriate for wildlife use, with some potential for traditional and recreational use.

3.4.5 Reclamation Goals

The goals during decommissioning and reclamation are to:

- Remove all equipment and buildings not necessary for future use and care of the site,
- Stabilize the terrestrial environment and replant native vegetation where applicable,
- Minimize disruption to the marine environment, and
- Restore land use potential.

Specific activities to be conducted during the decommissioning and reclamation process are described in further detail in the following sections.

3.4.6 Removal of Equipment and Infrastructure

Following the completion of quarrying activities, estimated to be sometime after 2070, the site will be decommissioned as outlined in the reclamation plan (Section 3.4.2). As part of this plan, all equipment and related infrastructure including the processing plant, machinery and equipment will be removed from the site. The purpose of removing the equipment and infrastructure is improve site aesthetics and allow the site to return to a more natural looking state, while at the same timing decreasing the potential for environmental risk over the long-term if these materials were left on-site.

It should be noted that following de-commissioning the land-owner, the MODG, may request that some infrastructure be left on-site that might be beneficial for future land uses. It is anticipated that discussions with MODG regarding final reclamation and decommissioning of the site will take place as the operation nears completion.

Equipment and infrastructure to be removed include:

- Mobile equipment including trucks and loaders;
- All conveying, crushing and screening infrastructure, including:
    - Primary, secondary and tertiary crushers;
    - Conveyors and control towers;
    - Wash tower and screening facilities;
    - Pump facilities and pipes from settling ponds
- Surface buildings not required for future land use by MODG, including office facilities and maintenance buildings and equipment sheds;
- Infrastructure including:

- septic system(s);
- fuel storage facilities;

- Any garbage, waste and debris will be disposed of in an approved waste disposal site;

Factors to be considered during removal of equipment and infrastructure include:

- Minimizing lag time between retirement of buildings or structures and their disassembly;
- Keeping retired buildings closed to discourage colonization by wildlife;
- Disassembling buildings and structures outside of the breeding season for most birds (April 1 to September 1). Alternatively, inspecting buildings or structures just before disassembly to ensure they are not being used for nest sites in compliance with Migratory Birds Convention Act. Otherwise perform nest surveys and limit activities until nests are no longer occupied. Also contact relevant authorities prior to site decommissioning (e.g., Canadian Wildlife Service);
- Minimize lag time between completion of aggregate production and commencement of equipment and infrastructure removal.

Following the removal of all equipment and infrastructure, the plant site and administrative areas will be graded to allow for future commercial, industrial, recreational, or residential land use, or to allow for restoration of the area for wildlife habitat.

3.4.7 Removal of the Marine Terminal

To avoid disturbance of the marine environment and enhance its potential for future use, the rubble mound, mooring dolphins, caissons, slewing rails, and buoys will likely be left in place. The shiploader arm and ancillary mechanical equipment including suspended conveyors, dust collectors, drive belts, and shuttle will be removed from the Project site.

3.4.8 Site Rehabilitation

The Proponent will undertake a progressive reclamation program at the Project site during operations, which will include the use of Best Management Practices developed for quarry facilities; only the area needed for production in any one year, would be grubbed. The subsoil, topsoil and root mat of this area would be placed in a dedicated stockpile and similarly, any overburden would be stockpiled separately. This material will be used in future reclamation. The reclamation process begins after the environmental controls are in place.

Hydroseeding stockpiles may be used as an alternative to the use of root mat in future activities. This approach will provide a source of native plant species which are well adapted to local climatic and soil conditions, while also reducing the need for fertilizer use. If it is necessary, seeds of native plant species which are well established to Nova Scotia and which are not aggressive weeds in the local plant communities of the Project site will be used to stabilize soils during reclamation. This option will be used in the event that grubbed material has not produced sufficient plant biomass to stabilize soils. Re-vegetated areas will be monitored for up

to 5 years after decommissioning to ensure that a self-sustaining vegetation cover is successfully established.

As distinct areas of the quarry become inactive, these areas will be graded to a stable slope of 2:1, covered with overburden, and (if warranted) seeded in the absence of laying a root mat. Within six (6) months of abandoning quarry operations, the rehabilitation of the site will have achieved:

- grading and contouring of all slopes and exposed rock faces, to the extent practical, in consideration of rock falls, slope stability, and safety;
- spreading stockpiled overburden and topsoil; and
- hydroseeding in the absence of laying a root mat.

The laydown (covered with quarried materials) and administrative areas (following the removal of all structures) will be graded, as required to allow for future commercial, industrial, recreational, or residential land use, or to allow for restoration of the area to existing conditions (wildlife habitat). An example of the potential end use is shown on **Figure 3.0-30.**

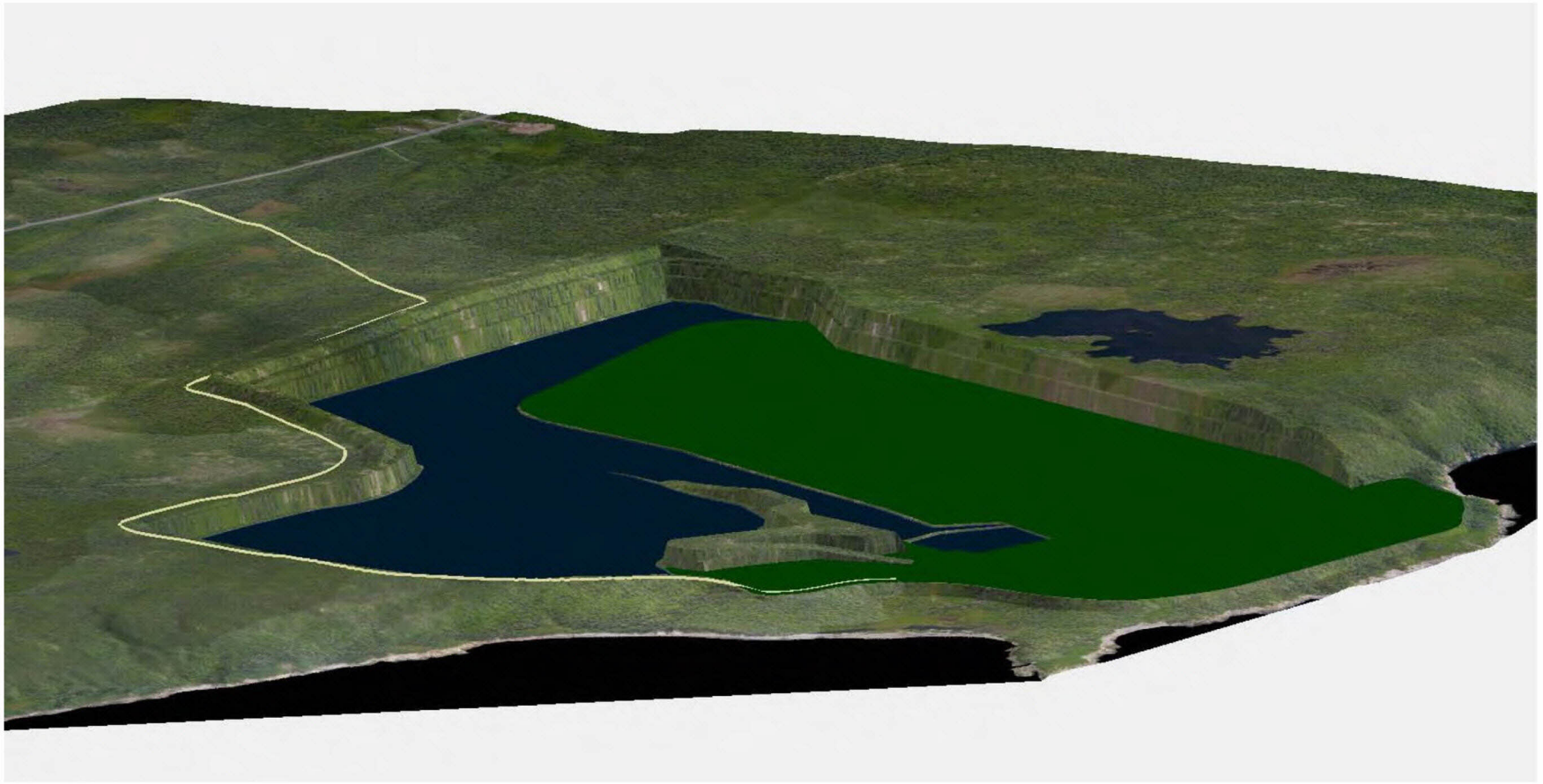
An Environmental Management Plan (EMP) will be developed for the Project and will include a number of mitigation measures that will address aspects of the Project including site rehabilitation. The Project EMP will ensure Project activities adhere to all relevant federal and provincial regulations (e.g. *MBCA*, *SARA*, etc.).

3.4.9 Reclamation Phasing Timeline

The following table provides an estimated timeline for reclamation activities.

Table 3.9
Reclamation Phasing Timeline

Activity	Anticipated Start Date	Anticipated Completion Date
Best Management Practices	2018	2070+
Operations	2021	2070+
Decommissioning (Equipment, Plant, Marine Terminal)	2070	2072
Reclamation	2072	2073
Monitoring and Acceptance	2073	2078



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Vulcan Materials Company

Potential End Use

REGION: NOVA SCOTIA | PLANT: BLACK POINT

DWN BY: CKR | DATE: 10/22/2014 | CHK BY:

JOB NO: | SCALE: No scale

PATH:

DWG. NO.

Figure 3.0-30

3.5 ACCIDENTS AND MALFUNCTIONS

Malfunctions and accidental events will be prevented and mitigated through a systematic approach to worker health and safety and environmental protection. Contractors will be required to submit health and safety policies and plans to the Proponent for review and approval prior to any onsite activities. Onsite workers will receive appropriate training to prevent and mitigate workplace accidents and environmental upsets.

The accidents and malfunctions that could potentially occur during site preparation and construction, any phase of operations, and the site decommissioning and closure phases of the Project are described below, while accident scenarios are described systematically in Section 7.18. Mitigation measures to prevent the occurrence of such events, and response procedures to be implemented in the event they do occur, are also described in Section 7.18 and will be developed in more detail as part of the Industrial Approval application process.

3.5.1 Fuel and Hazardous Materials Spills

Quarry, Plant, Shop and Loadout Areas

All phases of the Project (site preparation, construction, operation, closure and decommissioning) will include the use of fuels and equipment maintenance and servicing fluids. The fuels will include diesel fuel and gasoline required to operate the mobile equipment and portable generators (note: the generators will be discontinued following Phase 3). The equipment maintenance and servicing fluids include hydraulic oils, various viscosity grades of oils and lubricants, greases, antifreeze, brake and steering fluids, small quantities of other maintenance aids such as paints, WD40, and other solvents. Site development and quarry operations will also use blasting agents that may include diesel fuel and ammonium nitrate as components.

The potential for spills or leaks of any of these materials exists during all phases of the Project. The spills could result from equipment failure, damage to storage or piping systems, mobile equipment accidents, or failure to follow proper procedures related to fuel and other bulk material transfers or equipment maintenance activities. In the unlikely event of a large spill or leak, soil, groundwater and surface water contamination may occur, adversely affecting the quality of habitats and/or resulting in ingestion or uptake of contaminants by wildlife.

The risk to the environment from spills or releases of fuel and other substances is mitigated through a series of activities and controls. Any large spill event would be associated with materials stored in bulk quantities at the maintenance shop, primarily fuels and some lubricating oils. Materials stored on site in bulk will be stored in above ground storage reservoirs with secondary containment in compliance with provincial regulation. Any spillage inside the containment will be recovered and managed in accordance with provincial waste management requirements.

The processing plant area is designed to provide protection from fuel or other material spills. The main processing plant and shop area will be sloped to the south so that any spilled liquids will remain on-site. Larger spills could potentially be directed to the processing plant settling basins where the spilled material would be recovered. In the event that a settling basin is used to manage a large spill, the basin pump used to provide wash water would be shut off until the

spilled material has been recovered. In all cases, the spilled material will be contained and recovered as quickly as possible.

As required by workplace health and safety regulation, the employees working at Black Point will be trained in spill response procedures. Spill response materials (absorbents, pads, socks, booms) will be available in proximity to areas where fuels and other materials are located. Most spills or leaks will be localized near the source and be addressed by site personnel using the available spill response equipment. All fuel, chemicals and wastes will be handled in a manner that minimizes or eliminates the risk of spillage and accidents. In the event of any spill or leak at the site, immediate action will be taken to stop the leak and contain the spilled material. All contaminated material will be collected and stored in an appropriate manner so as to not result in a re-release to the environment until such a time as it will be transported to an approved treatment / disposal facility. All spills will be reported to the 24-hour environmental emergencies reporting system (1-800-565-1633) in accordance with the *Emergency Spill Regulations* enacted under the Nova Scotia *Environment Act*. As well, spills that contravene the provisions of CEPA 1999 will be reported to a federal enforcement officer and the public as required under CEPA 1999 (s. 212). A Spill Contingency Plan will be developed in support of the application for provincial Industrial Approval.

The Black Point facility will use best practices during fuel and other liquid transfer operations including monitoring and oversight of the transfer activities and verification to ensure that the receiving container has adequate capacity prior to beginning the transfer procedure. Tanks will be designed with level monitoring and overflow protection in accordance with prevailing provincial regulations.

All Project equipment and vehicles will meet industry standard requirements and be safety certified and fit for their intended use. Regular pre-shift inspections and maintenance programs will ensure the continued reliability and integrity of Project equipment. Necessary critical spares will be maintained in the event that an equipment change-out is required.

The Proponent will have a written agreement in place with a certified emergency response company (e.g., Emergency Services International; Kildoon Emergency Management Training) to provide land and water based spill response services prior to the initiation of Project construction activities.

Marine Terminal and Ship Operations

The risk of a fuel or hazardous substance release at the marine terminal is minimal because the facility will not be transferring fuel, ballast water, sewage, ship waste or any other material apart from the crushed stone aggregate between the ship and shore.

The ships will arrive “ballasted” and ballast water will be discharged during the loading. Ballast discharge is governed by the *Canadian Ballast Water Control and Management Regulations* (SOR/2011-237) as well as the International Marine Organization (IMO) International Convention for the Control and Management of Ships’ Ballast Water and Sediments. Compliance with the regulations and guidelines minimizes the risk of transfer of invasive species due to ballast water. Ships are required to comply with the ballast water exchange regulations unless they have a ballast water treatment system on board or retain ballast within the ship.

The requirements regarding ballast exchange vary based on the ship's route of travel and origin. Ships that originate and took on ballast water within waters under Canadian jurisdiction are not required to exchange ballast water before discharging. Ships originating outside of Canadian jurisdiction that took on ballast water outside of Canadian waters are required to exchange the ballast water at least 200 nautical miles outside of Canadian waters in water at least 2,000 deep. Ships coming into Black Point will be required to comply with the *Canadian Ballast Water Control and Management Regulations* and to maintain a Ballast Water Management Plan. The enforcement of these requirements is the responsibility of Transport Canada.

There is a potential for liquid spills or releases in the event of an accident that results in damage to the ship's hull sufficient to rupture a fuel tank, bilge water tank, or other ship structure that contains fuels, lubricating oils, hydraulic fluids, bilge or ballast water. Such an incident would release the affected material into the coastal waters. Factors such as the spill volume and composition, wave, current and wind conditions, and the promptness and effectiveness of response efforts would affect the extent of impact associated with the event. These impacts may include damage to fisheries, impacts to aquatic flora and fauna and waterfowl, as well as coastal impacts from residual material coating the shoreline (please see Sections 6.11 Shipping and Navigation and Section 7.18 Accident and Malfunctions for more detail on these subjects).

The likelihood of a ship-to-ship collision event is low given the lack of significant large shipping traffic in the area of the marine terminal. A collision with a fishing vessel would not likely result in damage severe enough to cause a release. The predominant fuel used by Project vessels is marine diesel; this material is responsive to spill control agents and standard spill response measures. The Project will mitigate this risk by ensuring that ship docking at the terminal is tug and pilot assisted as needed and required by law, the terminal and mooring structures are properly constructed and well lit, and also by having a written agreement with a certified spill response contractor to provide response services in the event of a spill affecting the marine environment. Other mitigating factors include continual redesign of vessels being produced to make them less susceptible to collision damage. This will reduce this risk over the life of the Project. As previously noted, an Emergency Spill Response Plan and emergency response training will also be employed at the site.

3.5.2 Erosion and Sediment Control Failure

The laydown area containing stockpiled materials will be designed to contain and direct runoff to the settling ponds and, under normal weather conditions, it is anticipated that there will be no water discharge from the operation. The engineered settling ponds cannot "fail" in the sense of a wall breech since they will be excavated into rock and bermed with several tens of meters of stone. The ponds may overflow, particularly during a prolonged or significant (i.e., 100-year) storm event but this overflow would not reach the ocean. In the event of an overflow, water would be contained within the site due to the south facing slope of the lower platform. The two ponds together will hold approximately 12,200 m^3 (approximately 3 million US gallons). Calculations indicate the lower platform can accommodate over 28,000 m^3 of water. This would flood a small portion of the lower platform to an approximately depth of 30 cm. Such a flood would temporarily halt operations in this area but would not, for example, affect processing plant machinery. This flooding would only occur if the electricity failed; should the electric pumps continue to function during a severe storm, then water can be transferred between the settling ponds and the pit sump. The water would be retained in the pit sump until clear, then tested and discharge if needed, or returned to settling ponds.

Additional temporary or permanent retention ponds may be installed elsewhere on the site during construction as required in NSE's Erosion and Sedimentation Control Handbook for Construction Sites (NSE 1988).

These areas, and erosion and sediment control measures installed elsewhere in the Project area, will be regularly inspected and monitored, particularly during and after extreme precipitation events. Erosion and sediment control structures found to be damaged will be repaired immediately and any other remedial action will be taken as necessary. Fines storage areas will be confined to areas within the quarry pit so any control failures would not result in an off-site release of material.

3.5.3 Vehicle and Vessel Collision

Vehicle Collisions

Vehicular collisions may occur during any phase of the Project. The vehicles operating at the site will primarily be Project related mining equipment including bulldozers, haul trucks, loaders, service vehicles (pick-up trucks) and company cars. Any vehicles accessing the site will be required to have stated business and check-in at the office or scale house. Traffic patterns, speeds, and right-of-way signage and training will minimize the risk of vehicle collisions on the Project property. Operators of mobile equipment will receive initial and annual training on safe equipment operation and on issues such as awareness of blind spots.

Vessel Collisions

The risk of vessel collisions is primarily associated with Phases 3 through 5. There is the potential for Project related vessel collisions during construction and other operating periods and decommissioning, but the limited amount of marine activity during those phases reduces the potential risk. The management of marine traffic in Chedabucto Bay is under the responsibility of the Canadian Coast Guard. It is mandatory that all large vessel traffic report to the Canadian Coast Guard at specified points and take local pilots on board. The potential for collisions will be minimized through controlling vessel speed; scheduling and coordinating activities with other marine users, Transport Canada and the Canadian Coast Guard; and posting Notices to Mariners as needed. The marine terminal will contain navigational aids and anti-collision radar will provide early warning of a potential collision hazard. The Project will also use weather reports and wind speed information to monitor for changing weather conditions that could increase the risk of collisions during vessel navigation to or from the terminal. This mitigation measure will provide a level of protection in addition to that provided by the Coast Guard and the use of tugs and pilots for navigation support (please see Sections 6.11 Shipping and Navigation and Section 7.18 Accident and Malfunctions for more detail on these subjects).

3.5.4 Fire

A fire at the Project site may occur during any phase of the Project due to an equipment accident, human carelessness, or natural causes such as a forest fire or lightning strike under dry conditions. The immediate concern for a fire is for human health and safety; additional concerns include habitat loss, direct mortality to wildlife, and loss or damage of property. The emissions from a fire would likely consist mainly of smoke (particulate matter) and CO_2, but could also include CO, NOx, SO_2, and other products of incomplete combustion. A large fire could create air contaminant levels greater than the ambient air quality standard over distances

of several kilometres; however, the likelihood of such cases is considered low and the event would be of short duration.

The risk of fire will be reduced by proper management of fuel and other flammable materials, and through appropriate operational procedures such as industry standard storage, handling and transfer techniques. The Emergency Response and Spill Contingency Plan, which will be prepared under the Environmental Management Plan as part of the Industrial Approval application process, will outline procedures for fire prevention, response and reporting. In the unlikely event of a large fire, local emergency response and firefighting capability will be called to respond to reduce the severity and extent of damage and to protect the safety of workers.

3.5.5 Health, Safety and Environmental Management

A Project-specific Environmental Management Plan (EMP) will be prepared to describe the procedures required to meet regulatory obligations and mitigating measures and commitments made in this EIS. The purpose of the EMP is to:

- Ensure that the commitments to minimize environmental effects in general, and specific regulatory commitments and commitments and mitigating measures made in this EIS will be met;
- Provide concise and clear instructions regarding procedures for protecting the environment and minimizing potential environmental effects;
- Document environmental concerns and appropriate protection measures associated with Project activities;
- Provide a reference document for planning and / or conducting specific activities which may have an effect on the environment;
- Function as a training document / guide for environmental education and orientation; and
- Communicate changes in the program through the revision process.

Environmental management is considered an integral element in the way daily activities are undertaken. The Proponent is committed to upholding this position while complying with commitment as well as detailed Project requirements for environmental management to staff, contractors, regulatory agencies and the public. Those involved in the Project will then incorporate the environmental management practices into their daily work routine. The EMP will be used during site preparation and construction (and decommissioning and reclamation) and normal operating conditions at the site. The EMP will also detail the various monitoring programs to be undertaken before (baseline), during (compliance and environmental effects), and after the Project (ongoing environmental effects).

Development of the EMP will be done in consultation with regulatory agencies and will be completed in advance of the commencement of site preparation and construction.

Environmental Management Plan Draft Table of Contents

1. Introduction
1.1. Commitment to Environment, Health and Safety
1.2. Purpose of the Environmental Management Plan
1.3. Scope, Organization and Maintenance
2. Responsibilities and Training
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2.2. Roles and Responsibilities
2.3. Training and Orientation Requirements
3. Summary of Key Environmental Issues and Environmentally Sensitive Areas
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3.2. Marine Fish and Water Quality
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4.1.1.1 Generic Best Management Practices
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4.1.3. Watercourse Access Installation and Removal
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4.2. Operations, Monitoring and Maintenance
4.2.1 Inspections and Bird Monitoring
4.2.2 Surface Water Discharge Monitoring
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4.2.4 Other Environmental and Compliance Monitoring
5. Waste Management
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5.2. Waste Management

5.3. Equipment Fuelling and Hazardous Materials Management

6. Environmental Monitoring

6.1. Baseline Monitoring

6.2. Compliance Monitoring

6.3. Environmental Effects Monitoring (EEM)

7. Emergency Response and Spill Contingency and Plans

7.1. Spills

7.2. Vessel Collision

7.3. Fires

7.4. Heritage and Archaeological Discovery

7.5. Erosion Control Failure

8. Incident Reporting

9. Contact List

10. References

Sections 1 and 2 of the EMP will introduce the EMP and provide the overarching objectives, scope and organization of the document (Section 1) as well as the organizational structure for environmental management and the roles and responsibilities of key personnel (Section 2). Section 3 will provide a brief overview of the key environmental and socio-economic issues and concerns specifically associated with the Project.

Sections 4 and 5 of the document will include specific mitigation measures for various activities associated with each phase of the Project to ensure protection of the environment. This will include regulatory requirements, commitments made in this EIS. Mitigation measures will be provided based on standard construction practices and will be adapted as required to meet the specific needs of the Project and the area. For example, the EMP will include / indicate:

- The appropriate timing of in-water works;
- Pre-construction meeting requirements;
- Erosion and sediment control and storm water management;
- Requirements for vessel speeds and course;
- Site restoration and stabilization procedures;
- Spill prevention and response procedures; and
- Waste management and fuelling procedures.

Section 6 of the EMP will include the details of the various monitoring programs to be undertaken. These programs will be developed in consultation and co-operation with regulatory

agencies such as DFO and will include (among other information) descriptions of the equipment to be used, the frequency of the monitoring and reporting requirements.

Baseline monitoring in the Project area has begun and the data collected was used in support of this EIS. Additional information will be collected in advance of Project construction to build on initial work and help characterize pre-development conditions.

Compliance monitoring will be conducted throughout site preparation and construction, operations, monitoring and maintenance, and decommissioning and reclamation phases of the Project. Compliance monitoring is intended to ensure conformity with municipal, provincial, and federal legislation and any conditions of approval to the EIS imposed by regulatory agencies. Monitoring frequency will be at regular intervals, and in response to significant storm events to ensure erosion control structures are functioning. Monitoring and inspection personnel will also be available to provide guidance and support during construction in sensitive areas and / or during sensitive periods.

Section 7 of the EMP will include various contingency and emergency response plans for both land and marine activities. Section 8 will outline the incident reporting requirements and will provide the format and information that must be provided with each report. Incident reporting will include spills reporting and wildlife sightings.

Section 9 of the EMP will include a list of Proponent contacts and the various regulatory agencies that have and / or will be involved through the Project as well as emergency contacts.

4.0 ALTERNATIVES TO THE PROJECT

4.1 Do Nothing Alternative

The alternatives analysis uses a systematic approach to evaluate different methods of achieving the Project's goals. Each technically and economically feasible alternative is in turn subject to further analysis within the EIS report. The Project consists of the quarrying, crushing and marine transport of granite aggregate. Ultimately, the Project is intended to meet market demand for aggregate and bring value to the Proponent's shareholders and to local area residents.

The Proponent's economic analysis supports the current Project description and suggests that it is the most practical and economically feasible approach to this development (Erdene 2011). Given this, the only alternative to this undertaking is to not undertake the Project at all, referred to as the "Do-Nothing Alternative". Not implementing the Project would naturally result in the non-fulfillment of the Project's goals and is thus not an economically feasible alternative. Implementing the Project as proposed will result in residual positive and adverse environmental effects, but significant adverse effects are not likely to occur (please see Section 12 of this report). The Project is also expected to provide long-term local and regional economic benefits as described in Section 7.13 of this report. Without the Project, neither the adverse effects nor the economic benefits would be realized.

4.2 Assessment Methodology

In the sections that follow, alternative means of undertaking the Project are described. Only those alternative means that are technically and economically feasible are further assessed with respect to their potential environmental and socio-economic impacts.

As a minimum the EIS Guidelines (CEA Agency 2014) require an alternative means assessment of the following subjects:

- Rock material extraction method
- Transportation methods/routes
- Construction methods for the marine terminal including management options for dredged material (on land versus at sea)
- Location of the marine terminal
- Location of stockpiles
- Location and type of waste management facilities
- Means of electrical generation

In addition to the components above, alternative quarry locations were evaluated and alternative quarrying methods were examined. Technical feasibility was assessed by the Vulcan project team based on their extensive experience at more than 200 operating quarries in the US Mexico, and the Bahamas. The relative economic feasibility each alternative was assessed based on anticipated capital, operating and lifecycle costs.

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As outlined in the EIS Guidelines, the assessment methodology consisted of:

1. Determining the technical criteria by which feasibility is determined and using these criteria to identify and describe the technically and economically feasible alternative means to carry out the Project;
2. Establishing through qualitative means which of these alternatives is in fact technically and economically feasible;
3. Identifying the VCs potentially affected by each alternative means and examining the effects of the alternatives on each VC. This is undertaken with a specific focus on both environmental effects and effects on potential or established Aboriginal and Treaty rights and related interests.
4. Identifying the preferred means for undertaking the Project.

4.3 Alternative Quarry Locations

A multi-year aggregate exploration and reconnaissance program was undertaken by the Proponent to investigate potential quarry sites in the Maritimes, concentrating on Nova Scotia due to its southerly location with respect to markets on the US east and Gulf coasts. This program included literature research and site-specific evaluations of existing physical, biological and socio-economic conditions. The following technical criteria were evaluated for potential sites:

- Geological resource suitability;
- Size and availability of site;
- Proximity to deep, ice free, sheltered water;
- Engineering feasibility;
- Presence or potential for environmental constraints such as species at risk, fish habitat and wetlands;
- Zoning, proximity to residential development and existing transportation networks;
- Economic diversity and sustainability; and,
- Presence or potential for unique heritage resources.

Because aggregates are a high-bulk low-cost commodity, the cost of transportation can easily exceed the price of the aggregate. So, for a marine quarry that requires considerably more capital than a land-based quarry to be profitable, the aggregate source must be located immediately adjacent to deep water and capable of being transported to the ship by conveyor. If trucks or rail are required to transport aggregate from the quarry to the wharf, the project would be uneconomical. Using these technical criteria, no other suitable alternative sites were found during the course of the exploration and reconnaissance program.

Insofar as no other economically viable sites were identified, the key VC affected by an alternate location would be Local Economy, Land and Resource Use. Alternate Project sites would presumably also impact other VCs related to the natural and human environment.

The key technical criteria which led to the selection of the Black Point Quarry Project site are:

- Availability of high quality, large tonnage, fine-to-medium grained, homogenous granite that meets or exceeds all of the necessary physical and chemical requirements to produce Class-A construction aggregate;

- Deep (>14 m), sheltered, ice-free bay for the location of the marine terminal to enable shipping of processed aggregate rather than trucking products through populated areas;

- Minimal to no overburden on the Project site, reducing development costs and limiting the potential for sedimentation during construction and operation;

- Proximity to well-traveled international shipping lanes with existing logistical support, such as pilot tugs; and,

- Appropriate zoning with no fundamental environmental or regulatory constraints, based on a preliminary review.

With Black Point, Guysborough Co. as the only technical and economically feasible location for the granite quarry, the following sections describe and evaluate alternative methods for undertaking the Black Point Quarry Project with respect to location and construction of the marine terminal and operational design aspects of the quarry.

4.4 Rock Extraction Method

Technical criteria to determine the feasibility of alternate extraction methods include simple practicality. Drilling and blasting is the proposed approach for material extraction from the Black Point Quarry. Alternative mechanical methods of rock extraction (e.g., ripping) are not practical or feasible due to the extremely hard and dense characteristics of the granite. Therefore, there are no feasible alternatives to drilling and blasting as a means of extracting this material. The VCs impacted by the alternatives rock extraction methods would be similar in both cases: both methods would result in noise and particulate emissions to air.

The differences in these methods relative to noise and particulate emissions are that ripping involves the use of heavy equipment with hardened metal teeth that essentially scrapes into the rock from above and along the front wall face. The noise created during ripping would be extreme due to the fact that granite ripping would be a slow process and continuous, requiring multiple machines to generate the amount of material needed to feed the process. The ripping process also would be a continuous source of dust emissions. In the case of drilling and blasting, the drilling process does not generate noise at such levels and the drill rigs include equipment to collect or reduce dust generated by drilling. Blasting is a very short duration event that is capable of generating ample amounts of stone to supply the plant; blasts only occur a few days a week at the most. Ultimately, the Black Point operation would not be economically feasible without the use of drilling and blasting.

4.5 Development and Transportation

Alternative site design and transportation methods/routes considered for the Project include:

- Development of a rock face open pit and progression in a southerly direction with transport of blasted rock to the processing area via large truck or conveyor system; and,

- Development of a glory hole open pit (from the top down) with transport of blasted rock to the processing area via a conveyor system with a tunnel.

Technical criteria to determine the feasibility of alternate site design and transportation options include worker and equipment safety, economics and practicality. The primary VC affected by

alternate site design and transportation options is Local Economy, Land and Resource Use. Due to worker safety concerns, operational issues and geotechnical considerations, the glory hole alternative consisting of a near vertical ore pass and underground horizontal portals was deemed not technically feasible. This option is also considerably more costly and so is not economically feasible when compared to the rock face approach.

The technical and safety challenges of the glory hole approach relate to the fact that all the stone produced would be dropped into a vertical shaft to a stockpile at the base of the hill. Rocks will frequently jam within the shaft, requiring blasting or other methods to free the blockage. The risk of injury or death to employees due to accidents involving workers trying to remove blockages as well as operating at the feed point and bottom stockpile area is not acceptable to Vulcan. The glory hole method would also generate higher levels of dust emissions and noise due to the fracturing created by the rock falling through the glory hole and then impacting the rock in the lower stockpile. The rock movement would also displace large volumes of air that would make it difficult to control the dust emitted from the operation.

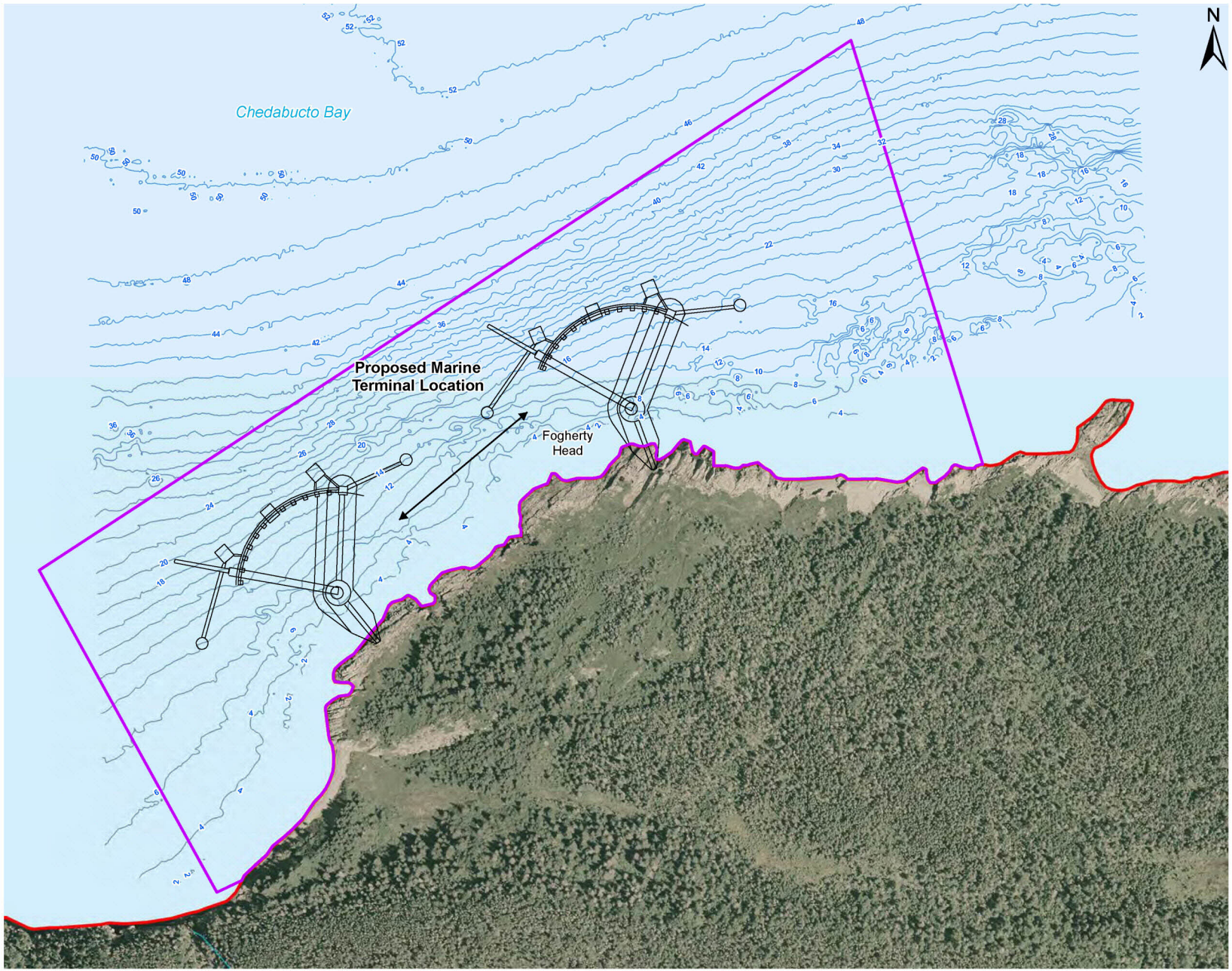
In contrast, the use of haul trucks and conveyors for material transfer is well established, well understood, and much easier to manage. The methods for controlling dust emissions are effective and easy to implement, and the equipment can be safely operated by trained personnel.

While there are existing bulk terminals in the Strait of Canso, all are too far from the proposed quarry to be of economic use. The cost to transport a tonne of aggregate by truck is about $0.15/km therefore, transporting material 50 km or so to the Strait would cost over $7.50/tonne, essentially doubling the cost of the aggregate. In addition, transport of aggregate to the Strait would require high frequency truck traffic through several communities, which would likely raise significant concerns from local residents and add a cost burden for road repairs to the municipality. Other negative factors associated with off-site truck transport include the impact of heavy truck traffic on road durability as well as the potential for vehicle accidents due to the increase in heavy vehicle traffic on local roads. Another major factor affecting the economics of overland transport is the limitations of truck transport imposed by winter conditions including icy roads and snow storms.

4.6 Marine Terminal Locations

The Proponent has considered alternate locations for the marine terminal. Technical criteria to determine the feasibility of alternate marine terminal locations consist primarily of navigational and operational safety considerations. The primary VCs affected by alternate terminal locations are Marine Species and Habitat and Commercial Fisheries and Aquaculture, although for the most part, different marine terminal locations affect these VCs in much the same way.

Based on feedback from local fishermen, the terminal should be located as far west as possible to increase the sheltering effect from wind and strong currents off Black Point. However, this location is not practical since the bathymetric profile to nearshore area is too shallow (15-20 m vs 25-30 m at the preferred location). The originally proposed terminal site and the proposed range of alternative sites are presented in **Figure 4.0-1**. The selected alternative is the easternmost location. Following multiple meetings and discussions with the local fishermen, the selected location of the marine terminal is the preferred location to minimize impacts to fishing areas.



LEGEND

- Property Boundary
- Crown Lease Land
- Waterbody
- Watercourse
- Bathymetry (2m)

0 25 50 100 150 Meters

SCALE: 1:3,000
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

MORIEN RESOURCES AND VULCAN MATERIALS

BLACK POINT QUARRY

ALTERNATIVE MARINE TERMINAL LOCATIONS

January 13, 2015	Rev 1.0	Figure No. 4.0-1
Project No. 210.05913.00000		

SLR Consulting (Canada) Ltd.

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4.7 Marine Terminal Construction Methods

Alternative construction methods for the marine terminal were investigated in order to reduce disruption to marine habitats and minimize costs. Technical criteria to determine the feasibility of alternate marine terminal construction methods consist of constructability, operational safety, operational performance and economic feasibility. The primary VC affected by alternate terminal construction methods is Marine Species and Habitat.

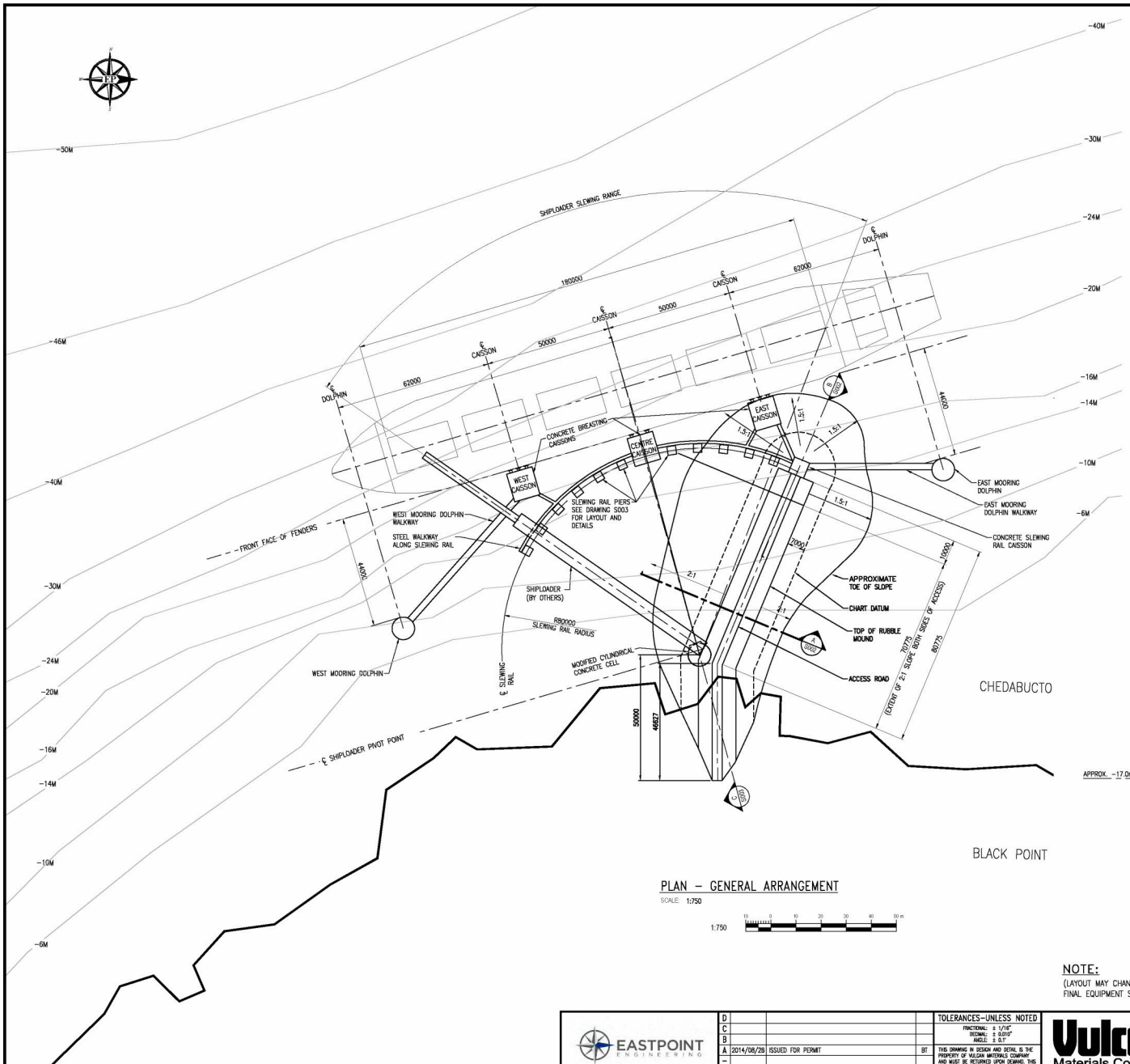
Two approaches to wharf construction were considered: the rubble mound approach and the concrete caisson approach. The rubble mound approach uses rock generated on site to form a continuous base upon which a wharf is constructed. In contrast, the caisson approach uses separate steel or concrete box-like forms (the caissons) to form pillars that support the wharf. Neither method requires in-water blasting or dredging although the caisson approach requires percussion (pounding) to install foundations into the seabed.

The rubble mound has a simpler design and is less expensive to design and build, and thus more cost effective. In addition, it permits the secure storage of any potentially acid-generating rock that may be present once the lower platform has been levelled for plant construction. The underwater storage of potentially acid-generating rock prevents acid formation and is a preferred management option for this material, should this be encountered during site construction.

The rubble mound is potentially more stable in rough weather and has lower maintenance costs over the long term. Most importantly, it is considerably more operationally efficient, since it allows for vehicular traffic and access to support maintenance of the ship mooring points. The caisson approach does not allow for vehicles and so maintenance would be conducted by boat, which is more expensive and potentially more dangerous.

The rubble mound typically occupies more of the seabed than the caissons and so it potentially affects more marine seabed habitat. Caissons also occupy seabed (to a lesser degree) but the wharf connecting the caisson would shade the seafloor, negatively affecting habitat quality and use. The rubble mound in time is expected to act as lobster habitat where the caisson method would not have a similar benefit.

Given the advantages of the rubble mound approach, in terms of constructability, operational safety, operational performance and economic feasibility, this design is chosen over the caisson approach. We underline that this approach will be used to construct the wharf beginning at the shore and extending to the ship mooring infrastructure. For mooring, ships will be attached to three mooring caissons as shown on **Figure 4.0-2**.

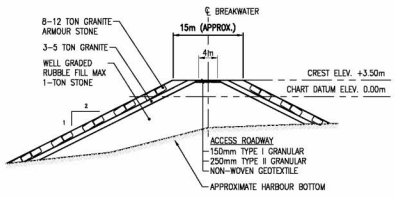


PLAN – GENERAL ARRANGEMENT

SCALE: 1:750

1:750

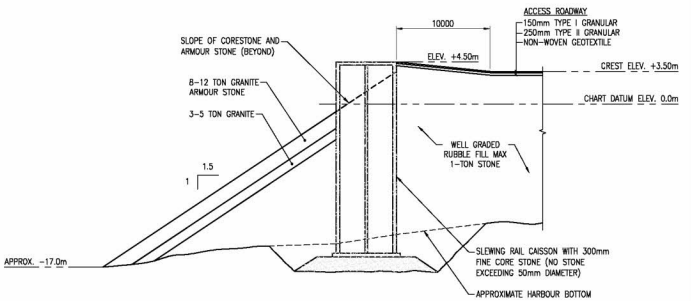
AREA OF IMPACT AT SEA FLOOR	
RUBBLE MOUND	7916m²
BREASTING CAISSONS (3)	1120m²
MOORING DOLPHIN (2)	1050m²
SLEWING RAIL AND PIER	992m²



A S002 SECTION – TYPICAL RUBBLE MOUND

SCALE: 1:500

1:500



B S002 SECTION – RUBBLE MOUND AT CAISSON

SCALE: 1:250

1:250

NOTE:
(LAYOUT MAY CHANGE TO SUIT FIELD CONDITIONS, FINAL EQUIPMENT SELECTION, ETC.)

EASTPOINT ENGINEERING

	DATE	REVISION	BY
D			
C			
B			
A	2014/08/28	ISSUED FOR PERMIT	BT
-			

TOLERANCES–UNLESS NOTED
FRACTIONAL: ± 1/16"
DECIMAL: ± 0.015"
ANGLE: ± 0.5°

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Vulcan Materials Company

GENERAL ARRANGEMENT
Figure 4.0-2:
Marine Terminal Deisgn

STATE	NOVA SCOTIA	PLANT	BLACK POINT
DRN BY	QHS	CHKD BY	BT
PROJ. NO.	55126	FILE REFER	EASTPOINT
DRN DATE	2014/09/08	CHKD DATE	2014/08/28
SCALE	AS NOTED	SHEET	2 OF 4
DRG. NO.	S002	REV.	A

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4.8 Stockpile Locations

Alternative stockpile locations were evaluated primarily to minimize costs and to limit potential impacts to wetlands. Technical criteria to determine the feasibility of alternate stockpile locations consist of operational performance and economic feasibility. The primary VC affected by alternate stockpile locations is Wetlands, since other VCs, such as Marine Species and Habitat and Commercial Fisheries and Aquaculture, would be equally affected (to a very limited degree) no matter which alternative was selected.

Stockpiles are proposed for the western portion of lower platform, adjacent to Chedabucto Bay and opposite the marine terminal. The alternative option places these stockpiles at the eastern side of the lower platform, adjacent to Chedabucto Bay and within 50 m of Wetland 2. In both alternatives, several wetlands would be lost (e.g., WLs 3, 4, 5 and 6 on **Figure 6.4-2**) but with the second alternative, Wetland 2 is potentially exposed to runoff from the stockpiles. More importantly, this location requires a complete reconfiguration of processing plant and a much longer conveyor system to deliver aggregate to the marine terminal. The preferred location is both operationally and economically more practical, and has the added benefit of lowering the risk of project-related impacts to a large wetland. The stockpile locations have also been selective to mitigate noise emissions from the processing operations thus reducing off-site noise impacts. The stockpiles will also provide a degree of visual screening for the processing plant.

4.9 Waste Management Facilities

There are two types of waste management facilities: a wastewater treatment facility to manage septic waste from site workers, and the berms that will control drainage from the piles of crusher fines (consisting of finely broken rock) generated after washing the crushed aggregate.

With respect to septic waste water treatment systems, technical criteria used to determine the feasibility of different systems include operational performance and, to a lesser degree, economic feasibility. The primary VCs affected by alternate wastewater treatment systems are Groundwater Resources and Marine and Surface Water Resources.

Alternative wastewater treatment facilities were considered but none are as practical, efficient or cost effective as a simple collection tank with follow up transport and treatment at the Canso municipal waste water treatment facility. Alternatives include a conventional septic tank and leach field, above ground systems that use imported, mounded soil to treat waste effluent, the use non-conventional systems such as multiple rotating biological contactors, peat-based treatment systems, constructed wetlands, and recirculating media filters such as sand filtration. Conventional on-site treatment for the 50-60 full time staff would require a large leach field with adequate soil depth above bedrock. These conditions do not exist near the administrative buildings where the washrooms will be located. Non-conventional systems are more expensive to purchase, install and operate, and typically do not perform well, especially in winter Ultimately, a gravity fed collection tank with off-site treatment was selected as the preferred option, at least initially. The use of a conventional, raised bed system will be investigated once the plant area is accessible. Existing soil thickness and texture will be investigated to determine if the construction of a raised bed treatment system is practical.

Alternate locations for the crusher fines have been considered. The technical criteria used to determine the preferred location includes handling costs (distance from site-of-generation combined with the number of times the crusher fines are moved, once generated), available

surface area, and pre-development habitat type. The VCs affected by crusher fines storage location include: Groundwater Resources, Marine and Surface Water Resources, Terrestrial Ecosystems, Habitat & Vegetation, Wetlands, and Terrestrial Wildlife.

Initially, crusher fines storage was proposed for areas outside of the quarry **(Figure 4.0-3**) but this was later determined to be unnecessarily distant from where this crushed rock will be generated. All waste rock will now be stored within the quarry. This has the additional advantage of ensuring the crusher fines can never be lost to the marine environment.

The storage of the fines inside the quarry also eliminates the potential for storm water runoff releases to the environment and the discharge of fines to surface waters because the quarry stormwater will be contained in the pit. The fines stock piles also can be sources of fugitive dust emissions and so locating them inside the quarry will help to contain these emissions.

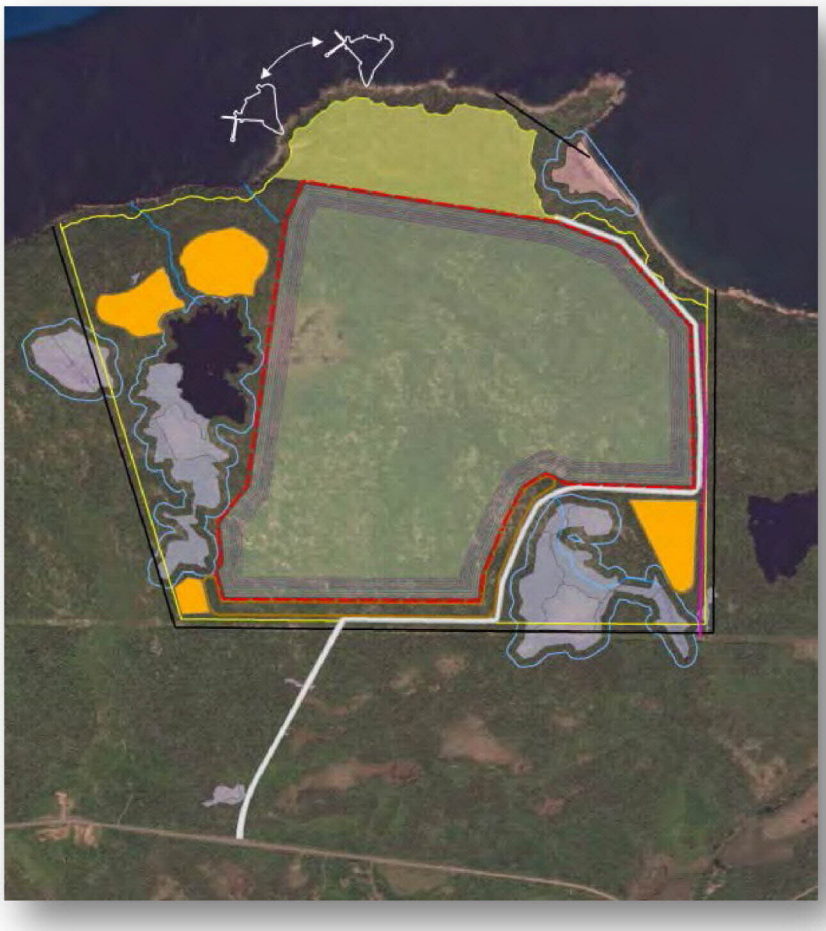

Figure 4.0-3:
Alternative Crusher Fines Storage Areas (Orange)

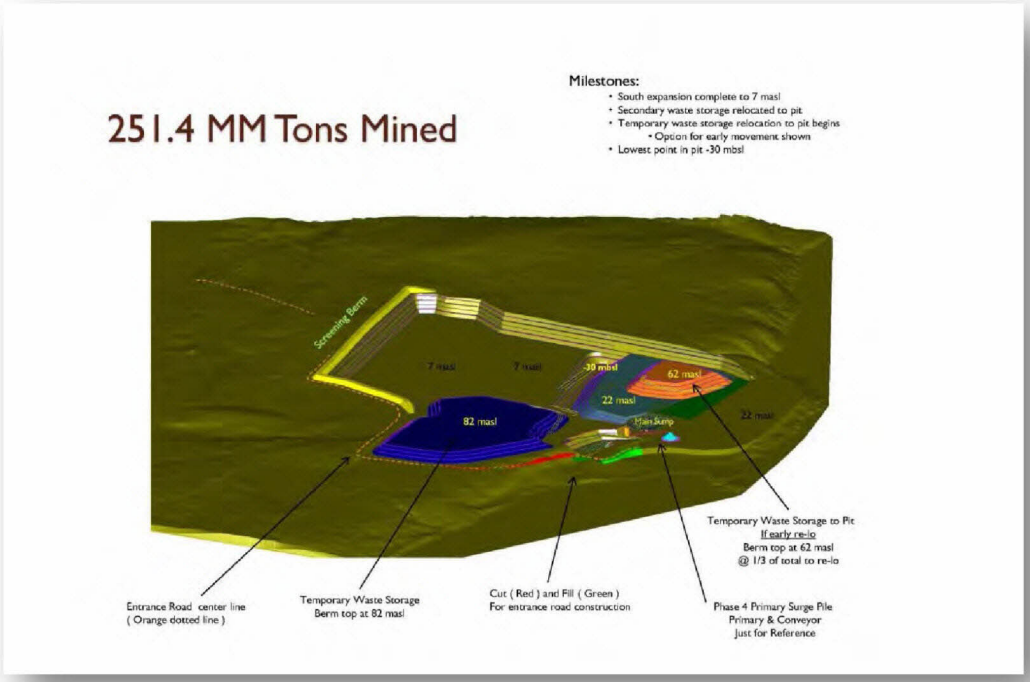

Figure 4.0-4:
Preferred Crusher Fines Storage Areas (Oranage and Blue)

4.10 Electrical Supply

Significant and reliable electrical power will be required for buildings and the operation of equipment (pumps, conveyors, crushers, screens, and ship loading). The total electrical power demand for the quarry is estimated to be between 10,000 and 12,000 horsepower (i.e., 5.0-6.0 MW), mostly for operation of large electrical motors associated with the processing plant equipment.

Alternative electrical supplies considered for this project include a tie-in to the existing high voltage Nova Scotia Power Inc. electrical transmission line that parallels the southern boundary of the Project site or the use of multiple on-site generators. Technical criteria used to determine the preferred option are operational cost, operational performance, safety considerations, and project emissions (both GHGs and noise).

Over the long term, electricity produced by generators is more expensive than conventional sources due to fuel costs, generator inefficiencies, the need for replacement lubricating oils, and the man-hours dedicated to on-going maintenance. The transport to site, storage and use of fuel for generators increase spill risks to surface and groundwater, and increase the risk of fire or explosion at the site. Project emissions from generators are significantly higher, both in terms of GHGs and noise, when compared to power generators at larger, more efficient power

stations. Given these factors, the preferred option is to tie in to the existing transmission line, rather than use permanent generators to power the site[5].

4.11 The Preferred Approach

Based on the relative consideration of technical and economic feasibility, likely environmental effects, overall social acceptability, the preferred approach consists of:

1. A granite aggregate quarry located on zoned industrial property in the MODG, near Black Point.
2. Quarrying methods that employ drilling and blasting.
3. Development of the quarry from the north to south, rather than from the top down.
4. Shipping from a newly constructed marine terminal, rather than trucking to an existing marine facility.
5. A largely rubble mound marine terminal located on the western end of the coastal property.
6. Stockpiles located on the western side of the property, facing the marine terminal
7. Off-site treatment of septic waste during initial project phases, possibly followed by the construction of conventional, raised bed septic waste treatment facility.
8. Crusher fines storage area located with respect to minimizing impacts to wetlands.
9. Crusher fines storage within the quarry, rather than exterior to the pit boundaries.
10. Tie in to a nearby electrical transmission line rather than using permanent on-site generators.

Table 4.1 summarizes the alternative means analysis for each component considered above and presents the preferred option selected for the Project.

[5] Temporary generators will be used during initial project construction phases to provide electricity to administrative buildings while the electrical tie in is being constructed.

Table 4.1
Summary of the Alternative Means of Undertaking the Project

Project Component	Alternative Means	Technical Feasibility	Economic Feasibility	Environmental Effects	Preferred Option
Quarry Location	Black Point Site	Technically Feasible	Economically Feasible	A number of environmental effects are associated with any quarry development; no significant residual environmental effects are anticipated at the Black Point site.	Yes
	Other Nova Scotia Sites	Not Technically Feasible considering the range and specificity of the geographical and resource requirements	Not Economically Feasible based on the Proponent's analysis and given the high-bulk low-cost nature of the aggregate resource	Not assessed since no feasible alternative site was identified	No
Rock Extraction Method	Drilling and Blasting	Technically Feasible	Economically Feasible	Environmental effects are similar in both alternatives: will result in noise and dust impacts. Drilling and blasting has less of an impact due to shorter duration and more established control methods.	Yes
	Ripping	Not Technically Feasible considering the hardness and density of the granite resource	Not Economically Feasible	Environmental effects are similar in both alternatives: will result in noise and dust impacts. Ripping would be more impactful due to more continuous and less controllable dust emissions.	No
Development and Transportation	Rock Face Open Pit	Technically Feasible	Economically Feasible	Environmental effects are largely similar under both mining options	Yes
	Glory Hole Open Pit	Not Technically Feasible primarily due to worker safety considerations	Economically Feasible but additional infrastructure would significantly increase production costs	Potential social (human health) effects are greater in the glory hole scenario due to increased worker exposure to accidents and malfunctions	No

	Transport via Ship from Dedicated Terminal	Technically Feasible	Economically Feasible	Environmental effects relate primarily to Local Economy, Land and Resource Use; shipping related effects are similar in both scenarios.	Yes
	Truck Transport to an Existing Terminal Followed by Transport via Ship (e.g., Auld's Cove)	Technically Feasible	Not Economically Feasible due to truck transportation costs, which would eliminate profitability	Significantly more environmental and economic impacts due to truck traffic through rural and residential areas. Increased air and noise emissions in this scenario.	No
Marine Terminal Location	Eastern Location	Technically Feasible	Economically Feasible	Environmental effects are similar under both alternatives. The VCs Marine Species and Habitat and Commercial Fisheries and Aquaculture would be affected in a similar manner at both terminal locations.	Yes
	Western Location	Not Technically Feasible due to shallow water depths	Economically Feasible	As above; this location is also slightly more sheltered from winds originating to the northeast.	No
Marine Terminal Construction	Rubble Mound Wharf	Technically Feasible and permits the secure storage of acid generating rock; more operationally efficient since it permits vehicular access to ship mooring points for maintenance	Economically Feasible; less expensive to design, build and maintain	Both approaches would affect Marine Species/Habitat and Commercial Fisheries to approximately the same degree. Rubble Mound Wharf occupies more seafloor than the Concrete Caisson Wharf but the rubble would eventually act as lobster habitat.	Yes
	Concrete Caisson Wharf	Technically Feasible but less stable in severe weather; more dangerous to maintain since boat access would be needed.	Economically Feasible	Concrete Caisson Wharf occupies less seafloor than the Rubble Mound Wharf but would shade the seafloor, negatively affecting habitat quality and use.	No
Stockpile Locations	Western End Opposite the Marine Terminal	Technically Feasible	Economically Feasible: this location is both operationally and	In both alternatives, several wetlands would be lost. This alternative provides effective noise and visual mitigation.	Yes

			economically more practical.		
	Eastern End near Wetland 2	Technically Feasible although it greatly increases the complexity of operation and may introduce occupational health and safety risks	Not Economically Feasible: this location requires a complete reconfiguration of processing plant and a much longer conveyor system to deliver aggregate to the marine terminal.	In addition to wetland loss, Wetland 2 is potentially exposed to runoff from the stockpiles in this alternative	No
Waste Management	Collection tank for septic wastes with transport and treatment at the Canso municipal waste water treatment facility	Technically Feasible and practical	Economically Feasible and cost effective	Minimal impact to Groundwater Resources and Marine and Surface Water Resources.	Yes
	Other septic treatment systems: conventional septic tank and leach field, raised bed systems, rotating biological contactors, peat-based treatment systems, constructed wetlands, and recirculating sand filtration	Not Technically Feasible due to lack of soil cover (conventional leach field): Technically Feasible but poor operational records when applied to operations at this scale (non-conventional treatment systems).	Economically more expensive to design, purchase, operate and maintain	Varying long term impacts can be expected to Groundwater Resources and Marine and Surface Water Resources through treated effluent discharge.	No
	"Crusher fines" storage outside of the quarry	Technically Feasible	Economically Feasible but more expensive considering the increased transport distance to the storage site and the greater number of times the materials would be handled	Increased risk of accidental discharge with potential negative effects on Marine and Surface Water Resources, Terrestrial Ecosystems, Habitat & Vegetation, Wetlands, and Terrestrial Wildlife. Similar anticipated effects (i.e., minimal) on Groundwater Resources in both alternatives. Increased handling and transport increases impacts to air quality.	No

	"Crusher fines" storage within the quarry	Technically Feasible	Economically Feasible	No risk of accidental discharge to the environment (potentially affecting Marine and Surface Water Resources, Terrestrial Ecosystems, Habitat & Vegetation, Wetlands, and Terrestrial Wildlife	Yes
Electrical Supply	Tie-in to the existing electrical transmission line	Technically Feasible	Economically Feasible; more expensive over the short term but costs are recovered over the longer term.	Environmental effects associated with habitat and vegetation loss within the right of way are minimized by using the same right of way for the access road.	Yes
	Use of multiple on-site generators	Technically Feasible	Economically Feasible but more expensive over the long term due to fuel, lubricant and transport costs, as well as maintenance and operating costs	Increased risks of fire and fuel spills given the generators' fuel requirements; increased impacts to ambient noise levels; increased GHG emissions	No

5.0 ENVIRONMENTAL EFFECTS ASSESSMENT METHODOLOGY

To establish the appropriate scope of an environmental assessment, it is standard practice to limit the assessment to those environmental components that are valued or of interest for ecological, scientific, cultural, regulatory and/or economic reasons. In keeping with the terminology used in the federal EIS Guidelines issued for the Black Point Quarry Project, these aspects are referred to as Valued Components (VCs). As described below, identification of the specific VCs considers feedback from the public, regulatory agencies, First Nations communities and other stakeholders. The EIS Guidelines (CEA Agency 2014) issued for the Black Point Quarry Project describe the type of Project information required, the scope of the environmental assessment and the factors to be considered during the assessment.

5.1 Overview

The method used to predict the effects of the Black Point Quarry Project was developed to meet the requirements of the EIS Guidelines (CEA Agency 2014). These Guidelines include requirements of both the federal and provincial governments. In addition, the methodology is intended to incorporate:

1. Subjects, concerns and issues raised by the Mi'kmaq, fishermen and the public at large over the course of the project;
2. The environmental and social aspects of interest to the scientific and regulator communities; and
3. Legislative and regulatory requirements that apply to this type of development.

The following sections describe the methodology used to derive:

- The spatial and temporal boundaries of the study areas;
- The origin and scope of the VCs that will be evaluated to assess project impacts;
- The probable interactions between the Project and the VCs;
- The potential environmental effects of the Project on the VCs;
- The mitigation measures that will be used to eliminate, reduce or control the potential environmental effects; and
- The residual effects that remain after mitigation measures are applied, combined with a determination of their significance.

The goal of applying a defined environmental assessment methodology is to carefully examine the Project and related activities to ensure they will not cause "serious or irreversible harm to the environment, especially with respect to environmental functions and integrity, system tolerance and resilience, and/or the human health of current or future generations" (CEA Agency 2014).

5.2 Application of the Precautionary Approach

The joint federal-provincial EIS Guidelines require that the proponent examine the proposed project infrastructure and activities and demonstrate the project has been planned in a "precautionary manner in order to ensure that they would not cause serious or irreversible damage to the environment…" (CEA Agency 2014). To demonstrate the precautionary approach, this environmental assessment:

1. Describes and justifies the assumptions made about the effects of the Project, and the approaches to minimize these effects;

2. Shows that priority will be given to strategies that avoid the creation of adverse effects;

3. Describes contingency plans that explicitly address accidents and malfunctions; and

4. Outlines follow-up and monitoring programs to verify impact predictions.

5.3 Valued Components Selection

The EIS Guidelines define Valued Components (VCs) as "attributes associated with the project that have been identified to be of concern by the proponent, government agencies, Aboriginal peoples and/or the public. The value of a component not only relates to its role in the ecosystem, but also to the value placed on it by humans" (CEA Agency 2014).

An internal issues-scoping exercise was undertaken to identify the VCs of both general and project-specific interest. For the Black Point Quarry Project, provisional VCs (Table 5-1) were identified through:

- Discussions regarding potential environmental concerns with the CEA Agency, DFO, Environment Canada, Transport Canada, NSE and NSDNR;
- A review of the EIS Guidelines prepared for this project, especially those subjects listed in section 9.1 of the Guidelines (CEA Agency 2014);
- A review of applicable provincial and federal regulation, including an appraisal of species of conservation concern and Species at Risk. The Guidelines specifically require consideration of the factors listed in subsection 19(1) of *CEAA 2012*, as well as those presented section 79 of the *Species at Risk Act* (CEA Agency 2014);
- Discussions with government scientific authorities (*e.g.*, hydrogeologists, Species at Risk specialists, wetland experts, etc.);
- Previous environmental studies conducted on site by AMEC, Davis MacIntyre Associates, Mi'kma'ki All Points Services and others;
- Comments raised a public open house meeting held by Morien in Queensport on April 22, 2014 and subsequent comments received as part of the ongoing public consultation process as noted in Section 11;
- Comments raised during face-to-face meetings with nearby residents, fishermen and other stakeholders, including the Mi'kmaq (Section 11);
- A review of information submitted in support of nearby and similar environmental assessments; and
- The professional experience of the Project team.

Table 5.1:
List of Provisional Valued Components

Environmental Aspect	Provisional VC
Atmospheric Resources	Air Quality & Climate Change
	Noise
	Ambient Light
Biophysical Resources	Geology, Soil & Sediment
	Groundwater Resources
	Marine and Surface Water Resources
	Terrestrial Ecosystems, Habitat & Vegetation
	Wetlands
	Terrestrial Wildlife
	Freshwater Species and Habitat
	Marine Species and Habitat
	Species at Risk
Socio Economic and Heritage Resources	Local Economy, Land and Resource Use
	Tourism and Recreation
	Commercial Fisheries and Aquaculture
	Archaeological and Heritage Resources
	Aboriginal Land and Resource Use

5.4 Likely Project-Environment Interactions

Most interactions between the Project and the surrounding environment are fairly obvious and can be logically expected once the project activities and infrastructure have been described. In many instances, project-environment interactions are *direct*. For example, the quarry will remove granite rock from beneath certain existing wetlands: these wetlands will inevitably be lost. Other interactions may be *indirect* and are less obvious. For example, if down slope wetlands outside the property boundary are fed by surface runoff falling on the granite, then removal of the granite rock may reduce runoff and so negatively affect these wetlands.

In order to determine the potential direct and indirect interactions, the Project team (a) reviewed the anticipated activities required to construct, operate and decommission the Project; (b) considered the potential direct and indirect effects from these activities, (c) identified likely pathways between the Project and the receiving environment, and (d) assessed the probable Project effects on the environment through these pathways.

A “pathway” is a link between a Project activity and the environment. It is the means or route through which the Project many positively or negatively affect one or more environmental and/or social receptors. On occasion, a VC can act as both a receptor and a pathway. For example, surface water (the receptor) may be affected by the Project if erosion is not properly controlled during construction. At the same time, surface water may act as a pathway if poor surface water quality negatively affects aquatic organisms that depend on that water.

This linkage between the source, the pathway and the receptor is the core of the environmental assessment process. Once the linkage has been established, the assessment process can

predict the magnitude and duration of impacts, then evaluate mitigation measures to limit or eliminate those impacts. These steps are described in detail for each VC in Section 7.0.

Potential Project interactions with the provisional VCs are presented in Table 5-2. Table 5-3 summarizes the rationale for the selection of each VC, and also includes a description of the potential for certain VCs to act as pathways as well as receptors.

Table 5.2:
Potential Project Interactions with Valued Components (VCs)

Project Activity	Geology, Soils and Sediment	Groundwater Resources	Surface Water Resources	Climate Change	Air Quality	Noise	Ambient Light	Terrestrial Habitat and Vegetation	Wetlands	Terrestrial Fauna	Migratory Birds	Freshwater Species and Habitat	Marine Water Quality	Marine Species and Habitat	Species at Risk	Economy, Land & Resources	Commercial Fisheries and Aquaculture	Marine Safety and Navigation	Visual Landscape	Tourism and Recreation	Aboriginal Lands and Resource Use	Archaeological Resources
Construction Phase																						
Clearing, grubbing and grading in preparation of construction	☑		☑	☑	☑	☑		☑	☑	☑	☑	☑	☑		☑	☑			☑	☑	☑	☑
Operation of construction machinery				☑	☑	☑					☑											
Blasting and excavation in preparation of construction	☑	☑	☑		☑	☑				☑	☑			☑	☑	☑			☑	☑		
Processing plant and associated infrastructure construction	☑		☑	☑		☑	☑	☑	☑	☑	☑				☑	☑						
Marine terminal construction (rubble mound)	☑			☑		☑	☑				☑		☑	☑	☑	☑	☑	☑	☑		☑	
Marine vessel operation in support of terminal construction				☑		☑					☑			☑	☑		☑	☑				
Watercourse and wetland alteration	☑		☑						☑	☑	☑	☑										
Stormwater management	☑		☑																			
Local employment and expenditure																☑				☑	☑	
Operation / Decommissioning Phase																						
Use of the access road			☑		☑							☑			☑							
Operation/removal of quarrying equipment and machinery				☑	☑	☑					☑											

Project Activity	Geology, Soils and Sediment	Groundwater Resources	Surface Water Resources	Climate Change	Air Quality	Noise	Ambient Light	Terrestrial Habitat and Vegetation	Wetlands	Terrestrial Fauna	Migratory Birds	Freshwater Species and Habitat	Marine Water Quality	Marine Species and Habitat	Species at Risk	Economy, Land & Resources	Commercial Fisheries and Aquaculture	Marine Safety and Navigation	Visual Landscape	Tourism and Recreation	Aboriginal Lands and Resource Use	Archaeological Resources
Blasting, crushing, screening and washing		☑	☑	☑	☑	☑					☑											
Watercourse and wetland alteration	☑		☑						☑	☑	☑	☑										
Operation of stockpiles and load-out facility					☑	☑	☑				☑		☑						☑	☑		
Stormwater and wash water management and use	☑		☑										☑									
Marine vessel operations											☑		☑	☑	☑	☑	☑		☑	☑	☑	
Waste water treatment system operation and discharge	☑		☑										☑				☑					
Local employment and expenditure																☑					☑	☑
Accidents and Malfunctions																						
Fuel or other spills on land	☑	☑	☑									☑	☑				☑					
Fire on site or on ship					☑																	
Marine collision and spills in the marine environment													☑	☑	☑	☑	☑		☑		☑	☑
Stormwater pond overflow																						
Unplanned explosive effect	☑	☑			☑	☑					☑											

Table 5.3:
Basis for Selection of VCs

Environmental Category	Valued Component (VC)	Project – Environment Interaction	(D=Direct; P = as Pathway)	Relevance to Environmental Features: Legal Requirement	Scientific Interest	Biophysical Context	Socio Economic	Human Health	Enjoyment of Life and Property	Cultural	Agency or Public Concern	Requirement of EIS Guidelines	Rationale for VC Selection (Interactions, Pathways and Relevance)
Biophysical Environment	Air Quality and Climate Change	D,P		☑		☑		☑	☑		☑	☑	• Potential for negative effects to local air quality. • Potential for contributions to local and global climate change. • Pathway to potential impacts on flora, fauna, and human health.
	Noise	D,P		☑		☑		☑	☑		☑	☑	• Potential for changes to existing acoustic environment. • Potential pathway for impacts on fauna and human health.
	Ambient Light	D, P							☑		☑	☑	• Potential for changes in the existing lighting conditions. • Potential pathway for impacts on fauna and human health.
	Geology, Soil & Sediment Quality	D, P				☑		☑			☑	☑	• Potential for generation of acid drainage from Halifax Formation bedrock. • Pathway to potential impacts on flora, fauna, and human health.
	Groundwater Resources	D,P		☑	☑	☑			☑		☑	☑	• Potential for negative effects on groundwater quality and quantity. • Potential for impacts on local water supply wells. • Pathway to potential impacts on human health.
	Marine and Surface Water Resources	D,P		☑	☑	☑		☑			☑	☑	• Potential marine water quality effects from acid generating rock, erosion during construction phase, stormwater discharges, accidental spills, and wastewater discharges. • Potential for siltation from erosion and stormwater discharges. • Pathway to potential impacts on fauna and human enjoyment of resources.
	Terrestrial Species	D,P		☑	☑	☑					☑	☑	• Potential for terrestrial habitat removal and/or alteration.

	and Habitat, including SAR											• Potential for adverse effects on species resulting from changes in terrestrial habitat. • Potential for adverse effects on SAR as a result of direct impact or habitat changes. • Pathway to potential impacts on traditional land uses/ resource uses.
	Freshwater Species and Habitat, including SAR	P	☑	☑	☑						☑	• Pathway to potential impacts on Aboriginal, commercial, recreational fisheries.
	Marine Species and Habitat, including SAR	D,P		☑	☑					☑	☑	• Potential for 'severe harm' effect to fisheries productivity. • Potential for adverse effects on marine SAR as a result of direct impact or 'severe harm'. • Pathway to potential impacts on Aboriginal, commercial, recreational fisheries and Human Health.
	Wetlands	D, P	☑	☑	☑					☑	☑	• Potential for direct loss and/or adverse effects on wetland extent and functions.
Socio-Economic and Cultural Environment	Local Economy, Land and Resource Use	D				☑	☑		☑	☑	☑	• Short term employment opportunities during construction. • Long-term employment opportunities during operation. • Economic spin-off effects. • Potential to positively or negatively affect real estate values • Contributions to municipal tax base. • Pathway to potential impacts on traditional land uses/ resource uses.
	Tourism and Recreation	D				☑			☑	☑	☑	• Potential to negatively affect wilderness/nature oriented tourism. • Improved economics leading to improvement of tourism infrastructure
	Commercial Fisheries and Aquaculture	D	☑	☑	☑	☑	☑	☑	☑	☑	☑	• Potential for displacement of fishermen to less productive areas • Potential for increased competition / lower harvests due to displacement • Potentially reduced harvest rates/ sales volumes as a consequence of adverse effects on resource.
	Aboriginal Land and Resource Use	D	☑			☑			☑	☑	☑	• Potential for conflict with traditional land uses and land claims.
	Archaeological & Heritage Resources	D	☑						☑	☑	☑	• Potential for disturbance of archaeological sites.

5.5 Project Boundaries

An important aspect of an environmental assessment is determining assessment boundaries that define the extent of anticipated effects. Project effects can be felt over different time periods (temporal boundaries), in different geographic areas (spatial boundaries) or can be limited by the nature of the effect (administrative and technical boundaries). Boundaries help focus the scope of the assessment to those zones that will logically experience actual project impacts.

5.5.1 Temporal Boundaries

Temporal boundaries represent the duration over which the Project activities interact with each VC. Since this may change depending on the VC, the duration of these interactions is described in each individual VC chapter. In general, the temporal boundaries are (a) the construction period, and (b) the operating life of the Project, through to decommissioning and reclamation.

Overall project timelines are based on an expectation of approximately two years to obtain regulatory approval before Project construction. This period allows sufficient time to achieve release from the environmental assessment process, which is followed by detailed project design and applications for construction and operating permits.

Initial processing plant construction is expected to require two to three years. As noted, the Proponent expects to begin with a smaller processing plant and expand operations as market conditions warrant. Construction on the marine terminal is expected to require approximately 11-13 months.

At this time, the expected operating life of the quarry is at least 50 years. Progressive reclamation will occur over the lifetime of the project, to extent this activity is possible within the active quarry. Closure, decommissioning, and final reclamation would follow the operating phase as is expected to require about two years.

5.5.2 Spatial Boundaries

Spatial boundaries are those geographic limits that help define the scale and range of the interactions between the Project and each VC. The spatial boundaries will also vary in accordance with each VC and so are presented in detail in each VC section. The following spatial boundaries are used for this assessment,

1. The **Project Area** (PA) is confined to all territory within the limits of the Project property boundary **(Figure 1.0-2);**

2. The **Affected Area** (AA) is the area which could potentially be affected by Project components or activities immediately beyond the PA. The Affected Area is similar to the area directly adjacent the Project property but can be larger depending on the component being considered.

   The extent to which the AA is within the spatial boundaries of the Project is VC-specific and dependent on biological and physical considerations. For most VCs the AA is generally

within two kilometers of the Project property limit. Affected Area boundaries may be defined, for example, by habitat use of certain species, sub-watershed boundaries, and/or the predicted geographic extent of measureable air and noise emissions;

3. The **Study Area**: the Study Area (SA) is defined by considering all Project-environment interactions, including diffuse or longer range effects such as noise and light, which can only be modeled at this time. It may include, for example, the waters of Chedabucto Bay south of the shipping lanes where the Project-related marine activities and interactions will occur; for other VCs the SA may include the MODG where the majority of the social and economic effects can be expected.

Table 5-4 shows the spatial boundaries used to collect data during the baseline assessment phase of the environmental assessment, which in turn is applied to the effects assessment for each VC.

Table 5.4:
Spatial Boundary Assessment by Valued Component

Environment	Valued Component (VC)	Project Footprint	Adjacent Lands	Chedabucto Bay	MODG	Nova Scotia	Comment
Biophysical Environment	Air Quality and Climate Change	☑	☑			☑	NS is addressed with respect to climate change; air quality is of local interest.
	Noise	☑	☑				AA is defined by the distance at which excessive noise effects are predicted.
	Ambient Light	☑	☑	☑			AA is defined by the distance at which light trespass is predicted.
	Geology, Soil & Sediment Quality	☑	☑	☑			Chedabucto Bay is included within AA.
	Groundwater Resources	☑	☑				AA extends to the limit of the groundwater drawdown cone at full quarry buildout.
	Marine and Surface Water Resources	☑	☑	☑			Affected marine waters include those that may be affected through accidental or treated water discharges as well as Chedabucto Bay between the shore and shipping lanes transited by Project related vessels. Affected surface waters are defined through hydrological connectivity to the Project site.
	Terrestrial Species and Habitat, including SAR	☑	☑				AA is defined by sub-watershed boundaries, habitat range and ecological links as well as by the geographic extent of predicted noise & air quality effects; marine areas for this VC are addressed in relation to waterfowl, wintering birds, and marine birds.
	Freshwater Species and Habitat,	☑	☑				Sub-watershed boundaries are used to define AA
	Marine Species and Habitat, including SAR			☑			AA is the marine terminal and vicinity and Chedabucto Bay between the shore and shipping lanes transited by Project related vessels.
	Wetlands	☑	☑				AA is defined through hydrological connectivity to the Project site.
Socio-Economic and Cultural Environment	Local Economy, Land and Resource Use	☑	☑	☑	☑	☑	AA is generally taken as Half Island Cove, Upper Fox Island and Fox Island Main; PA is the MODG
	Tourism and Recreation	☑	☑	☑	☑		AA is generally taken as extending from Half Island Cove to Fox Island Main.

Commercial Fisheries and Aquaculture		☑	☑	☑	PA includes the zoned fished by local fishermen who generally reside from Guysborough to Canso but may include fishermen from outside this area
Aboriginal Land and Resource Use	☑	☑	☑	☑	. AA includes all areas that could be affected by the Project (e.g., through noise, light, dust etc) and are potentially used by Aboriginal peoples for traditional purposes. Spatial boundaries are defined in relation to health and socio-economic conditions for Aboriginal peoples
Archaeological & Heritage Resources	☑				PA is confined to those areas disturbed by the Project

SAR = Species at Risk; MODG = Municipality of the District of Guysborough

5.5.3 Technical Boundaries

Technical boundaries represent limits to the Project team's ability to asses a VC, pathway or receptor. A technical boundary is a theoretical or actual limitation on the ability to measure, assess, and/or monitor potential environmental effects. These data gaps may in turn limit the ability to predict the potential effects of the Project on a particular VC. The EA methodology requires that these data gaps, if present, be described along with the steps taken to address the gaps (CEA Agency 2014).

5.5.4 Administrative Boundaries

Administrative boundaries are those limits that originate through regulatory, public policy or economic reasons. Administrative boundaries include, for example, the regulatory requirements as described in Section 2.0, the physical boundaries of wildlife sanctuaries, the different NAFO Division and Unit (fishing) Areas, and the temporal boundaries of hunting, fishing or trapping seasons. Where applicable, administrative boundaries are described in each VC chapter (Section 7.0)

5.6 Impact Prediction

Ultimately, an environmental assessment aims to determine whether a given project is "likely to cause significant adverse environmental effects"; these terms are defined in the reference CEA Agency (1994). As noted above, the environmental effects assessment consists of a series of steps beginning with the identification of the VCs. Following identification, the "baseline" or existing condition of each VC type is studied and described. Once the existing condition for each VC is known, the environmental assessment:

1. Predicts the adverse Project-related environmental effects or impacts and evaluates the scope and scale of these effects;

2. Describes a number of mitigation measures and practices that the Proponent will use to avoid, minimize, eliminate, mitigate, or compensate for the effects;

3. Predicts residual adverse environmental effects after mitigation but before the assessment of the cumulative effects described below.

4. Assesses the cumulative effects from other probable (i.e., certain and reasonably foreseeable) future projects, taking into consideration past and current projects; and

5. Determines the residual adverse effects remaining after mitigation and assesses the significance of these effects on each VC. This step also includes consideration of the cumulative effects described above.

5.7 Environmental Effects Assessment

As noted, the manner in which a project may affect the VCs is a function of the linkage or pathway from one to the other. The environmental effects of a project are a function of its activities, while the pathways are a function of several things, including project activities, ecological systems, and contaminant properties. Typically, the assessment uses provincial and federal guidelines and policies to determine potential pathways and effects, combined with computer or numerical modeling, knowledge of the site conditions and professional judgment. Other information sources include input from experts, stakeholders, and regulators; experience from previous environmental assessments; primary scientific literature.

5.8 Mitigation and Residual Effects

The next step in the environmental assessment determines the potential residual adverse environmental effects by Project phase. Residual adverse effects are derived using a three-step process:

1. Determine the potential interactions between the VCs and Project activities, for each Project phase, and the environmental effects of these interactions in combination with those from other likely future projects;

2. Assess the effect of the mitigation strategies applicable to each of the interactions; and

3. Characterize the nature and extent of the remaining, residual environmental effects after mitigation measures have been applied. That is, determine their “significance” and “likelihood”.

Environmental effects assessment matrices have been used to summarize the analysis of environmental effects (see Table 5-5 for an example). Cumulative environmental effects and potential impacts occurring from accidents, malfunctions and unplanned events are described in separate sections. This allows for a comprehensive analysis of all Project-VC interactions. Supporting discussion in the accompanying text highlights particularly important relationships, site data and assessment results.

A great variety of mitigation measures are available for most projects. These measures range from the use of standard industry best management practices for construction and operation, through training and sensitization of site workers, to site-specific design features that can be applied to limit or eliminate a particular effect. Based on the Proponent’s extensive experience with the potential environmental effects of aggregate production, a number of mitigation

measures were incorporated into the Project design and implementation plan in order to minimize potential adverse effects. In addition, mitigation measures can include environmental protection strategies, environmental management systems, and compensation projects, as noted in the EIS Guidelines, mitigation measures must be technically and economically feasible. Mitigation measures are described in each VC assessment chapter of Section 7.0.

Table 5.5:
Residual Environmental Effects Assessment Matrix for [Name of VC]

Project Environment Interaction	Potential Residual Environmental Effects A=Adverse P= Positive	Mitigation	Magnitude	Geographic Extent	Duration / Frequency	Reversibility	Ecological / Socio-Economic Context	Residual Effect	Significance of Residual Effect
Construction									
Activity 1									
Activity 2									
Operation									
Activity 1									
Activity 2									
Decommissioning									
Activity 1									
Activity 2									

Legend

Magnitude **(see Table 5.6)**:
U= Unknown
0 = Nil
1 = Low
2 = Medium
3 = High variation)

Geographic Extent:
1 = < 1 km^2
2 = 1 – 10 km^2
3 = 11 – 100 km^2
4 = 101 – 1,000 km^2
5 = 1,001 – 10,000 km^2

Duration:
1 = < 1 month
2 = 1 – 12 months
3 = 13 – 36 months
4 = 37 – 72 months
5 = > 72 months

Frequency:
1 = < 11 events/year
2 = 11 – 50 events/year
3 = 51 – 100 events/year
4 = 101 – 200 events/year
5 = > 200 events/year
6 = continuous

Reversibility:
R = Reversible
I = Irreversible

Ecological / Socio-Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity.
2 = Evidence of adverse environmental effects.

N/A = Not applicable
A = Adverse
P = Positive

The legend is typical for biological VCs and is provided for illustrative purposes only. The legend may vary from VC to VC as appropriate.

The prediction of residual effects follows three general steps (CEA Agency 1994):

- Determining whether the environmental effects are ***adverse***;
- Determining whether the adverse environmental effects are ***significant***; and
- Determining whether the significant adverse environmental effects are ***likely*** to occur.

Some of the key factors that must be considered in determining *adverse* environmental effects are given in the CEA Agency's guidance document (CEA Agency 1994). This guidance was used when applying Table 5.5 to each VC:

- Negative environmental effects on the health of biota;
- Loss of rare or endangered species;
- Reduced biological diversity;
- Loss or avoidance of critical / productive habitat;
- Habitat fragmentation or interruption of movement corridors and migration routes;
- Transformation of natural landscapes;
- Chemical discharge;
- Loss or detrimental change in current use of lands and resources for traditional purposes;
- Foreclosure of future resource use or production;
- Adverse environmental effects on human health or well-being;

5.9 Residual Effects and the Determination of Significance

Residual impacts are those environmental effects predicted to remain after the mitigation measures have been applied or implemented. The predicted residual effects are considered for each Project phase (construction, operation, and decommissioning) and for potential accidental events. The *significance* of these residual effects to the local and regional areas is evaluated by assessing those criteria outlined in guidance documents provided by the CEA Agency (1994):

- **Magnitude**: the amount or degree of change in a measurable parameter or variable relative to existing conditions. It refers to the severity of the adverse environmental effect after mitigation.
- **Geographic Extent**: the area over which the adverse effect is predicted to occur after mitigation.
- **Duration**: the period of time over which the adverse effect will occur following mitigation.
- **Frequency**: the number of times during the Project that an effect might occur (e.g., one time or multiple times).
- **Reversibility**: the likelihood that a VC will recover from an adverse environmental effect, including consideration of reclamation, restoration, compensation and offset programs. Reversibility is considered on a population level for biological VCs: while

a severe effect like mortality is irreversible at the individual level, the environmental effect on the population may be reversible.

- **Ecological or Social Context**: the general setting of the area where the Project is located, as indicated by existing levels of human activity and associated disturbance.

The magnitude or severity of an adverse Project effect can be difficult to ascertain in some cases. To help assess magnitude, a relative rating was used, based on that used for other recent projects in the area (Table 5-6).

With respect to geographic extent, frequency, and duration, the environmental assessment employed defined or absolute values for these parameters, as described in each VC section.

Table 5.6:
Definitions for Levels of Magnitude

Rating	Magnitude*
High	An environmental effect affecting a whole ecological population or group of people, or where the effect or parameter is outside the range of natural variability determined from local knowledge over many seasons.
Medium	An environmental effect affecting part of a population, or one or two generations, or where there are rapid and unpredictable changes in an effect or parameter so that it is temporarily outside the range of natural variability determined from local knowledge over many seasons.
Low	An environmental effect affecting a specific group of individuals in a population in a localized area, one generation or less, or where there are distinguishable changes in a specific parameter; however, the parameter is within the range of natural variability determined from local knowledge over many seasons.
Nil	No environmental effect.
Unknown	An environmental effect affecting an unknown portion of a population or group or where the changes in a specific parameter are unknown.

(source: modified from AMEC 2013).

*Note: Definitions for magnitude for air and water quality are specific and addressed separately in their respective chapters in Section 7.0.

To determine the likelihood of significant adverse residual effects, the assessment considers *probability* of occurrence and the *scientific uncertainty* regarding the information used in the impact assessment.

5.10 Cumulative Environmental Effects

Cumulative environmental effects are residual project effects combined with the environmental effects of future projects and/or activities.

For the Black Point environmental assessment, the descriptions of the existing environment and of the current condition of each VC already includes the effects other past and current projects occurring within the Project Area. The assessment assumes that these existing projects will continue in the future and will have similar effects as are currently observed. The assessment has, therefore, integrated the cumulative effects of these ongoing projects and activities.

The cumulative effects assessment presented in Section 9.0 thus focuses on the effects of future projects and activities. This is consistent with guidance documentation developed by the CEA Agency: "temporal boundaries...should take into account future physical activities that are certain and reasonably foreseeable, and the degree to which the environmental effects of these physical activities will overlap those predicted from the designated project" (CEAA 2013).

5.11 Follow Up and Monitoring

"Follow-up" is a process that verifies the accuracy of the predicted impacts and determines the effectiveness of the measures taken to mitigate the adverse environmental effects.

A series of follow-up programs will be developed for the Black Point Quarry Project; these programs are outlined in Section 10. The elements of the programs will be developed through consideration of each VC, and where appropriate or warranted, follow-up measures will be taken.

In addition to follow-up programs pursuant to requirements of *CEAA 2012*, the Proponent will also evaluate the need for monitoring required to ensure regulatory or corporate compliance, and commitments to third parties. To help achieve the goal cause of preventing "serious or irreversible harm to the environment" as required by the EIS Guidelines (CEA Agency 2014), the proponent will implement environmental management and contingency plans to prevent or address situations during construction, operations and decommissioning that may result in accidents or malfunctions and lead to unexpected effects.

5.12 Effects of the Environment on the Project

The effects of the environment on the Project (i.e., severe weather, earthquakes, etc.) have also been taken into consideration. Project activities and infrastructure were reviewed for interactions with the natural environment, including wind, waves, ice and extreme precipitation events. Project plans and activities have been designed to reflect the limitations imposed by the natural environment. A significant effect of the environment on the Project is one that:

- Harms Project personnel or the public;
- Results in a substantial delay in construction (e.g., more than one season) or shutdown of operations;
- Damages infrastructure and compromises public safety; and
- Damages infrastructure to the extent that repair is not economically or technically feasible.

The effects of the environment on the Project are assessed in Section 8.0. Where effects of the environment on the Project can in turn result in effects to the environment (e.g., an oil spill could result from weather or ice conditions), this is addressed in the environmental assessment for each of the VCs. In the case of an accidental event, the worst case scenario event, regardless of the cause, has been assessed for each VC (Section 7.18).

5.13 Description of the Retained VCs

Tables 5.2 and 5.3 demonstrate that the provisional VCs identified in the scoping exercise can be potentially affected by the Project through a variety of pathways. This section describes the nature of each VC in more detail and provides a rationale for its selection.

Air Quality and Climate Change

Air quality concerns associated with the generation of dust have been raised by community residents and the Mi'kmaq, and so Air Quality is identified as a VC. Air quality within the Project site is regulated by the province through the *Workplace Health and Safety Regulations*, which establishes the air quality conditions needed to maintain worker health. Air quality is also a pathway to food chain via the transport of dust and deposition of contaminants on vegetation and surface water. Air quality outside of the Project site is also regulated by the province, which sets air quality emissions standards for industrial operations. Greenhouse gas (GHG) emissions are associated with climate change and have been the subject of provincial regulation and policy initiatives. Vehicles used at the Project site will produce GHGs from the combustion of fuel.

Noise

Activities such as blasting and aggregate processing will undoubtedly produce noise and have the potential to alter the ambient noise conditions of the local area. Noise concerns have been raised by residents living to the east and west of the Property. Changes to ambient noise may also affect a variety of wildlife, migratory birds and SAR. Noise associated with quarry activities is regulated by the province.

Construction of the marine terminal will likely result in temporary increases to noise in the marine environment, which in turn may affect nearby marine biota. Noise may alter the behaviour patterns of certain marine species, which may in turn affect these species at different times of their life cycles. Shipping associated with the marine terminal will add to the noise already present in the marine environment.

Ambient Light

Since the Project site is currently undeveloped, night time ambient light conditions are low. As the site is developed into a quarry, artificial light will be introduced in the form of vehicle headlights, work area illumination, and lights installed on the marine terminal to ensure safe navigation. Changes to ambient light conditions have the potential to negatively affect wildlife in the immediate area and birds from further afield. Increases in night time light levels may also be perceived as a nuisance by local residents.

Bedrock Geology and Sediment

The Project site is currently undeveloped, although historical records suggest at least three families inhabited areas near the coast in the past. Despite this, there is no evidence to suggest that contaminated soils or sediment are present on the site. Bedrock geology and sediment was selected as a VC primarily due to the presence of Halifax Formation rocks which underlay a small portion of the site near the coast. The rocks have the potential to generate acid runoff

when excavated and exposed to oxygen. Excavation of these rocks will be required in preparation for the installation of the processing plant and aggregate stockpiles.

Sedimentation in the marine environment has been identified by fishermen and nearby coastal residents as a potential concern, since the discharge or runoff of sediment-laden water during construction and operation may have harmful effects on nearby lobster habitat. In addition, residents and fishermen have expressed concern regarding the transport of suspended sediment along the shore and into neighbouring bays.

Groundwater Resources

Groundwater extracted from dug and drilled wells is used for drinking water by the nearest residents living to the east, west and south of the Project. In addition, groundwater can play an important role in sustaining streams and wetlands and the habitats and wildlife that depend on them. The Project will remove granite from below the water table, which in turn will affect the local groundwater table. Project activities are perceived by nearby residents to have the potential to affect groundwater supply and quality within their wells. Groundwater is also a potential pathway that can transport contaminants offsite. Groundwater qualify is regulated by the province.

Marine and Surface Water Resources

As noted previously, marine water quality may be negatively affected by sediment laden water in the form of discharge or stormwater runoff. Acid rock drainage generated from the disturbance of Halifax Formation rocks may also affect marine water quality. Good quality water is essential to the well being of a large variety of organisms, from the smallest algae to large marine mammals. Marine water quality is also critical to the long term success and sustainability of the commercial fishery, which is a vital economic and social activity in the county and beyond. Marine water quality is regulated by the federal government, which is also responsible for managing and permitting the navigational aspects of the marine terminal.

Surface water quality and quantity play and important role in maintaining ecosystem health in downstream receptors, and surface water can transport contaminants off-site. Surface water can recharge groundwater and thus can act as a pathway for the transport of contaminants to the subsurface in the case of an on-site spill. Surface water is not used for drinking water purposes in the immediate Project area, but the project will use, treat and potentially discharge surface water during the course of operations. In addition, surface water quality may potentially be affected by accidental spills, fires or other events on the property. Surface water quality is regulated by the province.

Terrestrial Ecosystems, Habitat & Vegetation

Terrestrial ecosystems habitat and vegetation express local and regional biodiversity and support ecological resilience. These features form the basis upon which local wildlife populations depend. Terrestrial ecosystems and habitat will be permanently diminished or destroyed, and vegetation will be lost during the course of building and operating the Project. Mi'kmaq has expressed concerns with respect to their continuing ability to harvest terrestrial resources within the Project and adjacent areas, as well as the overall effect of Project activities

on ecological resources in general. Indirect impairments to ecosystems and habitat may occur through Project-related activities such as water use and dust emissions.

Wetlands

Wetlands are highly productive and diverse ecosystems that perform a number of biophysical and ecological functions. They may provide habitat or refuges for a diversity of species, including SAR, attenuate storm flows, recharge groundwater and provide discharge to downstream receptors during dry periods. Over the 50 year life of the Project, development will directly affect a number of wetlands on the Project site, and may indirectly affect others through effects to surface and groundwater flows. These effects will not be felt at once, but rather progressively as the quarry expands over its 50 year production life. Wetlands are regulated by the province.

Terrestrial Wildlife

Terrestrial wildlife species have ecological, aesthetic and recreational importance to the public and First Nations, primarily as a food source and as an economic and recreational resource. Project development will impair or eliminate the productive capacity of some terrestrial habitat within the Project footprint. Other indirect interactions (airborne dust, emissions, noise, vibration, light, water use) may affect species and habitat adjacent to the Project. Most terrestrial species and habitat are regulated by the Province but migratory birds are regulated at the Federal level.

Freshwater Species and Habitat

The creeks and lakes on the Property and in the immediate vicinity support important terrestrial habitat types and a number of aquatic species, but do not contain fish due to their acidity. Nevertheless, freshwater species and habitat are important biological components of larger ecological systems and are valued by the public and the Mi'kmaq. Project activities will destroy small areas of freshwater habitat (and may damage or impair other areas) but the Project will ultimately create considerably more freshwater habitat than currently exists on the site.

Marine Species and Habitat

Marine species and their habitat are valued for the aesthetic, cultural, ecological and economic attributes by First Nations and the public at large. Construction of the marine terminal will permanently destroy sea bottom habitat even as new habitat is created by the terminal foundations. To offset this habitat loss, habitat creation nearby is required by DFO. Transport of aggregate via seagoing vessels will impact upon the marine environment through noise associated with vessel passage and potentially through accidental spills or other incidents at sea. Marine SAR are of interest to scientists, regulators and public due to their inherent biological and cultural value and are protected under federal provincial legislation. Fish and fish habitat in general is regulated by DFO at the federal level.

Species at Risk

Species at Risk are identified as a VC due to their ecological role, scientific value and cultural attributes. Species at Risk may be regulated at the federal level, the provincial levels, or both. The direct loss of habitat used by terrestrial or marine SAR is the primary concern of this VC,

although SAR may be indirectly affected through noise, light and general activity at the Project site.

Local Economy, Land and Resource Use

Economic effects of the Project are of interest to local residents, municipal officials and the provincial government. Nearby residents gain their living through forestry, commercial fishing, tourism, government and service occupations. Project revenues or royalties that flow to the MODG and Project expenditures may positively affect local economies. The Project will also contribute to the municipal tax base. Regional economic improvements can affect the population size and demographics as workers move to the area, purchase property, goods and services, and raise families. Property values can also be affected by large scale project development.

Employment and business opportunities are valued by people who may benefit directly from income generated by the Project and/or indirectly from newly needed services. The Project will require a temporary labour force during construction and a smaller but significant labour force over the long term operation of the Project. In addition to direct hires, the Project will generate employment and economic activity through contracting for goods and services.

Existing and Planned Land Uses

A major development such as the proposed Project can affect existing as well as planned land uses. Current on-site land uses (trapping, local tourism) will be replaced by quarrying and associated activities. Existing and planned land uses on adjacent properties may be impacted through changes to the visual or acoustic environments. Land use is regulated by the Province and through municipal zoning and land use bylaws.

Tourism and Recreation

Residents and tourists alike make use of the local terrestrial and marine resources for outdoor activities such as camping, hiking, fishing, boating, off-road motoring, and hunting. These activities are popular and to a certain degree, available, due to the largely undeveloped nature of the area. The presence of quarry may influence perceptions regarding noise and changes in the visual character of the coastal landscape, resulting in changes to recreational resource use patterns. The Project may result in restrictions to currently accessible beaches and headlands at the Project site. Navigability of water courses and coastal waters is regulated by federal legislation.

Commercial Fisheries and Aquaculture

Marine commercial fisheries represent an important, sustainable resource of historical, cultural, social and economic value to local communities and the Mi'kmaq. As noted, there are no freshwater commercial or recreational fisheries on the Property. Aquaculture is not currently practiced along the south shore of Chedabucto Bay.

The marine terminal will result in limitations to lobster harvesting in the immediate area of the marine terminal and, as result, displacement of those who currently fish in the nearshore at the Black Point site into other areas. The transit of empty and loaded aggregate transport ships has

the potential to interfere with other commercial fishing activities that occur in deeper water between the shipping lanes and the south shore of Chedabucto Bay.

Accidental spills or discharges to the aquatic environment can alter water quality and physical habitat, which in turn can affect life-cycle stages of commercially important species and their food supply.

Fish harvesting is regulated by the Federal Government under the *Fisheries Act*.

Archaeological and Heritage Resources

Post-European contact heritage resources are found on the property near the coast where historical homesteads were established over the course of several generations. Archaeological and Heritage Resources were identified in the EIS Guidelines as an potential VC and concerns have been raised regarding the possible existence of these resources during the public outreach phase of the environmental assessment. Although a 30 m buffer zone will be left undisturbed along the coastline to protect some of these finds, much of the coastal zone inside this buffer will be built upon, thus disturbing, destroying or covering over some of these resources. Archaeological and Heritage Resources are protected through provincial legislation.

Aboriginal Land and Resource Use

Aboriginal culture in the form of traditional land and resource use is practiced on a regular basis by the Mi'kmaq community. Traditional hunting, fishing, and plant harvesting practices are deeply rooted and highly valued in these communities. Mi'kmaq land and resource use could be affected by the Project through the loss of access to or alteration of harvesting areas and traditionally use lands. Overarching Mi'kmaq land claims can affect the establishment of clear title to land designated for industrial development. Legal jurisprudence has defined federal and provincial responsibilities with respect to Aboriginal peoples and the settlement of outstanding land claims. Consideration of Aboriginal interests is legislated by federal and provincial laws and listed in the EIS Guidelines issued for this Project.

Black Point Quarry Project
Municipality of the District of Guysborough, NS

Environmental Impact Statement

PART 2 Section 6

Vulcan Materials Company

February 2015

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Appendix D: Noise and Vibration Technical Report
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Appendix F: Wetland Baseline Survey Report
Appendix G: AECOM 2011 Winter Bird Survey
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Appendix O: Air Quality Technical Report

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6.0 EXISTING CONDITIONS

6.1 Geophysical Environment

6.1.1 Physiography, Geomorphology and Topography

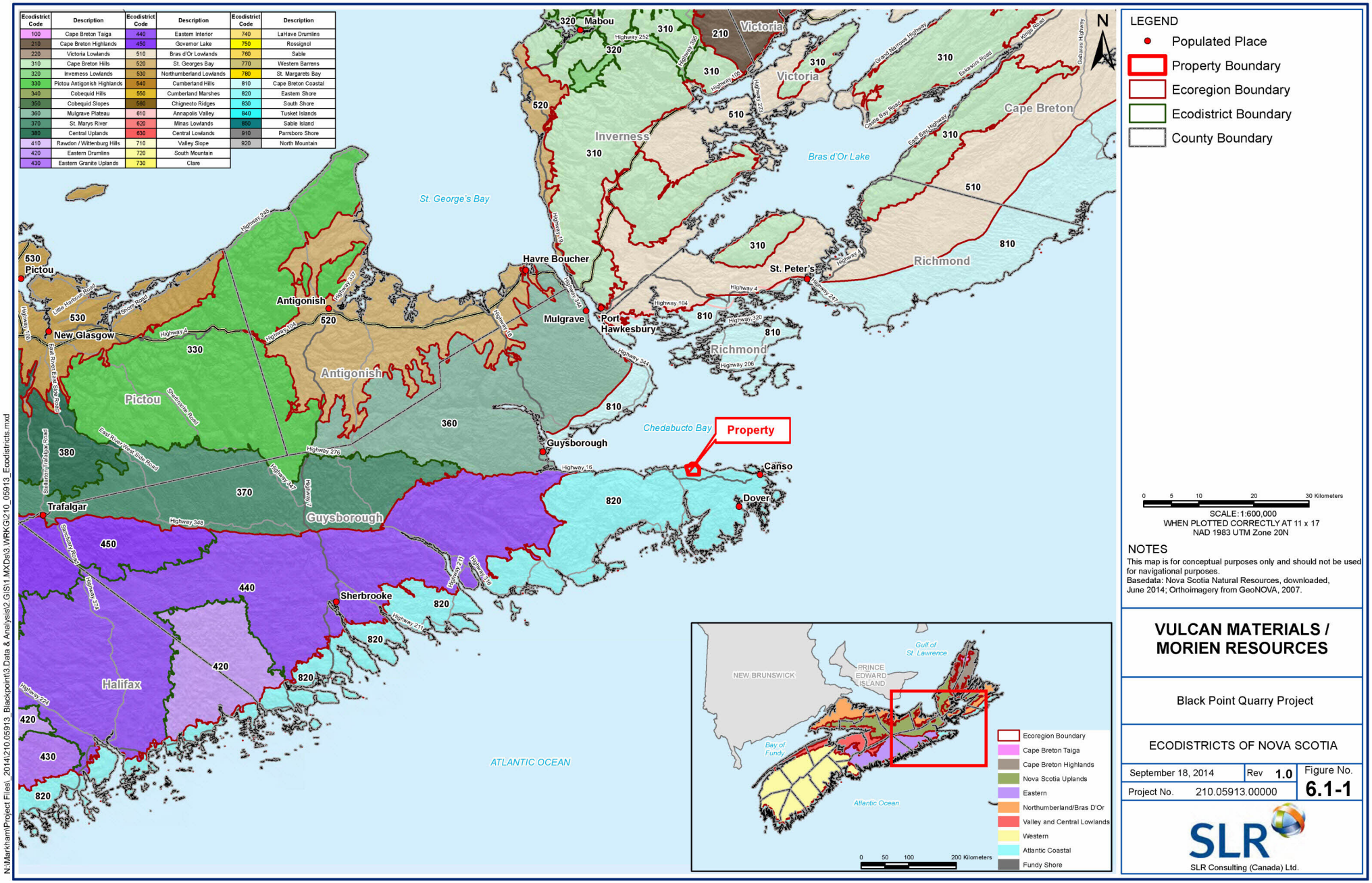
The Project site falls within the Atlantic Coast Ecoregion (**Figure 6.1-1**), which is located along the southeastern coast of Nova Scotia (Webb and Marshall 1999). There are eight ecoregions in Nova Scotia; all are subdivisions of the Atlantic Maritime Ecozone. Ecoregions are characterized by distinctive large-order landforms or assemblages of regional landforms, small order climates, water, soils, vegetation, and regional human activity uses and patterns (Neily *et al.* 2003).

The Atlantic Coast Ecoregion has a highly irregular shoreline. Inactive geological fault lines have had a strong influence on shaping the many deep inlets along the eastern shore of Nova Scotia but these predominantly northwest-trending faults are less common along the south shore of Chedabucto Bay where the coast is less embayed. The south shore of Chedabucto Bay is very linear with an east-west orientation that reflects the presence of the inactive Cobequid-Chedabucto Fault (see 6.1.4). The landforms are underlain predominantly by Paleozoic-age metamorphic and granite bedrock, which is covered by a discontinuous veneer of stony glacial till[1]. Common tree species in this Ecoregion include white spruce (*Picea galuca*), black spruce (*Picea mariana*), and balsam fir (*Abies balsamea*). Other tree species include the hardwoods red maple (*Acer rubrum*) and yellow birch (*Betula alleghaniensis*). Common wetlands in this ecoregion include fens, salt marshes, and raised and flat bogs (Webb and Marshall 1999).

Ecoregions are further divided into ecodistricts, which are characterized by distinctive groups of landforms, relief, bedrock and surficial geological material, soil, vegetation, water bodies, and land uses (Webb and Marshall 1999). The Project site is located within the Eastern Shore Ecodistrict. This Ecodistrict spans a varied landscape of landforms, geology, and soils between the east side of the Halifax peninsula up to and including the Canso peninsula. The influence of the Atlantic Ocean provides a consistent coastal climate which is reflected in the forest types found within the Ecodistrict. The Ecodistrict is bounded by granite barrens at both ends, with metamorphosed dark, clay-rich sandstones ("greywackes") and slates of the Halifax and Goldenville formations in between (Neily *et al.* 2003).

The Project site is located on a smooth granite hill with a maximum elevation of approximately 97 m above sea level (asl). This is one of the highest elevations in the region and places the Project site at the top of the local watershed. Topography slopes gently in all directions from the peak of the granite hill; to the north an abrupt change in elevation is observed at 60 m asl. The northwest edge of the property (north of Fogherty Lake) forms a cliff, which descends from 60 m asl to sea level over a distance of about 150 m. This cliff is lower in the north-central and northeast portions of the property between Fogherty Head and Black Point, where the topography levels off at approximately 20-30 m asl and gradually grades to the rocky coast (**Figure 6.1-2**).

[1] Glacial till is a heterogeneous mix of clay, sand, gravel and boulders left behind by melting glaciers.


Ecodistrict Code | Description
100 Cape Breton Taiga
210 Cape Breton Highlands
220 Victoria Lowlands
310 Cape Breton Hills
320 Inverness Lowlands
330 Pictou Antigonish Highlands
340 Cobequid Hills
350 Cobequid Slopes
360 Mulgrave Plateau
370 St. Marys River
380 Central Uplands
410 Rawdon / Wittenburg Hills
420 Eastern Drumlins
430 Eastern Granite Uplands
440 Eastern Interior
450 Governor Lake
510 Bras d'Or Lowlands
520 St. Georges Bay
530 Northumberland Lowlands
540 Cumberland Hills
550 Cumberland Marshes
580 Chignecto Ridges
610 Annapolis Valley
620 Minas Lowlands
630 Central Lowlands
710 Valley Slope
720 South Mountain
730 Clare
740 LaHave Drumlins
750 Rossignol
760 Sable
770 Western Barrens
780 St. Margarets Bay
810 Cape Breton Coastal
820 Eastern Shore
830 South Shore
840 Tusket Islands
850 Sable Island
910 Parrsboro Shore
920 North Mountain
St. George's Bay
Bras d'Or Lake
Chedabucto Bay
ATLANTIC OCEAN
Property
Mabou
Inverness
Victoria
Cape Breton
Havre Boucher
St. Peter's
Richmond
Antigonish
Mulgrave
Port Hawkesbury
Pictou
New Glasgow
Guysborough
Canso
Dover
Trafalgar
Sherbrooke
Halifax
Highway 252
Highway 395
Highway 105
Highway 223
Grand Narrows Highway
Eskasoni Road
Castle Bay Road
East Bay Highway
Gaelic Coast Highway
Highway 19
Highway 344
Highway 4
Highway 104
Highway 320
Highway 206
Highway 245
Highway 337
Little Harbour Road
Shore Road
Highway 106
East River East Side Road
Sherbrooke Road
East River West Side Road
Station Trafalgar Road
Highway 276
Highway 347
Highway 16
Highway 348
Strathcona Road
Highway 374
Highway 211
Highway 316
Highway 224
NEW BRUNSWICK
PRINCE EDWARD ISLAND
Gulf of St. Lawrence
Bay of Fundy
Atlantic Ocean
Ecoregion Boundary
Cape Breton Taiga
Cape Breton Highlands
Nova Scotia Uplands
Eastern
Northumberland/Bras D'Or
Valley and Central Lowlands
Western
Atlantic Coastal
Fundy Shore
0 50 100 200 Kilometers
N
LEGEND
Populated Place
Property Boundary
Ecoregion Boundary
Ecodistrict Boundary
County Boundary
0 5 10 20 30 Kilometers
SCALE: 1:600,000
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N
NOTES
This map is for conceptual purposes only and should not be used for navigational purposes.
Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.
VULCAN MATERIALS / MORIEN RESOURCES
Black Point Quarry Project
ECODISTRICTS OF NOVA SCOTIA
September 18, 2014
Rev 1.0
Figure No. 6.1-1
Project No. 210.05913.00000
SLR
SLR Consulting (Canada) Ltd.
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N
LEGEND
Property Boundary
Crown Lease Land
Waterbody
Watercourse
LIDAR Contour (2m)
Utility Line
Crown Lease Land
Chedabucto Bay
Fogherty Head
Black Point
Fox Bay
Watercourse 1
Watercourse 2
Watercourse 3
Watercourse 4
Fogherty Lake
Murphys Lake
0 100 200 400 Meters
SCALE: 1:10,000
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N
NOTES
This map is for conceptual purposes only and should not be used for navigational purposes.
Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.
MORIEN RESOURCES AND VULCAN MATERIALS
BLACK POINT QUARRY
PROPERTY BOUNDARIES
October 22, 2014
Rev 1.0
Figure No. 6.1-2
Project No. 210.05913.00000
SLR
SLR Consulting (Canada) Ltd.
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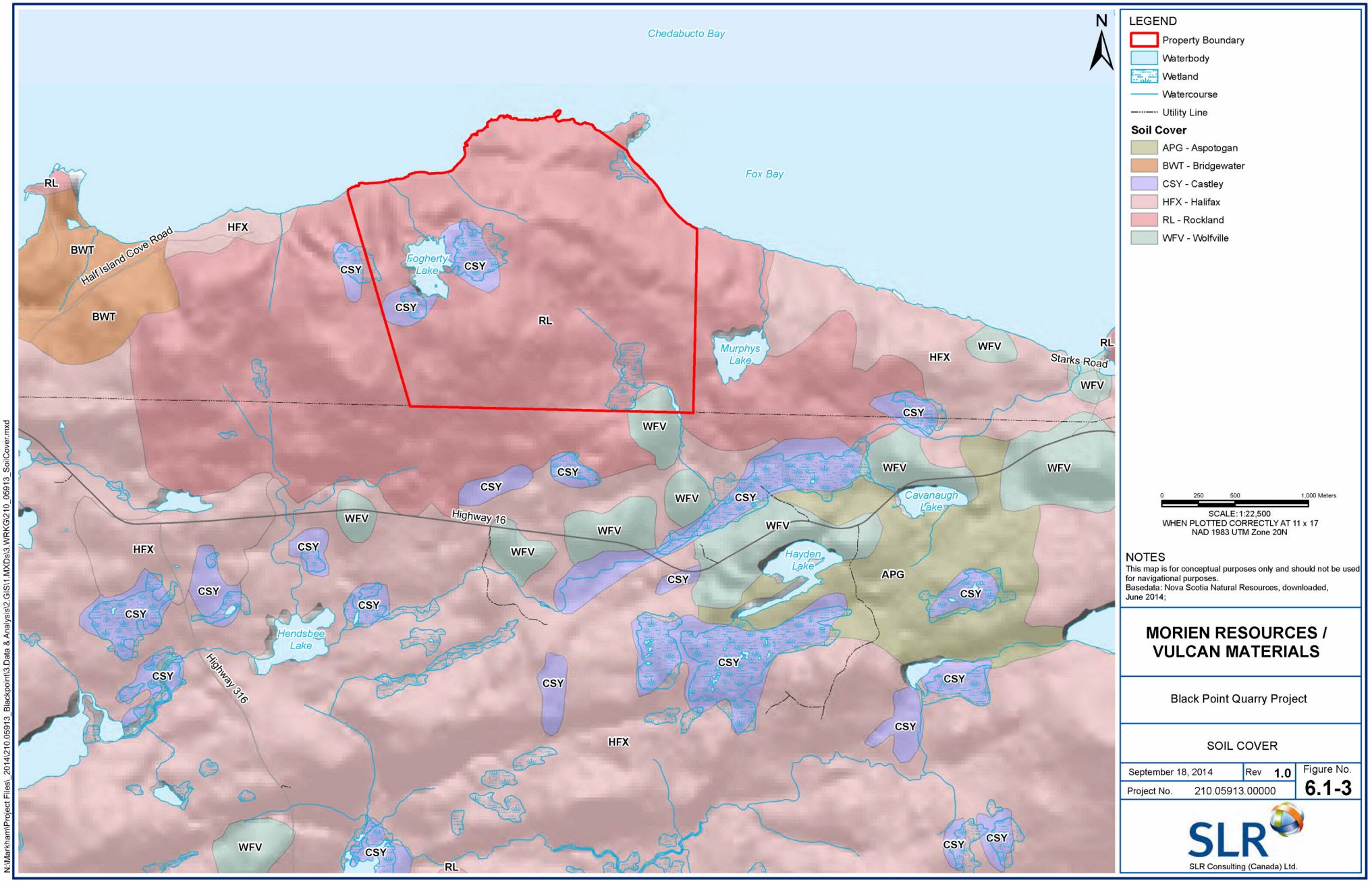
6.1.2 Soils/Sediment

Approximately 94% of the soils in Guysborough County have developed from glacial till, with the remainder being developed on alluvial (river) deposits or glaciofluvial (rivers of glacial origin) deposits. Textures in the soils developed over till range from sandy loam to loam in the upper layers, while the parent till material ranges from gravelly sandy loam to clay loam. Textures in the alluvial and glaciofluvial soils range from gravelly sandy loam to silt loam in the surface layer, while in the subsoil the material ranges from gravel to silt loam (Hilchey *et al.* 1964).

Soils are thin to non-existent on the top of the granite hill that dominates the property. Soils thicken to the east and west at lower elevations where wetlands have developed. The soil map labels the Project site as "Rockland", defined as soil areas with 50% or more of rock outcrops or boulders (**Figure 6.1-3**). Isolated pockets of peat, defined as brown, poorly decomposed organic material 30 cm or more in depth, are shown adjacent to Fogherty Lake, and form the Castley soil type. A single occurrence of Wolfville Series soil is shown in the extreme southeast corner of the property. This soil consists of "moderately stony, dark brown friable loam over dark grayish brown sandy clay loam". As noted above, this soil is developed from a parent material made of glacial till, in this case "firm dark reddish brown sandy clay loam glacial till" (SRI 1963).


N
Chedabucto Bay
Fox Bay
Half Island Cove Road
Fogherty Lake
Murphys Lake
Starks Road
Highway 16
Highway 316
Hendsbee Lake
Hayden Lake
Cavanaugh Lake
RL
HFX
BWT
CSY
WFV
APG
LEGEND
Property Boundary
Waterbody
Wetland
Watercourse
Utility Line
Soil Cover
APG - Aspotogan
BWT - Bridgewater
CSY - Castley
HFX - Halifax
RL - Rockland
WFV - Wolfville
0 250 500 1,000 Meters
SCALE:1:22,500
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N
NOTES
This map is for conceptual purposes only and should not be used for navigational purposes.
Basedata: Nova Scotia Natural Resources, downloaded, June 2014;
MORIEN RESOURCES / VULCAN MATERIALS
Black Point Quarry Project
SOIL COVER
September 18, 2014
Rev 1.0
Figure No. 6.1-3
Project No. 210.05913.00000
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6.1.3 Surficial Geology

Surficial geology in the vicinity of the Project site is described on published geology maps (Stea *et al*. 1992; Stea and Fowler 1979) as predominantly comprising Pleistocene-age granite and quartzite tills derived from local bedrock sources (**Figure 6.1-4**). The stony till shown within the property boundary is yellow-brown in color, loose and sandy. Regionally, it averages 2 m thick but is up to 5 m thick in some areas. The quartzite till is bluish-greenish-grey in color, loose and coarser grained than the stony till; it averages 3 m thick but may be up to 20 m thick in some places. A thin band of red till and/or marine deposits developed on Halifax Formation bedrock is present along the coastal portion of the property.

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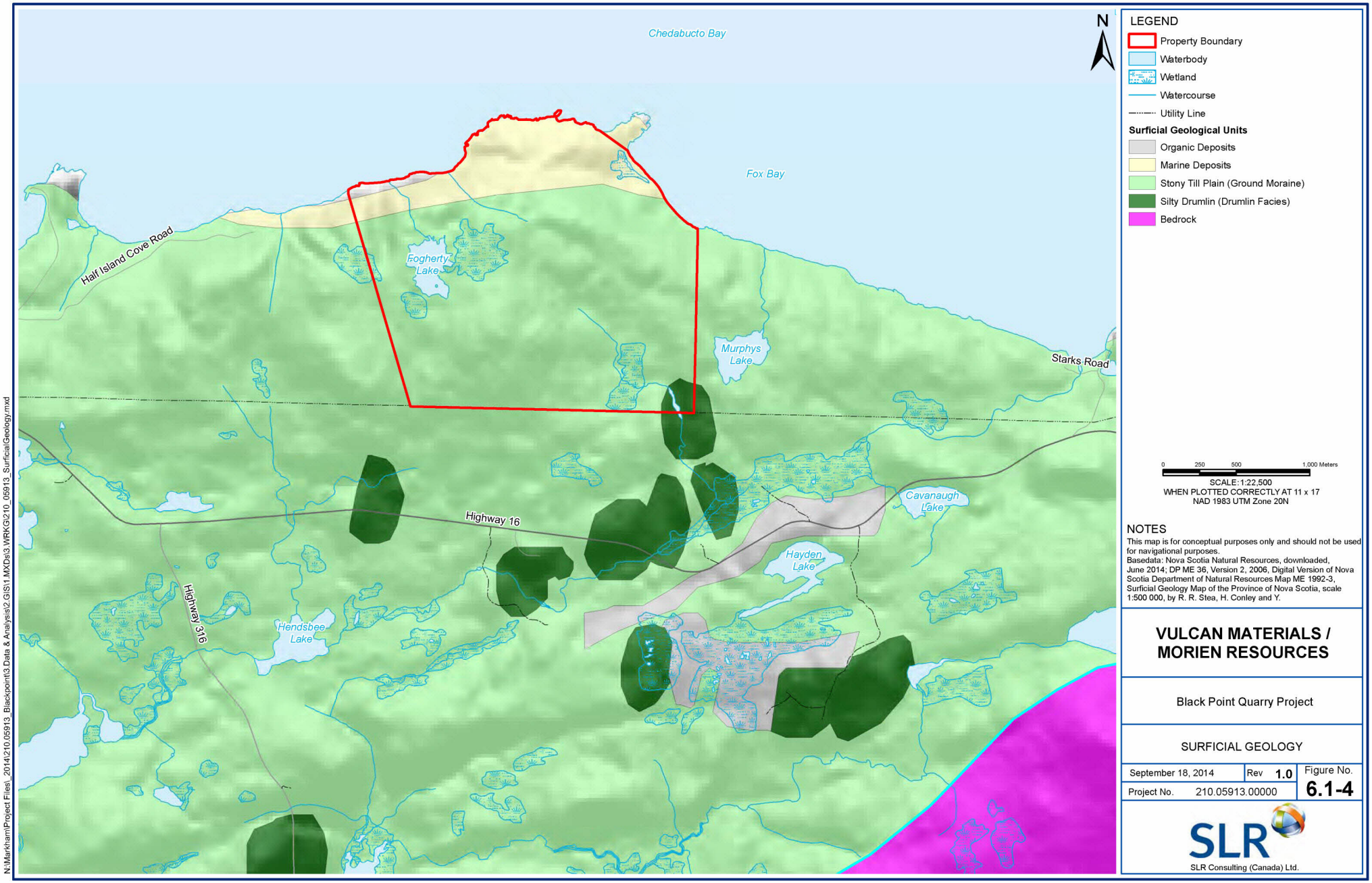
Chedabucto Bay
Fox Bay
Half Island Cove Road
Fogherty Lake
Murphys Lake
Starks Road
Highway 16
Highway 316
Cavanaugh Lake
Hayden Lake
Hendsbee Lake
N
LEGEND
Property Boundary
Waterbody
Wetland
Watercourse
Utility Line
Surficial Geological Units
Organic Deposits
Marine Deposits
Stony Till Plain (Ground Moraine)
Silty Drumlin (Drumlin Facies)
Bedrock
0 250 500 1,000 Meters
SCALE:1:22,500
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N
NOTES
This map is for conceptual purposes only and should not be used for navigational purposes.
Basedata: Nova Scotia Natural Resources, downloaded, June 2014; DP ME 36, Version 2, 2006, Digital Version of Nova Scotia Department of Natural Resources Map ME 1992-3, Surficial Geology Map of the Province of Nova Scotia, scale 1:500 000, by R. R. Stea, H. Conley and Y.
VULCAN MATERIALS / MORIEN RESOURCES
Black Point Quarry Project
SURFICIAL GEOLOGY
September 18, 2014
Rev 1.0
Figure No. 6.1-4
Project No. 210.05913.00000
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Observations made on site indicate these tills are essentially absent on the top of the granite hill, but thicken on the slopes of the hill at lower elevations. The tills are well exposed along the coastline at Half Island Cove (Figure 6.1-5) and Fox Island Main. Dug wells, which are used more often than drilled wells in this area to provide potable water, are installed in these loose tills.

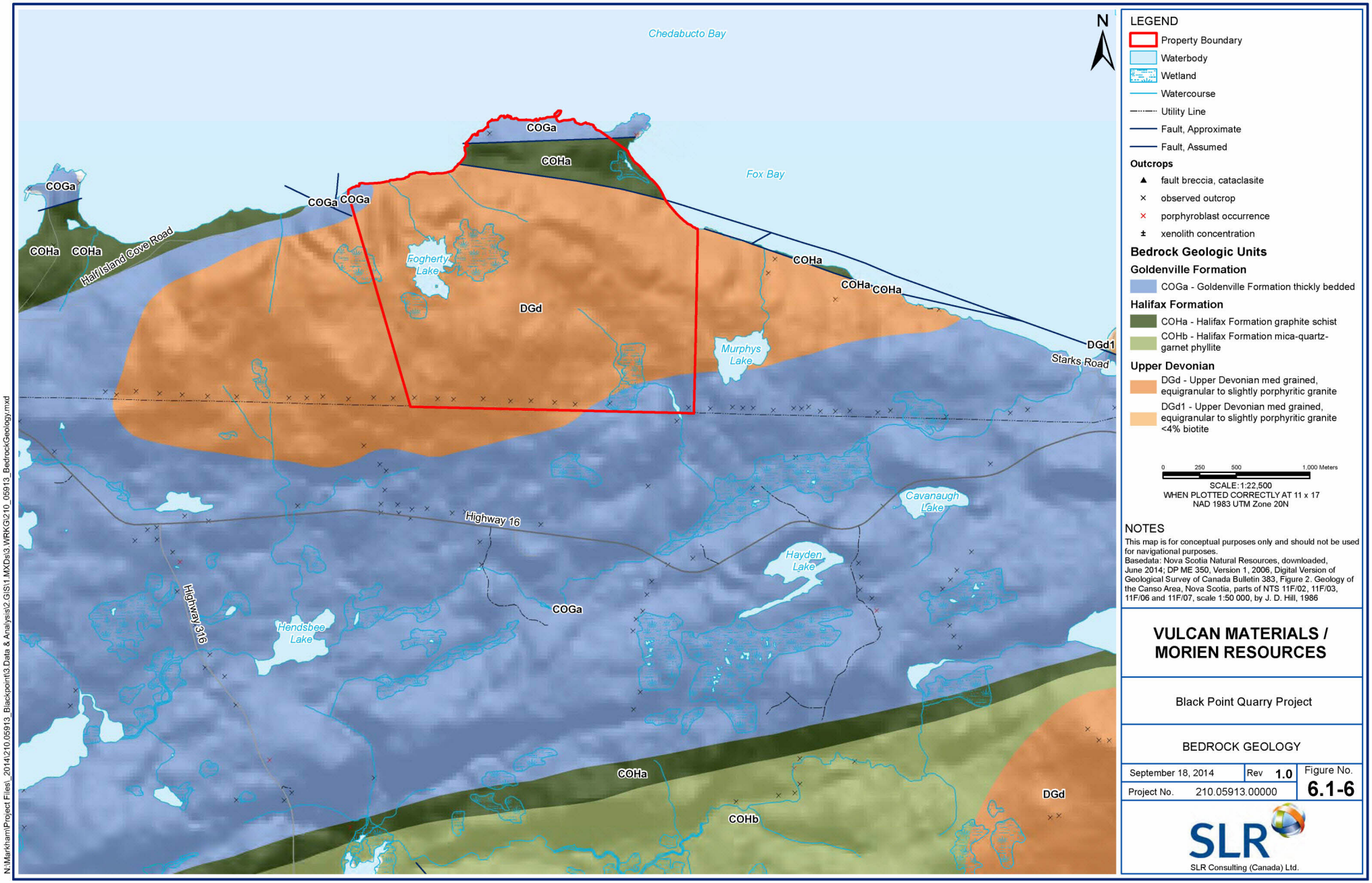
Figure 6.1-5:
View of glacial till east of Gaulman Point

6.1.4 Regional Geology

The Project site is located within the Meguma Terrane, south of the Cobequid-Chedabucto Fault System which separates the Meguma Terrane in the south from the Avalon Terrane in the north. The Meguma Terrane underlies the southern mainland of Nova Scotia, south of a line connecting the Minas Basin with Chedabucto Bay, and also extends seaward. The sedimentary rocks of the Meguma Terrane consist of primarily metamorphosed, fine-grained sandstones and slates with minor amounts of volcanic and carbonate rocks in local areas. The Meguma Terrane was later intruded by younger granitic rocks (NSMNH 1984), including the granite intrusion at Black Point that will provide the aggregate material for the Project.

Granite represents about 20-25% of the bedrock in Nova Scotia and is found throughout mainland Nova Scotia and Cape Breton. The granite intrusions in the Meguma Terrane were generated during the Acadian mountain building event, when the Meguma sedimentary pile was

compressed against, and possibly over, the Avalon Zone (NSMNH 1984). The geology of the site and surrounding area is presented on Figure 6.1-6.


N
Chedabucto Bay
Fox Bay
COGa
COHa
Half Island Cove Road
Fogherty Lake
DGd
Murphys Lake
DGd1
Starks Road
Highway 16
Highway 316
Cavanaugh Lake
Hayden Lake
Hendsbee Lake
COHb
LEGEND
Property Boundary
Waterbody
Wetland
Watercourse
Utility Line
Fault, Approximate
Fault, Assumed
Outcrops
fault breccia, cataclasite
observed outcrop
porphyroblast occurrence
xenolith concentration
Bedrock Geologic Units
Goldenville Formation
COGa - Goldenville Formation thickly bedded
Halifax Formation
COHa - Halifax Formation graphite schist
COHb - Halifax Formation mica-quartz-garnet phyllite
Upper Devonian
DGd - Upper Devonian med grained, equigranular to slightly porphyritic granite
DGd1 - Upper Devonian med grained, equigranular to slightly porphyritic granite <4% biotite
0 250 500 1,000 Meters
SCALE:1:22,500
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N
NOTES
This map is for conceptual purposes only and should not be used for navigational purposes.
Basedata: Nova Scotia Natural Resources, downloaded, June 2014; DP ME 350, Version 1, 2006, Digital Version of Geological Survey of Canada Bulletin 383, Figure 2. Geology of the Canso Area, Nova Scotia, parts of NTS 11F/02, 11F/03, 11F/06 and 11F/07, scale 1:50 000, by J. D. Hill, 1986
VULCAN MATERIALS / MORIEN RESOURCES
Black Point Quarry Project
BEDROCK GEOLOGY
September 18, 2014
Rev 1.0
Figure No. 6.1-6
Project No. 210.05913.00000
SLR
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6.1.5 Local Geology

The geology of the Project site and surrounding areas consists of Cambro-Ordovician age metamorphosed sedimentary rocks of the Goldenville and Halifax Formations Figure 6.1-6. The Goldenville Formation is the older of the two and is generally found to the south and west of the Project site, although this rock also outcrops on the tip of the Fogherty Head / Black Point headland. The Goldenville Formation consists of a thickly bedded metamorphosed muddy sandstone ("metawacke") with minor metamorphosed siltstone and slate ("metapelite"). Immediately to the south of the faulted boundary with the Goldenville Formation on the Fogherty Head / Black Point headland lies the Halifax Formation, consisting of graphite schist (a metamorphosed crystalline rock) interbedded with thin layers of metawacke (Hill 1991).

The majority of the Project site, including the area to be quarried, is underlain by medium-grained granite (Hill 1991). The granite has been intruded into the sedimentary rocks of the Goldenville and Halifax Formations. The granite's northern boundary with the Halifax Formation is a west-northwest to east-southeast trending fault. Similarly, the boundary between the Halifax and Goldenville Formations between Fogherty Head and Black Point is also a fault. These faults are thought to be part of the Cobequid-Chedabucto Fault Zone that has been inactive for millions of years.

Eleven bore holes have been drilled in the Project site footprint in order to confirm the granite's suitability as a construction aggregate. The drill logs are provided as an attachment to the Hydrogeological Technical Report in **Appendix A**. The logs describe a pinkish to greyish-white granite comprising 50% to 60% feldspar, 35% to 48% quartz and up to 10% biotite and muscovite mica.

The drill cores indicate that the most frequent fracturing and jointing occurs in the upper 40 m as demonstrated by the fracture frequency plot attached to Hydrogeological Technical Report in **Appendix A**. Two fault zones were noted in the core logs of drill holes BP-8 and BP-9 at 93 to 94 m below ground surface (bgs) and 20 m to 25 m bgs, respectively, and are shown on the fracture plots by fracture frequencies of >20 fractures per metre. Detailed topographic and LiDAR data of the site indicate a bifurcating lineament running from the northwest corner of Murphy's Lake to Watercourse 2 located northeast of Fogherty Lake. This northwest-southeast trend is consistent with known faulting in the area. Core holes BP-8 and BP-9 are located close to this lineament and potentially intersect a related fault.

Twenty-two granite core samples from three holes drilled during the 2014 resource assessment program were submitted to the laboratory for major and minor element analysis. In total, 49 parameters were measured, including the naturally occurring radioactive elements thorium and uranium. The analyses demonstrated the granite is chemically stable and is ideally suited for use as aggregate.

The whole rock analyses of these 22 samples demonstrated average thorium concentrations of 7.9 ppm (range 6.7-8.9 ppm) and average uranium concentrations of 7.08 ppm (range 6.18-8.15 ppm). These values are typical for Nova Scotia granites. In the rock classification system presented for the South Mountain granite (the rock that underlies much of southwestern Nova Scotia), the Black Point granite would be classified as a muscovite-biotite bearing 'fine-grained leucomonzogranite' or FGLMG (MacDonald *et al.* 1992). Average geochemical compositions of 105 FGLMG samples revealed average thorium concentrations of 6.3 ppm with a standard deviation of 4.2 and average uranium concentrations of 7.9 ppm U with a standard deviation of 5.5 ppm. Therefore compositions ranging from 2.1 ppm to 10.5 ppm for thorium and 2.4 ppm to

13.4 ppm for uranium are within one standard deviation of the arithmetic mean for this type of rock and can be considered average compositions.

6.1.6 Acid Rock Drainage (ARD) Potential

The granite at the Project site will be quarried to produce crushed-stone aggregate. Analytical testing was conducted in 2014 on the granite taken from three boreholes drilled in the granite resource (BP-7, BP-8 and BP-9) to confirm its suitability as construction aggregate. Testing included analysis of weight % sulphur and acid production potential as indicators of acid rock drainage (ARD) potential, since ARD has both structural and environmental implications. Testing indicated that the concentration of sulphur / sulphide in the granite is well below the threshold indicated in the *Sulphide Bearing Material Disposal Regulations* and is therefore considered non-acid producing (**Appendix B**). This is fully consistent with the chemical composition of aggregate quality granite: even limited ARD potential would render the rock un-useable as aggregate.

Halifax formation slates, which are often sulphide bearing, and Goldenville formation quartzite and greywacke, which is rarely sulphide bearing, are present within the proposed Project area at the northern end of the site. These rocks underlay the area proposed for the processing plant and aggregate stockpiles (Figure 6.1-6). Although they will not be quarried for aggregate, these formations may be disturbed for construction of the laydown area.

In October 2011, Black Point Quarry project geologists collected samples from these formations for ARD analysis. Five of the six surface samples collected have a sulphide content below the 0.4% threshold stipulated in the Regulations (**Appendix B**). One sample had a sulphide content above the threshold (i.e., 0.935%); however, the material was found to contain some neutralizing capacity with a laboratory-generated pH of 7.4 (i.e., slightly alkaline). From all indications, the Goldenville Formation rock on site is sulphide free and is proposed to be used in construction of the rubble-fill for the wharf. The Halifax Formation, which likely contains sulphides appears to exist only in a small band across the site (**Appendix B**) and will be avoided to the extent possible. As described in Section 7.4, the Proponent will sample and test these rocks prior to any excavation in accordance with the guidance provided in the provincial Sulphide Bearing Material Disposal Regulations. Should sulphide bearing materials be disturbed, the Proponent will work with NSE and NSDNR to confirm that all regulatory requirements are met before excavation begins.

6.1.7 Seismic Activity

Seismic activity may affect operations of any facility, particularly one close to the ocean where a tsunami can have consequences. Figure 6.1-7 shows the distribution and size of historical earthquakes recorded in eastern Canada, while Figure 6.1-8 shows the relative earthquake hazard across Canada. All of Nova Scotia is located within the next-to-lowest low hazard zone.

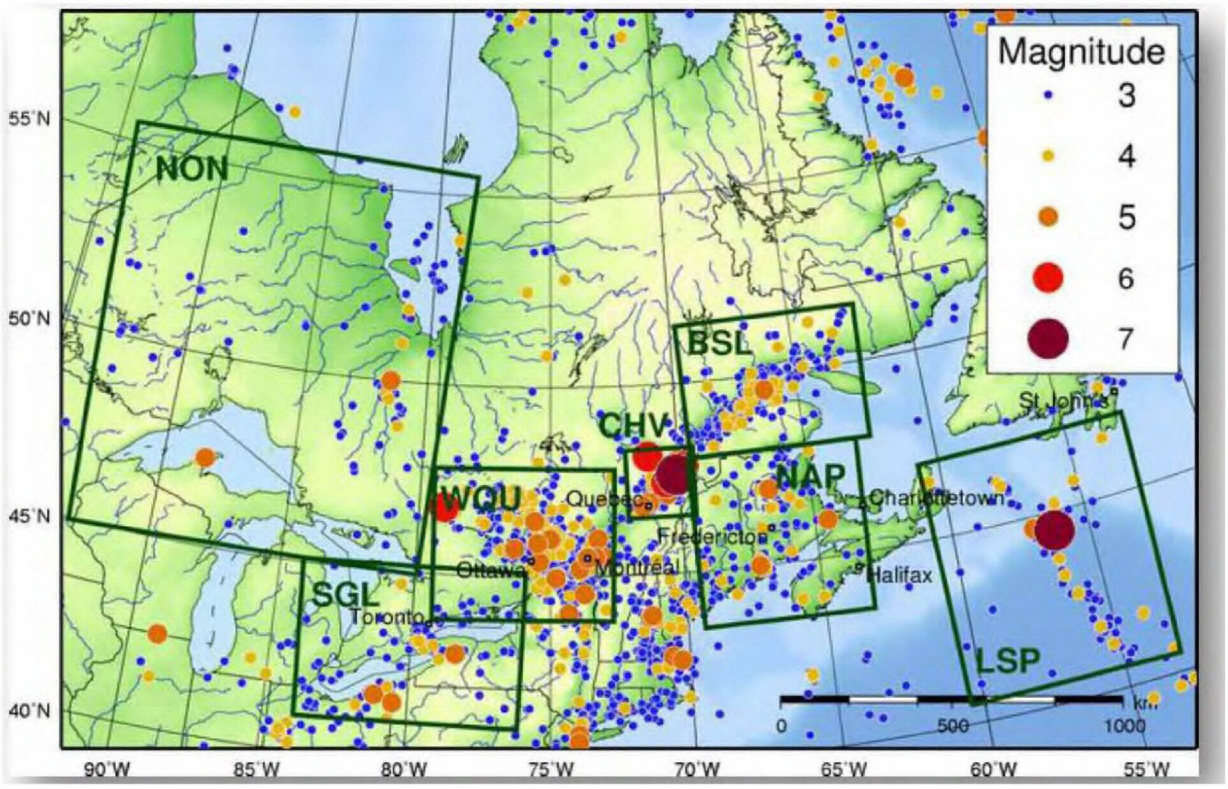


Figure 6.1-7:
Distribution and magnitude of historical earthquakes

Source NRCan 2013a

The rectangles delineate larger scale maps available at Earthquakes Canada. The Laurentian Slope Seismic Zone (LSP) denotes an area off Canada's southeast coast, which includes the Grand Banks of Newfoundland. The Laurentian Slope experienced about nine events 5.0 or greater between 1929 and 1977 (Ruffman 1995). The large red dot within the LSP zone identifies the location of a magnitude 7.2 earthquake that occurred in 1929. Tragically, this earthquake caused a tsunami which killed 28 people on Newfoundland's Burin Peninsula.

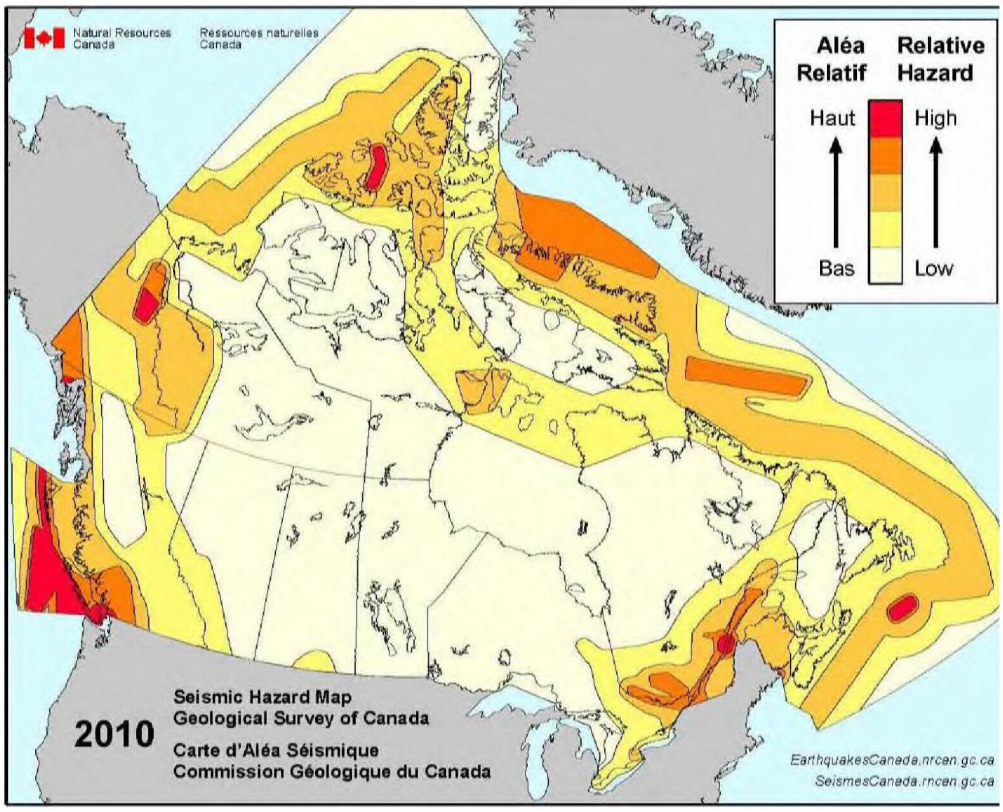


Figure 6.1-8:
Relative Earthquake Hazard

Each year, approximately 450 earthquakes occur in eastern Canada, of which four will exceed magnitude 4, thirty will exceed magnitude 3, and about 25 will be reported as felt (NRCan 2013a). A decade will, on average, include three events greater than magnitude 5, generally taken as the threshold of damage.

Earthquakes on Canada's east coast are not caused by tectonic movement along active plate boundaries, as is commonly the case on the west coast. It is thought that seismic activity in this region is related to the large scale, regional stress fields (NRCan 2013a) and slumping of sediment at the edge of the continental shelf into deeper water below.

Although tsunamis are not common, they have been recorded periodically along the eastern seaboard of North America. Ruffman and Tuttle (2005) have summarized tsunamis reported along the eastern continent (quoted from AMEC 2006).

- A local tsunami was noted on June 27, 1864, at St. Shotts on the southwest extremity of the Avalon Peninsula, Newfoundland;
- On November 17, 1872, tide gauges on the Fox Islands in Penobscot Bay and in North Haven, Maine registered a train of tsunami-like waves for about six hours;
- On August 10, 1884, a magnitude 5.6 earthquake in southern New York State created a tsunami that was observed in Philadelphia, along the coast at Trenton and Highlands, New Jersey, and through to New York Harbour;

- On October 4, 1884, three trans-Atlantic cables south of the Tail of the Banks broke at the same time over a down-slope distance of 10 nautical miles suggesting a slump; a possible tsunami may have resulted, however no tsunami reports are presently known;
- On January 9, 1926, an apparent tsunami was seen at Bernard, in Bass Harbour on Mount Desert Island, and at Corea in Maine;
- On November 18, 1929, the magnitude 7.2 "Grand Banks" earthquake (epicentre of 44.5°N, 56.3°W) triggered a large submarine slump that generated a tsunami and caused the loss of 28 lives. It represents Canada's largest documented loss of life directly related to an earthquake; and
- In 1940, a small tsunami-like event observed on the Island of Saint-Pierre may have been associated with the Laurentian Slope Seismic zone.

The 1929 Grand Banks earthquake is the highest magnitude earthquake recorded on the east coast. No damage from this earthquake or the ensuing tsunami was report in mainland Nova Scotia, although chimneys damaged on Cape Breton Island and minor landslides were reported. The tsunami was reportedly observed as far southwest as Lunenburg as well as in Bermuda. It was recorded on tide gauges as far south as Charleston in the US, in the Azores, and across the Atlantic Ocean in Portugal (NRCan 2013b).

The Black Point Quarry site is located at the edge of the "minor damage" zone for the 1929 tsunami (NRCan 2013b). As indicated in Figure 6.1-7, there are no historical earthquakes reported to originate in or near Cobequid Bay. For reference, reports of the 1929 earthquake were converted to Revised Modified Mercalli Intensities (MMI) and plotted on a map (Figure 6.1-9). Canso records a MMI of 5 out of 10 (shaking: moderate; damage very slight). In summary, the Project site is located in an area of low seismic hazard.

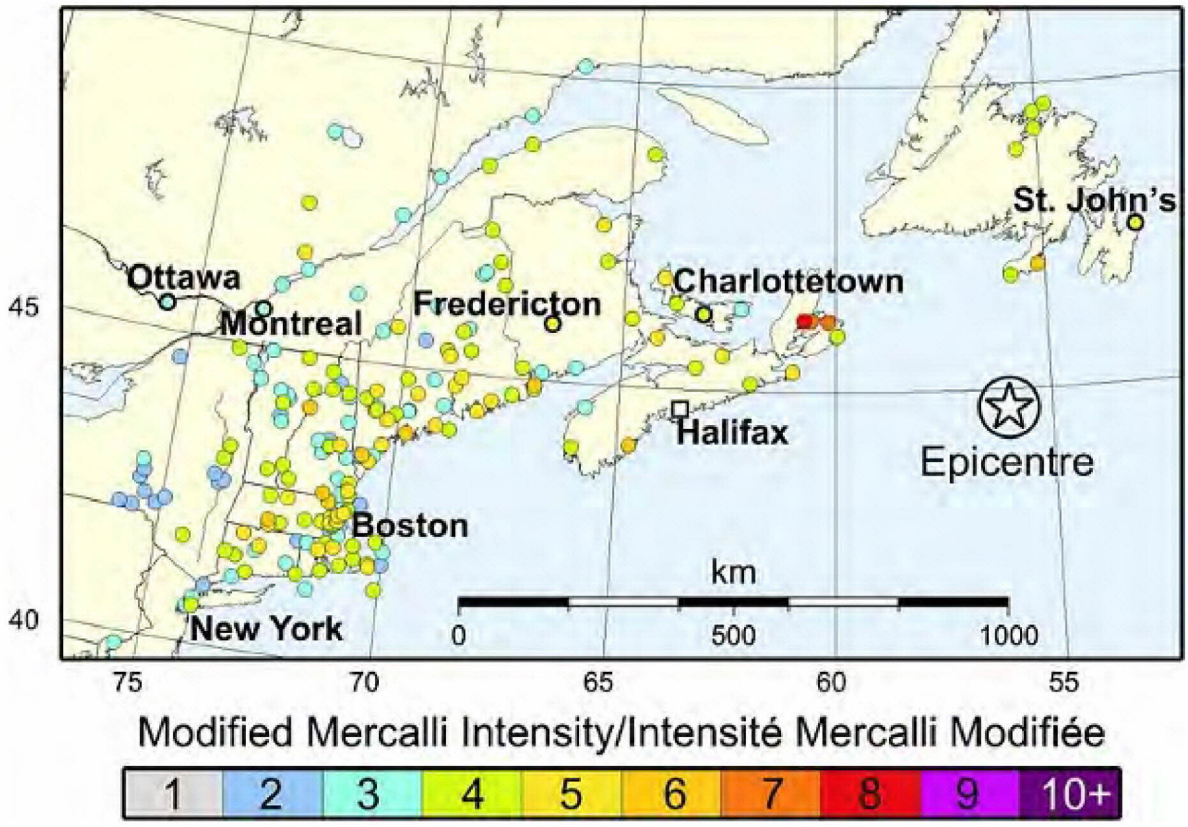


Figure 6.1-9:
Revised Modified Mercalli Intensities for the 1929 Grand Banks Earthquake

Source NRCan 2013c.

6.1.8 Isostatic Uplift and Subsidence

Sea level rise affecting coastal communities and ecosystems results from the combined effect of (a) increased global sea levels and (b) the added effect of regional or "isostatic" subsidence of the Earth's crust. Uplift and subsidence are the crust's secondary response to the removal through melting of the glaciers that covered much of Nova Scotia at the end of the last ice age, approximately 10,000 years ago.

At their peak, glaciers located centered in New Brunswick and Newfoundland reached several thousands of metres in thickness. The immense weight of these massive ice concentrations depressed the crustal rocks beneath them. At the same time as the crust beneath the glaciers was depressed, rocks further away from this centre of mass were flexed upward. The following analogy effectively describes this. The subsidence effect is similar to when a person sits upon a seat cushion: the cushion edge is displaced upward even as the centre of the cushion is pushed downward by the weight of the person. Once the weight of the glaciers was removed, the crust beneath the former glacier began to rise to its pre-glacial position, while the crust located further way began to subside as a secondary effect. This subsidence that followed isostatic rebound continues today. In much of Nova Scotia, crustal subsidence is exacerbating the effects of global sea level rise (Fader 2005; King and Fader 1988; Shaw *et al.* 2006).

6.1.9 Landslip Potential

No geotechnical analysis of the site specific conditions for future slope stability has been undertaken for this site. The granite proposed for use as aggregate is known to be highly resistant to fracture and slumping. The landslip potential is very low. The general lack of surficial deposits on the site limits the potential of these materials to fail (i.e., cause a landslide) during a seismic or heavy precipitation event. In addition, any surficial materials overlying the granite rocks will be stripped away prior to quarrying, and therefore will not be susceptible to slumping. Table 6.1-1: presents the geotechnical properties of the rock types found on the property.

Table 6.1-1:
Geotechnical Properties of Bedrock on the Property

Geologic Material	Density (pcf)	Compressive Strength psi x 1000	Permeability	Seismic Velocity fps x 1000
Igneous Intrusive	150-200	3-300	Low	12-20
Metamorphic High Grade	150-200	3-25	Low	12-20
	Excavation Difficulty	**Resistance to Weathering**	**Foundation Support**	**Stability in Cuts**
Igneous Intrusive	High	High	Good	Good
Metamorphic High Grade	High	High	Good	Good

Source: Koloski *et al.* 1989

As noted in Section 3.0, the crusher fines will be stored within the quarry itself. These materials are extremely stable when stockpiled. To ensure worker safety within the quarry, the stockpiles are designed to maintain their shape under all weather conditions. As described in Section 7.6, even if a waste rock pile were to slump, it would be entirely contained within the quarry.

6.2 Water Resources

6.2.1 Surface Water

Additional details of the baseline surface water environment are presented in the Surface Water Assessment Technical Report (**Appendix C**). A summary of the key findings is presented below.

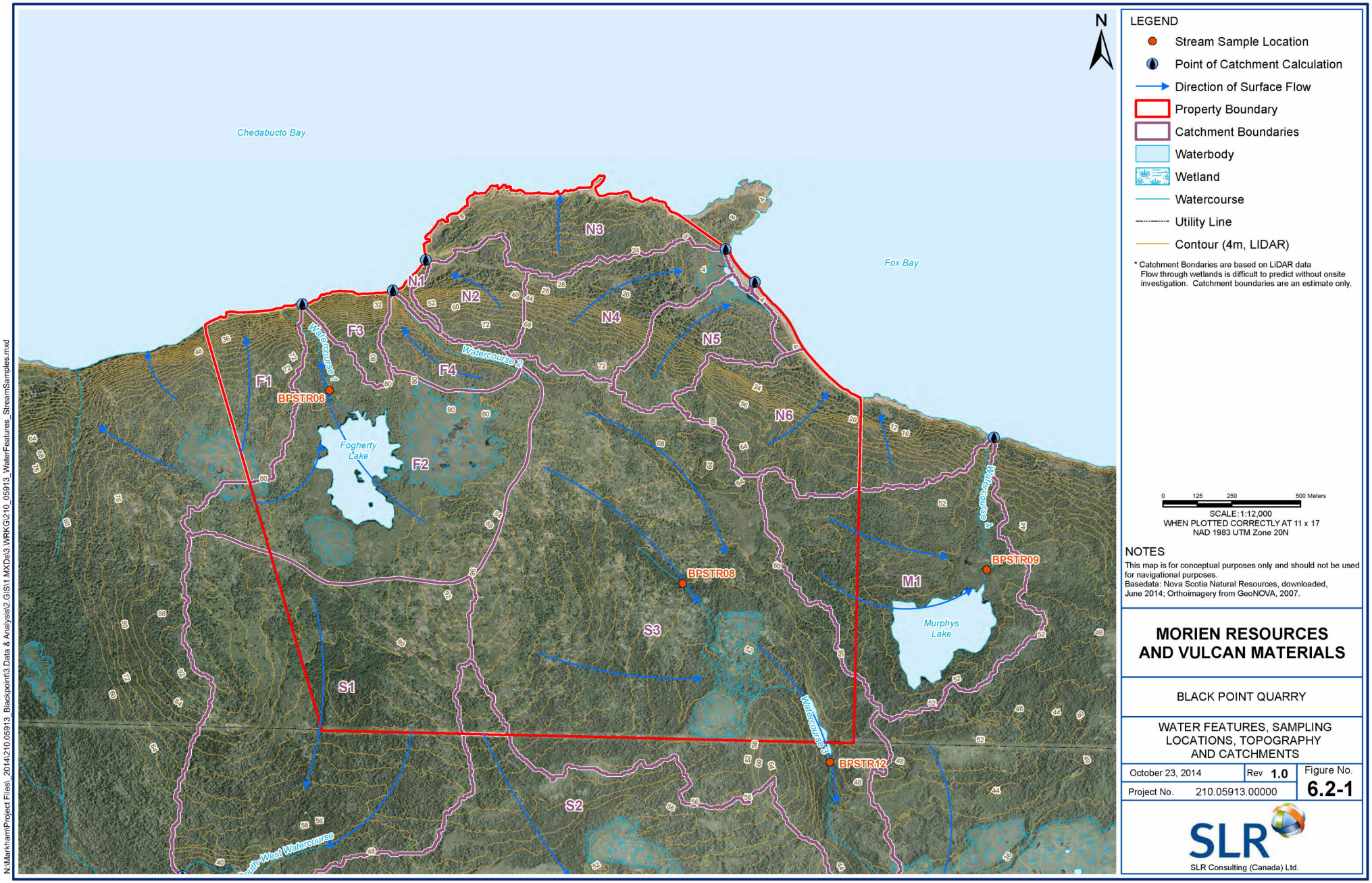
6.2.1.1 *Watersheds, Water Balance and Peak Flows*

The mean annual runoff for the site has been estimated using a water balance approach, taking account of rainfall and evaporation data (presented in Section 6.3) and an infiltration factor to estimate annual runoff. It is estimated that of the total 1426 mm of annual precipitation, 549 mm evaporates and 351 mm infiltrates into the ground, providing an annual runoff of 526 mm. This equates to 1 865 592 m^3 across the entire 354.5 ha site or an average flow of 59 L/s.

The Project site can be divided into 13 catchments, as shown in **Figure 6.2-1**, which drain to off-site watercourse systems (discussed in more detail in the following section) or directly to the ocean. The estimated mean annual for each catchment is presented in Table 6.2-1.

Table 6.2-1:
Catchment Areas and Mean Annual Runoff

Catchment	Flows To	Baseline Scenario (Pre Development)	
		Area (ha)	Mean Annual Runoff (m^3)
F1	Chedabucto Bay	14.4	75 573
F2	Chedabucto Bay (Through Fogherty Lake)	61.5	323 504
F3	Chedabucto Bay	5.8	30 387
F4	Chedabucto Bay	8.7	45 767
M1	Chedabucto Bay (Through Murphys Lake)	13.2	69 481
N1	Chedabucto Bay	1.0	5 401
N2	Chedabucto Bay	11.0	57 684
N3	Chedabucto Bay	19.9	104 481
N4	Chedabucto Bay	21.5	113 040
N5	Chedabucto Bay	14.4	75 632
N6	Chedabucto Bay	22.4	118 041
S1	Reynolds Brook	31.9	168 101
S2	Reynolds Brook	2.9	15 100
S3	Reynolds Brook	126.1	663 399
Total		**354.5**	**1 865 592**


N
LEGEND
Stream Sample Location
Point of Catchment Calculation
Direction of Surface Flow
Property Boundary
Catchment Boundaries
Waterbody
Wetland
Watercourse
Utility Line
Contour (4m, LIDAR)
* Catchment Bondaries are based on LiDAR data
Flow through wetlands is difficult to predict without onsite investigation. Catchment boundaries are an estimate only.
Chedabucto Bay
Fox Bay
Fogherty Lake
Murphys Lake
Watercourse 1
Watercourse 2
Watercourse 3
Watercourse 4
N1
N2
N3
N4
N5
N6
F1
F2
F3
F4
M1
S1
S2
S3
BPSTR06
BPSTR08
BPSTR09
BPSTR12
0 125 250 500 Meters
SCALE:1:12,000
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N
NOTES
This map is for conceptual purposes only and should not be used for navigational purposes.
Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.
MORIEN RESOURCES AND VULCAN MATERIALS
BLACK POINT QUARRY
WATER FEATURES, SAMPLING LOCATIONS, TOPOGRAPHY AND CATCHMENTS
October 23, 2014
Rev 1.0
Figure No. 6.2-1
Project No. 210.05913.00000
SLR
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Currently, precipitation falling on 54.7% of the site's surface area (193.8 ha) is directed by topography to the north, and discharges to Chedabucto Bay through surface water runoff and groundwater flow. This accounts for all precipitation (minus evapotranspiration) within catchment areas F1-F4, M1 and N1-N6. Some of these catchments, such as F2 and M1, provide surface water and shallow groundwater recharge to Fogherty and Murphys Lake, and the wetlands associated with these lakes. Flow from the remaining 45.4% of the site (160.7 ha) is directed south to wetlands and tributaries of Reynolds Brook.

Peak flows and flood volumes generated by the site during baseline and developed conditions were estimated using the SCS Method as presented in Surface Water Assessment Technical Report (**Appendix C**). As can be observed in the un-mitigated post-development scenario, peak flows will increase by 11% for a 1:25 year event and 8% for a 1:100 year event while the volume of runoff generated post development will be increased by 17% for a 1:25 year event and 13% for a 1:100 year event. Peak flows and flood volumes for the 25- and 100-year storms are given in Table 6.2-2.

Table 6.2-2:
Peak Flow Rates and Flood Volumes

Flood Hydrograph	1:25 years	1:100 years
Peak Flow (m^3/s)	47	62
Flood Volume (m^3)	258 000	341.000

6.2.1.2 *Site Watercourses*

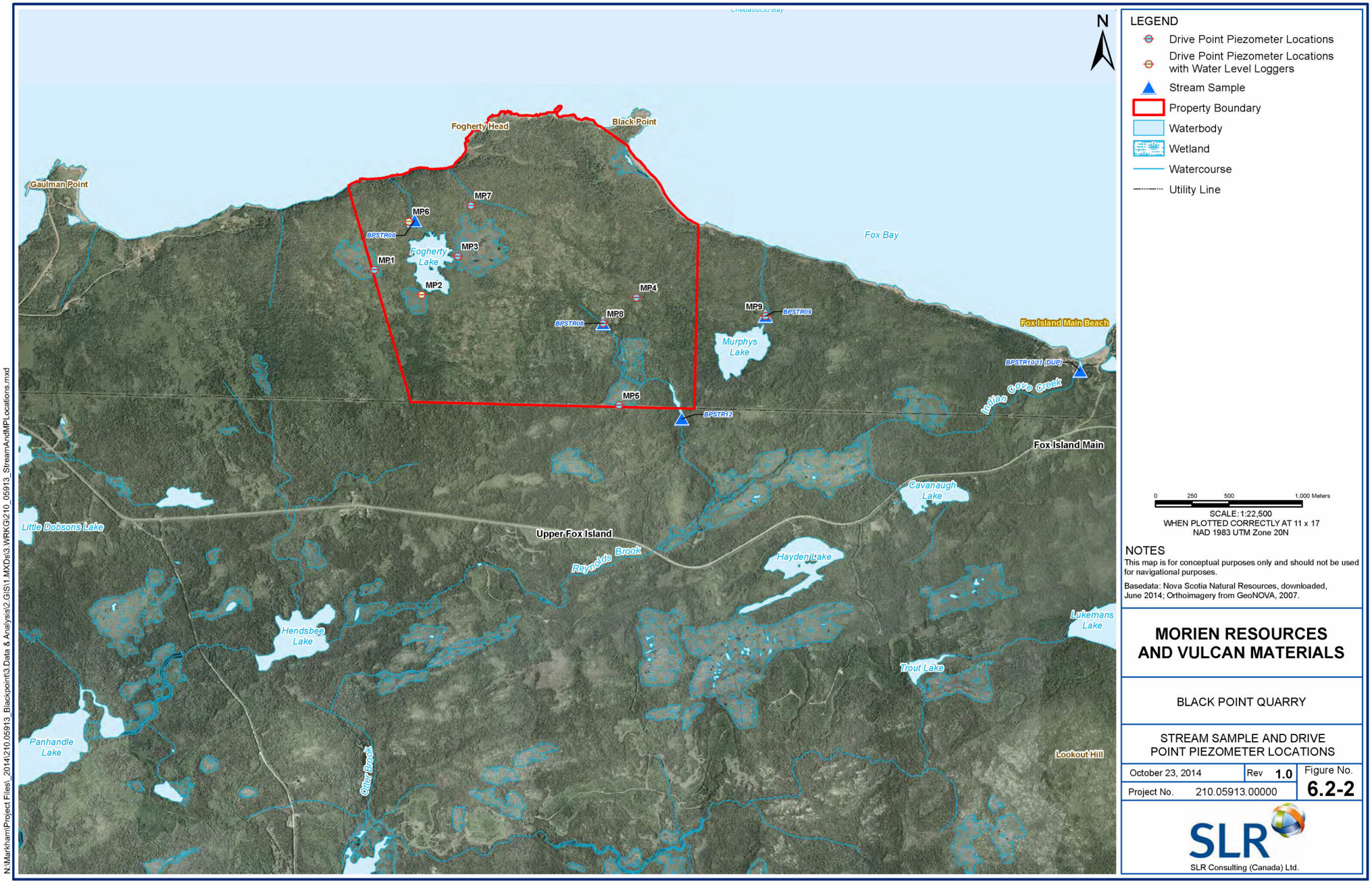
The site hosts numerous wetlands, Fogherty Lake, and three watercourses within the site boundary (**Figure 6.2-2**).

Fogherty Lake is a shallow waterbody surrounded by trees, barrens and exposed rock. The water is clear but darkly tea-coloured, and visibility is nil at approximately one metre depth. The lake substrate is exposed bedrock and large boulders. There is some woody organic debris on the lake bed, which has a strong sulfurous smell. Lake water is very acidic (field pH =2.94) (AMEC 2011 in **Appendix E**).

Three watercourses are identified within the site boundary and are described in full in AMEC's report (Appendix E), a summary of which follows:

- Watercourse 1 – which flows from Fogherty Lake north into Chedabucto Bay. A beaver dam is located near the upstream end of the watercourse. Upstream of the dam, the channel is deep and wide and the substrate largely consists of fines; downstream, the channel is a relatively narrow and shallow run with one area of natural deadwater. The northernmost 150 m of this watercourse was not surveyed, as it flows down a steep slope; however, the dimensions and substrate of the downstream reaches appeared to be similar to the run portions of the channel (AMEC 2011). Flow was measured (2014) and water quality monitored (2011, 2014) approximately 10 m downstream from the discharge of Fogherty Lake at location BPSTR06. The channel varied from approximately 0.50 to 1.0 m wide and had a moderate slope. The stream bed consisted of gravel with varied sized boulders scattered throughout.

- Watercourse 2 – flows within a steep valley from the centre of the site in a north-westerly direction into Chedabucto Bay. There was a great deal of deadfall in the channel valley. The upstream reaches were dry at the time of the 2011 survey, and further downstream the stream was very shallow; this watercourse is probably ephemeral. The stream was dry in July and August, 2014. The last 220 m of this watercourse was inaccessible, as it flows down a steep slope to the ocean, as does Watercourse 1; however, the dimensions and substrate of the downstream reaches appeared to be similar to the rest of the channel (AMEC 2011).



LEGEND

- Drive Point Piezometer Locations
- Drive Point Piezometer Locations with Water Level Loggers
- Stream Sample
- Property Boundary
- Waterbody
- Wetland
- Watercourse
- Utility Line

0 250 500 1,000 Meters

SCALE: 1:22,500
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

MORIEN RESOURCES AND VULCAN MATERIALS

BLACK POINT QUARRY

STREAM SAMPLE AND DRIVE POINT PIEZOMETER LOCATIONS

October 23, 2014	Rev 1.0	Figure No. 6.2-2
Project No. 210.05913.00000		

SLR Consulting (Canada) Ltd.

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- Watercourse 3 – flows south from the wetlands in the southeast part of the site, across the transmission line cut and towards another wetland system southeast of the site. This in turn is the headwaters of Reynolds Brook, which drains in a south-westerly direction, eventually discharging through Hendsbee and Cooeycoff Lakes into Tor Bay. The downstream portion of the assessed section of Watercourse 3 is a large pool resulting from a beaver dam on the watercourse constructed just south of the site property line. In 2014, flows were measured and water quality monitored at two locations; BPSTR12 which is downstream of wetland 17, and BPSTR08 which is upstream of wetland 17. This watercourse was also sampled in 2011. The discharge measurement at BPSTR12, also on Watercourse 3, was taken at the outflow of Wetland 1. The channel is 2.0 to 10.0 m wide with low, gradual banks, and moderate slope. The stream bed consisted primarily of a mix of small and large boulders. The discharge measurement was located at a narrow, well-contained section 1.0 m wide with large boulders on each side, and consistent flow throughout the section.

  The portion of Reynolds Brook nearest to the Property is located approximately 1.0 km southeast of the site. This point (the headwaters of Reynolds Brook) is marked by the discharge from a wetland located southeast of the Property beneath Route 16.

In addition to the abovementioned watercourses, the following significant off-site surface water resources are noted in close proximity to the site:

- South-West (off-site) Watercourse – ephemeral runoff from the south-west of the site drains towards a watercourse which flows to the south-west into Hendsbee Lake, approximately 1.3 km form the site.

- Murphys Lake (Sample ID BPSTR09) - runoff from the east of the site drains towards Murphys Lake which is located approximately 100 m east of the site. Murphys Lake drains to the north into Chedabucto Bay. The discharge measurement at BPSTR09 was measured approximately 20 m downstream from the discharge from Murphys Lake. The typical channel width was 1.0 m or less and had a moderate slope. The stream bed was muddy with fine gravel. The discharge measurement section was 0.80 m wide, had well-defined banks on each side, and had consistent flow throughout the entire section.

- Fox Island Main Creek (Sample ID BPRST10) - Fox Island Main creek drains a large wetland southeast of the Property and discharges north to Indian Cove approximately located 2.0 km east of the Property boundary. None of the surface water draining off the study Property feeds Fox Island Main Creek. Water samples and discharge measurements were taken approximately 10 m upstream from the bridge crossing at Starks Road, Fox Island Main. The typical full-bank channel width is approximately 3.0 m wide, with high banks and a moderate slope. The stream was in low-flow conditions at the time of July and August, 2014 measurements. The stream bed consisted of a mix of gravel and small boulders. The discharge measurement section was 1.1 m wide, well-defined with boulders at each bank, with flow concentrated primarily in middle of the cross-section and negligible at the banks.

- Reynolds Brook – As noted, Reynolds Brook is located south of Route 16 (Marine Drive) at least 1.0 km south of the Property and flows south-west into Hendsbee Lake. Reynolds Brook itself was not inventoried for the presence of fish, but Watercourse 3, which discharges into the wetland that feeds Reynolds Brook, does not support fish.

6.2.1.3 *Flow Measurements*

Shallow and low permeability soils and the numerous wetlands suggest that relatively low infiltration rates and therefore high runoff rates are typical across the site.

As presented in Table 6.2-3, flow measurements were taken in five watercourses at the end of July 2014 and end of August 2014 (**Appendix C**). The July flows were considered representative of dry (baseflow) conditions (no precipitation for the three days prior to measurements). These measurements show flow out of Fogherty Lake in Watercourse 1 to be 0.03 L/s and flow out of the southeast wetland in Watercourse 3 to be 7.7 L/s. The August flows were also considered representative of low flow conditions and measured flows were consistently lower than during the July round of measurements.

Table 6.2-3:
Stream Discharge Summary

Sample ID	Location Description	Discharge (L/s)	Dates Measured (2014)
BPSTR06	Fogherty Lake Outflow Watercourse 1	0.031 / 0	July 30 / Aug 27
None	Watercourse 2	0 / 0	July 30 / Aug 26
BPSTR08	Wetland 17 Inflow Watercourse 3 Upstream	0 / 0	July 30 / Aug 26
BPSTR09	Murphys Lake Outflow	0.170 / 0	July 31 / Aug 27
BPSTR12	Wetland 1 Outflow (Watercourse 3 downstream)	7.73 / 0.325	July 31 / Aug 27
BPSTR10	Fox Island Creek Outflow	4.24 / 0.394	July 25 / Aug 27

6.2.1.4 *Water Quality*

Surface water quality monitoring was undertaken at 5 locations on 31st July, 2014. These samples were intended to complement data collected in August and September, 2010 at many of the same sample locations, including Fogherty Lake (AMEC 2011 – **Appendix E**). The analytical results were compared against Canadian Water Quality Guidelines (CWQG) for the Protection for Aquatic Life (PAL) Freshwater Guideline Update 7.0 (CCME 2007). The results indicate:

- Laboratory-measured pH was low (4.33 – 4.70) in all 5 samples and is outside of the acceptable CWQG PAL guideline range (6.5-9.0).
- Lead slightly exceeded the CWQG PAL guidelines at two locations.
- Iron was elevated (320 – 1600 ug/L) in all 5 samples and exceeded the CWQG PAL guidelines (300 ug/L).
- Cadmium was above the CWQG PAL guidelines at one location (0.09 ug/L).
- Ammonia was elevated (0.08 – 0.086 mg/L) in 2 samples and exceeded the CWQG PAL guidelines (0.05 mg/L).
- Aluminium was elevated (270 – 820 ug/L) in all 5 samples and exceeded the CWQG PAL guidelines (5 ug/L).

The pH of surface water features is low and colour of water is typically dark brown, both characteristics are thought to be attributable to the peaty soils which are common across the site. The low pH is likely to be the cause of the elevated dissolved metals concentrations within

the samples. None of the on-site watercourses support fish habitat. Water quality data from 2010 and 2014 are presented in **Appendix C**.

6.2.1.5 *Surface Water Use*

No consumers of surface water were identified within two kilometers of the property boundary. As noted, the freshwater streams on the property, including Fogherty Lake, do not support fish populations and so are not used for recreational fishing. No industrial water taking occurs within two kilometers of the Project site. A Designated Water Supply Area (the Walsh or Wilkins Lake Water Supply Area) is located 4.5 km southeast of the property boundary. This water supply area is located within a separate watershed that does not receive surface water runoff from the Project site.

6.2.2 Water Supply Potential

Given the yields of wells in the vicinity of the Project (Section 6.2), groundwater is unlikely to yield sufficient water to meet development needs. Surface water bodies in the area are not suitable for processing water due to their acidity. In light of this, the Project will capture rainwater and snowmelt to meet water requirements.

The estimated mean annual runoff from the quarry and lower platform areas which will drain into the stormwater ponds and will be available for use in the processing plant and for dust suppression is estimated to be 1 248 202 m^3, which equates to an average flow of 3 420 m^3 per day during the fully developed site. However, runoff volumes will be lower during the initial stages of site development. Prior to excavation of the quarry, the mean annual runoff from the lower platform is expected to be 161 467 m^3 (442 m^3 per day). This volume will be sufficient, when stored to meet Project requirements, estimated at 315-378 m^3 per day for the expected 10-12 hrs of operation during Phase 1 and rising to about 3 859 m^3 per day during Phase 3.

6.2.3 Ground Water

The Project site is not equipped with municipal water or wastewater services. The nearest municipal water supply is located in Canso, approximately 10 km east of Black Point Quarry property. Residents in the communities of Fox Island Main, Upper Fox Island along Highway 16, and Half Island Cove, rely on groundwater wells for their potable water, and each house has a private septic system.

A residential well survey was conducted in July and August, 2014 to document the number of dug and drilled wells in the vicinity of the Project site, residential water quality, and water supply aquifer characteristics. This was combined with permeability testing undertaken on boreholes drilled in the granite proposed for aggregate use, and (as noted above) stream water sampling, stream flow measurements, installation of piezometers to evaluate discharge/recharge conditions in site wetlands, additional water samples taken from the granite boreholes and a number of water level measurements in these boreholes. The following sections provide information regarding groundwater conditions at and around the site, and describe the likely effects of the quarry on local groundwater supplies. Additional information regarding groundwater is found in the Hydrogeological Technical Report presented in **Appendix A**.

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Regional Groundwater Characteristics

The Nova Scotia Well Logs Database is a compilation of water supply well information provided to the province by licensed well drillers over the past several decades (NSE 2014a). The database typically contains information regarding well construction and lithology (rock types) but may also provide information on aquifer characteristics.

A total of 16 drilled wells are reportedly present within 2.0 km of the property boundaries. Most of these wells are located in Fox Island Main and along Highway 16 and were visited during the residential well survey. This information, combined with the residential well survey, provides a comprehensive data set regarding local water supply. Available data extracted from NSDNR's Interactive Groundwater Map (http://gis4.natr.gov.ns.ca/website/nsgroundwater) from the 16 drilled wells are presented on Table 6.2-4. No well logs data are available regarding dug wells.

Table 6.2-4:
Well Characteristics within Two Kilometres of the Property

Well Number	Address / Community	Depth (m)	Casing (m)	Depth to Bedrock (m)	Static Level (m)	Yield (Lpm)	Elevation (mASL)	Easting	Northing
10497	HALF ISLAND COVE	85.26	6.09	3.96	2.13	1.14	35	639500	5023500
840028	HALF ISLAND COVE	105.66	6.7	3.04	10.66	0.45	35	641188	5022332
840029	HALF ISLAND COVE	46.28	8.22	7.31	18.27	4.54	35	641188	5022332
870892	HALF ISLAND COVE	44.15	15.22	5.18	1.83	13.62	19	640500	5022500
891208	HALF ISLAND COVE	48.72	25.88	5.79	3.5	45.4	19	640500	5022500
980451	HALF ISLAND COVE	60.9	18.27	15.53	12.18	9.08	19	640500	5022500
62059	79 FOX ISLAND ROAD	103.53	7.92	6.09	6.09	1.14	15	648697	5022586
62060	79 FOX ISLAND ROAD	85.26	6.09	2.44	1.52	1.14	15	648690	5022586
62061	2238 HIGHWAY #16	85.26	19.79	18.57	-	-	34	650111	5022018
71270	169 FOX ISLAND ROA D	74.6	6.09	0.91	1.52	2.27	6	648809	5022942
810105	C/O HENRY DOBSON	90.44	6.7	3.35	3.04	4.54	35	641188	5022332
820027		75.46	6.7	3.35	1.22	6.81	33	647717	5022481
921506		38.06	8.83	7.92	6.09	18.16	30	649500	5022500
991271	FOX ISLAND	30.45	12.18	10.66	4.57	11.35	59	649500	5021500
111412	2290 HIGHWAY #16	50.24	18.27	15.83	3.04	13.62	38	649763	5022026
111413	3155 HIGHWAY #16 FOX ISLAND	62.42	15.22	11.88	3.04	22.7	35	644975	5019612
Average		68	12	7.6	5.2	10.4			

Table 6.2-4 indicates that surficial cover over bedrock is generally less than 10 m deep and drilled wells in the area typically range from 40 to 80 m deep (average 68 m). The water table is usually found about 5-6 m below ground surface.

Regionally, drilled well hydraulic characteristics are also reported in the database, for both metamorphic (Goldenville and Halifax Formation) and plutonic (granite) rocks (Table 6.2-5).

Table 6.2-5:
Drilled Groundwater Well Regional Hydraulic Characteristics

Region Name	Median Apparent Transmissivity (m2/day)	Median Q20 (Lpm)	Median Specific Capacity (m3/d/m)	Minimum Apparent Transmissivity (m2/day)	Maximum Apparent Transmissivity (m2/day)	Minimum Q20 (Lpm)	Maximum Q20 (Lpm)	Minimum Specific Capacity (m3/d/m)	Maximum Specific Capacity (m3/d/m)
Metamorphic	1.26	19.75	2.09	0.01	206.2	0.5	1801.11	0.01	448.29
Plutonic	1.43	22.7	2.47	0.06	320	1	1009	0.1	164.09

Similar hydraulic data are available on a regional basis for the surficial aquifer (Table 6.2-6).

Table 6.2-6:
Surficial Deposit Regional Hydraulic Characteristics

Groundwater Region Name	Median Apparent Transmissivity (m2/day)	Median Q20 (Lpm)	Median Specific Capacity (m3/d/m)	Minimum Apparent Transmissivity (m2/day)	Maximum Apparent Transmissivity (m2/day)	Minimum Q20 (Lpm)	Maximum Q20 (Lpm)	Minimum Specific Capacity (m3/d/m)	Maximum Specific Capacity (m3/d/m)
Glaciolacustrine/Till Plains/Colluvial	79.9	113.85	82.1	8.7	262.49	28.2	172.7	11.96	255.59

Both bedrock and surficial aquifers provide sufficient water quantities for residential use. Data from pumping tests completed in 1973 on two nearby wells are also reported from NSDNR's Interactive Groundwater Map Table 6.2-7. One well is located east of the site, at Sea Breeze Campground, and one is located west of the site, at the former Half Island Cove School near Dobson's Lake.

Table 6.2-7:
Pumping Test Data, 1973

Community	Test For	Formation	Depth (m)	Static (m)	Average Rate (m3/d)	Available Draw Down (m)	Max Draw Down (m)	Tapp (m2/d)	SC (m2/d)	Q20 (m3/d)	Q20 (l/min)	Easting	Northing
Fox Island Main	Sea Breeze	Goldenville	48.8	7.6	98.18	32	31.8	2.5	3.01	42.5	29.5	649076	5023051
Half Island Cove	School	Halifax	45.7	3	32.73	33.4	5.5	4.1	5.8	75.3	52.3	641188	5022332

Note: Tapp = apparent transmissivity; SC = specific capacity; Q20 = safe yield (20 year long-term yield)

The data indicate these two bedrock wells have intercepted significant water bearing fractures and are able to provide considerable volumes of water over the long term.

Regional groundwater chemistry for both bedrock and surficial deposits is presented in NSDNR's Interactive Groundwater Map. Table 6.2-8 presents bedrock water chemistry, which is generally based on over 200 water samples in the region. The rock type is reported as "metamorphic" indicating that these data were compiled from wells installed in Goldenville and Halifax Formation rocks, rather than the granite.

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Table 6.2-8:
Regional Bedrock and Surficial Aquifer Chemistry

	Groundwater (Bedrock)	Groundwater (Surficial)
HCO3 (mg/L)	63	39
Alk (mg/L)	65	37
Na (mg/L)	17	11
K (mg/L)	1.2	1.5
Ca (mg/L)	22.5	20.3
Mg (mg/L)	3.3	3.7
F (mg/L)	0.17	0.05
SO4 (mg/L)	11	11
Cl (mg/L)	16	18
Hrd (mg/L)	70.5	68.8
TDS (mg/L)	149	153.5
pH	7.7	6.9
NO3 - NO2N (mg/L)	0	0.4
As (ug/L)	1.45	1
U (ug/L)	0.3	0.2
Fe (ug/L)	125	50
Mn (ug/L)	65	13

Regional groundwater quality is similar for many parameters, with the notable exceptions of pH, which tends to be lower in surficial groundwater and metals, which are also lower in surficial aquifers. Bedrock groundwater tends to be "harder", containing more dissolved minerals and bicarbonate.

In addition, the Interactive Groundwater Map indicates that radionuclide potential is regionally "very likely" in granites and rocks immediately adjacent to granite in this area (i.e., within 1 km), and "likely" outside of this limit. Similarly, arsenic risk is regionally "very likely" throughout the area, from Canso to Queensport and beyond.

Residential Groundwater Characteristics

The objective of the residential well survey was to introduce the Project to residents living nearest to the site, respond to their questions, gather information regarding their well construction and water quality (to the extent this was known), collect water samples and undertake brief drawdown tests where permitted. The residential well survey included all residences at an approximate distance of 2 km west and south of the property, and all residences within about 3.5 km west of the site. This is referred to as "the vicinity of the Project" and includes all residences on Half Island Cove Road to the junction of Half Island Cove Wharf

Road; residences along Highway 16 between Route 316 and Fox Island Main Road; and residences along Fox Island Main Road and Starks Road in the community of Fox Island Main.

Of all the civic addresses visited in the vicinity of the Project, the majority (17 of 23 or 74%) obtain potable water from shallow dug wells excavated in surficial deposits. No surface water streams or lakes are used for potable water. A drilled well is present immediately south of the property boundary on Highway 16, while the remaining five drilled wells are located in Fox Island; three of these five wells are located east of Indian Cove, more than 3 km from the Property boundary. Sampled and non-sampled wells are summarized on Table 6.2-9.

Table 6.2-9:
Nearby Residential Wells

Map and Sample ID	UTM		Well Type	Notes
	Easting	Northing		
HALF ISLAND COVE ROAD AREA				
--	642692	5023616	?	Abandoned trailer
BPRWA002	642231	5023406	Dug	Dug well sample
BPRWA003	642232	5023505	Dug	Dug well sample / pumping test/logger left in unused well
BPRWA001	642088	5023441	Dug	Dug well sample / pumping test
--	642106	5023396	Dug	House is currently unoccupied
BPRWA004/5	642132	5023296	Dug	Dug well sample
--	642030	5023399	NA	Empty lot
--	642025	5023336	Dug	Abandoned trailer
BPRWA006	641731	5023150	Dug	Dug well sample
HIGHWAY 16 / UPPER FOX ISLAND AREA				
BPRWA013	643569	5021658	Dug	Dug well sample
BPRWA008	643589	5021745	Dug	Dug well sample
--	643696	5021694	Dug	Not home during well survey
BPRWA007	644835	5021376	Drilled	Drilled well sample / pump test
--	644710	5021586	Drilled	Drilled well sample - duplicate of above
BPRWA017	646643	5021585	Dug	Dug well sample
BPRWA014	647285	5021794	Dug	Dug well sample
BPRWA015	648538	5022253	Dug	Dug well sample
FOX ISLAND MAIN AREA				
BPRWA009/10	648615	5022586	Drilled	Drilled well sample
--			Dug	Not home during well survey
BPRWA016	648680	5022576	Drilled	Drilled well sample x 2 / pump test
--	648724	5022566	Dug	Not sampled; nearby wells are more representative
--	648782	5022762	Dug	Not home during well survey
--	648776	5022879	Drilled	Not sampled due to distance from site
--	648805	5022958	Drilled	Not home during well survey
BPRWA012	648466	5022724	Dug	Dug well sample
BPRWA011	649335	5023096	Drilled	Drilled well sample

Note: addresses are not given to protect privacy.

A total of 14 water samples (not including duplicates) were taken during the residential well survey. All targeted wells (defined as those closest to property boundary) were sampled, as well as additional well in the immediate vicinity. Samples were collected from 11 dug wells and 3 drilled wells, as shown on Table 6.2-9 above and on **Figure 6.2-3**.

Groundwater quality measured at residential wells is presented in Table 6.2-10.

Table 6.2-10 Residential Groundwater Quality

Sample Name				BPRWA001	BPRWA002	BPRWA003	BPRWA004	BPRWA005	BPRWA006	BPRWA007	BPRWA007_A	BPRWA007_B
			CDWQ	Dug Well Unfiltered	Dug Well Unfiltered	Dug Well Unfiltered	Dug Well Unfiltered	DUPLICATE of 004	Dug Well Unfiltered	Drilled Well Unfiltered	Filtered (Dissolved Values)	Unfiltered
Sample Date	**Unit**	**RDL**	**Guideline**	**16-Jul-14**	**16-Jul-14**	**16-Jul-14**	**17-Jul-14**	**17-Jul-14**	**17-Jul-14**	**17-Jul-14**	**28-Aug-14**	**28-Aug-14**
Field Parameters												
pH		---	---	6.57	7.52	6.15	6.33	---	6.67	7.53	---	---
Water Temperature	°C	---	---	12.8	15.1	15.7	12.1	---	17.3	12.6	---	---
Conductivity	µS/cm	---	---	140.0	272.0	398.0	108.0	---	257.0	354.0	---	---
% Dissolved Oxygen	%	---	---	---	---	---	---	---	---	---	---	---
Dissolved Oxygen	mg/L	---	---	---	---	---	---	---	---	---	---	---
General Chemistry												
pH[4]		n/a	NV	6.76	8.10	6.55	6.36	6.37	6.73	8.17	8.14	8.20
Reactive Silica as SiO2	mg/L	0.5	NV	6.9	9.1	4.6	6.9	6.9	5.7	11.0	10.0	10.0
Chloride	mg/L	---	NV	---	---	---	---	---	---	---	---	---
Dissolved Chloride (Cl)	mg/L	1.0	NV	37.0	15.0	32.0	12.0	12.0	12.0	14.0	14.0	14.0
Fluoride	mg/L	---	NV	---	---	---	---	---	---	---	---	---
Sulphate	mg/L	---	NV	---	---	---	---	---	---	---	---	---
Dissolved Sulphate	mg/L	2.0	NV	5.6	6.4	6.5	2.7	2.6	3.1	9.1	9.5	9.7
Alkalinity	mg/L	---	NV	31.0	95.0	30.0	6.4	6.6	17.0	100.0	100.0	100.0
True Color	TCU	50.0	NV	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Turbidity	NTU	0.1	NV	0.5	0.34	3.1	0.26	<0.10	0.28	0.82	0.42	0.69
Electrical Conductivity	umho/cm	1.0	NV	190.0	230.0	180.0	67.0	67.0	76.0	250.0	250.0	260.0
Nitrate + Nitrite as N	mg/L	0.05	NV	0.082	<0.050	<0.050	1.2	1.2	<0.050	0.059	0.066	0.065
Nitrate as N	mg/L	0.050	10	0.082	<0.050	<0.050	1.2	1.2	<0.050	0.059	0.066	0.065
Nitrite as N	mg/L	0.01	NV	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Ammonia as N	mg/L	0.05	NV	<0.050	<0.050	0.053	<0.050	<0.050	<0.050	<0.050	0.051	<0.050
Total Organic Carbon	mg/L	5.0	NV	0.71	0.56	1.4	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Ortho-Phosphate as P	mg/L	0.01	NV	<0.010	0.032	<0.010	0.025	0.027	<0.010	0.019	0.019	0.019
Total Sodium	mg/L	100.0	NV	17000.0	9500.0	14000.0	6800.0	6700.0	7000.0	31000.0	33000.0	32000.0
Total Potassium	mg/L	100.0	NV	1300.0	1100.0	5400.0	630.0	680.0	280.0	2300.0	2100.0	2100.0
Total Calcium	mg/L	100.0	NV	11000.0	26000.0	11000.0	2200.0	2200.0	6100.0	15000.0	15000.0	15000.0
Total Magnesium	mg/L	100.0	NV	4000.0	6400.0	2900.0	1600.0	1600.0	1100.0	4500.0	4600.0	4500.0
Biarb. Alkalinity (as CaCO3)	mg/L	1.0	NV	31.0	94.0	30.0	6.4	6.6	16.0	99.0	99.0	98.0
Carb. Alkalinity (as CaCO3)	mg/L	1.0	NV	<1.0	1.1	<1.0	<1.0	<1.0	<1.0	1.4	1.3	1.5
Hydroxide	mg/L	---	NV	---	---	---	---	---	---	---	---	---
Calculated TDS[5]	mg/L	1.0	NV	100.0	130.0	95.0	42.0	42.0	46.0	150.0	150.0	150.0
Hardness	mg/L	1.0	NV	44.0	91.0	39.0	12.0	12.0	20.0	57.0	57.0	57.0
Langelier Index (@ 20C)	NA	---	NV	-2.06	0.128	-2.28	-3.79	-3.76	-2.57	-0.017	-0.049	0.009
Langelier Index (@ 4C)	NA	---	NV	-2.31	-0.122	-2.53	-4.04	-4.01	-2.82	-0.268	-0.299	-0.241
Saturation pH (@ 20C)	NA	---	NV	8.82	7.987	8.83	10.1	10.1	9.3	8.19	8.19	8.19
Saturation pH (@ 4C)	NA	---	NV	9.07	8.22	9.08	10.4	10.4	9.55	8.44	8.44	8.44
Anion Sum	me/L	n/a	NV	1.79	2.47	1.64	0.61	0.61	0.74	2.59	2.59	2.60
Cation Sum	me/L	n/a	NV	1.63	2.26	1.55	0.55	0.55	0.71	2.55	2.62	2.62

Sample Name				BPRWA001	BPRWA002	BPRWA003	BPRWA004	BPRWA005	BPRWA006	BPRWA007	BPRWA007_A	BPRWA007_B
			CDWQ	Dug Well Unfiltered	Dug Well Unfiltered	Dug Well Unfiltered	Dug Well Unfiltered	DUPLICATE of 004	Dug Well Unfiltered	Drilled Well Unfiltered	Filtered (Dissolved Values)	Unfiltered
Sample Date	**Unit**	**RDL**	**Guideline**	**16-Jul-14**	**16-Jul-14**	**16-Jul-14**	**17-Jul-14**	**17-Jul-14**	**17-Jul-14**	**17-Jul-14**	**28-Aug-14**	**28-Aug-14**
Field Parameters												
% Difference / Ion Balance (NS)	%	n/a	NV	4.68	4.44	2.82	5.17	5.17	2.07	0.78	0.58	0.38
Total Suspended Solids	mg/L	---	NV	---	---	---	---	---	---	---	---	---
Total Phosphorus as P	mg/L	100.0	NV	<100.0	<100.0	<100.0	<100.0	110.0	<100.0	<100.0	<100.0	<100.0
Total Aluminum[3]	ug/L	5.0	NV	33.0	17.0	9.9	16.0	22.0	12.0	11.0	<5.0	5.7
Total Antimony	ug/L	1.0	6	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Arsenic	ug/L	1.0	10	<1.0	5.1	<1.0	<1.0	<1.0	<1.0	**50**	**46.0**	**48.0**
Total Barium	ug/L	1.0	1000	30.0	52.0	34.0	44.0	44.0	9.5	<1.0	<1.0	<1.0
Total Beryllium	ug/L	1.0	NV	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Bismuth	ug/L	2.0	NV	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Boron	ug/L	50.0	5000	<50.0	<50.0	<50.0	<50	<50.0	<50.0	60.0	58.0	59.0
Total Cadmium	ug/L	0.01	5	0.048	<0.010	0.034	0.025	0.022	<0.010	<0.010	<0.010	<0.010
Total Chromium	ug/L	1.0	50	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.3
Total Cobalt	ug/L	0.4	NV	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Total Copper	ug/L	2.0	NV	38.0	<2.0	160.0	24.0	24.0	180.0	<2.0	<2.0	3.6
Total Iron	ug/L	50.0	NV	160.0	<50.0	1200.0	<50.0	<50.0	92.0	82.0	<50.0	76.0
Total Lead	ug/L	0.5	10	0.64	<0.50	1.9	<0.50	<0.50	8.5	<0.50	<0.50	<0.50
Total Manganese	ug/L	2.0	NV	210.0	22.0	330.0	<2.0	<2.0	2.3	66.0	4.3	65.0
Total Molybdenum	ug/L	2.0	NV	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	7.1	7.3	7.3
Total Nickel	ug/L	2.0	NV	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2
Total Selenium	ug/L	1.0	10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Silver	ug/L	0.1	NV	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Strontium	ug/L	2.0	NV	30.0	51.0	52.0	13.0	14.0	25.0	98.0	100.0	100.0
Total Thallium	ug/L	0.1	NV	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Tin	ug/L	2.0	NV	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Titanium	ug/L	2.0	NV	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Uranium	ug/L	0.1	20	<0.10	0.25	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	<0.10
Total Vanadium	ug/L	2.0	NV	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Zinc	ug/L	5.0	NV	11.0	8.0	19.0	8.8	11.0	52.0	15.0	8.1	20.0
Mercury	mg/L	---	NV	---	---	---	---	---	---	---	---	---

NOTES:

NV = no value

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3. Aluminum Aesthetic Objective (CDWQ - AO): Conventional Treatment Plants = 0.1 mg/L (100 ug/L), Other Treatment Systems = 0.2 mg/L (200 ug/L)
4. pH Objective (CDWQ): 6.5 - 8.5
5. Calculated result only includes measured parameters. Actual TDS may be higher.
6. Sample results likely affected by water softner treatment system

BOLD RED Exceeds guideline

Sample Name			BPRWA008	BPRWA009	BPRWA010	BPRWA011	BPRWA012	BPRWA013	BPRWA014	BPRWA015[6]	BPRWA016[6]	BPRWA016	BPRWA017
			Dug Well Unfiltered	Drilled Well Unfiltered	DPLICATE of 009	Drilled Well Unfiltered	Dug Well Unfiltered	Dug Well Unfiltered	Dug Well Unfiltered	Dug Well Unfiltered	Drilled Well Unfiltered	DUPLICATE of 016 w/out Treat. Sys.	Dug Well Unfiltered
Sample Date	**Unit**	**RDL**	**17-Jul-14**	**17-Jul-14**	**17-Jul-14**	**17-Jul-14**	**18-Jul-14**	**22-Jul-14**	**25-Jul-14**	**30-Jul-14**	**31-Jul-14**	**29-Aug-14**	**29-Aug-14**
Field Parameters													
pH		---	6.79	6.56	---	6.28	5.99	6.72	6.62	---	7.46	---	7.68
Water Temperature	°C	---	19.7	12.6	---	14.3	18.9	16.4	17	---	10.7	---	14
Conductivity	µS/cm	---	---	---	---	104.0	260.0	240.0	165.0	---	249.0	---	197.0
% Dissolved Oxygen	%	---	---	---	---	---	---	---	---	---	---	---	---
Dissolved Oxygen	mg/L	---	---	---	---	---	---	---	---	---	---	---	---
General Chemistry													
pH[4]		n/a	7.12	6.66	6.80	6.50	5.95	7.68	6.83	7.41	7.37	7.51	7.9
Reactive Silica as SiO2	mg/L	0.5	9.6	4.9	4.9	22.0	8.0	11.0	5.7	13.0	19.0	4.8	11
Chloride	mg/L	---	---	---	---	---	---	---	---	---	---	---	---
Dissolved Chloride (Cl)	mg/L	1.0	16.0	10.0	9.9	21.0	25.0	15.0	9.8	94.0	21.0	40.0	12.0
Fluoride	mg/L	---	---	---	---	---	---	---	---	---	---	---	---
Sulphate	mg/L	---	---	---	---	---	---	---	---	---	---	---	---
Dissolved Sulphate	mg/L	2.0	5.1	3.3	3.4	3.9	7.0	5.6	3.9	6.2	12.0	2.9	4.9
Alkalinity	mg/L	---	49.0	15.0	14.0	30.0	10.0	52.0	36.0	100.0	93.0	94.0	99
True Color	TCU	50.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	8.2
Turbidity	NTU	0.1	1.2	<0.10	0.54	<0.10	13.0	0.37	0.19	1.2	<0.10	170.0	0.73
Electrical Conductivity	umho/cm	1.0	140.0	75.0	75.0	120.0	120.0	170.0	100.0	490.0	260.0	320.0	230.0
Nitrate + Nitrite as N	mg/L	0.05	<0.050	1.3	1.3	<0.050	0.067	1.1	<0.050	<0.050	<0.050	<0.050	0.16
Nitrate as N	mg/L	0.050	<0.050	1.3	1.3	<0.050	0.067	1.1	<0.050	<0.050	<0.050	<0.050	0.16
Nitrite as N	mg/L	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Ammonia as N	mg/L	0.05	0.056	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.38	<0.050
Total Organic Carbon	mg/L	5.0	60	0.99	1	0.52	1.4	0.64	1.2	0.95	0.79	3.6	0.75
Ortho-Phosphate as P	mg/L	0.01	<0.010	<0.010	<0.010	0.15	<0.010	0.012	<0.010	0.04	0.015	<0.010	0.012
Total Sodium	mg/L	100.0	9900.0	5800.0	5900.0	15000.0	15000.0	7700.0	5800.0	99000.0	57000.0		8200.0
Total Potassium	mg/L	100.0	1200.0	630.0	630.0	1200.0	660.0	930.0	650.0	<100.0	400.0		1800.0
Total Calcium	mg/L	100.0	15000.0	5900.0	6000.0	4200.0	2300.0	18000.0	13000.0	<100.0	<100.0	17000.0	34000.0
Total Magnesium	mg/L	100.0	2500.0	1300.0	1300.0	3400.0	2000.0	4500.0	1200.0	<100.0	<100.0	9500.0	4100.0
Biarb. Alkalinity (as CaCO3)	mg/L	1.0	49.0	15.0	14.0	30.0	10.0	51.0	36.0	99.0	93.0	94.0	98.0
Carb. Alkalinity (as CaCO3)	mg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Hydroxide	mg/L	---	---	---	---	---	---	---	---	---	---	---	---
Calculated TDS[5]	mg/L	1.0	89.0	46.0	46.0	89.0	70.0	99.0	62.0	270.0	160.0	170.0	140.0
Hardness	mg/L	1.0	47.0	20.0	20.0	25.0	14.0	64.0	38.0	<1.0	<1.0	82.0	100.0
Langelier Index (@ 20C)	NA	---	-1.36	-2.7	-2.58	-2.73	-4.02	-0.696	-1.81	---	---	-0.65	0.061
Langelier Index (@ 4C)	NA	---	-1.61	-2.96	-2.83	-2.99	-4.27	-0.947	-2.06	---	---	-0.9	-0.188
Saturation pH (@ 20C)	NA	---	8.48	9.36	9.38	9.23	9.97	8.37	8.64	---	---	8.16	7.84
Saturation pH (@ 4C)	NA	---	8.73	9.62	9.63	9.49	10.2	8.62	8.89	---	---	8.41	8.09
Anion Sum	me/L	n/a	1.54	0.74	0.72	1.28	1.07	1.66	1.07	4.78	2.69	3.08	2.44
Cation Sum	me/L	n/a	1.41	0.67	0.68	1.17	1.05	1.63	1.04	4.32	2.48	3.04	2.44

Sample Name			BPRWA008	BPRWA009	BPRWA010	BPRWA011	BPRWA012	BPRWA013	BPRWA014	BPRWA015[6]	BPRWA016[6]	BPRWA016	BPRWA017
			Dug Well Unfiltered	Drilled Well Unfiltered	DPLICATE of 009	Drilled Well Unfiltered	Dug Well Unfiltered	Dug Well Unfiltered	Dug Well Unfiltered	Dug Well Unfiltered	Drilled Well Unfiltered	DUPLICATE of 016 w/out Treat. Sys.	Dug Well Unfiltered
Sample Date	**Unit**	**RDL**	**17-Jul-14**	**17-Jul-14**	**17-Jul-14**	**17-Jul-14**	**18-Jul-14**	**22-Jul-14**	**25-Jul-14**	**30-Jul-14**	**31-Jul-14**	**29-Aug-14**	**29-Aug-14**
Field Parameters													
% Difference / Ion Balance (NS)	%	n/a	4.41	4.96	2.86	4.49	0.94	0.91	1.42	5.05	4.06	0.65	0
Total Suspended Solids	mg/L	---	---	---	---	---	---	---	---	---	---	---	---
Total Phosphorus as P	mg/L	100.0	110.0	<100.0	<100.0	280.0	<100.0	<100.0	110.0	<100.0	<100.0	<100.0	<100.0
Total Aluminum[3]	ug/L	5.0	94.0	21.0	21.0	16.0	46.0	15.0	83.0	6.3	6.9	<5.0	20.0
Total Antimony	ug/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Arsenic	ug/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	6.6	<1.0	<1.0	<1.0
Total Barium	ug/L	1.0	31.0	1.9	2.0	<1.0	9.0	24.0	7.7	<1.0	<1.0	3.9	19.0
Total Beryllium	ug/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	---
Total Bismuth	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	---
Total Boron	ug/L	50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0
Total Cadmium	ug/L	0.01	0.022	0.026	0.028	0.044	0.075	0.043	0.036	<0.010	<0.010	<0.010	<0.010
Total Chromium	ug/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Cobalt	ug/L	0.4	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.63	---
Total Copper	ug/L	2.0	150.0	260.0	280.0	51.0	120.0	5.2	8.4	<2.0	2.7	<2.0	<2.0
Total Iron	ug/L	50.0	140.0	<50.0	<50.0	<50.0	2900.0	<50.0	130.0	150.0	<50.0	<50.0	<50.0
Total Lead	ug/L	0.5	<0.50	6.0	7.0	<0.50	2.1	<0.50	0.81	<0.50	<0.50	<0.50	<0.50
Total Manganese	ug/L	2.0	3.3	16.0	13.0	13.0	290.0	<2.0	320.0	<2.0	4.9	1100.0	<2.0
Total Molybdenum	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Nickel	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	6.5	<2.0
Total Selenium	ug/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Silver	ug/L	0.1	<0.10	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10
Total Strontium	ug/L	2.0	33.0	44.0	45.0	24.0	15.0	46.0	29.0	<2.0	<2.0	57.0	93.0
Total Thallium	ug/L	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Tin	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Titanium	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Uranium	ug/L	0.1	0.11	<0.10	<0.10	1.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.65
Total Vanadium	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Zinc	ug/L	5.0	27.0	30.0	28.0	170.0	20.0	20.0	13.0	5.7	12.0	<5.0	<5.0
Mercury	mg/L	---	---	---	---	---	---	---	---	---	---	---	---

NOTES:

NV = no value

Canadian Drinking Water Quality CDWQ Guidelines: Aug 2012

3. Aluminum Aesthetic Objective (CDWQ - AO): Conventional Treatment Plants = 0.1 mg/L (100 ug/L), Other Treatment Systems = 0.2 mg/L (200 ug/L)
4. pH Objective (CDWQ): 6.5 - 8.5
5. Calculated result only includes measured parameters. Actual TDS may be higher.
6. Sample results likely affected by water softner treatment system

BOLD RED Exceeds guideline

Groundwater in the surficial deposits sampled in dug wells is generally high quality, with the only exceedances of the Canadian Drinking Water Quality (CDWQ) guidelines occurring in the aesthetic objective parameters iron, manganese and pH, and a small number of exceedances of the turbidity CDWQ guideline. The groundwater quality in the surficial deposits is indicative of recharge from rainfall having a short residence time in the subsurface, where fewer parameters have time to dissolve in the groundwater.

Groundwater in drilled wells is also generally of good quality with only one or two samples exceeding the aesthetic objectives for manganese and turbidity. Two samples plus a field duplicate from a single residential well[2] demonstrated arsenic concentrations which exceed the CDWQ Guideline. As noted above, the NSDNR Interactive Groundwater Map indicates that elevated arsenic concentrations are common in this region; in fact elevated arsenic in groundwater is well documented in the Goldenville Formation (Dummer *et al.* 2014).

Aggregate Granite Groundwater Characteristics

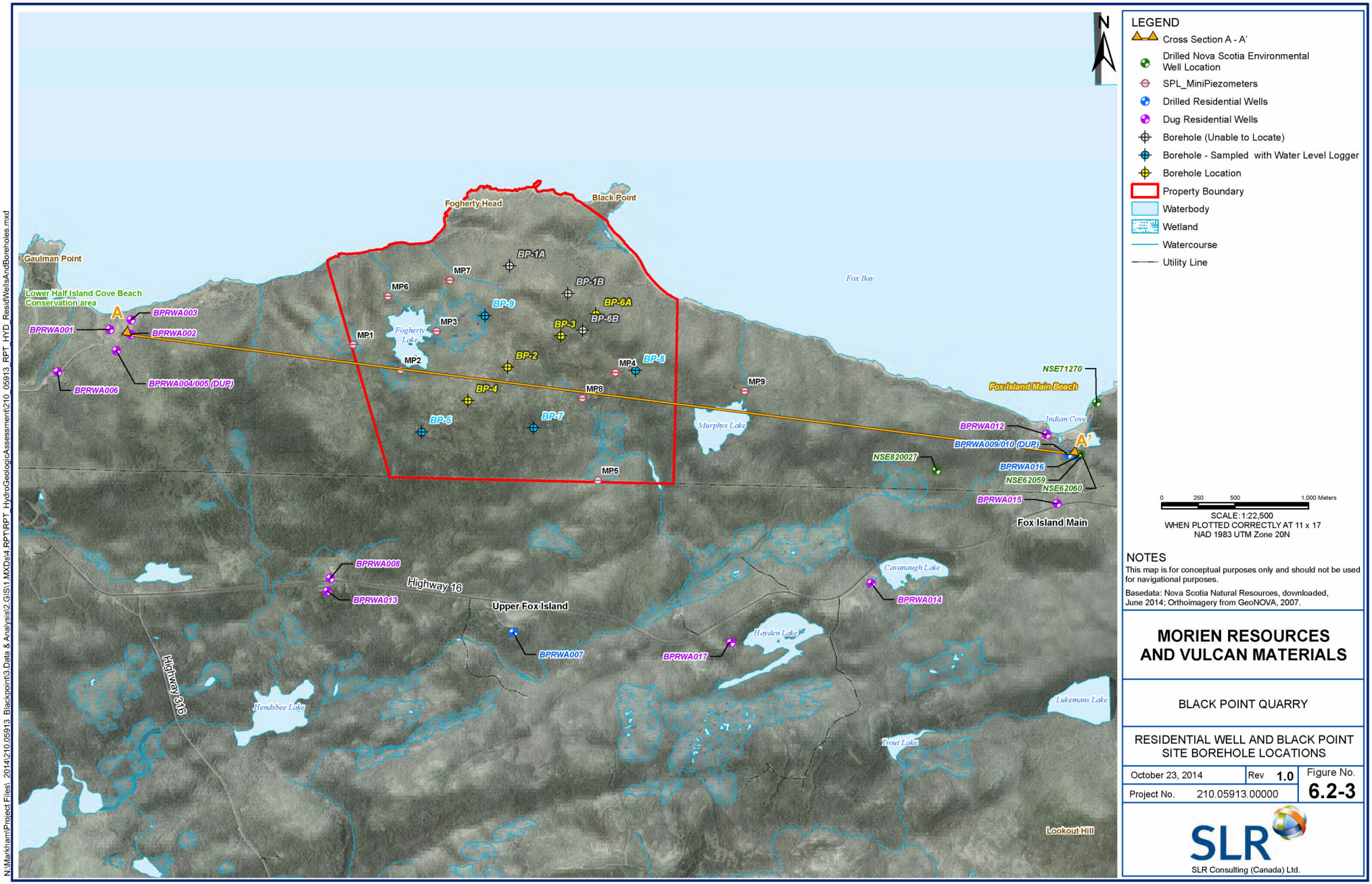
A total of 11 boreholes have been drilled within the granite to sample and asses the rock suitability as an aggregate source. Detailed drill logs describe the lithological and structural attributes encountered in the boreholes. Borehole depths ranged from 56 m to 136 m. Static water levels recorded in 2011 and 2014 are presented in Table 6.2-11.

[2] Address withheld for privacy considerations.

Table 6.2-11:
Static Water Levels

Borehole (Elevation)	Total Depth (m)[1]	Water Level (mbgs)	Water Level Elevation (masl)	Water Level (mTOC)	Water Level (mbgs)	Water Level Elevation (masl)	Water Level (mTOC)	Water Level (mbgs)	Water Level Elevation (masl)	Water Level (mTOC)	Water Level (mbgs)	Water Level Elevation (masl)
		14-Sep-11		5-Jun-14			21-Jul-14			25-Aug-14		
BP-1A (73 m)	100	2.79	70.21	-	-	-	-	-	-	-		
BP-6A (73 m)	56	4.65	68.35	n/a	3.73	69.27	n/a	4.01	68.99	n/a	4.64	68.36
BP-6B (69 m)	70	-	-	-	-	-	-	-	-	-	-	-
BP-1B (74 m)	80	-	-	-	-	-	-	-	-	-	-	-
BP-2 (82 m)	86	2.60	79.40	n/a	2.51	79.49	n/a	2.64	79.36	n/a	2.70	79.30
BP-3 (74 m)	60	3.15	70.85	n/a	3.12	70.88	n/a	3.27	70.73	n/a	3.39	70.61
BP-4 (100 m)	120	3.62	96.38	n/a	2.46	97.54	n/a	3.37	96.63	n/a	4.32	95.68
BP-5 (82 m)	89	2.89	79.11	n/a	2.33	79.67	n/a	2.33	79.67	n/a	3.54	78.46
BP-7 (70 m)	120	Drilled 2014	Drilled 2014	5.56	4.88	65.12		-0.68	70.68	6.37	5.69	64.31
BP-8 (58 m)	108	Drilled 2014	Drilled 2014	5.31	4.61	53.39	5.36	4.66	53.34	5.51	4.81	53.19
BP-9 (79 m)	130	Drilled 2014	Drilled 2014	6.17	5.49	73.51	6.3	5.62	73.38	6.57	5.89	73.11

Notes:
1: Data from boreholes logs;
n/a – not applicable / "-" no information available
masl = meters above sea level / mTOC – meters below top of casing / mgbs – meters below ground surface



LEGEND

- Cross Section A - A'
- Drilled Nova Scotia Environmental Well Location
- SPL_MiniPiezometers
- Drilled Residential Wells
- Dug Residential Wells
- Borehole (Unable to Locate)
- Borehole - Sampled with Water Level Logger
- Borehole Location
- Property Boundary
- Waterbody
- Wetland
- Watercourse
- Utility Line

0 250 500 1,000 Meters

SCALE: 1:22,500
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

MORIEN RESOURCES AND VULCAN MATERIALS

BLACK POINT QUARRY

RESIDENTIAL WELL AND BLACK POINT SITE BOREHOLE LOCATIONS

October 23, 2014	Rev 1.0	Figure No. 6.2-3
Project No. 210.05913.00000		

SLR Consulting (Canada) Ltd.

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As described in the Hydrogeological Technical Report (**Appendix A**), the granite bedrock is a crystalline rock with negligible primary porosity. Groundwater movement occurs within the joints and fractures. Analysis of fracture frequency reported in the drill logs indicates that the highest frequency of fractures within the granite occurs in the upper 40 m. Two fault zones were noted in the core logs for BP-8 and BP-9 and depending on their nature may act as preferential pathways or boundaries to groundwater flow. It appears that most groundwater flow occurs in the upper 40 m.

A number of slug and pumping and recovery tests were undertaken on granite core holes BP-5, BP-7, BP-8 and BP-9 (**Appendix A**). Initial slug tests indicated hydraulic conductivities of approximately 6×10^{-7} m/s to 7×10^{-7} m/s, however, later pumping and recovery tests indicated hydraulic conductivities of 2×10^{-7} m/s to 6×10^{-7} m/s. It is considered that the longer pumping and recovery tests give a better idea of the bulk granite properties due to their larger water level changes and radius of influence around the wells.

Groundwater samples were taken from four of the granite boreholes on two occasions. On the first occasion (June), a bailer was used to remove ten bailer volumes (approximately 10 L) of water prior to sampling. On the second occasion (August), an electric pump was used to withdrawn water from the well for approximately one hour before sampling. Field measurements (temperature, electrical conductivity and pH) were measured at 15 minute intervals to determine when to sample; when these parameters stabilized, water samples were taken[3]. Water quality results from both sampling events are presented in Table 6.2-12.

[3] Pumping parameters prior to sampling were: BH-5: 6.3 L/min for 135 min; BH-7: 5.7 L/min for 30 min; BH-8: 3.2 L/min for 135 min; BH-9: 2.6 L/min for 99 minutes.

Table 6.2-12 Granite Borehole Water Quality Results

Sample Name			BPBH05	BPBH05_2	BPBH07	BPB07_2	BPBH08	BPBH08_2	BPBH09	BPBH09_2
Location			Unfiltered	Unfiltered	Unfiltered	Unfiltered	Unfiltered	Unfiltered	Unfiltered	Unfiltered
Parameter	**Unit**	**RDL**	**22-Jul-14**	**27-Aug-14**	**23-Jul-14**	**28-Aug-14**	**23-Jul-14**	**28-Aug-14**	**23-Jul-14**	**28-Aug-14**
Field Parameters										
pH		---	---	5.6	---	6.9	---	6.4	---	6.9
Water Temperature	°C	---	---	9.2	---	11.4	---	9.5	---	9.6
Conductivity	µS/cm	---	---	38.7	---	83.8	---	80.0	---	118.5
% Dissolved Oxygen	%	---	---	---	---	---	---	---	---	---
Dissolved Oxygen	mg/L	---	---	---	---	---	---	---	---	---
General Chemistry										
pH [4]		n/a	5.05	5.85	6.51	6.82	6.48	6.80	6.70	6.92
Reactive Silica as SiO2	mg/L	0.5	9.6	14.0	18.0	21.0	23.0	24.0	27.0	27.0
Chloride	mg/L	---	---	---	---	---	---	---	---	---
Dissolved Chloride (Cl)	mg/L	1.0	9.3	8.7	11.0	11.0	10.0	9.6	13.0	14.0
Fluoride	mg/L	---	---	---	---	---	---	---	---	---
Sulphate	mg/L	---	---	---	---	---	---	---	---	---
Dissolved Sulphate	mg/L	2.0	<2.0	<2.0	2.9	<2.0	2.8	2.5	<2.0	<2.0
Alkalinity	mg/L	---	<5.0	<5.0	18.0	38.0	29.0	38.0	41.0	54.0
True Color	TCU	50.0	110.0	99.0	210.0	140.0	<5.0	<5.0	62.0	130.0
Turbidity	NTU	0.1	40.0	6.0	19.0	17.0	39.0	3.2	37.0	7.6
Electrical Conductivity	umho/cm	1.0	46.0	55.0	84.0	120.0	92.0	110.0	120.0	140.0
Nitrate + Nitrite as N	mg/L	0.05	0.11	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Nitrate as N	mg/L	0.050	0.11	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Nitrite as N	mg/L	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Ammonia as N	mg/L	0.05	0.072	0.060	<0.050	<0.050	<0.050	<0.050	0.15	0.19
Total Organic Carbon	mg/L	5.0	13.0 (1)	7.9	10.0 (1)	9.5	1.4	0.87	5.2 (1)	11.0
Ortho-Phosphate as P	mg/L	0.01	0.013	0.061	0.065	0.041	0.12	0.16	0.14	0.30
Total Sodium	mg/L	100.0	6700.0	6300.0	11000.0	14000.0	12000.0	10000.0	15000.0	17000.0
Total Potassium	mg/L	100.0	1100.0	370.0	2700.0	1900.0	2200.0	880.0	4600.0	4500.0
Total Calcium	mg/L	100.0	740.0	2000.0	3300.0	5900.0	5800.0	6800.0	3400.0	5800.0
Total Magnesium	mg/L	100.0	660.0	750.0	1900.0	2400.0	2300.0	3200.0	1900.0	2500.0
Biarb. Alkalinity (as CaCO3)	mg/L	1.0	<1.0	<1.0	18.0	38.0	29.0	38.0	41.0	54.0
Carb. Alkalinity (as CaCO3)	mg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Hydroxide	mg/L	---	---	---	---	---	---	---	---	---
Calculated TDS [5]	mg/L	1.0	35.0	33.0	65.0	79.0	83.0	82.0	100.0	110.0
Hardness	mg/L	1.0	4.6	8.0	16.0	25.0	24.0	30.0	16.0	25.0
Langelier Index (@ 20C)	NA	---	---	---	---	-2.16	---	-2.12	---	-1.94
Langelier Index (@ 4C)	NA	---	---	---	---	-2.41	---	-2.37	---	-2.19
Saturation pH (@ 20C)	NA	---	---	---	---	8.98	---	8.92	---	8.86
Saturation pH (@ 4C)	NA	---	---	---	---	9.23	---	9.17	---	9.11
Anion Sum	me/L	n/a	0.27	0.25	0.75	1.07	0.95	1.10	1.21	1.49
Cation Sum	me/L	n/a	0.64	0.46	0.95	1.16	1.28	1.08	1.4	1.56

Sample Name			BPBH05	BPBH05_2	BPBH07	BPB07_2	BPBH08	BPBH08_2	BPBH09	BPBH09_2
Location			Unfiltered	Unfiltered	Unfiltered	Unfiltered	Unfiltered	Unfiltered	Unfiltered	Unfiltered
Parameter	Unit	RDL	22-Jul-14	27-Aug-14	23-Jul-14	28-Aug-14	23-Jul-14	28-Aug-14	23-Jul-14	28-Aug-14
% Difference / Ion Balance (NS)	%	n/a	40.7	29.6	11.8	4.04	14.8	0.92	7.28	2.3
Total Suspended Solids	mg/L	---	---	---	---	---	---	---	---	---
Total Phosphorus as P	mg/L	100.0	340.0	110.0	270.0	<100.0	820.0	200.0	420.0	310.0
Total Aluminum [3]	ug/L	5.0	2900.0	430.0	2700.0	510.0	3000.0	<5.0	1200.0	1000.0
Total Antimony	ug/L	1.0	2.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Arsenic	ug/L	1.0	9.5	4.8	39.0	16.0	2.1	1.0	31.0	60.0
Total Barium	ug/L	1.0	15.0	1.5	10.0	3.4	17.0	<1.0	14.0	15.0
Total Beryllium	ug/L	1.0	<1.0	<1.0	1.4	<1.0	<1.0	<1.0	<1.0	<1.0
Total Bismuth	ug/L	2.0	<2.0	<2.0	2.1	<2.0	<2.0	<2.0	<2.0	<2.0
Total Boron	ug/L	50.0	<50.0	<50.0	<50.0	<50.0	<50	<50.0	<50.0	<50.0
Total Cadmium	ug/L	0.01	0.35	0.47	1.8	1.1	0.17	0.074	0.11	0.043
Total Chromium	ug/L	1.0	18.0	<1.0	4.2	<1.0	9.4	<1.0	5.0	<1.0
Total Cobalt	ug/L	0.4	1.7	2.7	11.0	7.2	0.65	<0.40	3.1	1.60
Total Copper	ug/L	2.0	15.0	11.0	130.0	110.0	61.0	<2.0	22.0	11.0
Total Iron	ug/L	50.0	6100.0	290.0	2700.0	350.0	6600.0	<50.0	8200.0	4900.0
Total Lead	ug/L	0.5	7.3	0.71	5.7	0.9	48.0	<0.50	2.6	2.9
Total Manganese	ug/L	2.0	150.0	910.0	400.0	420.0	240.0	1100.0	1400.0	1900.0
Total Molybdenum	ug/L	2.0	3.9	<2.0	13.0	9.5	3.6	<2.0	7.0	14.0
Total Nickel	ug/L	2.0	3.0	<2.0	11.0	11.0	2.7	<2.0	4.9	2.7
Total Selenium	ug/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Silver	ug/L	0.1	73.0	0.64	75.0	6.7	17.0	<0.10	4.5	0.45
Total Strontium	ug/L	2.0	4.7	14.0	22.0	50.0	20.0	23.0	20.0	47.0
Total Thallium	ug/L	0.1	<0.10	<0.10	0.13	<0.10	<0.10	<0.10	<0.10	<0.10
Total Tin	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Titanium	ug/L	2.0	35.0	2.2	59.0	8.0	24.0	<2.0	22.0	18.0
Total Uranium	ug/L	0.1	17.0	47.0	260.0	430.0	14.0	4.2	20.0	37.0
Total Vanadium	ug/L	2.0	2.5	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Zinc	ug/L	5.0	390.0	130.0	1800.0	710.0	580.0	190.0	1500.0	350.0
Mercury	mg/L	---	---	---	---	---	---	---	---	---

Notes:

NV = no value; "--" = not measured

5. Calculated result only includes measured parameters. Actual TDS may be higher.

In general, groundwater in the granite exhibits elevated concentrations of metals such as aluminium, iron, manganese, lead, arsenic and uranium when compared to surface water samples. The parameter pH was low in two of eight samples (ranging from 5.05 to 5.85), indicating neutral to slightly acidic conditions within the granite. The reported arsenic and uranium concentrations are considered background levels: regional maps prepared by the province indicate that elevated concentrations of arsenic are considered very likely in the area (NSE 2005) and uranium is considered most likely to occur in areas containing granitic intrusions (NSE 2014b). Background uranium concentrations in the granite bedrock are described in Section 6.1.5.

Discharge and Recharge

Nested-pair or single drive point mini-piezometer (MP) pairs are currently in use at nine locations to determine groundwater recharge and discharge on the Property. Five piezometer installations, including piezometers MP1, MP2 and MP5 installed in wetlands, along with streams at locations MP6 and MP8 indicate downward gradients which suggest aquifer recharge is occurring at these locations. Upward vertical gradients measured at wetland areas MP3, MP4 and MP7, along with the stream at MP9 indicate that discharge from the aquifer is occurring at these locations.

6.3 Atmospheric Resources

6.3.1 General Climate and Weather Patterns

The climate of Nova Scotia is generally moderate and moist due to the surrounding bodies of water (Gulf of St. Lawrence to the north, Bay of Fundy to the west, and Atlantic Ocean to the south and east). During the summer, Nova Scotia experiences warm temperatures with winds originating from the south. This is attributed to high pressure systems moving up the Atlantic Coast from the tropics. In the winter westerly and northwesterly winds bring cold air from the northern interior of Canada to Nova Scotia.

Historical climate records were obtained from weather stations near the proposed Project site. The following Meteorological Service of Canada (MSC) weather stations were considered to represent the Project site.

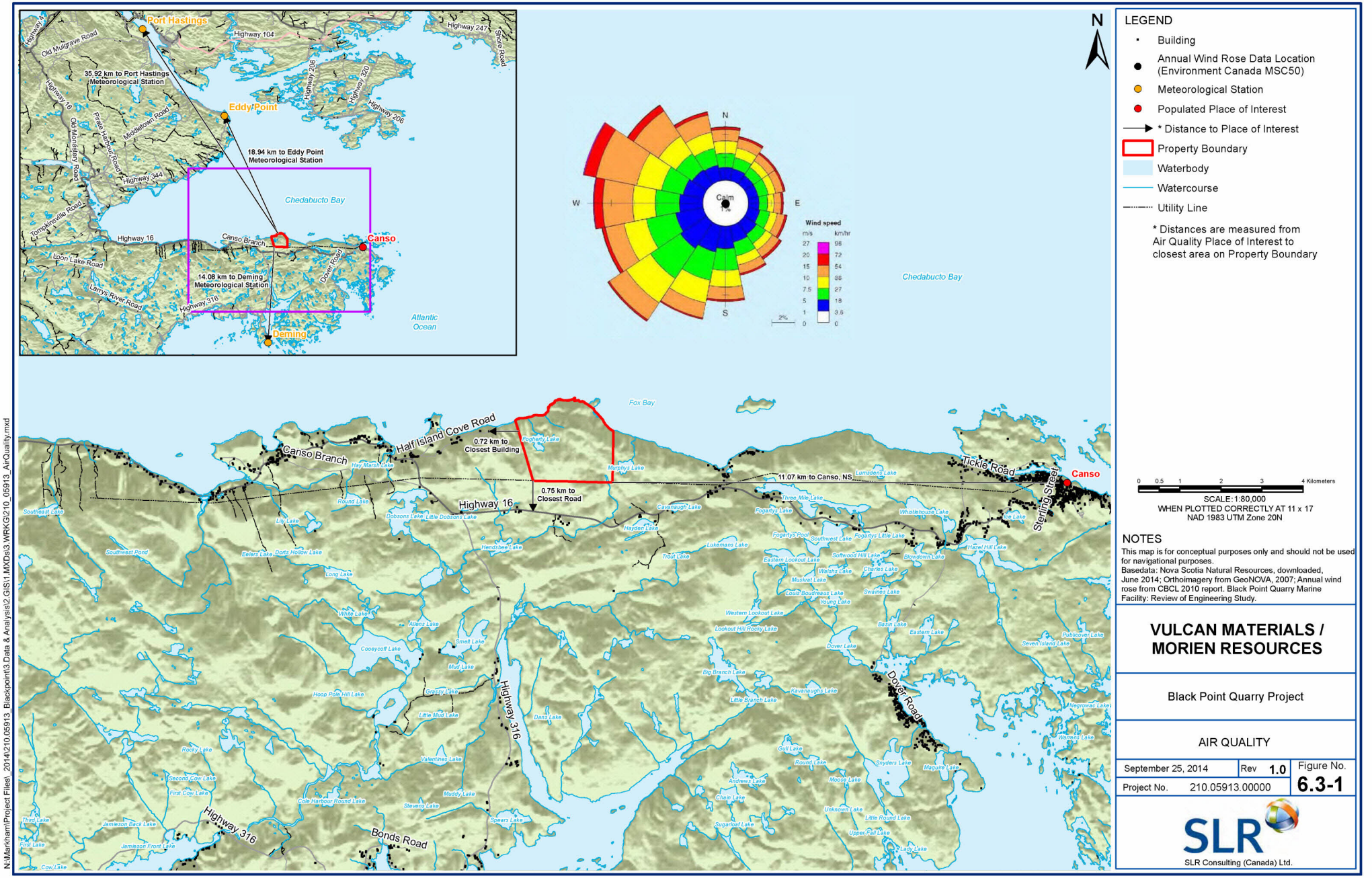
- Deming, N.S. [45°12’59.007”N, 61°10’40.090”W];
- Port Hastings, N.S. [45°38’00.000”N, 61°24’00.000”W];
- Eddy Point, N.S. [45°31'00.000" N, 61°15'00.000" W].

A map of the surrounding area showing the location of each meteorological station is provided as **Figure 6.3-1**. The approximate distance to these stations from the Project site is 19.8 km northwest for Eddy Point, 15 km southwest for Deming Point, and 37 km northwest for Port Hastings. Although the data accumulated from Eddy Point are older, it is more representative of the Project site due to its location on the coast of the Chedabucto Bay. None of these weather stations currently collect climatic data. Table 6.3-1 summarizes climate data collected from these stations.

Table 6.3-1:
Climate Near the Project Site

Weather Stations	Eddy Point, N.S. 1951-1980	Deming, N.S. 1981-2010	Port Hastings, N.S. 1971-2000
Coordinates	45°31'00.000" N, 61°15'00.000" W	45°12'59.007"N, 61°10'40.090"W	45°38'00.000"N, 61°24'00.000"W
Elevation	66.10m	15.80m	23.10m
Daily Max Temperature [°C]	9.9	9.1	10.5
Daily Min Temperature [°C]	2.4	3.1	2.2
Daily Mean Temperature [°C]	6.1	6.1 +/- 1.6	6.4 +/- 0.6
Extreme Max Temperature [°C]	33.3	31.1[06/22/1976]	37.2 [07/29/1892]
Extreme Min Temperature [°C]	-25.6	-25 [02/13/1967]	-26.7 [02/03/1897]
Rainfall [mm]	1081.4	1320.8	1357.0
Snow [cm]	279.6	119.7	182.1
Extreme Snow Depth [cm]	---	86 [03/01/1962]	157 [03/17/1987]
Precipitation [mm]	1349.3	1440.5	1538.5
Extreme Daily Snow [cm]	63.0	28.2 [12/28/1977]	63.5 [12/30/1890]
Extreme Daily Rainfall [mm]	78.6	115.6 [11/18/1976]	127.8 [08/30/1968]

Source: EC: Atmospheric Environment Branch, Canadian Climate Normals (EC 2009 and EC 2015).



LEGEND

- Building
- Annual Wind Rose Data Location (Environment Canada MSC50)
- Meteorological Station
- Populated Place of Interest
- * Distance to Place of Interest
- Property Boundary
- Waterbody
- Watercourse
- Utility Line

* Distances are measured from Air Quality Place of Interest to closest area on Property Boundary

0 0.5 1 2 3 4 Kilometers

SCALE: 1:80,000
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.
Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007; Annual wind rose from CBCL 2010 report. Black Point Quarry Marine Facility: Review of Engineering Study.

VULCAN MATERIALS / MORIEN RESOURCES

Black Point Quarry Project

AIR QUALITY

September 25, 2014	Rev 1.0	Figure No. 6.3-1
Project No. 210.05913.00000		

SLR Consulting (Canada) Ltd.

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6.3.1.1 *Temperature and Precipitation Normals and Extremes*

It is assumed that the climate normals for Deming, which is 15 km southwest of the Project site, are generally representative of the climate at the Project site. The design of mitigation measures and assessment of impacts are not heavily influenced by slight changes in climate normal, as would be expected from slightly longer data records. Temperature and precipitation normals recorded at the Deming, N.S. weather station are shown in Table 6.3-2. The extreme temperatures (i.e., weather events occurring <5% of the time) recorded by this weather station ranged from -25°C and +31.1°C.

At Eddy Point approximately 20 km northwest of the site, freezing rain and snowfall amounts are highest between the months of October and May, with December through to March are typified by the heaviest precipitation events (EC 2014a). According to monthly totals recorded for the years 1951-1980, Eddy Point typically experiences monthly rainfall amounts ranging from a low of approximately 89 mm to a high of approximately 165 mm, while Deming records from 75 mm to 145.2 mm (1981-2010).

More recent temperature data from the Hart Island station (45°21'00.000" N, 60°59'00.000" W) near Canso, N. S. are presented in Table 6.3-3. This station is located approximately 13.9 km east of the Project site. However, the precipitation data were not available for the Hart Island station.

Table 6.3-2:
Climate Data From Deming, N.S. (1981-2010)

Parameters	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Year
Temperature													
Daily Maximum [°C]	-0.5	-0.9	1.3	5.3	9.7	14.3	17.9	20.2	18.1	12.8	7.6	2.7	9.1
Daily Minimum [°C]	-7.4	-7.3	-4.3	-0.2	3.5	7.9	12.2	14.6	12.2	7.3	2.3	-3.3	3.1
Daily Mean [°C]	-4.0	-4.1	-1.5	2.6	6.6	11.1	15.1	17.4	15.2	10.1	5.0	-0.3	6.1
Extreme Maximum [°C]	10.5	10.0	11.0	20.0	24.0	31.1	30.0	28.5	26.1	21.7	19.4	12.2	
Extreme Minimum [°C]	-25.0	-25.0	-19.0	-11.0	-3.5	-0.6	4.4	4.4	2.0	-4.4	-12.0	-23.5	
Precipitation													
Mean Rainfall (mm)	85.6	75.0	97.6	128.1	116.6	100.4	101.8	100.9	114.8	144.2	142.8	113.0	1320.8
Mean Snowfall (mm)	30.4	28.9	22.4	10.4	0.7	0.0	0.0	0.0	0.0	0.0	5.2	21.6	119.7
Total Precipitation (mm)	116.1	103.9	120.0	138.5	117.3	100.4	101.8	100.9	114.8	144.2	148.0	134.6	1440.5
Extreme Daily Rainfall (mm)	59.7	60.0	87.8	114.0	86.9	55.9	95.0	90.7	103.6	100.2	115.6	67.3	
Extreme Daily Snowfall (mm)	26.0	28.0	22.9	27.9	8.9	0.0	0.0	0.0	0.0	2.5	17.0	28.2	
Extreme Daily Precipitation (mm)	59.7	65.0	87.8	114.0	86.9	55.9	95.0	90.7	103.6	100.2	115.6	67.3	

Source: http://climate.weather.gc.ca/climate_normals/results_1981_2010_e.html?stnID=6336&autofwd=1

Table 6.3-3:
Temperature Data at Hart Island, N.S. 2013

Parameters	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Daily Maximum [°C]	10.4	6.9	7.4	11.1	23	25.8	29.8	23.8	23	19.5	16.7	9.5
Daily Minimum [°C]	-19.9	-16	-10.7	-3.7	0.2	7.1	11.7	12.3	7.7	1.3	-6.1	-15
Daily Mean [°C]	-4.6	-2.5	0.0	3.0	8.2	13.1	19.0	18.2	15.5	10.8	4.9	-1.6

Source: Atmospheric Environment Branch. Canadian Climate Normals 1951-1980. (MSC 2002)

6.3.2 Wind Normals and Extremes

Sea breezes, a wind that blows inland from the ocean at typically low wind speeds, are common along coastal regions of the province. This is due to the difference in solar insulation of land and ocean surfaces. As the land and ocean absorbs heat from the sun, warmed air rises from these surfaces which lower the pressure. The air above the surface of the ocean warms more slowly than the land, so air pressure over the ocean is higher than air pressure over the land. Wind will naturally blow from areas of higher surface pressure to lower surface pressure resulting in daytime sea breezes. The reverse can occur at night, but due to the cold coastal waters, these "land breezes" do not typically occur in Nova Scotia. Sea breezes are light in nature and accordingly will only have minimal impact on the quarry and marine facility. In addition, sea breezes, which are most common from May to October, generally come from the southwest and therefore the marine terminal will be in the lee of the land, further reducing the impact from breezes.

During the winter season, the wind typically comes from the west and northwest at an average speed of 22 km/h. In the summer, the wind typically blows from the south and southwest with an average speed of 10-15 km/h (EC 2006a). Chedabucto Bay often experiences easterly gales since the wide entrance to the Bay faces the open ocean in an easterly direction. The average and extreme wind speed and directional values are displayed in Table 6.3-4.

Table 6.3-4:
Wind Statistics, Eddy Point NS.

Month	Average Speed (km/h)	Most Frequent Direction	Extreme Hourly Speed (km/h)	Direction	Extreme Gust Speed (km/h)	Direction
January	19.5	W	70	SSE	97	ENE
February	19.4	NW	64	NNW	106	WNW
March	19.1	NW	77	W	130	SW
April	16.6	NW	71	E	93	E
May	15.6	NW	55	NE	85	S
June	14.1	S	64	SVL	89	NNE
July	13.2	Calm	60	S	87	S
August	12.7	Calm	44	SSW	65	NW
September	14.7	S	50	WNW	89	W
October	16.6	W	64	S	137	S
November	17.9	W	61	W	91	NW
December	19.2	W	69	SSE	93	S
Year	16.6	NW	77	W	137	S

Source: Atmospheric Environment Branch. Canadian Climate Normals 1951-1980. (in JWEL 2004)
Elevation: 66.1 m

The one-hour probabilities of winds exceeding a given speed were calculated for a five year set of recorded data from Eddy Point and are presented in Table 6.3-5 (JWEL 2004).

Table 6.3-5:
Frequency of Wind Speeds at Eddy Point, N.S. Weather Station

Velocity in Knots and (km/h)	Frequency (%)
0.1 (0.2)	99.9
7.6 (14.1)	50.0
16.4 (30.4)	10.0
25.5 (47.3)	1.0
33.0 (61.1)	0.1
40.0 (74.1)	0.01

Source: Atmospheric Environment Branch. Canadian Climate Normals 1951-1980. (MSC 2002)

The MSC50 Environment Canada hourly wind data were also used to characterize the wind conditions for the Project site (CBLC 2010). The annual wind rose and location from the MSC50 data is presented in **Figure 6.3-1**. Note, the MSC50 data is from a wind hindcast model, which generated 54 years of hourly wind direction and intensity from many sources and are not real-time measurements such as those presented above. The MSC50 data is from a single grid point located approximately 6 kilometres northeast of the Project site. This grid point was selected because it was the closest of the six available MSC50 grid points in Chedabucto Bay. It is anticipated that the wind and wave conditions at this grid point will differ somewhat from the conditions along the coastline at the Project site, as it is located towards the middle of Chedabucto Bay. The model showed winds predominantly from the northwest during the winter and fall months and predominantly from the southwest during late spring and summer months.

Data for wind direction and intensity, and wave direction and height, both in percentage and hours per year, are given in Table 6.3-6. These data indicate that winds in excess of 20 m/s (i.e. 72 km/h) were present 0.42% of the year (36.51 hours) when averaged over the past 54 years. Winds in excess of 27 m/s (97 km/h) were not recorded on a yearly basis, when averaged over the past 54 years. Wave heights at the MSC50 grid point near the Project site were less than 2 metres in height 92.77% of the time whereas waves from 2 to 3 metres and 3 to 4 metres were present 5.96% and 1.02% of the time, respectively. Waves in excess of 4 metres were relatively minor and only present over 0.25% of the year on average.

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Table 6.3-6 Wind and Wave Direction and Intensity

Wind Direction and Intensity by Percent Occurance

Wind Bin [m/s]		Percent Occurance N	NE	E	SE	S	SW	W	NW	Total in Bin	Exceedence of lower wind limit
27 -	35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20 -	27	0.05	0.04	0.03	0.03	0.01	0.03	0.14	0.08	0.42	0.42
15 -	20	0.42	0.35	0.33	0.37	0.3	0.33	1.47	1.30	4.86	5.28
10 -	15	2.08	1.46	1.28	1.39	2.14	3.32	5.26	5.32	22.26	27.54
7.5 -	10	2.22	1.44	1.18	1.39	2.84	4.72	4.01	3.72	21.52	49.06
5 -	7.5	2.44	1.81	1.61	1.99	3.72	5.94	4.29	3.44	25.24	74.30
1 -	5	2.35	1.88	1.89	2.48	3.84	5.26	4.13	3.07	24.91	99.20
0 -	1	0.07	0.06	0.08	0.09	0.12	0.13	0.13	0.1	0.78	100.00
		9.64	7.05	6.40	7.74	12.96	19.73	19.42	17.04	100.00	

Wind Direction and Intensity by Annual Durations

Wind Bin [m/s]		Hours Per Year N	NE	E	SE	S	SW	W	NW	total in bin	Exceedence of lower wind limit
27 -	35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20 -	27	4.49	3.45	2.69	2.58	0.87	2.44	12.67	7.31	36.51	36.51
15 -	20	36.78	31.11	28.58	32.31	26.42	28.75	128.56	113.67	426.18	462.69
10 -	15	182.69	128.13	112.54	121.93	187.29	291.38	460.99	466.67	1951.61	2414.3
7.5 -	10	194.56	126.29	103.65	121.43	249.00	413.59	351.10	326.47	1886.10	4300.40
5 -	7.5	214.03	158.49	141.2	174.63	325.76	520.83	375.85	301.45	2212.32	6512.72
1 -	5	205.98	164.78	165.82	217.32	336.76	461.19	362.36	269.32	2183.54	8696.26
0 -	1	6.22	5.62	6.80	8.09	10.15	11.55	11.18	8.96	68.56	8764.82
		844.75	617.87	561.28	678.30	1136.31	1729.72	1702.72	1493.85	8764.82	

Wave Direction and Height by Percentage Occurance

Hsig Bin [m]		Percent Occurance N	NE	E	SE	S	SW	W	NW	total in bin	Exceedence of lower wave limit
7 -	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6 -	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5 -	6	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.04	0.04
4 -	5	0.00	0.00	0.13	0.03	0.00	0.00	0.00	0.00	0.16	0.21
3 -	4	0.01	0.06	0.53	0.19	0.00	0.00	0.00	0.01	0.81	1.02
2 -	3	0.15	0.35	1.94	0.98	0.12	0.12	0.70	0.58	4.94	5.96
1 -	2	2.64	2.93	5.19	4.57	1.51	2.62	5.52	6.06	31.05	37.01
0.5 -	1	1.81	2.32	5.23	6.93	3.73	4.75	6.85	2.75	34.36	71.38
0 -	0.5	0.33	0.54	5.06	11.83	7.28	1.34	1.77	0.47	28.62	100.00
	total	4.93	6.21	18.13	24.53	12.65	8.84	14.84	9.87	100.00	

Wave Direction and Height by Annual Durations

Hsig Bin [m]		Hours Per Year N	NE	E	SE	S	SW	W	NW	total in bin	Exceedence of lower wave limit
7 -	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6 -	7	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.25	0.25
5 -	6	0.00	0.00	3.44	0.11	0.00	0.00	0.00	0.00	3.55	3.80
4 -	5	0.00	0.25	11.60	2.56	0.00	0.00	0.00	0.00	14.42	18.22
3 -	4	0.49	5.36	46.87	17.07	0.25	0.18	0.35	0.53	71.11	89.33
2 -	3	13.33	30.93	169.69	85.62	10.78	10.82	61.31	50.64	433.10	522.43
1 -	2	231.20	256.83	455.03	400.92	132.73	230.11	483.65	531.65	2722.11	3244.54
0.5 -	1	158.33	203.60	458.56	607.14	327.38	416.16	600.32	240.94	3012.42	6256.96
0 -	0.5	28.53	47.64	443.99	1037.08	638.01	117.54	154.87	41.22	2508.88	8765.84
	total	431.87	544.61	1589.43	2150.50	1109.15	774.81	1300.49	864.97	8765.84	

6.3.3 Adverse Weather

The Atlantic coast of Nova Scotia and the south coast of Newfoundland experience more storms over the course of one year than any other region in Canada (EC 2006a). These storms bring high winds along the coast, heavy precipitation, storm surges exceeding 1.0 m, freezing rain, and peak waves nearing 14 meters in height (EC 2006a). The winds that affect the coast and mainland Nova Scotia can exceed 150 km/h, and may result in extreme wind chills during the winter. Additionally, Nova Scotia can experience reduced visibility due to precipitation events and fog, as well as blizzards and ice storms in the winter.

Nova Scotia lies within the limit of the Atlantic Hurricane system. Hurricanes tend to develop within or east of the Caribbean Sea with many storms moving up the eastern seaboard. There have been 19 Atlantic hurricanes that have made landfall in Nova Scotia over the past 100 years (Environment Canada 2014d). Of these, 16 were Category 1 storms with wind speeds from 119 to 153 km/h and three were Category 2 intensity with wind speeds from 154 to 177 km/h. In the past 100 years there have been no storms reaching Category 3, 4 or 5 intensities. In addition, over the past 100 years there have been 19 tropical storms (wind speeds from 63 – 118 km/h) that have made landfall in Nova Scotia. The potential impacts on Nova Scotia, especially in coastal regions including the Project site in Chedabucto Bay where these storms may make landfall, are high winds, storm surges and heavy rainfall. Additional information regarding the impacts of severe weather, including climate change effects, is presented in Section 8 Effects of the Environment on the Project.

The majority of Atlantic hurricanes and tropical storms that move up the eastern seaboard dissipate or are significantly attenuated as they come into contact with the cold waters off the northeastern coast of Canada and the United States. The resulting impact on coastal regions of Nova Scotia is heavy tidal swells and high waves. The peak hurricane season in Nova Scotia usually falls between September and October. It should be noted however that hurricanes have been landing in Nova Scotia more frequently as of late, including Hurricane Juan in 2003, and can develop outside the September – October period (Wightman 2012).

Given its position extending into the Atlantic Ocean, Nova Scotia, especially coastal regions, experiences a considerable number of fog days, typically in the spring to early summer. Halifax International Airport has 122 days/yr with at least 1 hour of fog, largely due to the chilled air above the Labrador Current mixing with the moist warm air from the Gulf Stream. Coupled with sea breezes, these bands of fog that lie off the coast of Nova Scotia during the daytime hours have a tendency to move inland into the bays and inlets at night. The nearest station to the Project site monitoring this data is near Canso. Canso is approximately 12 km from the Project site and is an appropriate representation of conditions at the Project site because both locations are along the southern coast of the Chedabucto Bay. Canso experiences 115 days/yr of at least 1 hour of fog cover (EC 2006a).

Fog, ice fog, freezing fog, precipitation and other severe weather can pose a serious threat or risk to marine vessels in the proposed Black Point area. The monthly average number of occurrences with adverse weather that were monitored at South Side Harbour Station near Canso, N.S. is presented in Table 6.3-7 (Farmzone 2014).

Table 6.3-7:
Adverse Weather Events at South Side Harbour, N.S. Over Last 30 Years

Days With	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec
Freezing Rain / Freezing Drizzle	5	3	2	2	0	0	0	0	0	0	1	1
Thunderstorms	0	0	0	0	0	0	1	0	0	0	0	0
Hail	0	0	0	0	0	0	0	0	0	0	0	0
Fog, Ice Fog, Freezing Fog	Data Unavailable											
Haze or Smoke	Data Unavailable											
Blowing Dust	Data Unavailable											
Blowing Snow	Data Unavailable											

Source: Farmzone 2014. The Weather Network 2014. Adverse Weather for Canso, N.S.

Note: Fog Forms, Haze/Smoke, and Blowing Dust/Snow were not recorded over the 30 years that data were collected from the South Side Harbour Station in Canso, N.S. However, 115 days of fog persisting for at least 1 hour were recorded in Canso, N.S. in 2013 (EC 2006a).

On the coastline of Chedabucto Bay, visibility can often be reduced to one-half nautical mile twelve months of the year. However, reduced visibility attributed to dense fog is much more likely in the late spring and early summer (July being the month with the most fog) when the warm air from the south flows over the cold coastal waters of the Atlantic Ocean. By early fall in Nova Scotia, with contributions from cool dry air and elevated ocean temperatures, the fog dramatically decreases. During the winter season, poor visibility occurs less than 10 percent of the time and can often be attributed to snow or heavy rain.

A further concern for ships travelling into and out of Chedabucto Bay is the build-up of ice on the ship or any other structures, including the shoreline ("shorefast ice") due to freezing spray. Freezing spray occurs when ocean spray (as a result from increased winds, heavy seas and even the motion of the vessel) spreads over the ship and freezes on point of contact. The typical seasonal range for freezing spray occurs between November and April; however it is highest in February (JWEL 2004).

North westerly or northerly winds generally contribute to freezing spray. When the strong, cold winds are persistent from the northwest, fall and winter temperatures in Nova Scotia can plummet. When air temperatures drop below the freezing point of salt water, i.e. –2°C or lower, freezing spray conditions in seawater can exist.

6.3.4 Regional Ambient Air Quality

6.3.4.1 *Overview*

Air quality in this region is generally good and the pollutant levels meet national and provincial quality standards and objectives. This can be largely attributed to its small population, small industrial base, and climatic conditions that provide excellent dispersion of air contaminants (NSE 1998). The ambient air quality also benefits from the mixture of relatively clean polar and Arctic air masses. However, on some occasions, there has been a tendency for the long-range transport of air masses, originating in central Canada and the eastern seaboard, to enter into the Nova Scotia area and cause poor air quality conditions. (EC 2014b). Historically, these air

masses have imported gaseous sulphur compounds responsible for acid rain, which has caused considerable degradation to the Province's surface water resources.

The Air Quality Health Index (AQHI) is measured for Halifax, Sydney, Kentville, Greenwood, Pictou, and Port Hawkesbury. The AQHI measures the current levels of outdoor air pollution and related human health risks using a scale of 1 to 10 representing low to very high risk levels. Three air pollutants are measured in order to calculate the AQHI and include ground-level ozone (O3), particulate matter less than 10-micron in diameter (PM2.5) and nitrogen dioxide (NO2). The closest monitoring station to the Project site is Port Hawkesbury and the current air quality levels can be viewed online at the Nova Scotia Environment website at www.airhealth.ca.

The Project site is located in a rural setting with little industrial development; the closest industrial development is in Port Hawkesbury approximately 40 km east of the Black Point property. Industrial sites that reside within a 50 km radius include: the Pacific West Paper Mill, Point Tupper Generating Station, ExxonMobil Point Tupper Fractionation Plant, NuStar Terminals hydrocarbon trans-shipping facility and the Goldboro (LNG) gas plant. There is also several mineral extraction and shipping facilities within 50 km of the Project site, including the Martin Marrietta aggregate quarry and marine facility and the Georgia Pacific gypsum load-out facility, both located along the Canso Strait. Aside from this, there are no other anthropogenic sources within 100 km that could negatively affect the ambient air quality.

6.3.5 Ambient Air Quality Standards

Nova Scotia Department of the Environment (NSE) has set maximum permissible ground level concentrations for ambient air quality in the province of Nova Scotia (Table 6.3-8).

Table 6.3-8:
NS Ambient Air Quality Standards

Contaminant	Averaging Period	Maximum Permissible Ground Level Concentration	
		($\mu g/m^3$)	(pphm)
Carbon Monoxide (CO)	1 hour	34,600	3,000
	8 hours	12,700	1,100
Hydrogen Sulphide (H_2S)	1 hour	42	3
	24 hours	8	0.6
Nitrogen Dioxide (NO_2)	1 hour	400	21
	Annual	100	5
Ozone (O_3)	1 hour	160	8.2
Sulphur Dioxide (SO_2)	1 hour	900	34
	24 hours	300	11
	Annual	60	2
Total Suspended Particulate (TSP)	24 hours	120	-
	Annual	70	-

Source: Nova Scotia *Air Quality Regulations*, Schedule A.

In 2012, provincial jurisdictions agreed to the implementation of a new air quality management program. The new Canadian Ambient Air Quality Standards (CAAQS) are authorized as new objectives under the Canadian Environmental Protection Act, 1999 (CEPA) and replace the current Canada Wide Air Quality Standards under CCME (2000). Currently, standards for particulate matter less than 2.5-micron in diameter (PM2.5) and ground-level ozone (O3) have been developed. CEPA is currently working on baseline standards for nitrogen dioxide (NO2) and sulfur dioxide (SO2). The CAAQS are voluntary objectives. Table 6.3-9 details the new air quality standards for PM2.5 and ozone to be established by 2015 and 2020.

Table 6.3-9:
Canadian Ambient Air Quality Standards for $PM_{2.5}$ and Ozone

Pollutant	Averaging Time	Standard 2015	Standard 2020
$PM_{2.5}$	24- Hour	28 $\mu g/m^3$	27 $\mu g/m^3$
	Annual	10 $\mu g/m^3$	8.8 $\mu g/m^3$
Ozone	8-hr	63 ppb	62 ppb

Source: CCME, 2010

6.3.6 Regional Air Quality Baseline

Ambient air quality in Nova Scotia is monitored using a network of 13 sites operated by NSE and Environment Canada through the National Air Pollution Surveillance (NAPS) Network. Motor vehicles, electrical power generation, and pulp and paper processing are the major local sources of air pollutants in the province. Common air pollutants monitored regularly are sulphur dioxide (SO_2), total particulate matter (TPM), PM2.5, particulate matter less than 10 microns in diameter (PM10), carbon monoxide (CO), O_3, and NO_2. There is no air quality monitoring station

in Black Point. The closest NSE monitoring site to the Project site is located in Port Hawkesbury at the old Post Office, approximately 38 km from the site.

The province had an ambient air monitoring station running in the Port Hawkesbury/Point Tupper area, which measured the concentrations of SO_2, Hydrogen Sulphide (H_2S), and TSP. The measured values at these sites were published in 1993 and are presented in Table 6.3-10. The most recent data available for this monitoring station were from a report published by Environmental Canada in August 2013. According to this report, the SO2 concentrations at the Post Office site were 231 ppb (1-hour max) and 41 ppb (24-hour max) in 2007 (EC 2013a). The proposed Project area, being very much undeveloped, would probably have better air quality and thus less airborne emissions compared to Point Tupper due to Point Tupper's proximity to local industry.

Table 6.3-10:
Ambient Air Quality at Nearest Monitoring Stations

	1-Hour Max Concentration	24-Hour Max Concentration	Annual Mean Concentration	Total Number of Exceedances of 1-Hour N.S. Standard
		Sulphur Dioxide (SO_2)		
Point Tupper (1993)	538 ppb	196 ppb	8.0 ppb	10
Old Post Office (1993)	100 ppb	23 ppb	4.0 ppb	Not Available
		Hydrogen Sulphide (H_2S)		
Point Tupper (1993)	61.8 ppb	16.6 ppb	0.7 ppb	9
		Particulate Matter 2.5 microns (PM2.5)		
Port Hawkesbury (2013)	Not Available	Not Available	6 ug/m^3	Not Available
		Nitrogen Dioxide (NO2)		
Port Hawkesbury (2013)	Not Available	Not Available	9.4 ug/m^3	Not Available
		Total Suspended Particulate (TSP)		
Point Tupper (1993)	Not Available	60 µg/m^3	23 µg/m^3	2
Old Post Office (1993)	Not Available	55 µg/m^3	25 µg/m^3	Not Available

Source: NSDOE 1994 Ambient Air Quality in Nova Scotia (Point Tupper and Old Post Office); Environment Canada 2013 National Air Pollutant Surveillance (NAPS) Monitoring Results 2013 (Port Hawkesbury).

Based on the information above, background concentrations of criteria air pollutants are most likely not exceeding current provincial and national standards at the proposed Black Point Quarry site.

6.3.7 Ambient Noise (Terrestrial and Marine)

The existing terrestrial noise environment has been determined by measurement at two representative geographic locations (one inland, and one nearer the coast). The locations are the residential receptors located nearest to the Property boundary. Noise data were recorded in A-weighted decibels (dBA) and reported in three categories:

1. as equivalent continuous noise level (L_{eq}),

2. as the noise level exceeded for 10% of the time (L_{10}), which is used to give an indication of the upper limit of fluctuating noise, such as that from road traffic; and

3. as the noise level exceeded 90% of the time (L_{90}). This last parameter is generally taken to be the ambient or background noise level.

At both locations, measurements were collected over 1-hour intervals. This data have been collated to report results over the daytime (7am to 7pm), evening (7pm to11pm), and night-time (11pm to 7am) periods. Time periods corresponding to wind speeds greater than 20 km/h or periods of precipitation have not been included in the summary analysis. The results are summarised in Table 6.3.11.

Table 6.3-11:
Measured Ambient Noise Levels

Location	Time Period	Sound Level (dBA)		
		L_{eq}	L_{90}	L_{10}
Location #1 Coastal Half Island Cove Road	Daytime (7am to 7pm)	38.3	27.1	43.2
	Evening (7pm to 11pm)	31.7	28.9	34.4
	Night-time (11pm to 7am)	33.1	28.2	37.0
Location #2 Inland Eagle Valley Road	Daytime (7am to 7pm)	51.0	24.2	56.3
	Evening (7pm to 11pm)	48.9	25.8	53.9
	Night-time (11pm to 7am)	42.1	24.3	35.8

As is expected for a remote rural environment, existing L_{90} background noise levels are very low, below 30 dBA in all time periods at both locations. At each location, little temporal variation was observed in background noise levels throughout the daytime, evening and night-time. The location near the coast had slightly higher background noise levels than the inland location. However, the L_{eq} (or average) noise levels were higher at the inland location, probably due to the influence of road traffic noise.

At the measurement location west of the Project site near the coast, the dominant noise sources noted were natural, including waves, birds, and the movement of leaves. At the location further inland traffic noise from the road was observed, in addition to natural noise sources.

Ambient underwater noise levels in the Project area have not been measured. While there are no existing localised anthropogenic sources, underwater noise can propagate over large distances. For this reason, both natural and anthropogenic sources may contribute to the existing underwater noise environment. Natural underwater noise sources include wind, waves, precipitation, sea ice, marine fauna, and seismic background activity. Anthropogenic noise sources include commercial fishing, shipping, seismic exploration activity, sonar equipment, construction and industrial activity, and distant explosive detonations. Whether natural or anthropogenic sources dominate in the Project area at any particular time and location depends on changing natural conditions, and the proximity and level of the human activities.

Appendix D (Noise and Vibration Technical Report) provides a more detailed description of the existing ambient noise environment. This report also explains the technical terminology used to describe noise levels.

6.3.8 Ambient Light

Given its remote location, there are no existing data sources for summarizing the current light levels in the vicinity of the Project. The Project site is it not easily accessible and so transitory ambient light sources from vehicles are rare (from the occasional ATV) to non-existent. Given this, ambient light levels are expected to be minimal and typical of an undeveloped rural area.

The largest artificial light sources in the Project area are the nearest residences on Half Island Cove Road and in Fox Island Main, and vehicle traffic along Highway 16. Additional light originates from passing and anchored ships, which are visible from the shore of the Property. Estimates indicate that 500 – 600 ships traverse Chedabucto Bay annually, not including fishing and recreational vessels (G. Freer, pers. comm. 2014).

6.4 Terrestrial Environment

The description of the terrestrial environment includes habitat, vegetation and wildlife found in the Project site and nearby areas. It also includes birds observed in the marine areas adjacent to the Project site.

Between 2010 and 2014 a number of desk top reviews and field surveys were conducted within the Project area to gather field data for a description of the existing terrestrial environment. The work was carried out in particular to:

- Describe existing habitats and develop a habitat map;
- Confirm, identify, and describe significant habitats including wetlands;
- Delineate and functionally assess wetlands in Project Study Area;
- Identify high potential habitats for rare vascular plant species;
- Determine likely lichen habitat, conduct a rare lichen survey, and evaluated existing habitats for their potential to support rare lichen species;
- Identify and describe indications of previous disturbance; and
- Record (opportunistic) wildlife sightings.

Table 6.4-1 provides a summary of the various terrestrial environment baseline field surveys.

Table 6.4-1:
Terrestrial Environment Baseline Field Surveys

Ecological Component	Type of Survey and Information Collected	Survey Date
Vascular Plants	Included species at risk (SAR)/species of conservation concern (SOCC); Compiled vascular plant species list for entire Project site	June 2010; August 2010; August 2014
Lichens	Focused surveys for Species at Risk (SAR)/species of conservation concern (SOCC)	June 2010; August 2014
Birds	Compiled species lists including passerine migration, early and late breeding birds, raptors (owls), early and late shorebird migrants	April 2010; May 2010; June 2010; August 2010; September 2010 January 2011
Mammals	Moose fall rut surveys; general mammal surveys were conducted in conjunction with other taxonomic groups	Targeted survey in September 2014; casual observation as part of various surveys listed in this table

Ecological Component	Type of Survey and Information Collected	Survey Date
Wetlands	Wetland delineations, habitat assessments and functional assessments	August 2010; July 2011; August 2014
Herpetiles	Surveys conducted in conjunction with other taxonomic groups	Part of various surveys listed in this table
Odonates	Compiled lists of species utilizing Project site	June/July 2010; August 2010

Field surveys were supplemented by a review of existing information from various information sources including Species of Conservation Concern (SOCC) databases, federal and provincial government departments and agencies, non- profit groups, internet websites, existing reports and knowledgeable individuals. Specific sources utilized include:

- Atlantic Canada Conservation Data Centre (ACCDC);
- NSDNR;
- NSE;
- NSMNH;
- Canadian Wildlife Service (CWS)/ EC; and
- Other sources as indicated where applicable.

6.4.1 Terrestrial Habitat and Vegetation

The following description of existing terrestrial habitat at the Black Point Project Area is based on observations during field surveys conducted in June 2010, August 2010 and August 2014 as well as compiled data from existing sources.

Ecological Land Classification (ELC) links the abiotic and biotic components of each ecosystem. Climate, landform, and soil influence the distribution of vegetation (NSDNR 2003). ELC therefore provides information on the factors that influence habitats present at the Project site. The site is located in the Acadian Forest Ecozone, the Atlantic Coastal Ecoregion (Ecoregion 8) and the Eastern Shore Ecodistrict (Ecodistrict # 820) (NSDNR 2006). Ecodistrict 820 has an annual precipitation of 1426 mm, a growing season of 195 days, a mean annual temperature of 5.8°C, a mean summer temperature of 14.8°C and a mean winter temp of -3.7°C (NSDNR 2003).

Large portions of the District 820 are covered with forest. The presence of the Atlantic Ocean has more influence on the forests in this ecodistrict than the soils, geology or landform. The ocean provides a consistent coastal climate, resulting in the absence of Red Spruce (*Picea rubens*), Sugar Maple (*Acer saccharum*), White Pine (*Pinus strobus*) and American Beech (*Fagus grandifolia*) in coastal forests. Coastal forest is typically dominated by Balsam Fir (*Abies balsamea*), Black Spruce (*Picea mariana*) and scattered White Spruce. The coastal forests are short lived and usually exist less than 100 years, but the moist climate is conducive to natural regeneration. Typically, most stands of Balsam Fir and Black Spruce have already developed a layer of regeneration while the overstorey breaks up. The influence of the ocean extends inland until it reaches the 60 m contour. Therefore, the Project site is influenced by the ocean (NSDNR 2003).

The Black Point Quarry Project Area encompasses two Ecosections (NSDNR 2006). Ecosection WCKK applies to the western section of the Project Area as well as the northern boundary between the Atlantic coast and the steep cliff. The central and eastern portion of the

Area is classified as Ecosection WCHO. Descriptions of the climatic, geographic and ecological conditions such as disturbance patterns associated with this classification can be found in NSDNR (2003). Ecosections describe the more permanent physical features of topographic patterns, soil texture and soil drainage (NSDNR 2003). Ecosection WCKK indicates well drained, coarse textured soil on hilly terrain. Ecosection WCHO indicates well drained, coarse textured soil on hummocky terrain (NSDNR 2006).

Study Method

In preparation for the vascular plant field surveys, maps of existing habitat were assembled, indicating streams, wetlands and habitats including forest types. A priority species list was prepared prior to conducting field work in order to help guide the plant surveys by identifying plant species at risk /conservation concern potentially present on the site. In order to prepare this priority list an ACCDC data search was obtained to identify any plant species at risk/conservation concern previously identified within 100 km radius of the site.

Surveys within the Project site focused on habitats suitable for potential vascular plant species at risk. Habitats with high potential for species at risk include freshwater and marine wetlands, as well as floodplains of streams and rivers. Forest habitats, except forests in flood plains, are estimated to have medium to low potential for rare vascular plants. Surveys for rare vascular plants were timed to cover both early and late phenology. Further details regarding survey methods and photos are provided in **Appendix E**.

6.4.1.1 *Habitat Survey Results*

Forest inventory mapping available from NSDNR is based on aerial photography and satellite data. For Guysborough East, which includes the Black Point Quarry site, the mapping used the aerial photography from 1990 to 1998, satellite data last obtained 1999-2002, and treatment data from 2003. The current Forest Inventory Map (NSDNR 2007/2012) was reviewed (NSDNR 2013) and supplemented with field data to prepare a terrestrial habitat map of the Project Area (Figure 6.4-1).

The majority of the Project site consists of a mix of coniferous forest and open/shrub barren vegetation. Vegetation on the Project site remains relatively unaltered with the exception of a few property cut lines, ATV trails and skidder tracks (constructed for underground exploratory testing). A number of treed and open bogs are located on the site while other wetland types present include fen, swamp and marsh. Mixed forests are uncommon but occur in patches on the main portion of the site.

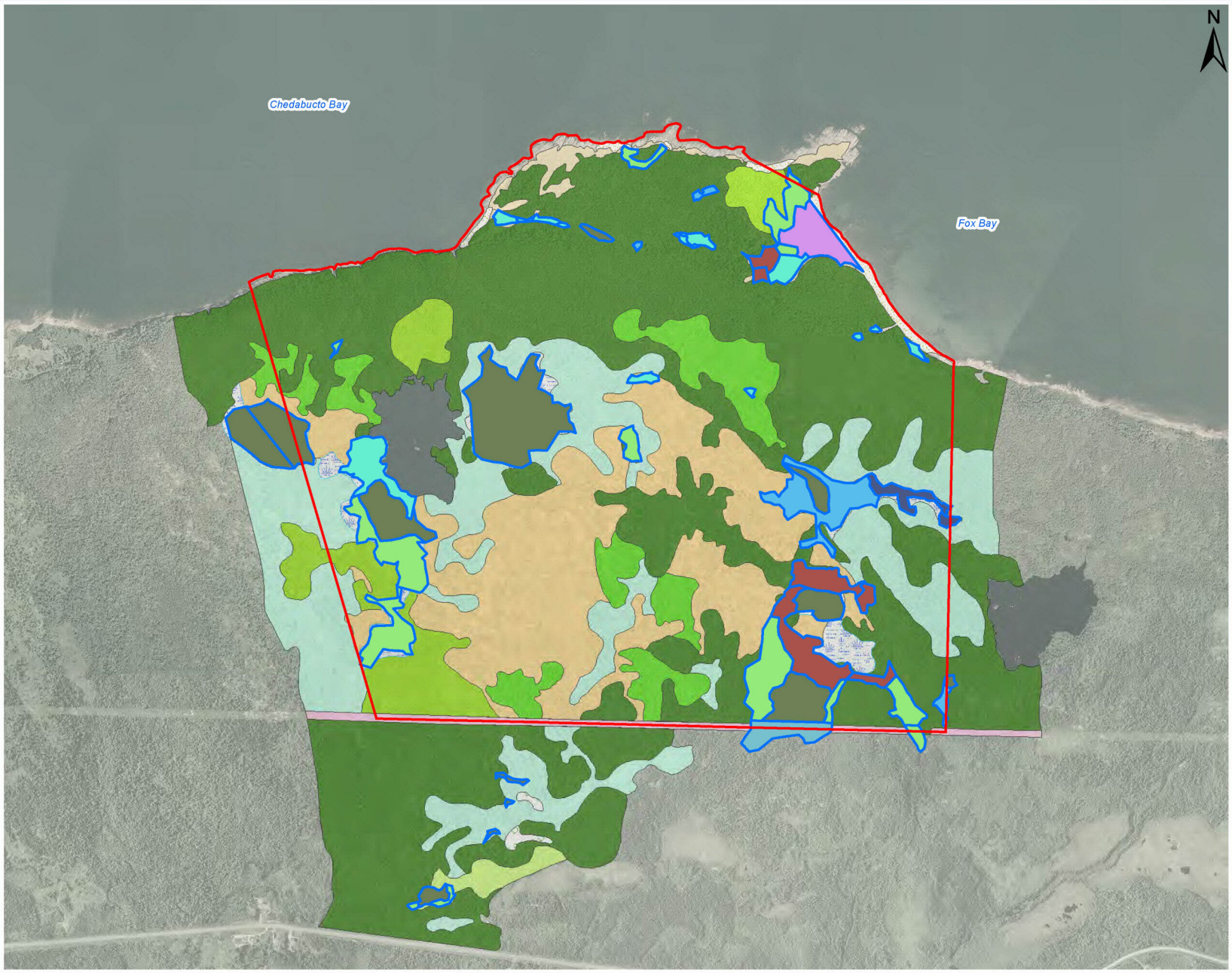
A steep cliff is located near the north end of the Study Area which separates the northern portion from the rest of the Project site. Coniferous forest dominates the cliff and lower north end of the site while a disturbed regenerating forest was also noted in this area as well as a number of wetlands (fen, marsh and bog types). Habitat located immediately adjacent to the coast includes low shrub coastal barrens, rock cliffs, and cobble/boulder/sand beaches.

The following description of habitat is based on the most frequent plant species observed in 2014, and tree size where applicable. Seven habitat types and plant communities were identified, including one category of wetlands, containing several wetland classes. The habitat types are summarized in Table 6.4-2. Photos depicting habitat types are provided in **Appendix E**. Photos of wetlands are also provided in the separate wetland survey report (**Appendix F**). A

delineation of habitat types in the Black Point Study Area is shown on Figure 6.4-1 as well as Figure 6.4-2. The individual types are described in more detail below.

Table 6.4-2:
Habitat Types - Definitions and Summaries

Picture #	Type	Definition and Summaries
2-1; 2-2	Natural Stand: Coniferous Forest	Forest stands composed of more than 75% coniferous (softwood) trees. In the Project footprint, the trees in these polygons are more mature than the trees in "young coniferous forest". Dominated by Black Spruce and Balsam Fir, mature or nearing maturity, with tree diameters for Balsam Fir and Black Spruce from about 15 cm diameter at breast height (dbh[3]) to 20 cm and occasionally 30 cm dbh; Red Maple and Heartleaf Birch (*Betula cordifolia*) are few and up to 20-30 cm dbh.
2-6	Tall Shrubs	At the Project site, tall shrubs with an estimated height of around 2 m, dominated by Huckleberry, Mountain Holly and Pin Cherry. NSDNR categorized this area as "brush", which is defined as any area containing less than 25% merchantable tree cover and contains non-merchantable woody plants consisting of at least 25% cover.
	Young Coniferous Forest	Areas of re-growth, most often following forestry activity, and other disturbance. Dominated by young trees (saplings) with occasional patches of shrubs (often Mountain Holly (*Nemopanthus mucronatus*), Witherod (*Viburnum nudum*) or alders (*Alnus incana*)). Older regenerating forest[5] is dominated by young Balsam Fir with an estimated height of 6-10 m.
2-10	Riparian	Habitat along watercourses. In the Project footprint, there is little such habitat. Long stretches of streams have no real floodplain, possibly due to the steep gradient of the terrain.
2-4 ;2-5	Barren	Any area of less than 25% live tree cover containing "ericaceous" vegetation with less than 50% rock out crops and/ or boulder cover and less than 50% other woody plant cover. Area dry and firm in summer. Indicator plants: Bearberry (*Arctostaphylos uva-ursi*), Rhodora (*Rhododendron canadense*), Blueberry (*Vaccinium* sp.), Huckleberry (*Gaylussacia* sp.) and Lambkill (*Kalmia angustifolia*).
2-7	Natural Stand: Mixed Forest	Forest stands composed mostly of Balsam Fir, White Birch, Red Maple, and Black Spruce.
See Appendix F	Fresh Water Wetlands	"Any wet area not identified as a lake, river or stream". Encompasses the wetland classes: fen, marsh, swamp, and open water; definition extended to include wetland class bog.



LEGEND

- Site Boundary

Terrestrial Habitats

- Wetland
- Coniferous Forest
- Open Coniferous Forest
- Open Mixed Forest
- Regenerating Coniferous Forest
- Regenerating Forest
- Bog
- Coastal Barren
- Open Barren
- Shrub Barren
- Sand Gravel Beach
- Powerline Transmission Corridor

DelineatedWetlands

- Bog
- Fen
- Forested Swamp
- Fresh Marsh
- Shrub Bog
- Shrub Fen
- Shrub Swamp
- Treed Bog

0 125 250 500 Meters

SCALE: 1:12,500
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

VULCAN MATERIALS / MORIEN RESOURCES

BLACK POINT QUARRY
ENVIRONMENTAL ASSESSMENT

BLACK POINT TERRESTRIAL HABITATS

September 24, 2014	Rev 1.0	Figure No. 6.4-1
Project No. 210.05913.00000		

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Coniferous Forest

Coniferous forest is a forest dominated by coniferous trees (greater than 75%). The dominant tree species is Balsam Fir and Black Spruce (occasionally White Spruce closer to the coast). A few Mountain Ash (*Sorbus* sp.), Heart-leaf Birch and Red Maple are scattered throughout. The coniferous forest can be more or less open, resulting in various light conditions. The ground cover is dominated by feather mosses with up to 95% cover (e.g., *Hylocomium splendens*, *Pleurozium shreberi*); other mosses including *Dicranum* sp., *Ptilidium crispa- castrensis*, and occasionally peatmoss (*Sphagnum* sp.) occur. Sparse patches of terricolous lichens (such as reindeer lichen and related species (*Cladonia rangiferina (Cladonia sp. / Cladina* sp., C. *maxima*) are found infrequently. Herbaceous plants such as Bunchberry (*Cornus canadensis*), Sarsaparilla (*Aralia nudicaulis*), Starflower (*Trientalis borealis*), Twin Flower (*Linnaea borealis*), Canada Mayflower (*Maianthemum canadensis*) Goldthread (*Coptis trifolia*), Common Wood Sorrel (*Oxalis montana*) and ferns (e.g., *Dryopteris* sp., *D. felix femina*, or Bracken (*Pteridium aquilinium*), and in damp areas occasionally Cinnamon Fern (*Osmunda cinnamomea*)) are sparse.

Sheep Laurel (*Kalmia angustifolia),* blueberries (*Vaccinium* sp.), and seedlings or saplings of trees and Witherod contribute to a sparse low shrub stratum. Standing and fallen woody debris occur in many areas. Some patches of open coniferous forest can also have a well developed layer of low shrubs, mostly Lambkill, as well as herbaceous plants and mosses. Local relief in coniferous forests on the Site is generally hummocky.

Young (Regenerating) Coniferous Forest

This habitat type encompasses both younger and older regenerating forests. Regenerating forests are areas of re-growth, usually following apparent clear-cut harvesting or other disturbances. These young forests consist of dense stands or young trees dominated by young trees (seedlings, saplings) and shrubs (often Mountain Holly, Witherod, or Alders). Balsam Fir is the dominant tree species, accompanied by spruce (Black Spruce with some White Spruce), and scattered Heart-leaf Birch, Red Maple, and Mountain Ash. Herbaceous ground vegetation is often sparse due to the density of the woody vegetation. Ground cover consists of patches of conifer needles or patches of feather mosses with bunchberry where there is more. This habitat type is primarily located in the northern end of the Study Area, southwest of Wetland 2 (WL2).

Tall Shrub Habitat

Tall shrub habitat is dominated by tall Huckleberry, Mountain Holly and Witherod, scattered alders and occasionally Rhodora, with scattered tree saplings (Balsam Fir, Black Spruce, Red Maple, Mountain Ash, Heart-leaf Birch). The shrubs are an estimated 2 m or more high, and the tree saplings reach an estimated 4 to 6 m height. Ground cover consists of mosses (e.g., peatmoss (*Sphagnum* sp.) and others such as *Dicranum* sp.), ferns (*Dryopteris* sp., bracken, occasionally Ladyfern (*Dryopteris filix- femina*)), Bunchberry and scattered Sarsaparilla. Low shrubs in the understorey are sparse: Lambkill and Velvet-leafed Blueberry (*Vaccinium myrtilloides*) occur, and occasionally Labrador Tea (*Rhododendron groenlandicum*) and Huckleberry. A few scattered larger trees can be found, e.g., Black Spruce, Larch (*Larix laracina*) Balsam Fir or Heart-leaf Birch with a diameter at breast height (dbh) of an estimated 15 to 20 cm. Tall shrub habitat is located throughout the Study Area however it is the dominant habitat in the central portion.

Barren

Much of the Project Site is dominated by low barren vegetation. This habitat type can either be dominated by shrub species such as huckleberry (*Gaylussacia baccata*), late low blueberry and common juniper (*Juniperus communis*) growing to heights of less than one metre. Other forms of this habitat type are dominated by black crowberry mats growing over rocks. This type of barren is typically located closer to the coast (on headlands), but can occur inland over bedrock outcrops.

Riparian

Riparian habitats are found along the small watercourses throughout the Study Area. There is little such habitat within the Study Area where long stretches of streams have no real floodplain, possibly due to the steep gradient of the terrain and the small size of the streams. Consequently, species composition is often similar to the surrounding habitats. A few submergent aquatic vascular plants such as Burreed (*Sparganium* sp.) were found, e.g., in Wetland 1. A stretch of well- developed riparian habitat was found along the un-named streams associated with Wetland 1 and Wetland 14. These areas are dominated by a thick Sphagnum ground layer, Cinnamon Fern, Balsam Fir and Black Spruce.

Mixed Forest

Mixed forest patches are scattered throughout the Project site. These areas are dominated by canopy species such as red maple (*Acer rubrum*), heart-leaved paper birch (*Betula papyrifera var. cordifolia*), balsam fir, and understorey species including lambkill, late low blueberry, twinflower, bunchberry, starflower and wild sarsaparilla (*Aralia nudicaulis*). This habitat type is generally located in the southern end of the Project Site but does occur in patches closer to the coast.

Fresh Water Wetlands

Twenty-two freshwater wetlands were detected during the surveys in August 2010, July 2011 and September 2014. Wetland types encountered within the Project Site include open/treed bogs, fens, and treed/shrub swamps. Wetlands surveyed within the Project Area are described in more detail below in Section 6.4.2 and in the 2014 Wetland Baseline Survey Report (**Appendix F**).

Other Habitat

In addition to the vegetation as described above, the following plant communities were noted during the course of the field surveys. The ocean shoreline vegetation is typical of marine shores and includes Beach Pea, Sea Rocket (*Cakile edentula*), Oysterleaf (*Mertensia maritima*), Seaside Plantain, Scotch Lovage, and Sea Lavender. Seaweeds (*Fucus sp., Ascophyllum sp.*) are attached to the rocks in the intertidal and subtidal zone.

6.4.1.2 *Plant and Lichen Species of Conservation Concern (SOCC)*

A total of 189 vascular plant species were recorded during the field surveys conducted in 2010 and 2014. A complete list of plant species recorded for the site is provided in **Appendix E**. No

plant species listed by the Species At Risk Act (SARA) or the Nova Scotia Endangered Species Act (NSESA) was recorded during the field surveys. Two plant species of conservation concern were recorded. Plant and lichen Species at Risk (SAR) and species of conservation concern are discussed further in Section 6.7.

One vascular plant species of conservation concern was detected on the Project site during the June 2010 surveys. Southern Twayblade (*Listera australis)* has an ACCDC rarity rank of S2. This species was encountered along two streams located within the Project Area. One location contained over 40 individuals within a relatively small area whereas only one individual was found at the second location. An additional plant species of conservation concern, Northern Comandra (*Geocaulon lividum* – ACCDC rank S3) was detected during the August 2014 field survey. This species was noted in Wetland 18 (WL18) in the open bog portion of this wetland. Numerous individuals were reported throughout this wetland.

Lichen surveys were conducted within the Project Site in June 2010 and August 2014. A list of species recorded and methodologies are discussed in **Appendix E**. Three lichen species of conservation concern were noted during the 2014 surveys and include: Black-footed Reindeer Lichen (*Cladonia stygia*: ACCDC S2S3; Canadian General Status rank 3), Naked Kidney Lichen (*Nephroma bellum*: ACCDC S3?; Canadian General Status rank 3) and Coastal Bushy Beard Lichen (*Usnea flammea*: ACCDC S2S3; Canadian General Status rank 3). In addition, Angelhair Ramalina Lichen *Ramalina thrausta*, detected in 2010, is still considered a species of conservation concern, with a General Status rank of 3.

6.4.1.3 *Indications of Past Disturbance*

As discussed above, the majority of the Project site is in a natural state with little evidence of disturbance, except for past clearing on the lower platform where homesteading occurred. Some vegetation cutting has occurred to clear property boundaries and a small number of ATV trails are present on site. Recently a number of skidder trails have been cleared to allow a drill rig access to various test pit locations throughout the site for underground exploratory purposes. There is also some evidence of past tree clearing (indicated by remaining stumps) in various portions of the site.

6.4.2 Wetlands

6.4.2.1 *Study Methods*

Several definitions of "wetland" exist in literature:

- Lands that are seasonally or permanently covered by shallow water, including lands where the water table is at or close to the surface. The presence of abundant water causes the formation of hydric soils and favours the dominance of either hydrophytic or water-tolerant plants. The five major types of wetlands are: marshes, swamps, bogs, fens and shallow open waters (EC 2013b).
- A wetland is land "where the water table is at, near, or above the surface or which is saturated for a long enough period to promote such features as wet-altered soils and water tolerant vegetation" (EC 1996).
- A wetland is land that is "saturated with water long enough to promote wetland or aquatic processes as indicated by poorly drained soils, hydrophytic (i.e., water-loving) vegetation and various kinds of biological activity which are adapted to a wet environment" (GC 1991).

- Wetlands are areas of "marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres" (United Nations Educational, Scientific and Cultural Organization (UNESCO) 1987).

Although each definition is slightly different, the relevant common aspects adopted for the purpose of this report that define a wetland are:

- Land that is saturated or covered by water for some time during the growing season;
- Poorly drained soils; and
- Predominantly hydrophytic vegetation.

Following this definition, wetland determinations were based on the following three criteria:

- Majority of dominant vegetation species are wetland associated species;
- Hydrologic conditions exist that result in periods of flooding, ponding, or saturation during the growing season; and
- Hydric soils are present.

A combination of desktop review and field work was utilized to identify and assess wetland habitat occurring within and/or adjacent to the Project area. Wetland delineations were conducted according to standard methodologies approved by NSE (NSE 2014c). The determination of wetland habitat in the field was based largely on the Corps of Engineers Wetland Delineation Manual (the Manual) (Environmental Laboratory 1987) and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual (US Army Corps of Engineers (USACE), 2012). Functional assessments were conducted using the NovaWET method which has been developed by NSE for the purpose of assessing wetland functions in NS. A field report is presented in **Appendix F** which provides further details related to the methodologies used to delineate and assess all wetlands identified as well as detailed results of the wetland study.

6.4.2.2 *Wetland Survey Results*

A total of 22 wetlands were identified within the Project footprint and/or determined to be hydrologically connected downstream (Figure 6.4-2 and Table 6.4-3). The majority of wetland habitat identified consists of open bogs and riparian fens which range in size from approximately 16.5 ha to <0.5 ha. Other wetland types identified include swamp and marsh as well as complexes including a combination of a number of these wetland types. The total area of wetland habitat identified within the Project Study Area is approximately 57 ha.

Ten (10) of the 22 wetlands surveyed were found to occur directly within the proposed footprint of the Pit, Fill Areas and Plant Location (WL1, WL3 – WL6 and WL11-WL15 inclusive in Table 6.4-3). Four (4) wetlands surveyed were also found to occur within the proposed footprint of the access road (WL12- WL20 inclusive). Seven (7) wetlands surveyed (WL7-WL10, WL16, WL21 and WL2) were found to occur outside the proposed footprint of all Project components however these wetlands may be indirectly impacted by the project and as such were included in the surveys. Complete wetland delineation, habitat assessments and functional assessments were conducted for all 22 wetlands surveyed.

Table 6.4-3 provides a summary of all wetlands assessed along with their general characteristics and corresponding coordinates (UTM Zone 20, NAD 83).

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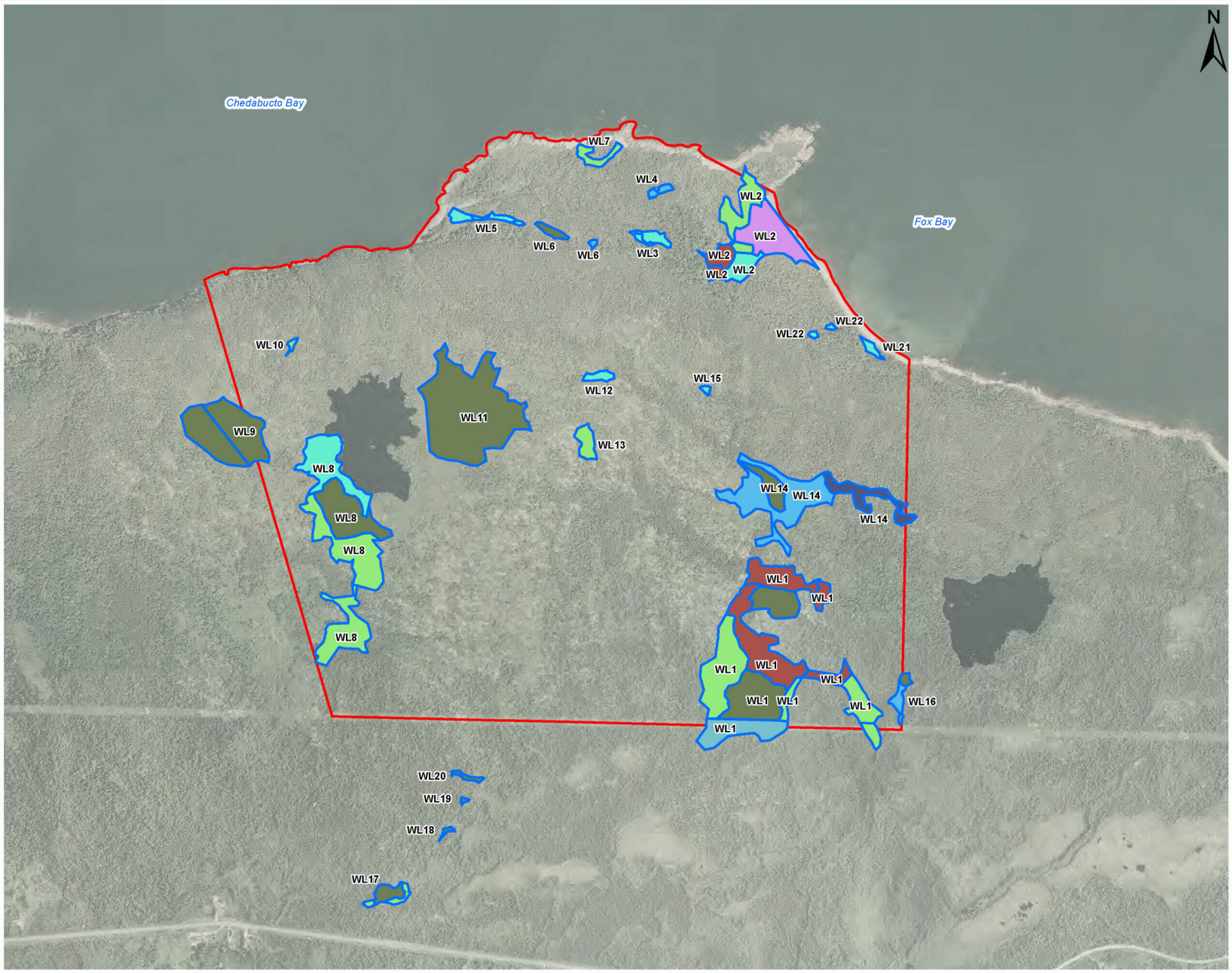

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LEGEND

Site Boundary

DelineatedWetlands

- Bog
- Fen
- Forested Swamp
- Fresh Marsh
- Shrub Bog
- Shrub Fen
- Shrub Swamp
- Treed Bog

0 125 250 500 Meters

SCALE:1:12,500
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

VULCAN MATERIALS / MORIEN RESOURCES

BLACK POINT QUARRY
ENVIRONMENTAL ASSESSMENT

BLACK POINT WETLAND HABITAT

September 24, 2014	Rev 1.0	Figure No. 6.4-2
Project No. 210.05913.00000		

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Table 6.4-3:
Wetland Locations and Characterizations

Wetland #	Coordinates		Type	Size (ha)	Landscape Position	Water Flow Path	Landform
	Easting	Northing					
1	645437	5022529	Bog/Swamp Complex	16.5	Lotic Stream	Throughflow	Basin
2	645430	5024058	Fen/Swamp/ Marsh Complex	6	Lotic Pond	Inflow	Basin
3	645076	5024059	Riparian Fen	0.5	Lotic Stream	Throughflow	Slope
4	645076	5024059	Bog	0.2	Terrene	Isolated	Basin
5	644431	5024129	Riparian Fen	0.5	Lotic Stream	Throughflow	Slope
6	644737	5024077	Bog	0.3	Terrene	Outflow	Basin
7	644845	5024349	Riparian Treed Swamp	0.5	Lotic Stream	Throughflow	Slope
8	644009	5023134	Swamp/Bog/Fen Complex	10.3	Lotic Stream	Throughflow	Flat
9	643617	5023397	Bog	4.6	Terrene	Isolated	Flat
10	643857	5023694	Riparian Treed Swamp	0.1	Lotic Stream	Throughflow	Slope
11	644458	5023456	Bog	9.0	Terrene	Isolated	Flat
12	644737	5024077	Bog/Fen Complex	0.3	Terrene	Outflow	Basin
13	644860	5023362	Treed Swamp	0.6	Terrene	Isolated	Slope
14	645506	5023190	Fen/Bog Complex	6.2	Lotic Stream	Throughflow	Slope
15	645265	5023544	Riparian Fen	0.07	Lotic Stream	Throughflow	Slope
16	645920	5022505	Bog	0.45	Terrene	Isolated	Basin
17	644193	5021827	Bog/Swamp Complex	0.74	Terrene	Outflow	Basin
18	644396	5022050	Bog	0.07	Terrene	Isolated	Basin
19	644440	5022148	Bog	0.04	Terrene	Isolated	Basin
20	644447	5022225	Bog	0.15	Terrene	Isolated	Basin
21	645820	5023684	Fen	0.19	Lotic Stream	Inflow	Slope
22	645630	5023728	Riparian Fen	0.1	Lotic Stream	Throughflow	Slope
Total Wetland Area (ha)				57.3			

The functional assessments conducted for the 22 wetlands located within the Project site determined that the overall watershed condition within which these wetlands are located is in a relatively unaltered state with wetland habitat covering approximately 11% of the total land area of the watershed. The buffer area surrounding these wetlands is fully vegetated and relatively unaltered providing high quality wildlife habitat and water quality functions. All wetlands assessed were determined to provide high floristic quality where the plant community is composed of native species characteristic of the wetland type with a very minor component of non-native species. Table 6.4-4 presents a summary of the various significant functions for which each wetland was assessed to provide (see **Appendix F** for more details regarding the functional assessments).

Table 6.4-4:
Wetland Functional Assessment Summary

Significant Function	WL1	WL2	WL3	WL4	WL5	WL6	WL7	WL8	WL9	WL10	WL11	WL12	WL13	WL14	WL15	WL16	WL17	WL18	WL19	WL20	WL21	WL22
SF1-Watershed condition (H-Significantly modified, M-Modified, L-Relatively unaltered)	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
SF2-Proportion of WL area in watershed & opportunity for floodwater detention (H,M,L)	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
SF3-Rate the general wetland condition/integrity (H,M,L)	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
SF4-Rate the overall condition and integrity land adjacent to wetland (H,M,L)	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
SF5-Is the WL a WSS? (Y/N)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF6-Does the WL support commercial/recreational fish/shellfish? (Y/N)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
**SF7-Species of concern (Fed/Prov)? Specify.*	S2	N	N	N	N	N	N	S2	N	S3	S2	S2	N	N	N	N	S2	S2,S3	S2	S2	N	N
SF8-Wetland has conservation/ compensation agreements/activity? (Y/N)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF9-Wetland is calcerous fen, black ash or cedar swamp? (Y/N)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF10-Within Drinking Water Protected Area (designated watershed/wellfield) (Y/N)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF11-WL within a floodplain and upstream of or within of a populated area? (Y/N)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF12-Fed/Prov/Municipal area of interest? (Y/N)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF13-WL hydrologic condition	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT
SF14-WL important for maintaining stream flow? (Y/N)	Y	N	Y	N	N	Y	N	Y	N	N	N	N	N	Y	N	N	Y	N	N	N	N	N
SF15-WL ability to detain surface water (H,M,L)	M	H	M	M	M	M	M	M	M	M	M	M	M	H	M	M	H	M	M	M	M	M

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Significant Function	WL1	WL2	WL3	WL4	WL5	WL6	WL7	WL8	WL9	WL10	WL11	WL12	WL13	WL14	WL15	WL16	WL17	WL18	WL19	WL20	WL21	WL22
SF16-Wetland improves water quality? (Y/N)	Y	Y	Y	N	N	Y	Y	Y	N	Y	N	N	N	Y	Y	N	Y	N	N	N	Y	Y
SF17-Evidence of excess nutrient loading/ contamination? (H,M,L)	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
SF18-WL contributes to water quality in downstream resources (H,M,L)	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
SF19-WL serves as a recharge site (Y/N)	N	N	N	N	N	N	N	N	Y	N	Y	N	N	N	N	Y	N	Y	Y	Y	N	N
SF20-WL serves as a discharge site (Y/N)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SF21-WL ability to stabilize shoreline (H,M,L)	M	H	L	L	L	L	M	M	L	M	L	L	L	M	M	L	L	L	L	L	L	M
SF22-Is the plant community unique or rare regionally or provincially? (Y/N)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF23-Does the WL contain a diversity of plant communities (H,M,L)	H	H	L	L	M	L	L	H	M	L	M	L	L	M	L	L	M	M	M	M	L	L
SF24-Rate the overall integrity/quality of plant community? (H,M,L)	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
**SF25-Are there any observed rare or endangered plant species? Specify.*	S2	N	N	N	N	N	N	S2	N	S3	S2	S2	N	N	N	N	S2	S2,S3	S2	S2	N	N
SF26-Does wetland support fish/fish habitat? (Y/N)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
**SF27-Rare or endangered fish/wildlife species found in the wetland?*	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF28-Overall fish and wildlife habitat quality (H,M,L)	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
SF29-Rate the wetland's community use/ value (H,M,L)	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L

Notes:

* SF7/SF25/SF27 is considered a red rated function if a species present is listed by SARA or NSESA as Endangered/Threatened/Special Concern; NSDNR - Red listed; or Ranked by ACCDC as S1

Cells highlighted in red indicate this function is considered to be critical to the watershed or represent a highly degraded watershed. These functions are typically unique or rare or associated with a high risk to the watershed if lost (NSE 2014c).

unless otherwise stated: H=High; M=Moderate/Medium; L=Low; Y=Yes; N=No; NAT=Natural

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Wetland 1 (WL1)

WL1 is a fen/bog/swamp wetland complex approximately 16.5 ha in total area located in the southeast end of the Project Area. An un-named stream flows into this wetland from the northwest corner and outlets from the southeast corner. A shrub and treed swamp borders the stream as it flows through the wetland. A power transmission corridor is present along the southern end of this wetland. This wetland may significantly contribute to the maintenance of water flow to the unnamed stream that constitutes the inlet and outlet of this wetland. One lichen species of conservation concern, Black-footed Reindeer Lichen (*Cladonia stygia* – ACCDC rank; S2S3) was recorded in WL1.

Wetland 2 (WL2)

WL2 is characterized as a wetland complex comprised of marsh, fen and swamp wetland types. This wetland borders a small pond at the northern boundary located behind a barrier beach. Two small unnamed streams enter this wetland on the south side but there is no evidence of an outlet channel. There is evidence that this area does receive periodic salt water influx during storm events (presence of dried seaweed and ocean litter such as lobster traps and buoys) however the vegetation present in this wetland indicate that this is a fresh water pond. This wetland provides a high diversity of habitat that can be utilized by various wildlife species. WL2 may also serve to stabilize the shoreline during storm events.

Wetland 3 (WL3)

WL3 is characterized as a sloped throughflow fen wetland located in the northern end of the Project Area. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated. This wetland may significantly contribute to the maintenance of water flow to the unnamed stream that constitutes the inlet and outlet of this wetland which flows east and connects to WL2.

Wetland 4 (WL4)

WL4 is characterized as an isolated treed bog wetland located near the coast in the northern end of the Project Area. Dominant species in this wetland include Cinnamon Fern, Three-seeded Sedge (*Carex trisperma*) and Black Spruce. The land surrounding the wetland is dominated by coniferous forest and is in a natural state and fully vegetated. Although the wetland contains low diversity in terms of species and plant communities, the plant community present is considered of high quality.

Wetland 5 (WL5)

WL5 is characterized as a sloped throughflow fen wetland at the northern end of the Project Area. This wetland contains a mix of herb and shrub dominated areas. The herb fen portions of this wetland are dominated by Cottongrass (Eripohorum sp), and Bog Aster (*Oclemena nemoralis*) while the shrub portion is dominated by Alder and Mountain Holy. Broadleaf cattail (*Typha latifolia*) is present within the small stream that flows through this wetland.

Wetland 6 (WL6)

WL6 is characterized as an outflow bog wetland. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated. This wetland is important in maintaining stream flow of the unnamed stream that originates from the west and east ends of this wetland. These outflow streams hydrologically connect Wetland 6 to Wetland 5 in the west and WL3 in the east.

Wetland 7 (WL7)

WL7 is characterized as a throughflow swamp wetland which occurs at the forest edge at the northern end of the Project Site. Dominant species in this wetland include Cinnamon Fern, Three-seeded Sedge (*Carex trisperma*) and Black Spruce. The land surrounding the wetland is dominated by coniferous forest and is in a natural state and fully vegetated.

Wetland 8 (WL8)

WL8 is characterized as a wetland complex comprised of a mix of bog, fen and swamp types that follows an un-named watercourse along the western end of the Project Area. This wetland may significantly contribute to the maintenance of water flow to this stream which southwest beyond the Project Area. The Bog Portion of this wetland may also serve as a groundwater recharge site which is based on the lack of perennial outlet channel, type of wetland and conditions of upland soil. Wetland 8 contains a high diversity of plant communities providing habitat to a variety of wildlife species. Two lichen species of conservation concern, Black-footed Reindeer Lichen (*Cladonia stygia* – ACCDC rank; S2S3) and Coastal Bushy Heard Lichen (*Usnea flammea* – ACCDC rank; S2S3) were recorded in WL8.

Wetland 9 (WL9)

WL9 is characterized as an isolated domed bog wetland located on the western boundary of the Project Area. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated. This wetland may serve as a groundwater recharge site which is based on the lack of perennial outlet channel, type of wetland and conditions of upland soil. The plant community in this wetland was determined to be relatively intact with moderate species diversity and little to no influence of invasive/non-native species. One lichen species of conservation concern, Black-footed Reindeer Lichen (*Cladonia stygia* – ACCDC rank; S2S3) was recorded in WL9.

Wetland 10 (WL10)

WL10 is characterized as a throughflow treed swamp wetland located in the western end of the Project Area. An ATV trail was noted to run through the southern end of this wetland. Although this wetland contains low diversity of plant communities, the community present is of high quality. One lichen species of conservation concern, Naked Kidney Lichen (*Nephroma bellum* – ACCDC rank; S3?) was recorded in WL10.

Wetland 11 (WL11)

WL11 is characterized as a large isolated domed bog wetland located in the central portion of the Project Area near Fogherty Lake. This wetland may serve as a groundwater recharge site. The plant community in this wetland was determined to be relatively intact with moderate species diversity and little to no influence of invasive/non-native species. One lichen species of conservation concern, Black-footed Reindeer Lichen (*Cladonia stygia* – ACCDC rank; S2S3) was recorded in WL11.

Wetland 12 (WL12)

WL12 is characterized as an outflow bog / fen wetland located in the central portion of the Project Area. A skidder trail has been constructed through this wetland however the integrity of the wetland and surrounding buffer is considered to be high. Although this wetland contains low diversity of plant communities, the community present is of high quality. One lichen species of conservation concern, Coastal Bushy Beard Lichen (*Usnea flammea* – ACCDC rank; S2S3) was recorded in WL12.

Wetland 13 (WL13)

WL13 is characterized as an isolated treed swamp wetland located in a depression in the landscape in the central portion of the Project Area. Vegetation surrounding the wetland consists of a mix of coniferous forest and shrub barren. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated.

Wetland 14 (WL14)

WL14 is characterized as a wetland complex comprised of a mix of bog and fen types. The plant community in this wetland was determined to be relatively intact with moderate species diversity and little to no influence of invasive/non-native species. This complex consists of a number of different wetland types and as such it is considered to have a moderate diversity of high quality vegetation communities. This wetland may significantly contribute to the maintenance of water flow to the unnamed stream that constitutes the inlet and outlet of this wetland which flows to the east eventually into Murphy's Lake.

Wetland 15 (WL15)

WL15 is characterized as a sloped throughflow fen wetland located in a depression in the landscape. A skidder trail is present through the east side of the wetland. A small watercourse flows through this wetland from west to east, eventually connecting to Wetland 14. Vegetation surrounding the wetland consists of a mix of coniferous forest and tall shrub barren. Although this wetland contains low diversity of plant communities, the community present is of high quality.

Wetland 16 (WL16)

WL16 is characterized as an isolated bog wetland. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated. This wetland is located at

the eastern boundary of the Project Area. Wetland 16 may serve as a groundwater recharge site.

Wetland 17 (WL17)

WL17 is characterized as an outflow bog / swamp wetland complex located along the proposed access road to the Site. This wetland may significantly contribute to the maintenance of water flow to the unnamed stream that originates from this wetland and extends to the west of the Site. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated. Two lichen species of conservation concern, Coastal Bushy Beard Lichen (*Usnea flammea* – ACCDC rank; S2S3) and Naked Kidney Lichen (*Nephroma bellum* – ACCDC rank S3?) was recorded in WL17.

Wetland 18 (WL18)

WL18 is characterized as an isolated bog wetland located along the proposed access road to the Project Site. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated. One plant species of conservation concern, Northern Comandra (*Geocaulon lividum* – ACCDC rank; S3) was recorded in WL18. One lichen species of conservation concern, Black-footed Reindeer Lichen (*Cladonia stygia* – ACCDC rank; S2S3) was also recorded in WL18. This wetland may also serve as a groundwater recharge site.

Wetland 19 (WL19)

WL19 is characterized as an isolated bog wetland located on the proposed access road to the Project Site. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated. One lichen species of conservation concern, Black-footed Reindeer Lichen (*Cladonia stygia* – ACCDC rank; S2S3) was recorded in WL19. This wetland may also serve as a groundwater recharge site.

Wetland 20 (WL20)

WL20 is characterized as an isolated bog wetland located on the proposed access road to the Project Site. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated. One lichen species of conservation concern, Black-footed Reindeer Lichen (*Cladonia stygia* – ACCDC rank; S2S3) was recorded in WL20. This wetland may also serve as a groundwater recharge site.

Wetland 21 (WL21)

WL21 is characterized as a sloped inflow fen wetland located at the north east corner of the Project Area. Although there is no outflow channel present, outflow from this wetland likely occurs under/through the boulder, cobble beach located along the northern boundary of this wetland. An old ATV trail is present through this wetland however there is a second more recently used trail travelling around the wetland indicating that users are now avoiding the wetland. The plant community in this wetland was determined to be relatively intact with

moderate species diversity and little to no influence of invasive/non-native species. Although this wetland contains low diversity of plant communities, the community present is of high quality.

Wetland 22 (WL22)

WL22 is characterized as a sloped throughflow fen wetland located at the north east end of the Project Area. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated. This wetland consists of two open fen portions connected by a small watercourse. Although this wetland contains low diversity of plant communities, the community present is of high quality.

6.4.3 Terrestrial Wildlife

Important Terrestrial Fauna Habitats

Significant habitats include sites where SAR or species of conservation concern occur, habitats that are rare in NS, and sites where unusually large concentrations of wildlife occur (NSEL 2009). The NSDNR maintains a Significant Species and Habitats (SigHab) database (NSDNR 2012a), which in addition to sites described above may also report habitats that are critical for species that are not rare but are valued by humans, or are sensitive to human developments.

The NSDNR (SigHab) database (NSDNR 2012a) was reviewed in order to obtain a complete list of significant habitats identified within 100 km of the Project footprint. It should be noted, however, that this database may not be comprehensive or up to date for the Project area. A total of 956 significant habitat polygons (identified by unique site ID numbers) are located within 100 km of the proposed Project site, including:

- 170 deer wintering areas;
- 127 migratory bird areas;
- 193 areas with species of concern;
- 39 areas for SAR; and
- 427 areas considered “other habitats”.

Forty-one of these significant habitats are located within 20 km of the Project site (Figure 6.4-5), only one (for Harlequin Duck) overlap with the Project site. Almost half of the significant habitats (18) are areas with avian species of concern; the others are migratory bird areas (10), areas with avian SAR (4), deer wintering areas (1), and “other habitats” (8) which include important habitats for Common Eider and nesting areas for raptors or colonial species.

Table 6.4-5:
Significant Habitats Within 20 km of the Project Site

Site #	Type	Primary Species	Approximate Location in relation to Project area
RI360	Species of concern	Common Tern	Across Chedabucto Bay, approximately 19 km to the north.
RI358	Migratory bird	Common Eider	Across Chedabucto Bay, approximately 19 km to the north.
RI323	Migratory bird	Double-crested Cormorant	Across Chedabucto Bay, approximately 18.7 km to the northeast.
RI324	Species of concern	Common Tern	Across Chedabucto Bay, approximately 18.5 km to the northeast.
RI367	Migratory bird	Whimbrel	Across Chedabucto Bay, approximately 16.5 km to the northeast.
GU855	Migratory bird	Unspecified	Across Chedabucto Bay, approximately 18.8 km to the west-northwest.
GU858	Migratory bird	Unspecified	Located 16.0 km to the east.
GU915	Migratory bird	Common Eider	Nearest point is 16.4 km to the south-southeast.
GU875	Migratory bird	Common Eider	Nearest point is 15.5 km to the south-southwest.
GU874	Species of concern	Common Eider	Nearest point is 16.9 km to the southwest.
GU876	Other habitat	Significant area	Located 15.5 km to the south-southwest.
GU873	Species of concern	Common Eider	Located 17.5 km to the southwest.
GU872	Species of concern	Common Eider	Nearest point is 17.9 km to the southwest.
GU877	Migratory bird	Common Eider	Nearest point is 16.9 km to the south-southeast.
GU938	Species of concern	Roseate Tern	Located 19.5 km to the southwest.
GU940	SAR	Tern (unclassified)	Nearest point is 14 km to the south-southwest.
GU985	Other habitat	Bald Eagle	Located 13.8 km east of the site.
GU871	Migratory bird	Waterfowl	Nearest point is 15.5 km to the southwest.
GU988	Deer wintering area	White-tailed Deer	Nearest point is 19 km to the west-northwest, across Chedabucto Bay.
RI705	Other habitat	Common Eider	Across Chedabucto Bay, approximately 18 km to the northeast.
RI706	Other habitat	Common Eider	Across Chedabucto Bay, approximately 18.3 km to the northeast.
RI707	Other habitat	Common Eider	Across Chedabucto Bay, approximately 18.3 km to the northeast.
RI708	Other habitat	Common Eider	Across Chedabucto Bay, approximately 18.8 km to the northeast.
GU990	SAR	Harlequin Duck	Nearest point is 7.6 km to the south-southeast.
GU991	SAR	Harlequin Duck	Nearest point is 9.2 km to the east.
GU992	SAR	Harlequin Duck	Extends along part of the coast of the Canso peninsula, including the northern edge of the Project area.
GU994	Migratory bird	Double-crested Cormorant	Located 12.5 km to the east.
GU995	Species of concern	Tern (unclassified)	Located 14.8 km to the northwest, across Chedabucto Bay.
GU1002	Species of concern	Tern (unclassified)	Located 16.3 km to the south-southwest.
GU1004	Species of concern	Tern (unclassified)	Located 15.9 km to the south-southwest.
GU1005	Species of concern	Tern (unclassified)	Located 9.6 km to the west.

Site #	Type	Primary Species	Approximate Location in relation to Project area
GU1006	Species of concern	Tern (unclassified)	Located 4.6 km to the west.
GU1007	Species of concern	Tern (unclassified)	Nearest point is 17.5 km to the east.
GU1008	Species of concern	Tern (unclassified)	Located 13.5 km to the east.
GU1009	Species of concern	Cormorant (unclassified)	Located 17.2 km to the east.
GU1010	Other habitat	Great Blue Heron	Nearest point is 12.2 km to the southeast.
GU1011	Species of concern	Tern (unclassified)	Located 13.8 km to the southeast.
GU1012	Species of concern	Tern (unclassified)	Located 15.9 km to the south.
GU1013	Species of concern	Tern (unclassified)	Located 16.3 km to the south.
GU1014	Other habitat	Great Blue Heron	Nearest point is 16.5 km to the south.
RI735	Species of concern	Tern (unclassified)	Across Chedabucto Bay, approximately 19 km to the northeast.

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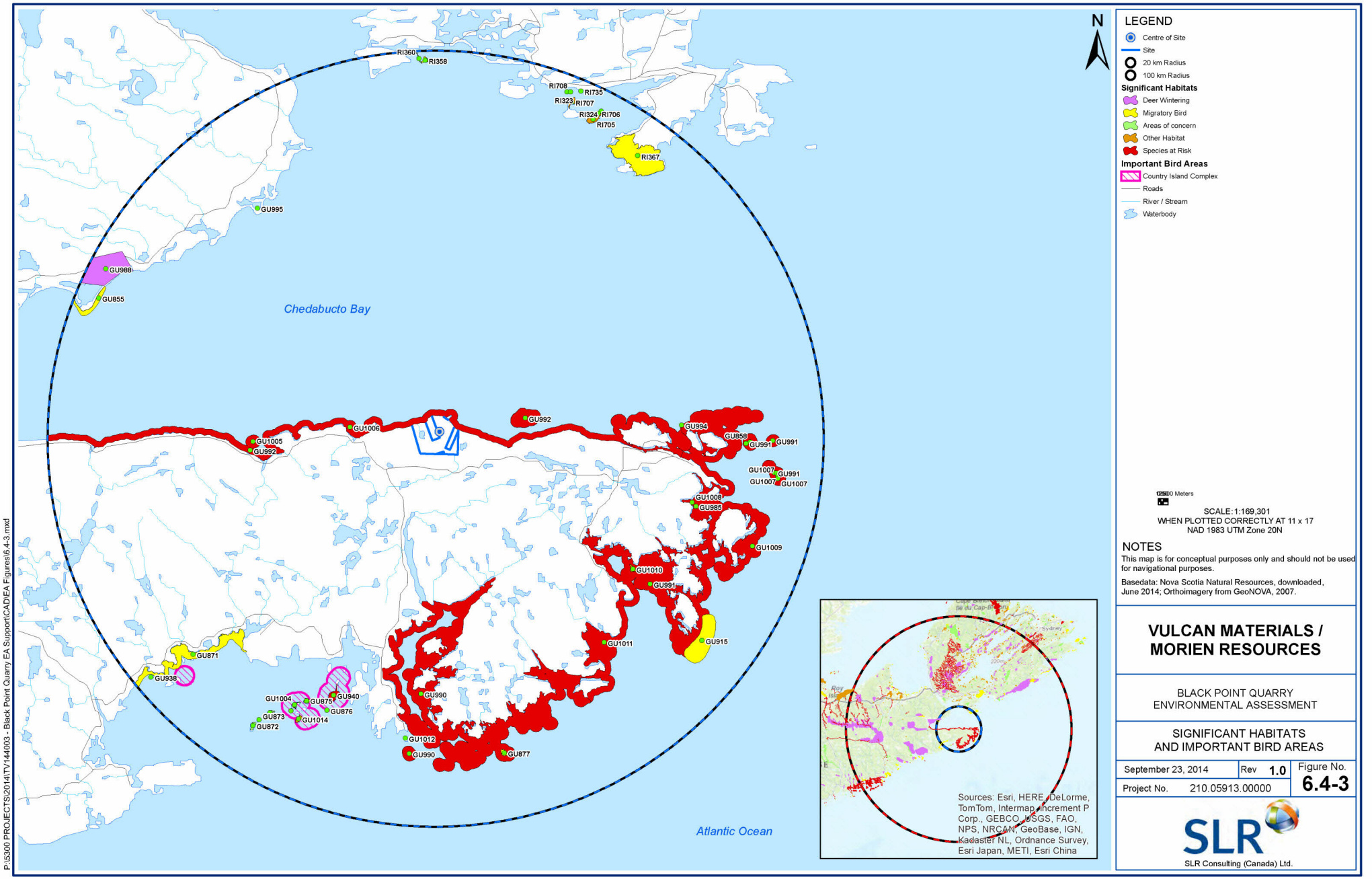
N
LEGEND
Centre of Site
Site
20 km Radius
100 km Radius
Significant Habitats
Deer Wintering
Migratory Bird
Areas of concern
Other Habitat
Species at Risk
Important Bird Areas
Country Island Complex
Roads
River / Stream
Waterbody
Chedabucto Bay
Atlantic Ocean
RI360
RI358
RI708
RI735
RI323
RI707
RI324
RI706
RI705
RI367
GU995
GU988
GU855
GU1005
GU992
GU1006
GU992
GU994
GU858
GU991
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GU1007
GU991
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GU985
GU1009
GU1010
GU991
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GU940
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GU873
GU1014
GU872
GU990
GU1012
GU990
GU877
0 2500 Meters
SCALE:1:169,301
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N
NOTES
This map is for conceptual purposes only and should not be used for navigational purposes.
Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.
Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China
VULCAN MATERIALS / MORIEN RESOURCES
BLACK POINT QUARRY
ENVIRONMENTAL ASSESSMENT
SIGNIFICANT HABITATS
AND IMPORTANT BIRD AREAS
September 23, 2014
Rev 1.0
Figure No.
6.4-3
Project No. 210.05913.00000
SLR
SLR Consulting (Canada) Ltd.
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C 1340-337

One significant habitat was located along the northern coast of the Project footprint, Site # GU992 - SAR (Harlequin Duck). Harlequin Duck (NSESA: Endangered; SARA: Special Concern) are most often found along the coast of NS from November to April, where they congregate in coastal waters along turbulent rocky shores to feed (EC 2007).

Areas of particular importance to the survival of bird species may be given the designation of Important Bird Area (IBA). The IBA program is coordinated by BirdLife International, and administered in Canada by the Canadian Nature Federation and Bird Studies Canada (IBA 2014). The criteria used to identify important habitat are internationally standardized, and are based on the presence of species at risk, species with restricted range, habitats holding representative species assemblages, or a congregation of a significant proportion of a species' population during one or more season. These criteria are used to identify sites of national and international importance.

There is only one IBA located within 25 km of the Project area, the Country Island Complex (NS028), located in Country Harbour and Tor Bay. The Country Island Complex includes Country Island, Goose Island, an unnamed island off Charlos Cove, a peninsula at Fisherman's Harbour, Inner West Bird Island, and three sites in Tor Bay (Cooks, Dorts, and Hog Islands), and its nearest point is approximately 13 km from the Project area to the southwest. Each of these sites supports or has previously supported nesting Roseate Terns, with the largest number found on Country Island (IBA 2014). In 2000, 54 nests were recorded in the Country Island Complex (IBA 2014), although in 2014, just 15 pairs were reported (J. Rock, pers. comm. 2014). The complex also supports a globally significant colony of Leach's Storm-petrel (*Oceanodroma leucorhoa*) (IBA 2014).

Marine traffic associated with the quarry involves at maximum about two bulk carriers visiting the site per week. These vessels will travel within existing commercial shipping lanes, which pass to the south of the South Shore (Port Joli sector) IBA (NS004) near the town of Liverpool. This IBA includes four designated Migratory Bird Sanctuaries (Port Joli, Port Hebert, Sable River and Haley Lake) and provides a variety of coastal habitats including tidal rivers and estuaries, mud or sand flats, open seas, inlets, coastal cliffs and rocky shores (IBA 2014). Nationally significant numbers of Piping Plover (*SARA* and *NSESA*: Endangered) have nested in this IBA, and during fall migration, large numbers of shorebirds including Black-bellied Plover, Willet, Least Sandpiper, Semipalmated Sandpiper, and Pectoral Sandpiper, feed on the tidal flats. In the winter months, large numbers of waterfowl including Canada Goose, American Black Duck, and Harlequin Duck are present (IBA 2014).

Vertebrates

Birds

Most birds are protected under the MBCA, while others (including raptors, non-migratory game birds, and kingfishers) are regulated under the NSWA. In order to obtain site-specific information on bird species in the Project area, avian field surveys were conducted at the site in 2010 and 2011, and supplemental avian observations on the Project site were made during the September 2014 moose survey.

Field surveys for birds were carried out at those times of the year when birds make the most intensive use of the area; details of the survey methodologies can be found in **Appendix E** (AMEC 2010 surveys) and **Appendix G** (AECOM 2011 winter bird surveys). Survey times were

chosen based on known breeding and migration periods, and all habitats used by the targeted birds were surveyed at appropriate times of the year to maximize the quality and quantity of data obtained. Surveys were conducted at the time of day with the highest likelihood of detecting the target species (e.g., early morning for breeding passerines, and during the appropriate parts of the tidal cycle for shorebirds), and in favourable conditions to maximize detection probability (low winds, no precipitation). Survey dates and primary targets were as follows, and the survey locations are provided in Figure 6.4-4.

- April 14th, 2010: year-round residents and early breeders, including owls;
- May 18th and 19th, 2010: main passerine migration and early breeders;
- June 22nd and 23rd, 2010: main passerine breeding;
- August 25th, 2010: shorebird migration;
- September 23rd, 2010: late shorebird migration; and
- January 18th and 19th, 2011: winter bird species.

Results were obtained for the Second Maritimes Breeding Bird Atlas for the 10 km by 10 km Atlas square which includes the Project area (MBBA 2014). Breeding evidence was recorded for 43 species in Square 20PR42, including four confirmed breeding and 12 considered to be probably breeding based on observed evidence (**Appendix E**). Data were obtained for the Audubon Christmas Bird Count (CBC) in the Strait of Canso, which is the count location nearest the Project area, centred approximately 30 km to the northwest (National Audubon Society 2014). A total of 116 species have been identified in the 17 years of Christmas Bird Counts for which data were available (1995 - 2012; see **Appendix E**). Additional information on bird species in the general Project area was obtained from the ACCDC, Important Bird Areas (IBA) of Canada website, and through information requests from EC-CWS and NatureCounts.

Species Protected under *Nova Scotia Wildlife Act* (NSWA)

Raptor and owl species reported during 2010 and 2011 field surveys of the Project site include Barred Owl, Northern Saw-whet Owl, Bald Eagle, American Kestrel, Merlin, Northern Harrier, Red-tailed Hawk, Sharp-shinned Hawk, and an Osprey was observed in the Project area in 2014. In addition to owls and raptors, Belted Kingfisher, Spruce Grouse and Ruffed Grouse were observed during the 2010-2011 field surveys (**Appendix E**). All of these species are considered possibly breeding in the Project area.

Short-eared Owl and Long-eared Owl were both reported within 100 km of the Project area according to ACCDC (2010), although only the former has potential to breed in the Project area based on available habitat. Broad-winged Hawk, Rough-legged Hawk and Northern Goshawk have each been reported on one occasion in the Strait of Canso Christmas Bird Count (**Appendix E**). NSDNR reports a significant habitat for Bald Eagle 13.8 km east of the Project area (Table 6.4-5).

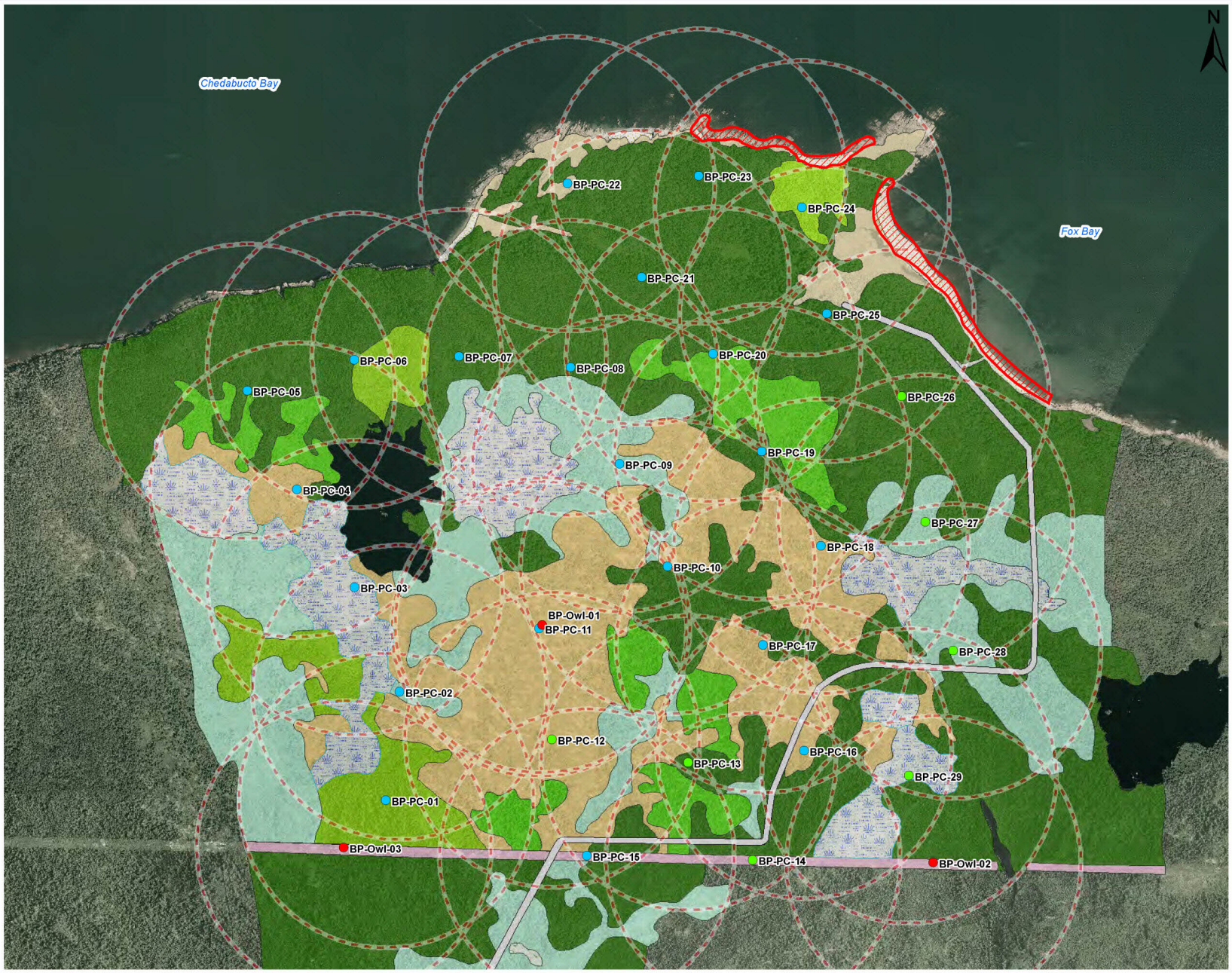
Migratory Birds Protected under the MBCA

Most species of migratory birds, including passerines, waterfowl, shorebirds and seabirds, are protected under the MBCA. These groups are discussed in turn below.

C 1340-339

Landbirds

During June 2010 breeding bird surveys conducted in the Project area, a total of 39 species of migratory landbirds (including passerines, woodpeckers and unclassified species such as hummingbirds) were observed to be possibly breeding in the Project area, including sparrows, finches, thrushes, kinglets, vireos, and numerous warbler species (Table B.1-2 in **Appendix E**). An additional 11 confirmed or potentially breeding species were not observed in the Project area during the breeding season, but reported in the MBBA square in which the Project is located (MBBA 2014); these include Tree Swallow, Bank Swallow, Barn Swallow, Blue Jay, Common Grackle, Ceder Waxwing, European Starling, Fox Sparrow, Mourning Dove, Red-eyed Vireo and Tennesee Warbler (**Appendix E**) The Common Nighthawk was not observed.



LEGEND

2010 Bird Survey Locations

- Early Morning Point Count
- Late Morning/Mid Afternoon Point Count
- Owl Survey
- Shorebird Survey Area
- 400m Buffer (2010 Bird Survey Locations)

Terrestrial Habitats

- Wetland
- Coniferous Forest
- Open Coniferous Forest
- Open Mixed Forest
- Regenerating Coniferous Forest
- Regenerating Forest
- Bog
- Coastal Barren
- Open Barren
- Shrub Barren
- Sand Gravel Beach
- Powerline Transmission Corridor

0 125 250 500 Meters

SCALE: 1:10,000
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

VULCAN MATERIALS / MORIEN RESOURCES

BLACK POINT QUARRY
ENVIRONMENTAL ASSESSMENT

2010 BIRD SURVEY LOCATIONS

September 24, 2014	Rev 1.0	Figure No. 6.4-4
Project No. 210.05913.00000		

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In May 2010, 39 species of migrating passerines were observed, while in fall (August and September) 2010, 15 passerine species were noted (Table B.1-1 and Table 3.3 in **Appendix E**).

In the Project area, early spring 2010 and winter 2011 surveys yielded a few common resident landbird species (Table 3.1 in **Appendix E**). Other potential wintering landbird species in the area may be found in the Strait of Canso CBC results (**Appendix E**).

Shorebirds

Overall, the eastern shore of NS does not support large numbers of migrating shorebirds, and only small numbers of shorebirds were observed during the fall surveys at the Project area. A total of five species of shorebirds were found during the 2010 field surveys, all along the sand/gravel beach during the fall migration period (**Appendix E**). Two of those species, the Greater Yellowlegs and Spotted Sandpiper, have potential to breed in the project area, although no evidence of breeding was noted. Fogherty Lake does not appear to provide good breeding habitat for these species, as the bank vegetation is dense and shrubby, and there are no shallow areas for wading.

The barrens habitat present on the Project site provides potential stopover habitat for species such as Whimbrel. In September 2014, two days of surveys were conducted, primarily in the open barrens and wetland habitats, for Mainland Moose (see Appendix N Attachment F for geographical coverage). These surveys included recording of any shorebird sightings. However, no Whimbrel was observed; the timing of these surveys was not optimal for Whimbrel, which is most abundant in the area in July and August, but is known to occur as late as October. In the August 2010 shorebird surveys, observations along the coastline as well as on the site (primarily around Fogherty Lake) were conducted, and again, no Whimbrel were observed; nonetheless, it is possible that they are present at and near the Project site in the late summer and early fall.

The Atlantic Canada Shorebird Survey (ACSS) database provides records of 7 shorebird species from a single survey on 15 August 1979 of several beaches between Port Shoreham and Hadleyville, west of Boyleston and across Chedabucto Bay from the Project area. A total of 4 Black-bellied Plovers, 14 Semipalmated Plovers, 1 Greater Yellowlegs, 1 Willet, 2 Least Sandpipers, 16 Ruddy Turnstones and 17 Spotted Sandpipers were reported (Bird Studies Canada 2015).

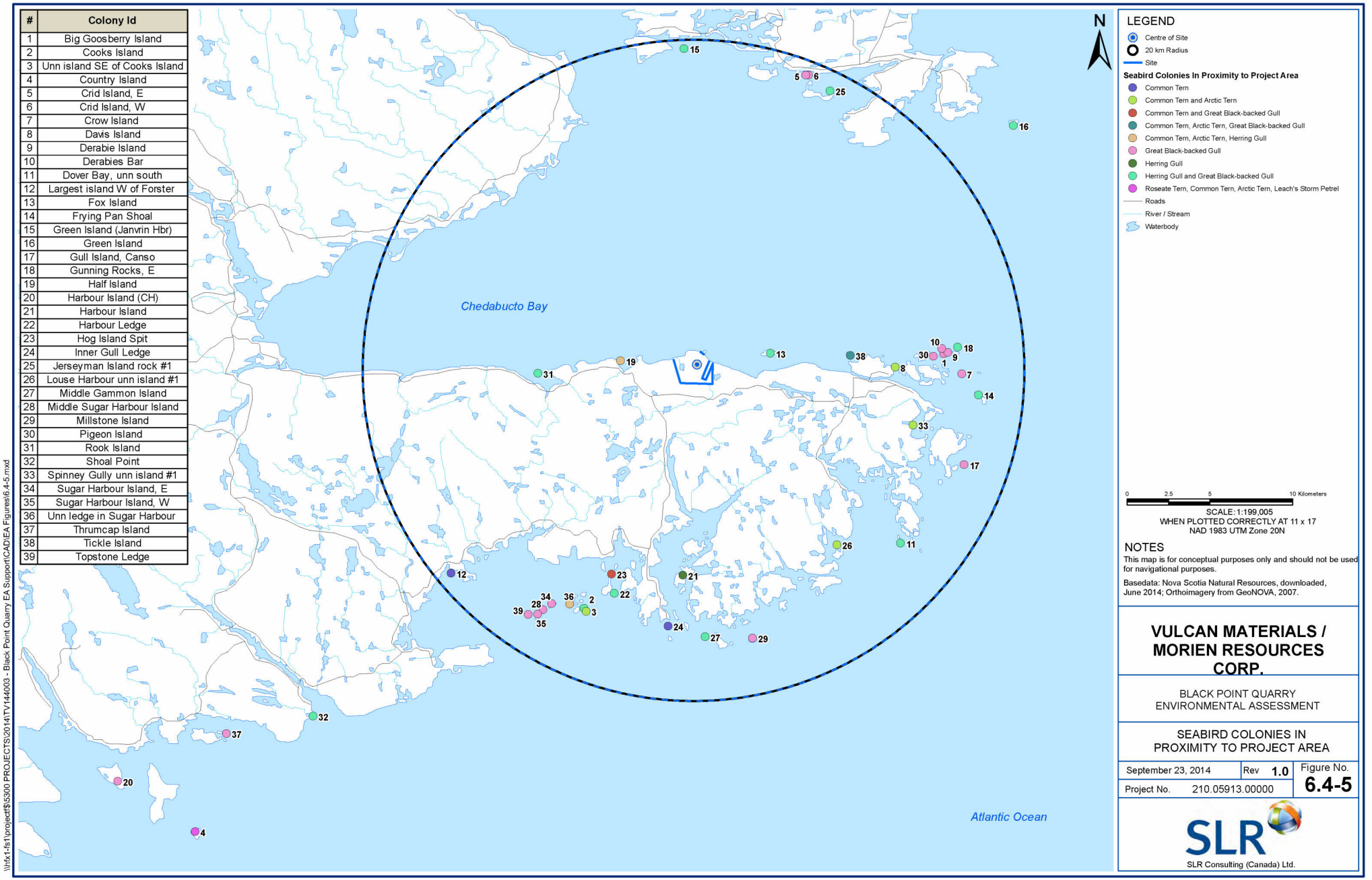
No shorebirds were observed in the MBBA in Square 20PR42, which includes the Project Site. The American Oystercatcher nests on Grassy Island, approximately 12 km east of the Project area near the town of Canso; this is one of only two known nesting sites in Canada for the American Oystercatcher, a species that suffered large declines in the early 20th century (EC-CWS pers. comm. 2014). . Purple Sandpiper has been reported in the general area in the Strait of Canso CBC (**Appendix E**) as well as during winter waterfowl surveys conducted by EC-CWS (A. Hicks, pers. comm. 2014); this species breeds in the Arctic, but regularly occurs in NS in the winter months, when it feeds along rocky coastlines.

Seabirds and Waterfowl

During field surveys conducted at the site, a total of 12 species of seabirds and waterfowl were observed in coastal environments at or near the Project area, including three gull species, two

cormorant species, four ducks, Common Loon, Northern Gannet and Horned Grebe (**Appendix E**). No breeding evidence for any of these species was observed.

In the MBBA, confirmed breeding was reported in Square 20PR42 for Common Eider and Great Black-backed Gull, and evidence of breeding was reported for Black Guillemot, Common Tern, Herring Gull, Red-breasted Merganser and Common Loon (**Appendix E**). A total of 39 seabird colonies have been identified in the vicinity of the Project area (EC-CWS 2014); these are illustrated on **Figure 6.4-5**. The largest, Country Island, is situated approximately 40 km southwest of the Project sites and supports approximately 1500 nesting pairs of terns including Common, Arctic and Roseate Tern, as well as a large colony of Leach's Storm Petrels (approximately 12,000 pairs). Black Guillemot and Common Eider also nest on Country Island, although numbers of breeding pairs are not provided (Rock and Shervill 2012). The other colonies support large gulls (Herring and Great Black-backed), Common Terns and Arctic Terns; the nearest such colonies are Half Island to the west and Fox Island to the east, each approximately 3 km from the Site.



#	Colony Id
1	Big Goosberry Island
2	Cooks Island
3	Unn island SE of Cooks Island
4	Country Island
5	Crid Island, E
6	Crid Island, W
7	Crow Island
8	Davis Island
9	Derabie Island
10	Derabies Bar
11	Dover Bay, unn south
12	Largest island W of Forster
13	Fox Island
14	Frying Pan Shoal
15	Green Island (Janvrin Hbr)
16	Green Island
17	Gull Island, Canso
18	Gunning Rocks, E
19	Half Island
20	Harbour Island (CH)
21	Harbour Island
22	Harbour Ledge
23	Hog Island Spit
24	Inner Gull Ledge
25	Jerseyman Island rock #1
26	Louse Harbour unn island #1
27	Middle Gammon Island
28	Middle Sugar Harbour Island
29	Millstone Island
30	Pigeon Island
31	Rook Island
32	Shoal Point
33	Spinney Gully unn island #1
34	Sugar Harbour Island, E
35	Sugar Harbour Island, W
36	Unn ledge in Sugar Harbour
37	Thrumcap Island
38	Tickle Island
39	Topstone Ledge

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

VULCAN MATERIALS / MORIEN RESOURCES CORP.

BLACK POINT QUARRY
ENVIRONMENTAL ASSESSMENT

SEABIRD COLONIES IN PROXIMITY TO PROJECT AREA

September 23, 2014	Rev 1.0	Figure No. 6.4-5
Project No. 210.05913.00000		

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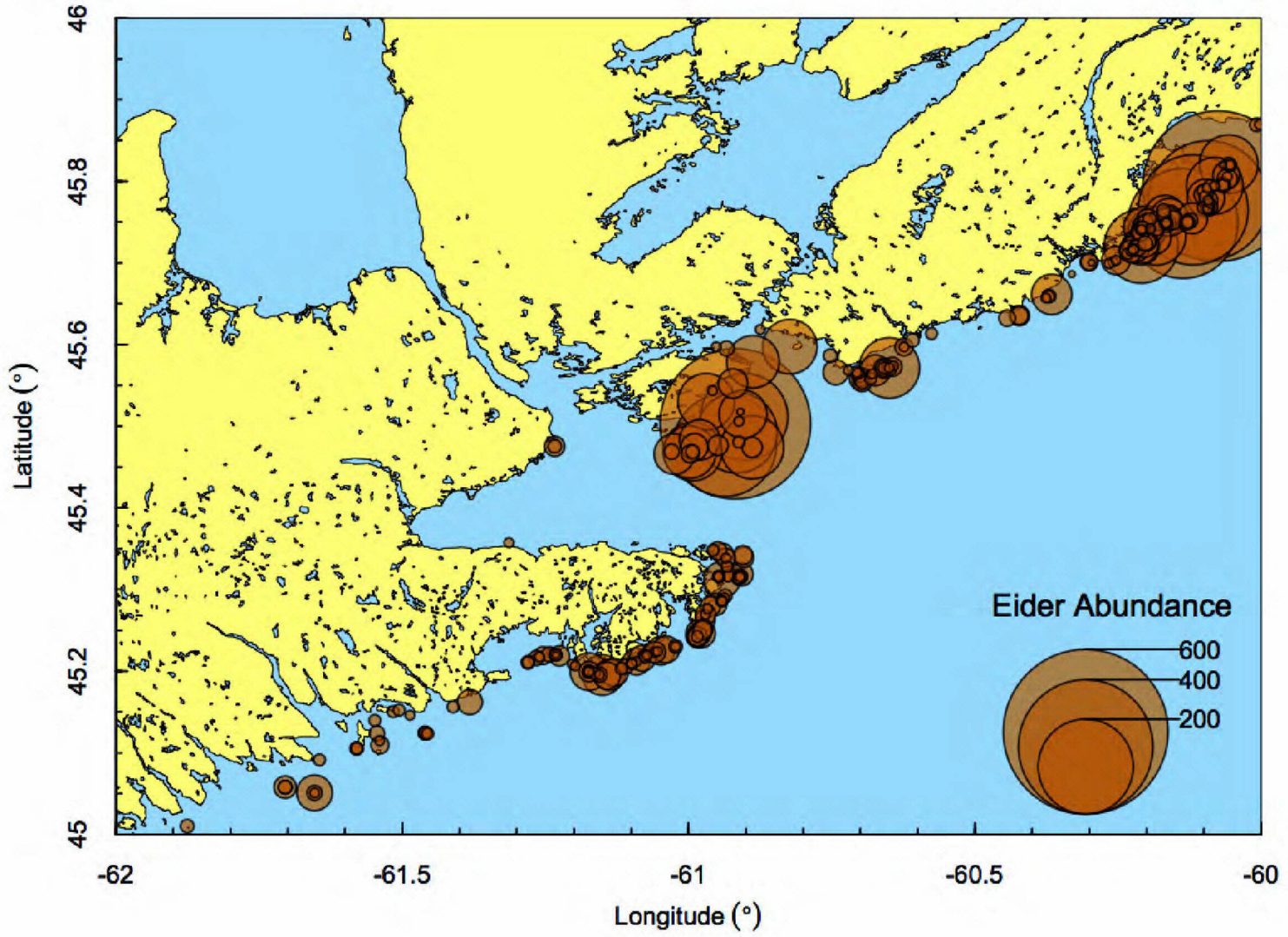
Results of winter surveys for waterfowl conducted by NSDNR and EC-CWS between 1992 and 2011 were obtained from EC-CWS. In Survey Block 226, which extends from approximately the mouth of Guysborough Harbour to the town of Canso and encompasses Black Point, Common Eider, American Black Duck, Common Goldeneye, Long-tailed Duck, Common Loon, mergansers, and scoters are observed most years. Canada lies at the northern edge of the wintering ranges for Surf Scoter, Black Scoter and White-winged Scoter, and while little information exists on the winter distributions of these species, it is likely that most individuals overwintering in Canada likely do so along the eastern shore of Nova Scotia (EC-CWS pers. comm. 2014). Unidentified cormorants, Bufflehead and Mallard have occasionally been observed; the cormorants are likely to be Great Cormorant, which is more abundant in the area during the winter months. Brant and Harlequin Duck were each reported on a single occasion. "Unidentified Goldeneye" has been reported in some survey years; these are likely to be Common Goldeneye but could potentially include Barrow's Goldeneye as well. Waterfowl density in Block 226 is relatively low compared to the adjacent Block 225 that extends from Canso to Dover Island and includes numerous small offshore islands off Canso at the mouth of Chedabucto Bay where thousands of Common Eiders are regularly seen in the winter surveys (A. Hicks, pers. comm. 2014). Other potential wintering seabird species in the area may be found in the Strait of Canso CBC results (**Appendix E**).

EC-CWS (pers. comm. 2014) provided further information on distribution and abundance of Common Eiders along eastern Nova Scotia during winter of 2012 (**Figure 6.4-6**), and stated that significant numbers of eiders are also known to moult along the east coast of Nova Scotia. During this moulting period, which occurs in late August to September for breeding females and June to July for immature, adult males and non-breeders (Goudie *et al*. 2000), birds are flightless and are highly vulnerable to oiling and very sensitive to disturbance. It is not known whether eiders moult in the Project study area.

The main overwintering site for the estimated 1100 to 1200 Harlequin Ducks that overwinter in Nova Scotia is located more than 100 km southeast of the Project site within the Eastern Shore Islands Wildlife Management Unit, but some Harlequin Ducks do winter in and near Chedabucto Bay (Soulliere and Thomas 2009). Little information exists on Harlequin Duck spring and fall use of the eastern shore of Nova Scotia, but large numbers of birds have been detected at times, which are assumed to be migrants (Soulliere and Thomas 2009). In the Chedabucto Bay area, Harlequin Ducks have been reported during fall migration, but not during spring migration (Soulliere and Thomas 2009). However, surveys conducted in May and early June of 2014 have detected significant numbers of Harlequin Ducks among offshore islands of the Eastern Shore in the Bay of Islands (Simon 2014), and it is believed that similar searches would likely detect spring migrants within the Project study area (EC-CWS pers. comm. 2014).

EC-CWS initiated the Eastern Canadian Seabirds at Sea (ECSAS) program in 2006 to monitor seabird species at sea. Available data from between 44°N and 46°N and 59°W and 62°W were obtained from EC-CWS; with only three ECSAS surveys conducted in this general area (in early July of 2007, 2008 and 2011), data are relatively scant (C. Gjerdrum, pers. comm. 2014). Nonetheless, they provide some general information on species presence in the area. Sightings in this broad area of interest included Great Shearwater and Sooty Shearwater, Black-legged Kittiwake, Northern Fulmar, Northern Gannet and Wilson's Storm-petrel (ECSAS 2014). None of these species nest in or near the Project area (EC-CWS 2014), and they are highly pelagic outside of the breeding season, and so are highly unlikely to occur in the Project area, other than possibly along shipping routes.

Common Eiders 3 March 2012



LEGEND

NOTES
This map is for conceptual purposes only and should not be used for navigational purposes.

Source: EC-CWS (pers. comm. 2014).

MORIEN RESOURCES CORP.

BLACK POINT QUARRY
ENVIRONMENTAL ASSESSMENT

COMMON EIDER ABUNDANCE
WINTER 2012

January 20, 2015	Rev 1.0	Figure No. 6.4-6
Project No. 210.05913.00000		

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Mammals

Throughout the field surveys conducted in the site in 2010 and 2014 by AMEC, and in 2011 by AECOM, evidence of mammal species presence such as sightings, tracks, vocalizations, tufts of hair, scat, and skeletal remains was recorded. Eleven terrestrial mammal species were observed by sight or sign in the Project area during the field surveys; a list of these species including one non-terrestrial species (the Gray Seal) is presented in Table 6.4-8. In addition to these, an unidentified vole was observed during the January 2011 AECOM surveys.

Table 6.4-6:
Terrestrial Mammal Species Identified in Project Area

Common Name	Scientific Name	Evidence
Red Squirrel	*Tamiasciurus hudsonicus*	Sighting, vocalizations
Eastern Chipmunk	*Tamias striatus*	Vocalizations
American Beaver	*Castor canadensis*	Dams, lodges
North American Porcupine	*Erethizon dorsatum*	Sighting
Bobcat	*Lynx rufus*	Tracks
Coyote	*Canis latrans*	Scat, tracks
Black Bear	*Ursus americanus*	Sighting, scat
Short-tailed Weasel	*Mustela erminea*	Sighting
Snowshoe Hare	*Lepus americanus*	Sighting, scat
White-tailed Deer	*Odocoileus virginianus*	Tracks, scat
Moose	*Alces alces*	Tracks, scat
Gray Seal	*Halichoerus grypus*	Sighting (offshore)

In addition to the above-noted species observed on the Site, suitable habitat exists for other mammals such Raccoon (*Procycon lotor*), and Red Fox (*Vulpes vulpes*), and small mammal species including shrews, voles, and mice are assumed to be present.

The NSDNR Hunter and Trapper Harvest website (NSDNR 2014a) was consulted in order to obtain information on species presence and harvest numbers for furbearer species, as well as White-tailed Deer and Snowshoe Hare, in Guysborough County from 2012-2013 (Table 6.4-9).

Table 6.4-7:
Hunter and Trapper Harvest in Guysborough County, 2012-2013

Common Name	Scientific Name	Number Harvested
Common Muskrat	*Ondatra zibethicus*	136
Fisher	*Martes pennanti*	7
American Beaver	*Castor canadensis*	207
North American River Otter	*Lontra canadensis*	72
American Mink	*Neovison vison*	27
Short-tailed Weasel	*Mustela erminea*	64
Bobcat	*Lynx rufus*	41
Canada Lynx	*Lynx canadensis*	1
Red Fox	*Vulpes vulpes*	14
Raccoon	*Procycon lotor*	15
Striped Skunk	*Mephitis mephitis*	3
Red Squirrel	*Tamiasciurus hudsonicus*	39
Coyote	*Canis latrans*	65
Snowshoe Hare	*Lepus americanus*	7,209

Common Name	Scientific Name	Number Harvested
White-tailed Deer	*Odocoileus virginianus*	325

The range of Canada Lynx (NSESA - Endangered) is largely restricted to Cape Breton Island (Nova Scotia Lynx Recovery Team (NSLRT) 2006), so their presence in the Project area is considered unlikely. Eastern Cougar (*Felis concolor*) (COSEWIC - Data Deficient) has been reported in NS, but with little substantial evidence corroborating its presence.

While the Project area is not located within the core habitat for mainland moose (NSESA - Endangered) as identified in the species' recovery plan (NSDNR 2007a), moose sightings have been documented in and around the Project area (M. Pulsifer, pers. comm.) and moose scat and tracks were noted by AMEC in July 2014. In September, a targeted field survey was conducted on the site, with the purpose of confirming presence of moose on the site and developing an understanding of the numbers and sex of moose using the site during the fall season and which areas and habitats they may be using. It is intended to supplement this survey data with winter track surveys and spring pellet surveys, to be conducted in early 2015. Results of the moose survey are discussed in Section 6.7, and details are provided in **Appendix H**.

Bats may be present in the Project area, and in fact, bat sightings have been reported within five km of the site in 2013 and 2014 (Nova Scotia Bat Conservation (NSBC) 2014). The town of Canso, located 12 km to the east of the site, reportedly supports a large concentration of bats (NSBC 2014). Bats in Nova Scotia commonly over-winter in abandoned mine workings; however, a search of the Nova Scotia Abandoned Mine Openings database (NSDNR 2014b) revealed no openings within 20 km of the site, and there are no documented caves or mines used by bats within 75 km (Moseley 2007). There are seven species of bats known to occur in Nova Scotia, four of which are migratory: Eastern Red Bat (*Lasuirus borealis*), Hoary Bat (*L. cinereus*), Big Brown Bat (*Eptesicus fuscus*), and Silver-haired Bat (*Lasionycteris noctivagans*). The three year-round resident species, the Little Brown Myotis (*Myotis lucifugus*), Northern Long-eared Myotis (*M. septentrionalis*) and Tri-coloured Bat (*Perimyotis subflavus*), are listed as Endangered by SARA, COSEWIC and NSESA, primarily due to the effects of the devastating fungal disease, White-nose Syndrome. Of these species, only the Little Brown Myotis and Northern Long-eared Myotis are likely to be present in the Project area; the four migratory species are irregular visitors to NS, and the Tri-coloured Bat is generally restricted to the southwestern part of the province (Broders *et al.* 2003).

Herpetiles

During terrestrial wildlife and freshwater field surveys conducted on the Project site in 2010 and 2014, reptile and amphibian observations were recorded during surveys for other taxonomic groups. Any evidence of herpetile species, including sightings, vocalizations, cast skins (snakes), skeletal remains, egg masses or presence of larvae, was recorded. Ponds and watercourses and their banks were scanned using binoculars during the day to detect presence of turtles, either in the water or basking, night-time field work included listening for vocalizations of frogs and toads, and coarse woody debris such as fallen logs and branches was overturned to look for salamanders and newts.

A list of herpetile species determined to be utilizing habitats on the proposed Project site is provided in Table 6.4-10.

Table 6.4-8:
Reptile and Amphibian Species Identified in Project Area

Common Name	Scientific Name	Evidence
Maritime Garter Snake	*Thamnophis sirtalis*	Sighting
Yellow Spotted Salamander	*Ambystoma maculatum*	Sighting of larvae
American Toad	*Bufo americanus americanus*	Sighting of adults, vocalizations
Spring Peeper	*Pseudacaris crucifer crucifer*	Sighting of adults, vocalizations
Green Frog	*Rana clamitans melanota*	Sighting of adults, vocalizations
Northern Leopard Frog	*Rana pipiens*	Sighting
Bullfrog	*Rana catesbieana*	Sighting of adults and larvae

Other herpetile species could be present based on habitat and range, including Eastern Smooth Green Snake (*Opheodrys vernalis*), Red-bellied Snake (*Storeria occipitomaculata*), Ring-necked Snake (*Diadophis punctatus*), Snapping Turtle (*Chelydra serpentina*), Painted Turtle (*Chrysemys picta*), Wood Turtle (*Glyptemys insculpta*), Wood Frog (*Lithobates sylvaticus*), Mink Frog (*L. septentrionalis*), Leopard Frog (*L. pipiens*), Blue-spotted Salamander (*Ambystoma laterale*), Spotted Salamander (*A. maculatum*), Eastern Red-backed Salamander (*Plethodon cinereus*), Four-toed Salamander (*Hemidactylium scutatum*), and Eastern Newt (*Notophthalmus viridescens*) (Gilhen 1984).

Snapping turtles (SARA: Special Concern; NSESA: Vulnerable) are not considered likely on the site based on the quality of available freshwater habitat. Wood Turtle (SARA and NSESA: Threatened), the most terrestrial of the three turtle species in NS, is considered to be possibly present although has not been observed in any surveys to date.

Invertebrates

Odonates (dragonflies and damselflies) were surveyed on the site in June and July 2010 by local odonate expert Mr. Paul Brunelle, assisted by AMEC staff. Additional specimens were collected during August and September 2010 by AMEC staff, and added to Brunelle's report. The complete odonate report, including details on the approach and methodology, is provided in **Appendix E**, Attachment B2. Odonates require wet areas for breeding, and the ponds, wetlands and watercourses in the Project area provide suitable habitat for these species. During the June and July surveys, the greatest odonate abundance was observed at Wetland 12 and at Wetland 2, Ponds 1 and 2; abundance was observed to be lower than expected at some other parts of the Project area (Fogherty Lake and Wetlands 17 and 19), although that may have been due in part to poor weather conditions at the time these location were surveyed. In all, 47 records of 25 species were documented during the June and July surveys (22% of the species known to occur in mainland NS), and an additional 18 records of 8 species (including 3 species not found in the earlier surveys) were collected in the August and September surveys **(Appendix E**). This was considered by Mr. Brunelle to be a moderate diversity. One species, the Spot-winged Glider (*Pantala hymenaea*) has a General Status rank of Sensitive.

Butterflies are expected to be present at the Project site, particularly in the central part, the wetlands and the coast, where suitable herbaceous vegetation exists. Butterfly observations were conducted by an experienced Maritimes Butterfly Atlas participant during the 2010 field

surveys; however, just one species, the Red Admiral (*Vanessa atalanta*), was identified in the Project footprint. According to the Maritimes Butterfly Atlas, there have been no observations to date in the 10 km by 10 km atlas square (20PR42) in which the Project area is situated (ACCDC: Maritimes Butterfly Atlas 2014). However, there have been a total of 10 records of 6 species in the two squares adjacent to 20PR42 for which observations were reported (20PR52 and 20PR41), all of which have a Canadian General Status rank of Secure in NS:

- Least Skipper (*Ancyloxypha numitor*);
- Peck's Skipper (*Polites peckius*);
- Tawny-edged Skipper (*Polites themistocles*);
- Long Dash Skipper (*Polites mystic*);
- Clouded Sulphur (*Colias philodice*); and
- Northern Blue (*Plebejus idas*).

6.5 Freshwater Environment

6.5.1 Methodology

This section summarizes the different freshwater environments located in the Project Area, including fish habitat. This information was gathered through desktop analysis, consultation with resource agencies, and on-site investigations in 2010 and 2014. **Appendix I** contains supporting field documentation for this subject. Freshwater fish and fish habitat baseline conditions were classified as lakes and watercourses based on size, depth, and percent of in-water vegetation.

The boundaries for aquatic assessment were based on the potential influence from the Project footprint, and the availability and accuracy of existing data. Efforts were made to sample all representative habitat types at each waterbody and watercourse location.

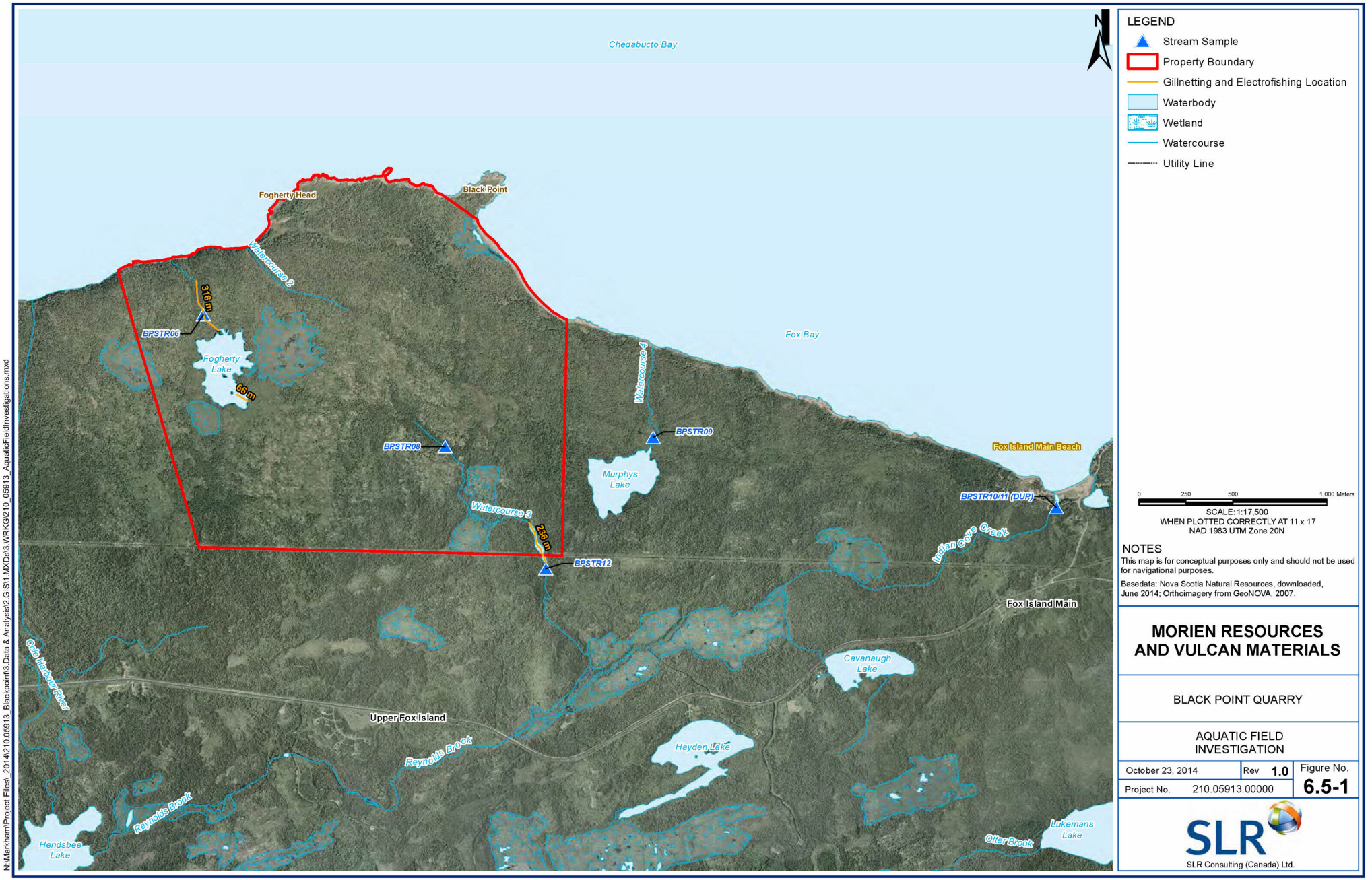
Ultimately this information was used to identify fish and fish habitat that are part of or support recreational, commercial, or Mi'kmaq fisheries.

6.5.1.1 *Field Investigations*

Aquatic field investigations were completed August 24th to 26th and September 20th to 22nd, 2010 by AMEC (**Appendix E**). Additional field data were collected on July 24th, 25th and 31st, 2014 by SLR. One water body and four unnamed watercourses were identified within the Project Area (**Figure 6.5-1**). The timing of the sampling events is summarized in the Table 6.5-1. Field investigations were completed in accordance with NBDNR/DFO New Brunswick Stream Survey and Habitat Assessment Protocol (Hooper *et al.* 1995).

Field investigations included fish community sampling, water quality samples and fish habitat mapping. The sampling program was designed to determine the presence or absence of fish within the Project Area. Fish collection methods were chosen to provide representative data for a broad range of species and size classes. Selection of sampling gear was based on waterbody size, depth and flow.

Prior to commencing fish community investigations, a Scientific Fish Collection Permit was obtained (License No. 323774) in accordance with Section 52 under the *Fisheries Act*.


Chedabucto Bay
Fogherty Head
Black Point
Watercourse 2
316 m
BPSTR06
Fogherty Lake
66 m
Fox Bay
Watercourse 4
BPSTR09
BPSTR08
Murphys Lake
Fox Island Main Beach
BPSTR10/11 (DUP)
Watercourse 3
259 m
BPSTR12
Indian Cove Creek
Fox Island Main
Gaio Harbour River
Cavanaugh Lake
Upper Fox Island
Hayden Lake
Reynolds Brook
Reynolds Brook
Hendsbee Lake
Otter Brook
Lukemans Lake
N
LEGEND
Stream Sample
Property Boundary
Gillnetting and Electrofishing Location
Waterbody
Wetland
Watercourse
Utility Line
0
250
500
1,000 Meters
SCALE: 1:17,500
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N
NOTES
This map is for conceptual purposes only and should not be used for navigational purposes.
Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.
MORIEN RESOURCES AND VULCAN MATERIALS
BLACK POINT QUARRY
AQUATIC FIELD INVESTIGATION
October 23, 2014
Rev 1.0
Figure No. 6.5-1
Project No. 210.05913.00000
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6.5.1.2 *Habitat Assessment*

Habitat assessments characterized water body type, stream morphology, water chemistry, bank habitat, in-water habitat, and noted migratory obstructions and potential enhancement opportunities. Each distinct habitat type within the identified watercourses and water bodies were sampled. Observations were recorded on habitat assessment forms to limit variability of observations among field staff and to assure consistent observations throughout the Project Area. Representative photographs of water bodies were taken and catalogued.

Measured field parameters included conductivity (µS/cm), water depth (m), pH, water and air temperatures (ºC) and dissolved oxygen (mg/L).

Substrate classification was based on particle diameter and grouped into six substrate categories: Boulder (>461 mm); Rock (180-460 mm); Rubble (54-179 mm); Gravel (2.6-53 mm); Sand (0.06-2.5 mm); and Fines (0.5^{-3}-0.05 mm).

Vegetation was visually assessed by estimating percent cover. Dominant aquatic plants were identified and percent cover was estimated for each species present. Riparian vegetation was also assessed for density and species.

6.5.1.3 *Fish Collection*

Fish community data were collected using gillnets, baited minnow traps, and a backpack electrofisher: gillnets in deep water environments; minnow traps in shallow near shore areas; and backpack electrofishing in shallow stream environments.

Two of the four watercourses were fished using a five minute “spot sampling” electrofishing technique. In the south end of Fogherty Lake, two multi-panel gillnets (2.5 cm to 10 cm mesh size) were deployed for two hours, and four minnow traps (baited with cat food) were set for four hours.

6.5.1.4 *Water Quality*

Surface water samples from designated locations (**Figure 6.5-1**, Table 6.5-1) were collected in laboratory bottles, placed on ice and sent for analysis to AGAT Laboratories in Dartmouth, NS. Water samples analyzed for general chemistry, total metals (including mercury), total suspended solids, and low-level phosphorus.

Table 6.5-1:
Summary of Field Investigations, 2010 and 2014

	Fogherty Lake			Watercourse 1			Watercourse 2			Watercourse 3			Watercourse 4		
	Aug 2010	Sep 2010	Jul 2014	Aug 2010	Sep 2010	Jul 2014	Aug 2010	Sep 2010	Jul 2014	Aug 2010	Sep2 010	Jul 2014	Aug 2010	Sep 2010	Jul 2014
Habitat Survey	X			X			X			X					
Backpack electrofishing	X			X			X			X					
Minnow Traps	X			X			X			X					
Gill Nets	X			X			X			X					
Water Quality	X	X	X	X	X	X	X	X	X	X	X	X		X	X

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Surface water quality data were compared to the most recent version of Canadian Council of the Ministers of the Environment (CCME) Canadian Water Quality Guidelines (CWQGs) for the protection of aquatic life (CCME 2012).

The CWQGs are numerical limits or narrative statements based on the most current, scientifically defensible toxicological data available for the parameter of interest, and are meant to protect all forms of aquatic life and all aspects of the aquatic life cycles, including the most sensitive life stage of the most sensitive species over the long term. Ambient water quality guidelines developed for the protection of aquatic life provide the science-based benchmark for a nationally consistent level of protection for aquatic life in Canada (CCME 2012). Water Quality Guidelines are provided in Table 6.5-2.

Table 6.5-2:
Surface Water Quality Guidelines

Parameter	Units	CWQG
Aluminium	ug/L	5
Ammonia (total)	mg/L	0
Antimony	ug/L	NV
Arsenic	ug/L	5
Barium	ug/L	NV
Bicarbonate alkalinity	mg/L	NV
Boron	ug/L	NV
Cadmium	ug/L	0.017
Calcium	ug/L	NV
Chloride	mg/L	120
Chromium	ug/L	NV
Colour	TCU	NV
Iron	ug/L	300
Lead	ug/L	1
Magnesium	ug/L	NV
Manganese	ug/L	NV
Molybdenum	ug/L	73
Nickel	ug/L	25
Nitrate (as N)	mg/L	3
Nitrite (as N)	mg/L	0.06
Potassium	ug/L	NV
pH	pH	6.5-9
Selenium	ug/L	1
Silver	ug/L	0.1
Sodium	ug/L	NV
Sulphate	mg/L	NV
Thallium	ug/L	0.8
Total dissolved solids (TDS calculated)	mg/L	NV
Turbidity	NTU	NV
Uranium	ug/L	NV
Zinc	ug/L	30

Note: CWQGs = Canadian Water Quality Guidelines (CCME 2012); NV = no value (no established guideline value)

6.5.2 Waterbodies and Watercourses

This section summarizes the key aquatic features within the Project Area. All of the data collected in the desktop analysis and field investigations are used to provide a description of the fish and fish habitat associated within the freshwater systems. The Project site includes one waterbody (Fogherty Lake) and three watercourses. A fourth watercourse (the outlet to Murphys Lake), is located immediately east of the Property boundary. These features were identified using topographic mapping and aerial photography followed by confirmatory field investigations.

6.5.2.1 *Fogherty Lake*

Fogherty Lake is situated approximately 420 m from Chedabucto Bay, where its flow ultimately outlets. This 6.8 ha lake is shallow and surrounded by trees, barrens and exposed rock. The lake is acidic (pH 3) and tea colored. Substrate within the lake comprises coarse materials such as bedrock and boulder, with an overlaying thin organic layer.

Vegetation surrounding the lake includes leather leaf (*Chaemodaphne calyculata*), sheep laurel (*Kalmia angustifolia*), possum-haw viburnum (*Viburnum nudum*), rhodora (*Rhododendron canadense*), chokeberry (*Photina* sp.) Labrador tea (*Ledum groenlandicum*), bunchberry (*Cornus canadensis*), black spruce (*Picea mariana*) and tamarack (*Larix laricina*). Yellow water lily (*Nuphar lutea*) was observed growing in the lake.

6.5.2.2 *Watercourses*

Watercourse 1 is the outflow of Fogherty Lake located to the north of the lake and the watercourse outlets into Chedabucto Bay. This watercourse has a well-defined channel with deep water and its substrate is dominated by fine grained materials. A beaver dam is located near the upstream extent of the watercourse. Upstream of the dam, the channel is deep and wide and the substrate largely consists of fines; downstream, the channel is a relatively narrow and shallow with one area of no visible flow. The northernmost 150 m of this watercourse were not surveyed in detail, as the watercourse flows down a steep drop off into Chedabucto Bay; however, the dimensions and substrate of the downstream reaches appeared similar to the observed run portions of the channel (AMEC 2011, **Appendix E**).

Watercourse 2 originates in a gully located within the north central portion of the Project site, and flows in a northwesterly direction to discharge into Chedabucto Bay. There was a great deal of deadfall in the channel valley when it was first surveyed in 2011. The upstream reaches were dry at the time of the survey, and further downstream the stream was very shallow; this watercourse is probably intermittent. No flow was observed in 2014. The last 220 m of this watercourse was inaccessible, as it flows down a steep slope to the ocean, as does Watercourse 1. However, the dimensions and substrate of the downstream reaches appeared similar to the rest of the channel (AMEC 2011, **Appendix E**).

Watercourse 3 originates in the southeast portion of the Project site, flows south through softwood forest, riparian shrub, and bog habitat (Wetland 1), and ultimately discharges into Reynolds Brooks and then Hendsbee Lake, south of the Project site. The downstream portion of the assessed section comprises a large pool resulting from a beaver dam on the watercourse just south of the property line.

Watercourse 4 is the outlet of Murphys Lake, located outside (east of) the Property boundary. The pH values measured at this location were on the order of 2.65. Due to the pH, fish habitat was not assessed in Watercourse 4.

Indian Cove Creek, which discharges into Indian Cove at Fox Island Main, was also sampled in 2014 to provide water quality data for comparison to the Project site (Section 6.2). This creek is also referred to as Fox Island Main Creek.

6.5.3 Fish and Fish Habitat

No fish were captured in Fogherty Lake or any of the watercourses during fish collection events. The field measured pH level in Fogherty Lake was 2.9 and in the watercourses pH levels ranged from 2.9 to 3.4. Based on the highly acidic conditions in freshwater environments, these water bodies are not likely to support fish species. Partial or complete barriers to Chedabucto Bay exist at outflow locations of all watercourses.

Inland freshwater fish species common to Guysborough and Canso include Speckled, Brown, and Rainbow Trout, Yellow and White Perch, Brown Bullhead, Shad, Gaspereau, Smelt, American Eel, Shiners, Sticklebacks, White Sucker, and Creek Chub. Creek Chub and Stickleback have been observed in systems with pH levels as low as 5.4 and 3.7, respectively (USGS 1982). Sensitivity of other freshwater fish to pH is as follows (Robertson & Bryan 2004):

- pH range tolerated by Trout, including Speckled Trout: 4.1 to 9.5
- Toxic limits for Perch: <4.6 to >9.5
- Toxic limits for Sticklebacks: ≤5
- Fish avoidance beyond range 5.4 to 11.4

In summary, most freshwater fish populations begin to disappear as pH approaches 5 and at pH of 4.5 most freshwaters are devoid of fish. Given the observed pH in study area waters, and the sensitivity of freshwater fish to pH, fish are not likely to persist in the study area. It should be noted that fish habitat was not assessed in Reynolds Brook, located 1.0 south of the Black Point site. For the purposes of the EIS, Reynolds Brook is assumed to support fish at some point between the wetland to the east that forms its headwaters and downstream Hendsbee Lake located approximately 3.0 km to the west.

A complete summary of freshwater habitat located within the study area is detailed in Table 6.5-3.

Table 6.5-3:
Existing Fish and Fish Habitat Summary

Waterbody	Flow	Thermal Regime	Substrate Type	Vegetation	Supports Fishery
Fogherty Lake	Permanent	Warmwater	bedrock and boulder thin organic layer	Moderate density and diversity	No
Watercourse 1	Permanent	Warmwater	fine substrate materials	Moderate density and diversity	No
Watercourse 2	Ephemeral	Warmwater	fine substrate	Moderate density and	No

			materials	diversity	
Watercourse 3	Permanent	Permanent	fine substrate materials	Moderate density and diversity	No
Watercourse 4	Permanent	Permanent	NC*	NC	No

NC* = not characterised; lack of fishery conclusion based on low pH measurements in 2014.

6.5.4 Water Quality

6.5.4.1 *Field Parameters*

In Fogherty Lake, surface water temperature was measured at 22.7ºC in August 2010. The lake had acidic pH levels of 2.94. Conductivity was very low, 43 µS/cm. The water was well oxygenated, with surface dissolved oxygen (DO) content of 8.67 mg/L in August, 2010.

Surface temperatures in the watercourses ranged from 21.4^{0}C to 14.9^{0}C, pH ranged from 3.41 to 2.94, conductivity ranged from 91.0 to 43.0 µS/cm, and DO ranged from 4.52 to 8.47 mg/L in August and September 2010 respectively (Table 6.5-4). These parameters are indicative of acidic conditions with low conductivity and DO levels.

Table 6.5-4:
Summary of Field Parameters, August 2010 Sampling Event

Parameters	Fogherty Lake	Watercourse 1	Watercourse 2	Watercourse 3
Conductivity (µS/cm)	43	62	91	53
Water Temperature	22.7	21.4	14.9	16
pH (CCME Guideline 6.5-9)	2.9	3.4	3.2	2.9
Dissolved Oxygen (mg/L)	8.7	6.7	8.5	4.5

6.5.4.2 *Conventional Parameters*

In Fogherty Lake, laboratory measured pH was 4.3, indicating acidic conditions. Conductivity was measured at 52 µS/cm, and calculated TDS was 19 mg/L. The lake is relatively soft (hardness 3.2 mg/L), with an average surface conductivity of 52 µS/cm. Average turbidity values were low (mg/L and 0.7 NTU) indicating clear waters.

The laboratory pH results for water samples from the watercourses ranged from 3.9 to 4.3 indicating acidic conditions. Conductivity ranged from 59 to 102 µS/cm, and calculated TDS ranged from 22 to 33 mg/L. The watercourses are soft (hardness 3.5 to 5.8 mg/L), and turbidity values are low (0.7 to 2.8 NTU) indicating clear waters.

6.5.4.3 *Nutrients*

Total ammonia exceeded CWQGs in Fogherty Lake (0.03 mg/L) and all four watercourses, 0.09 mg/L in watercourse 1, <0.05 mg/L in Watercourse 2 and 3, and 0.08 mg/L in Watercourse 4.

Total phosphorus was 0.035 mg/L in Fogherty Lake and ranged from 0.03 mg/L to 0.16 mg/L in the watercourses. Nitrite and nitrate were below CWQG during sampling events in Fogherty Lake and the watercourses.

6.5.4.4 *Metals*

In Fogherty Lake, several metals exceeded their guideline values and this is likely related to the acidity of the water, which promotes mineral dissolution and metal mobility. Total aluminium and cadmium were above CWQGs at 335 ug/L and 0.023 ug/L, respectively. Iron (319 ug/L), lead (2.6 ug/L), manganese (16 ug/L), and zinc (26 ug/L) all exceeded their guideline values.

Aluminium and iron exceeded guidelines in all watercourses. Cadmium and lead concentrations also exceeded guidelines at 0.019 ug/L and 1.2 ug/L, respectively in Watercourse 3.

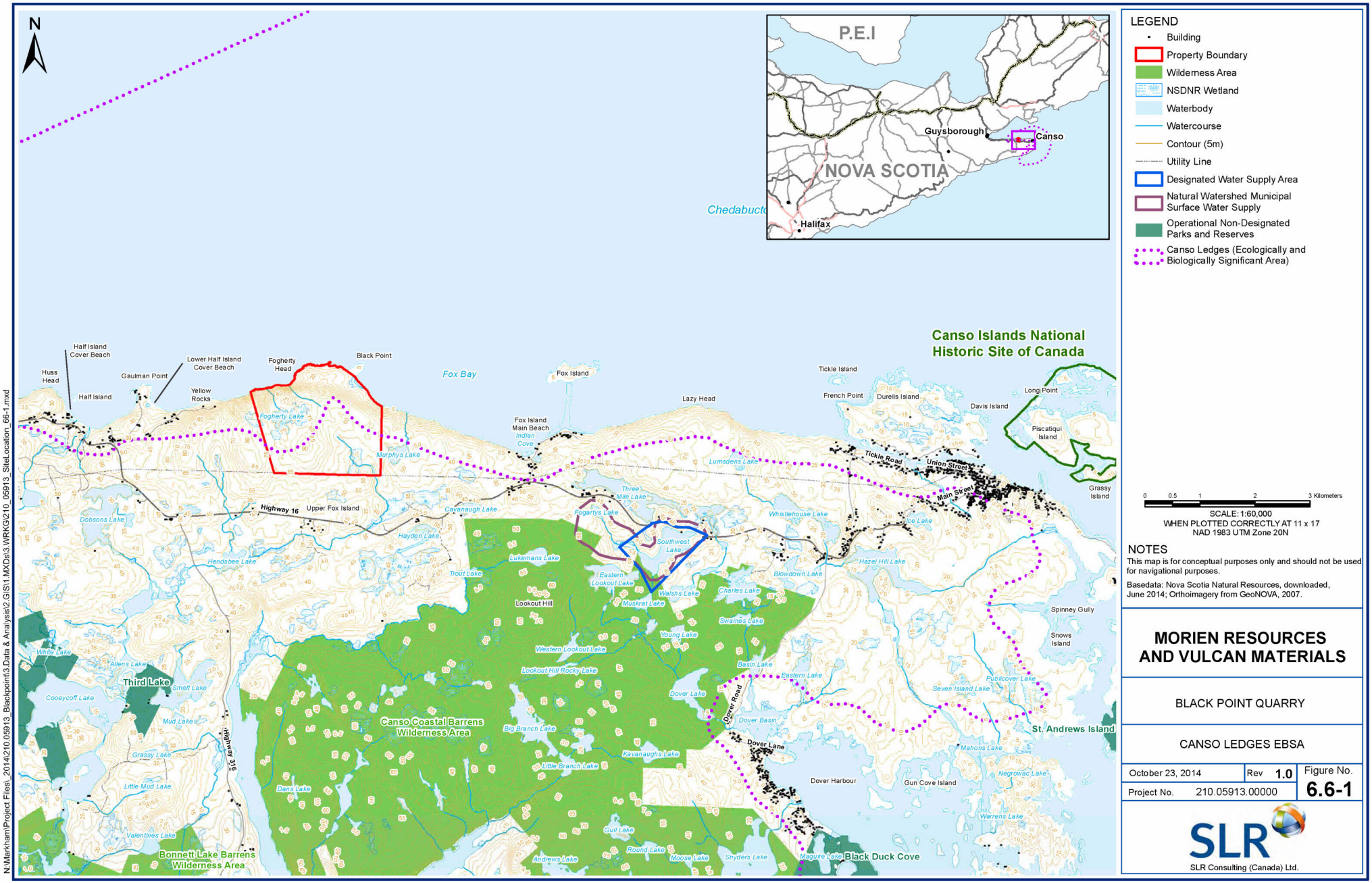
6.6 Marine Environment

6.6.1 Physical Oceanography

6.6.1.1 *Overview*

Chedabucto Bay is approximately 45 km long from Canso to Guysborough (east to west) and approximately 20 km wide at its widest from West Arichat to Fox Island Main (north to south). The south shore of Chedabucto Bay between Canso and Guysborough is a relatively straight, steep coast with a narrow offshore shelf (CHS Chart 4335; Owens 1971). This is a shoreline resistant to wave erosion composed largely of rock platforms and low cliffs with pocket beaches of shingle and coarse sand. The amount of sediment in the littoral zone increases from east to west as indicated by the presence of spits and bars in the Salmon River - Guysborough area (Owens 1971).

This Project site is located within the Canso Ledges Ecologically and Biologically Significant Area (EBSA - **Figure 6.6-1**). This area extends from the mainland adjacent to White Head Island to Queensport along the coast of Chedabucto Bay and wraps around the Canso Peninsula. The Ledges extend approximately 10 km seaward in most areas (Hastings *et al.* 2014).



LEGEND

- Building
- Property Boundary
- Wilderness Area
- NSDNR Wetland
- Waterbody
- Watercourse
- Contour (5m)
- Utility Line
- Designated Water Supply Area
- Natural Watershed Municipal Surface Water Supply
- Operational Non-Designated Parks and Reserves
- Canso Ledges (Ecologically and Biologically Significant Area)

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

MORIEN RESOURCES AND VULCAN MATERIALS

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CANSO LEDGES EBSA

October 23, 2014	Rev 1.0	Figure No. 6.6-1
Project No. 210.05913.00000		

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The Canso Ledges EBSA is an area of high productivity for cod, wolffish, lobster, snow crab, and historically for cod spawning. A steep seabed close to shore results in relatively high diversity of species in a relatively narrow nearshore band (e.g., lobsters, snow crab, shrimp) that are normally more dispersed when depth gradients are shallower.

Extensive and diverse marine algae contribute to the primary productivity of the area. There are fewer eelgrass beds and salt marshes in this area compared to other parts of the Nova Scotia coast due to the rocky shores which better support kelp (algae) growth (Gromack *et al*. 2010).

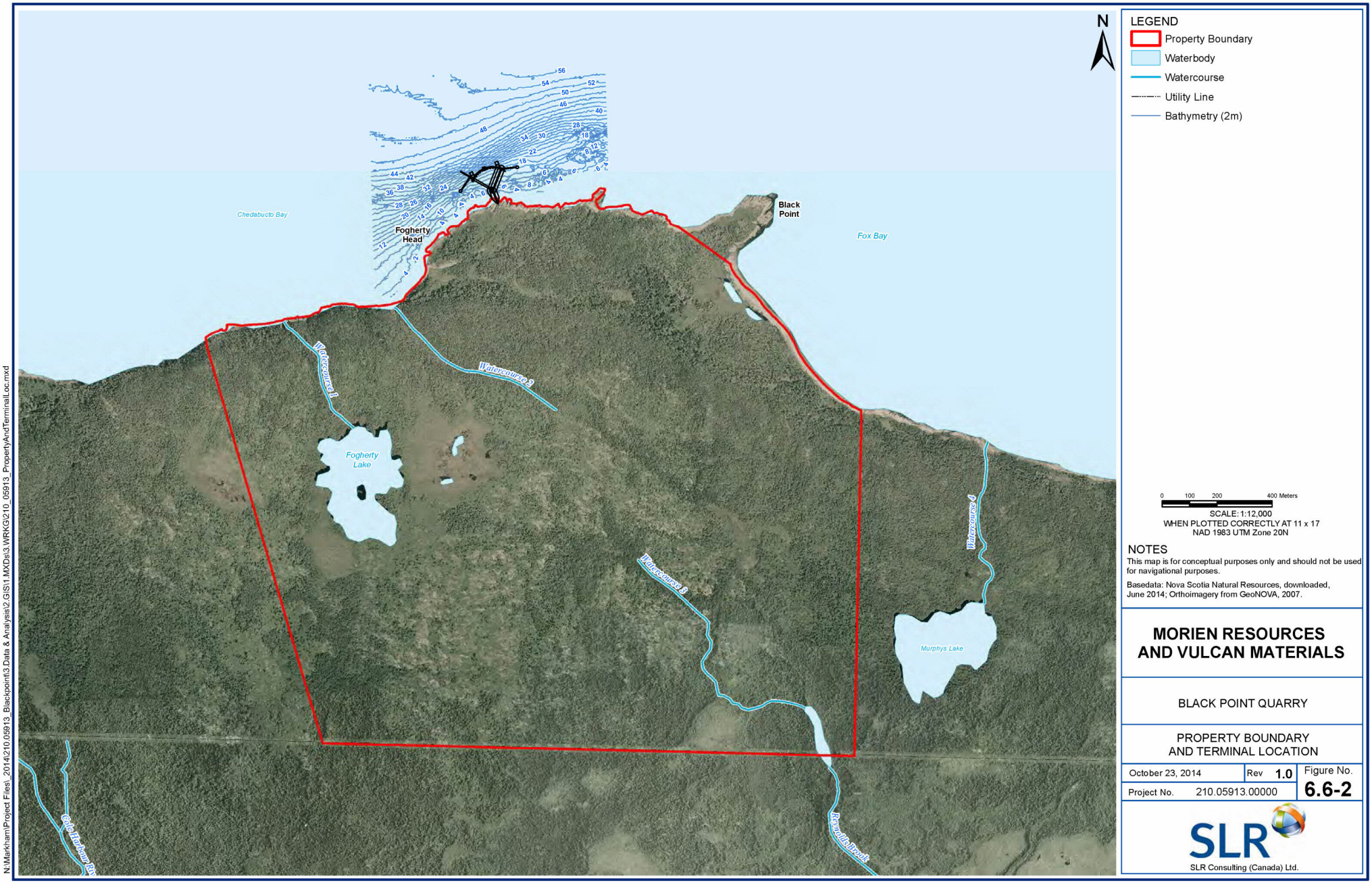
In the past Fin Whales aggregated in the Canso Ledges area in winter but whether they still use the area is unknown. Dolphins likely congregate in the area in summer. Migrating waterfowl, particularly Common Eider, use the area for spring staging (late March-April). Colonies of Great Blue Heron, Common Eider and Double-crested Cormorant breed in the area (April to late August), and probably Common and Arctic Terns as well. Deep areas off the Canso Ledges referred to as the Deep Holes of Canso serve as a deep water reserve for lobster, supporting some of the largest lobsters along the Eastern Shore (Doherty and Horsman 2007). The ecologically significant features of Chedabucto Bay as described by Hastings *et al.* (2014) are summarized at the end of this section.

6.6.1.2 *Bathymetry*

Chedabucto Bay borders the Project site to the north. Chedabucto Bay is 107.9 m deep at the mouth near Canso and has a maximum depth of 146 m at the seaward extent of the Project Area (Canadian Hydrographic Service Charts 4013 and 4321). The area is tidally dominated with a high tidal to freshwater ratio of approximately 487:1 (Gromack *et al.* 2010). Chedabucto Bay has a flushing time of 295.3 hours (DFO 2008a) and has been classified as an intermediate pelagic bay (Greenlaw 2009). Chedabucto Bay has a watershed drainage area of 2,148.4 km^2 (DFO 2008a).

The seabed descends to a depth of 30 m within approximately 300 m from the shoreline where the marine terminal is proposed (**Figure 6.6-2)**. Along the south shore of Chedabucto Bay, the coastline forms a relatively straight fault line-scarp with low, resistant rock cliffs and intertidal platforms. There is an extensive bed of *Ascophylum nodosum* (a common brown alga sometimes referred to as Rockweed) in the area.

Water depth ranges from 0 to approximately 15 m in the area proposed for the rubble mound structure and ranges from approximately 16 m to 22 m deep where the mooring and berthing structures will be located.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Chedabucto Bay
Fogherty Head
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Watercourse 1
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Rewdell Brook
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Property Boundary
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MORIEN RESOURCES AND VULCAN MATERIALS
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PROPERTY BOUNDARY AND TERMINAL LOCATION
October 23, 2014
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Figure No. 6.6-2
Project No. 210.05913.00000
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6.6.1.3 *Hydrography*

Currents

Dominant currents in the Study Area originate in St Lawrence River and the Gulf of St Lawrence (**Figure 6.6-3**). The Nova Scotia Current is the primary inflow, originating in the Gulf of St. Lawrence and entering the region through Cabot Strait. This current has a general south-westward drift over the Scotian Shelf, passing across the mouth of Chedabucto Bay and continuing into the Gulf of Maine (Herbert *et al.* 2012). Tidal currents in Chedabucto Bay off the Project Area are approximately 2.6 knots (0.51 m/s).

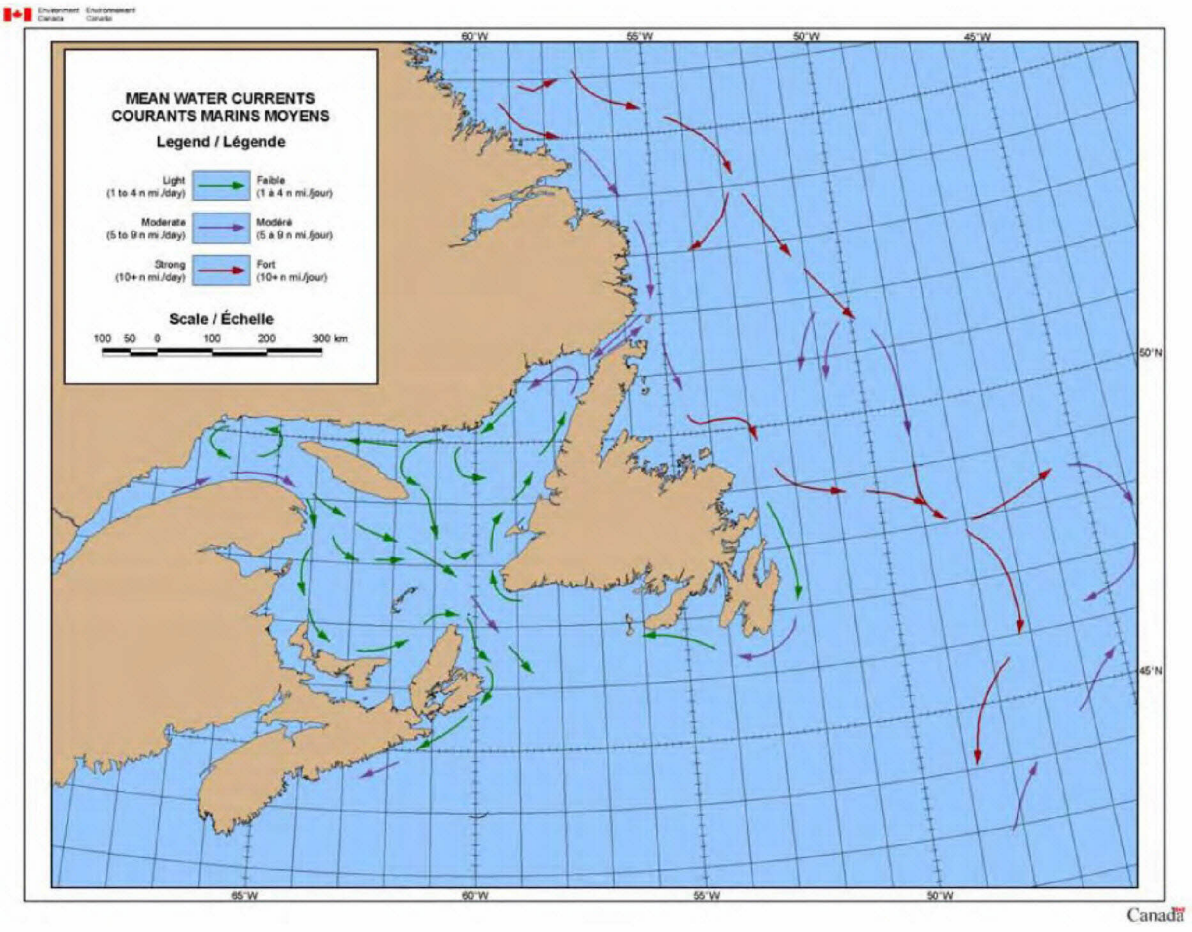


Figure 6.6-3:
Surface Currents on the East Coast

Source: CCG 2012.

Tides

Chedabucto Bay experiences semi-diurnal tides with mean tidal ranges of 1.28 m (Canso) to 1.37 m (Guysborough). The highest tides are about 2.0 m at Canso and slightly less (1.95 m) at Guysborough (Owens 1971).

Wind and Waves

Wind data summarized from a meteorological station at Canso from 1964 to 1970 show that the highest wind speeds are mainly from the north-west (see also Figure 6.3-1) and occur from December to February (Owens 1971). Table 6.6-1 summarizes average and maximum winds recorded at Canso from 1964 to 1970[4]. Anemometer data collected at Canso (for a recording period of less than 10 years) indicates a maximum hourly wind speed from the northwest of about 97 kph and 80 kph from the east (CCG 1981); these values are higher than those reported in Table 6.6-1.

Table 6.6-1:
Average and Maximum Winds (Canso 1964 – 1970)

Month	Average of the Monthly Mean Speeds (kph)	Prevailing Direction	Average of the Monthly Maximum Recorded Speed (kph)	Direction Dominant
Jan.	23.01	NW	67.59	NW/NW
Feb.	23.82	NW	64.37	NW
Mar.	22.21	NW	56.33	NE
Apr.	21.57	NW	53.11	NW/SW
May	20.44	SW	53.11	SW
June	18.67	SW	46.67	SW
July	17.06	SW	43.45	SW
Aug.	19.15	SW	46.67	SW
Sept.	18.34	SW	48.28	SW
Oct.	20.92	SW	54.72	SE
Nov.	22.05	NW/SW	57.94	NE
Dec.	23.82	NW	61.15	SE

Source: Owens 1971

[4] Owens (1971) does not specify whether these are annual hourly maximum winds or hourly maximums over the entire data set.

Table 6.6-2:
Return Periods for Winds at Canso, NS

Return Period (years)	2	5	10	15	20	25	50	100
Wind Speed (knots/kph)	46/85	51/94	55/102	58/107	59/109	60/111	64/119	68/126

Source: CCG 1981.

Table 6.6-3 provides more recent wind data collected at Hart Island and Eddy Point, NS. The table lists the maximum wind gusts recorded each month over the course of several years.

Table 6.6-3:
Maximum Wind Speeds, Hart Island and Eddy Point, NS

Hart Island (2005-2014) Station 820318, Elevation 8.20 m

	Direction of Max. Gust (10's Degrees)	Max. Gust (km/h)		Direction of Max. Gust (10's Degrees)	Max. Gust (km/h)
	2014			2013	
Jan	32	102	Jan	20	93
Feb	22	107	Feb	21	106
Mar	8	95	Mar	28	115
Apr	5	83	Apr	22	70
May	19	67	May	22	74
June	31	67	June	22	74
July	21	83	July	22	69
Aug	23	72	Aug	31	89
Sept	16	89	Sept	20	63
Oct	30	78	Oct	31	74
Nov	18	102	Nov	32	102
Dec	20	85	Dec	10	107
	Direction of Max. Gust (10's Degrees)	Max. Gust (km/h)		Direction of Max. Gust (10's Degrees)	Max. Gust (km/h)
	2012			2011	
Jan	29	93	Jan	23	95

Feb	22	100	Feb	30	109
Mar	20	89	Mar	30	91
Apr	14	89	Apr	21	93
May	22	72	May	3	74
June	14	69	June	19	78
July	23	69	July	21	76
Aug	22	70	Aug	19	89
Sept	13	82	Sept	34	85
Oct	26	82	Oct	32	104
Nov	29	80	Nov	19	89
Dec	27	95	Dec	22	119

	Direction of Max. Gust (10's Degrees)	Max. Gust (km/h)		Direction of Max. Gust (10's Degrees)	Max. Gust (km/h)
	2010			2009	
Jan	8	96	Jan	31	120
Feb	31	80	Feb	31	95
Mar	31	70	Mar	1	80
Apr	32	74	Apr	22	74
May	23	82	May	30	95
June	31	95	June	24	96
July	19	63	July	15	85
Aug	21	57	Aug	29	93
Sept	16	109	Sept	2	70
Oct	12	98	Oct	1	83
Nov	29	82	Nov	36	96
Dec	14	117	Dec	11	95

	Direction of Max. Gust (10's Degrees)	Max. Gust (km/h)		Direction of Max. Gust (10's Degrees)	Max. Gust (km/h)
	2008			2007	
Jan	13	87	Jan	N/A	N/A
Feb	17	91	Feb	N/A	N/A
Mar	29	106	Mar	N/A	N/A
Apr	28	76	Apr	N/A	N/A
May	19	82	May	N/A	N/A
June	32	72	June	N/A	N/A
July	17	56	July	N/A	N/A
Aug	36	80	Aug	N/A	N/A
Sept	31	56	Sept	30	72
Oct	1	76	Oct	32	74
Nov	11	106	Nov	19	124
Dec	12	132	Dec	31	102

	Direction of Max. Gust (10's Degrees)	Max. Gust (km/h)		Direction of Max. Gust (10's Degrees)	Max. Gust (km/h)
	2006			2005	
Jan	N/A	N/A	Jan	28	113
Feb	N/A	N/A	Feb	32	76
Mar	N/A	N/A	Mar	34	80
Apr	N/A	N/A	Apr	22	70
May	N/A	N/A	May	34	98
June	N/A	N/A	June	20	69
July	N/A	N/A	July	22	74
Aug	N/A	N/A	Aug	20	82
Sept	N/A	N/A	Sept	31	82

Oct	N/A	N/A	Oct	9	85
Nov	N/A	N/A	Nov	N/A	N/A
Dec	N/A	N/A	Dec	N/A	N/A

Eddy Point (1977-1984) Station 8201716 Elevation 66.10

	Direction of Max. Gust (10's Degrees)	Max. Gust (km/h)		Direction of Max. Gust (10's Degrees)	Max. Gust (km/h)
	1984			1983	
Jan	32	76	Jan	15	81
Feb	31	74	Feb	32	100
Mar	32	93	Mar	33	87
Apr	8	65	Apr	8	69
May	20	61	May	21	72
June	33	69	June	18	46
July	18	50	July	8	57
Aug	N/A	N/A	Aug	31	67
Sept	N/A	N/A	Sept	18	52
Oct	27	46	Oct	1	61
Nov	32	70	Nov	15	80
Dec	13	74	Dec	32	93

	Direction of Max. Gust (10's Degrees)	Max. Gust (km/h)		Direction of Max. Gust (10's Degrees)	Max. Gust (km/h)
	1982			1981	
Jan	12	81	Jan	21	102
Feb	32	83	Feb	16	83
Mar	17	70	Mar	12	74

Apr	21	67	Apr	22	74
May	22	56	May	32	70
June	20	57	June	18	56
July	32	52	July	33	56
Aug	32	74	Aug	21	54
Sept	33	54	Sept	4	59
Oct	35	63	Oct	19	65
Nov	31	78	Nov	15	74
Dec	32	93	Dec	21	80

	Direction of Max. Gust (10's Degrees)	**Max. Gust (km/h)**		**Direction of Max. Gust (10's Degrees)**	**Max. Gust (km/h)**
	1980			**1979**	
Jan	16	83	Jan	32	83
Feb	31	78	Feb	30	106
Mar	15	81	Mar	17	93
Apr	9	78	Apr	15	70
May	32	76	May	31	67
June	19	65	June	22	56
July	33	65	July	27	59
Aug	31	65	Aug	18	57
Sept	22	63	Sept	20	83
Oct	16	65	Oct	21	93
Nov	32	91	Nov	22	52
Dec	29	72	Dec	29	85

	Direction of Max. Gust (10's Degrees)	**Max. Gust (km/h)**		**Direction of Max. Gust (10's Degrees)**	**Max. Gust (km/h)**
	1978			**1977**	

Jan	15	94	Jan	14	89
Feb	7	74	Feb	18	78
Mar	29	80	Mar	33	93
Apr	33	74	Apr	28	80
May	18	85	May	32	67
June	19	59	June	21	56
July	21	48	July	17	59
Aug	34	50	Aug	17	56
Sept	30	67	Sept	33	74
Oct	16	85	Oct	15	69
Nov	22	78	Nov	18	85
Dec	29	83	Dec	15	85

Source: GC 2015.

As noted in Section 6.3.2, wave heights at the MSC50 grid point near the Project (45.4N, 61.1W, approximately 5 km northeast of the site) were less than 2 metres in height 92.77% of the time whereas waves from 2 to 3 metres and 3 to 4 metres were present 5.96% and 1.02% of the time, respectively. Waves in excess of 4 metres were relatively minor and only present over 0.25% of the year on average. The annual wave rose in presented in **Figure 6.6-4** while wave direction and intensity is compiled in Table 6.3.6.

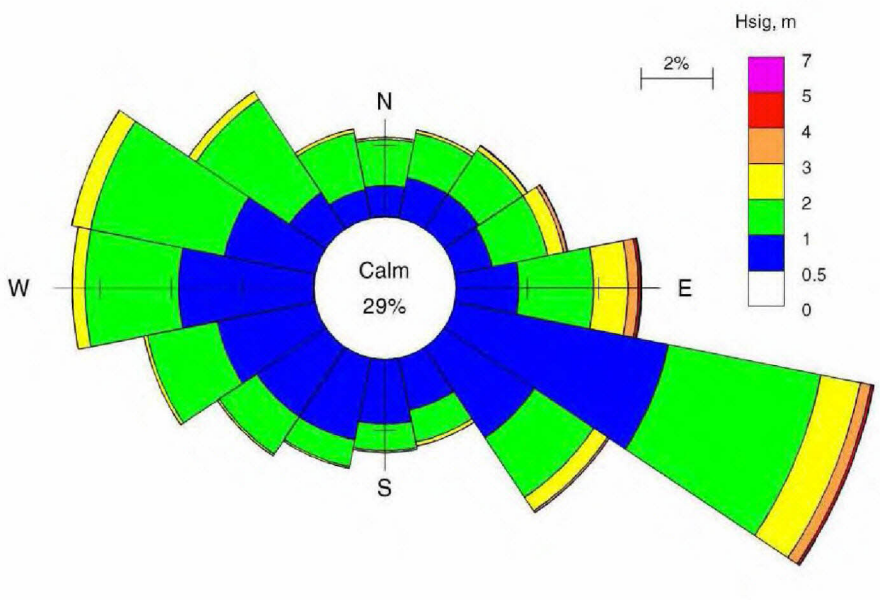


Figure 6.6-4:
Annual Wave Rose (45.4N, 61.1W)

Source: MSC50 Environment Canada data in CBCL 2004

Chedabucto Bay has a broad opening the east and the bathymetry at the mouth of the Bay permits ocean waves to penetrate deep into the Bay. This suggests that the most severe conditions within Chedabucto Bay will be comparable to those for the Scotian Shelf area off Chedabucto Bay. Using 10 years of ship-observed wave data for the Scotian Shelf Neu (1980, reported in CCG 1981) found the largest significant wave height for a one-year period to be 8.6 m and for 10 years, 11.7 m. The significant wave height is taken to be the average of the highest one-third of all the wave heights present. The maximum wave height is much higher than the significant height; in the open ocean the ratio of maximum wave height to significant wave height ranges from about 1.8 to 2.0.

Storm surge is described in Section 8.0 Effect of the Environment on the Project.

Ice

Ice typically forms around Prince Edward Island, along the north shore of Nova Scotia and along the western shore of Cape Breton in January and persists until early April (CCG 2012). In these areas, ice ridging can be extensive but seldom exceeds 2 m in height. Typically the southern and eastern shores of Nova Scotia and Cape Breton, including Chedabucto Bay, remain ice free over the winter although ice may in fact form or move into the Bay on occasion (**Figure 6.6-4**; CCG 2012).

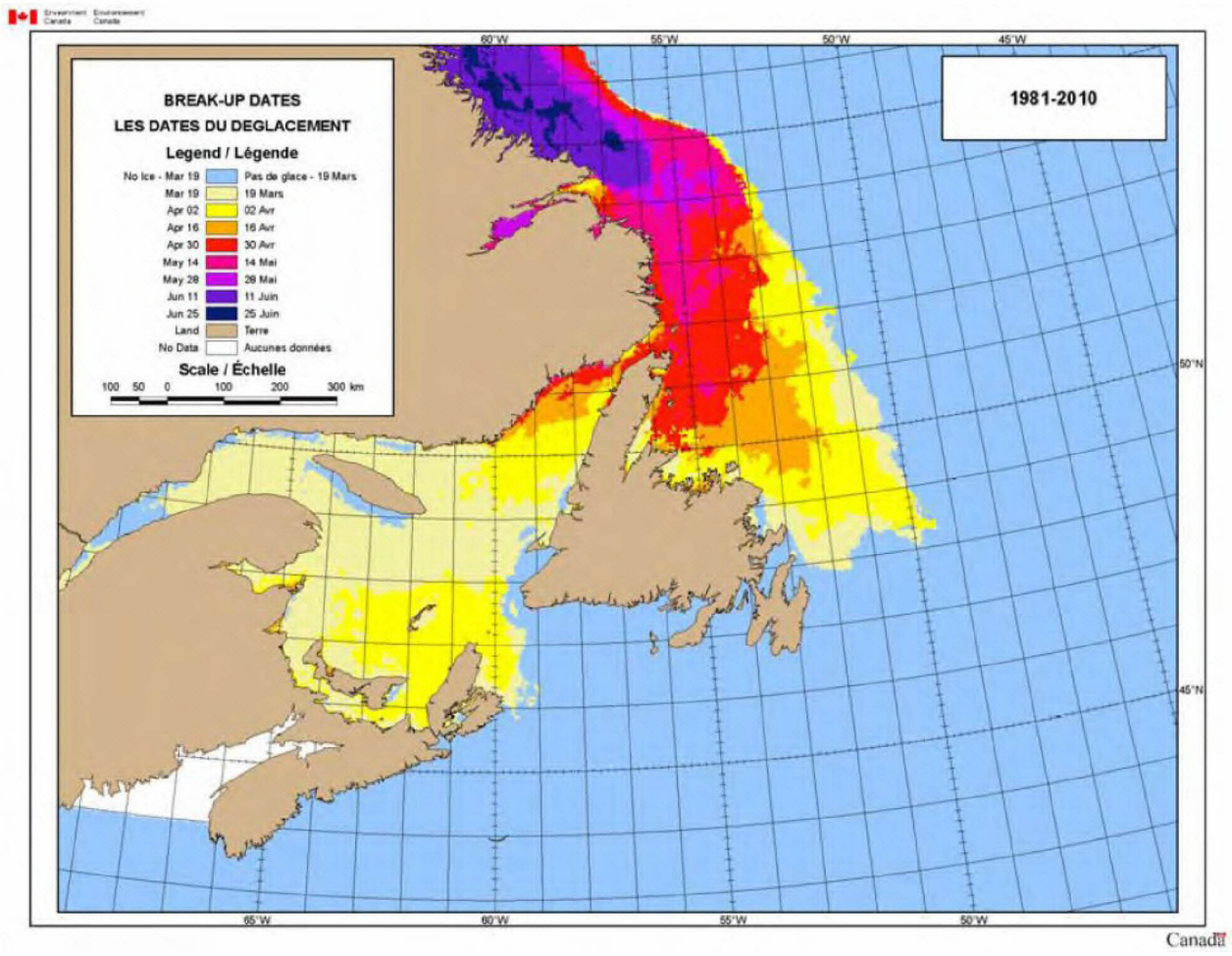


Figure 6.6-5:
Variability of Ice Extent on the East Coast

Source: CCG 2012.

There has been essentially no ice on the Scotian Shelf from April 2009 until the end of the season in May 2012. The ice volume during 2012 was the fourth lowest in the 51 year record. Only 1969, 2010 and 2011 had lower coverage and volume. The periods 1987-1993 and 2003-2004 were predominantly colder than normal, and 1999-2000 and 2010-2012 were warmer than normal (Hebert *et al*. 2012). The ice coverage varies considerably from year to year but in general, there were normal to above normal conditions from 1980/81 to 1994/95 then below normal conditions from 1995/96 to 2009/10 (CCG 2012).

6.6.2 Marine Biology

6.6.2.1 *Methodology*

Available reports and maps, consultation with resource agencies, and on-site investigations form the basis of information for characterizing existing conditions for key fish and fish habitat features in the marine environment in the Project Area as defined in Section 5.0. **Appendix J**

presents supporting field notes and other documentation that helps to characterise the marine biological environment.

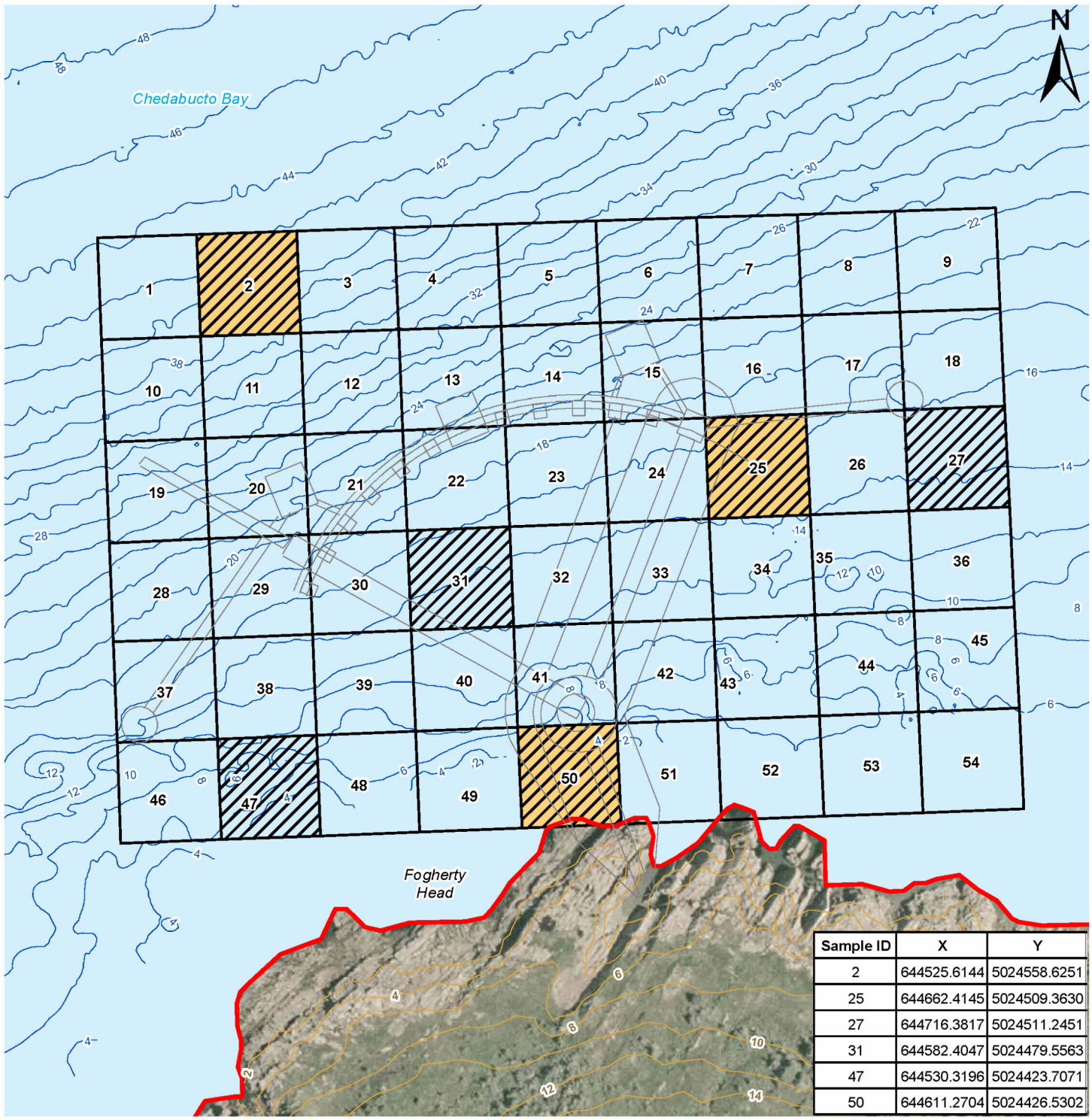
Information on fish and fish habitat collected for the marine environment will be used to:

- Characterize habitat type, function and fish presence;
- Form the knowledge base to assess project impacts;
- Inform and recommend mitigation strategies;
- Form the basis upon which to characterize residual effects; and
- Form the basis upon which to identify a suite of measures to offset serious harm to fish and fish habitat.

The Study Area has been defined by considering Project-environment interactions and includes the Project Area (i.e., the Property boundary including the seabed Crown lease), Adjacent Areas and Chedabucto Bay. The most detailed studies occurred within the Project Area. Efforts were made to characterize representative habitat types in the Adjacent Areas and Chedabucto Bay. Ultimately this information was used to identify fish and fish habitat that are part of or support recreational, commercial, or Mi'kmaq fisheries.

Field Investigations

The area of detailed aquatic investigation included the zone proposed for installation of the marine terminal. The zone extended 240 m along the shoreline and 165 m seaward, perpendicular to the shore, for a total area of 39,600 m^2. For comparison, the marine terminal rubble mound is expected to occupy about 11,000 m^2 of the seabed. This larger area was characterized by underwater video surveys. Video recordings of approximately 1200 meters of sea floor was compiled along 6 transects and reviewed to characterize the existing seabed. **Figure 6.6-6** presents the video transect locations. Transect 1 (T1), T2, and T3 each measured 250 m and were oriented parallel to the shoreline while T4, T5, and T6 each measured 150 m and extended perpendicular from the shoreline. Waypoints for the start and finish of each transect were measured and recorded using a handheld GPS. The underwater observations extend approximately 1 m on either side of the transect line.



Sample ID	X	Y
2	644525.6144	5024558.6251
25	644662.4145	5024509.3630
27	644716.3817	5024511.2451
31	644582.4047	5024479.5563
47	644530.3196	5024423.7071
50	644611.2704	5024426.5302

LEGEND

- Property Boundary
- Benthic Invertebrate Sampling Location
- Marine Sediment Sampling Location
- Sampling Location Grid
- Waterbody
- Bathymetry (2m)
- LIDAR Contour (2m)

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.
Basedata: Nova Scotia Natural Resources, downloaded, June 2014;

0 12.5 25 50 Meters

SCALE: 1:1,500
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

MORIEN RESOURCES AND VULCAN MATERIALS

BLACK POINT SURFACE WATER ASSESSMENT

MARINE SEDIMENT AND BENTHIC INVERTEBRATE SAMPLING LOCATIONS

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Project No. 210.05913.00000		

SLR global environmental solutions

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Marine field investigations were completed between August 31 and September 3, 2010 within the proposed footprint of the marine infrastructure. The underwater surveys captured information relating to the presence and absence of benthic invertebrates, macrofaunal and macrofloral species. Substrate characteristics, algae cover, and incidental fish were also documented. Observations along the video transects were made for each 5 m segment.

The following observations were made for each 5 m increment along each transect:

- Visual estimate of substrate grain size distribution (in order of dominance);
- Identification and abundance of macrofaunal species; and
- Identification and percent coverage of macrofloral species.

In order to review the 5 m transects and assess species presence and abundance, four categories were developed as described by AMEC in **Appendix J** (Table 6.6-3).

Table 6.6-4:
Field Investigation Methodology

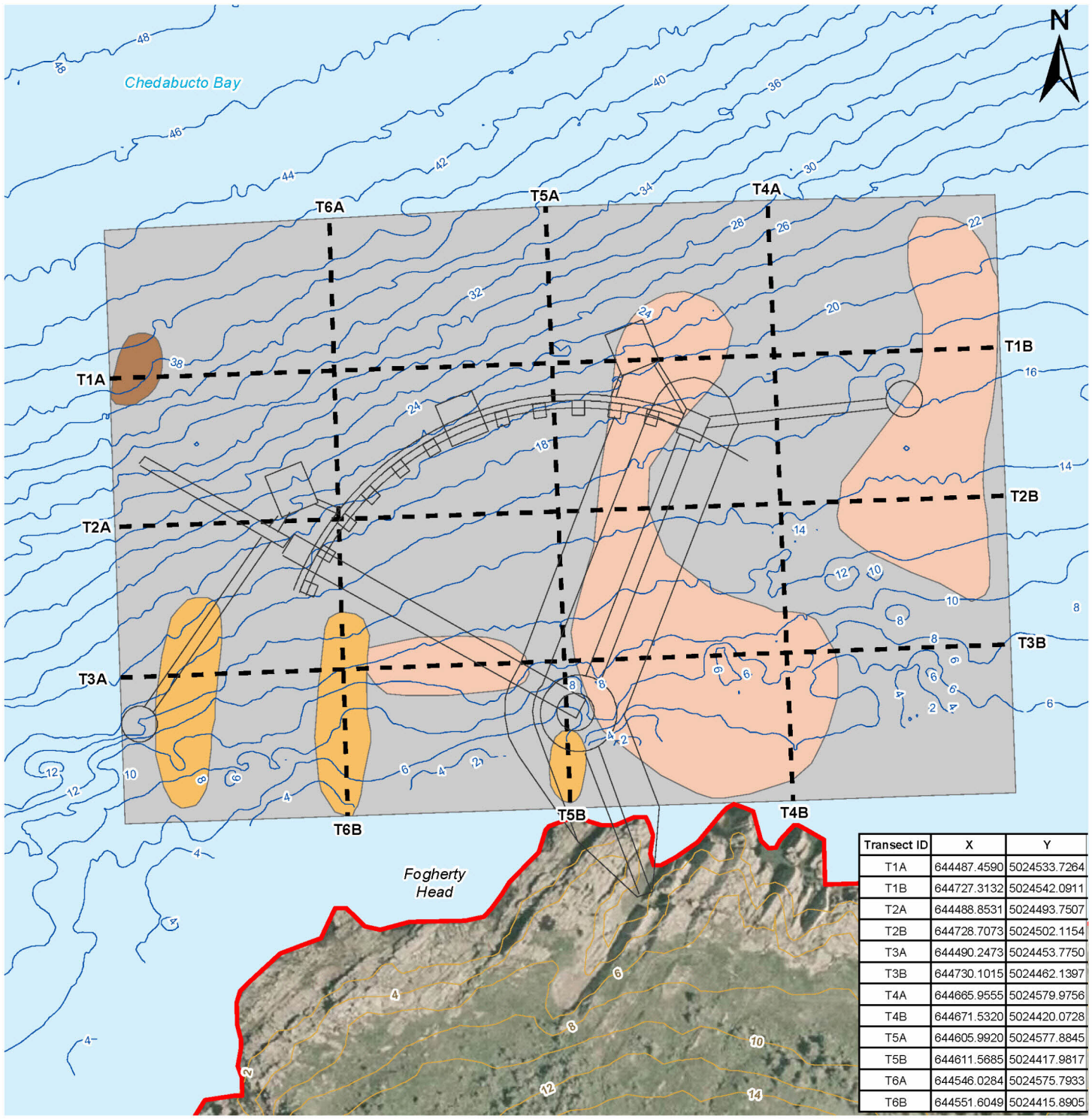
Category		Description
A	Abundant	Numerous (not quantitative) observations made throughout the entire 5 m segment.
C	Common	Numerous (not quantitative) observations made intermittently along the 5 m segment.
O	Occasional	Quantifiable observations made intermittently along the 5 m segment.
U	Uncommon	Quantifiable observations made infrequently along the 5 m segment.

Marine Invertebrate Community Survey

Benthic invertebrates are animals that colonize on or near the sea bottom in aquatic environments. Benthic invertebrates are considered effective indicators of ecosystem conditions because

a. they have limited mobility and are therefore constantly exposed to the effects of pollution;
b. they are reasonably long-lived so the effects of environmental stressors can be quantified;
c. short-term changes in environmental conditions do not dictate sampling results; and
d. they are a well-documented, aquatic ecological indicator with various tolerance levels.

To facilitate the collection of benthic invertebrates, a sampling grid was plotted over a map of the marine terminal footprint, and sampling locations within the footprint were selected randomly using a random number generator (**Figure 6.6-7**). In total, six benthic invertebrate sampling stations were used to characterize existing conditions and inform assessment of effects.



Transect ID	X	Y
T1A	644487.4590	5024533.7264
T1B	644727.3132	5024542.0911
T2A	644488.8531	5024493.7507
T2B	644728.7073	5024502.1154
T3A	644490.2473	5024453.7750
T3B	644730.1015	5024462.1397
T4A	644665.9555	5024579.9756
T4B	644671.5320	5024420.0728
T5A	644605.9920	5024577.8845
T5B	644611.5685	5024417.9817
T6A	644546.0284	5024575.7933
T6B	644551.6049	5024415.8905

LEGEND

- Property Boundary
- LIDAR Contour (2m)
- Transect Location
- Bathymetry (2m)
- Waterbody

Substrate

- Boulder
- Cobble
- Rock
- Sand

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.
Basedata: Nova Scotia Natural Resources, downloaded, June 2014;

0 12.5 25 50 Meters

SCALE: 1:1,500
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

MORIEN RESOURCES AND VULCAN MATERIALS

BLACK POINT SURFACE WATER ASSESSMENT

BENTHIC HABITAT VIDEO SURVEY
TRANSECT LOCATIONS AND SUBSTRATE

October 23, 2014 | Rev 0.0 | Figure No. 6.6-7

Project No. 210.05913.00000

SLR global environmental solutions

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On September 1, 2010 Connors Diving Services performed the sample collection. The diver placed a 0.25 m^2 quadrate on the substrate surface and used a small container to penetrate the substrate, to a minimum depth of 5 cm. Several litres of sediment were collected at each of the six sampling locations. The sediment was placed in a clean 20 L bucket, brought to surface, and thoroughly mixed. Four litres of each sample was measured for the benthic invertebrate sample.

The samples were sieved though a 1.0 mm screen using filtered seawater to remove the risk of osmotic shock to any organisms. The samples were preserved with 70% isopropanol in 1 L glass Mason jars. Each jar was inverted several times to insure proper mixing and preservation.

Samples were analyzed by BioTech Inc. (Smithtown, NB) for benthic invertebrate identification and enumeration.

Statistical analysis of the benthic invertebrates' samples included:

- Benthic invertebrate identification and enumeration for each station;
- Number of species and number of individuals per species for each station;
- Number of species per station by major taxonomic group; and
- Density (number of organisms/m^3) and biomass (g/m^2 wet weight) for each station.

Marine Sediment Sampling Program

The sediment sampling program and analysis was completed in accordance with Environment Canada's publication *Guidance Document on Collection and Preparation of Sediments for Physiochemical Characterization and Biological Testing* (December 1994).

In order to assess disposal options for sediment potentially removed during the construction of the Project, the analytical sample results were compared to the following:

- Canadian Environmental Protection Act (CEPA) Disposal at Sea Regulations (formerly the Ocean Dumping Control Act);
- Canadian Council of Ministers of the Environment (CCME) Probable Effects Levels (PELs) for marine/estuarine sediment;
- CCME Soil Quality Guidelines (SQGs) for the Protection of Environment and Human Health in agricultural, residential/parkland, and commercial/industrial applications; and
- Atlantic Risk-Based Corrective Action (RBCA) Tier 1 Version 2.0 Risk-Based Screening Levels (RBSLs).

The sediment samples were collected concurrently with the benthic invertebrate sampling program. On September 1, 2010, a total of six marine sediment samples were collected from the same well-mixed benthic invertebrate samples within the proposed footprint of the marine terminal.

Two 250 ml jars of sediment were collected at each station. A duplicate jar of sediment was collected for each of the stations to safeguard against loss or damage during transport. All samples were sent to Maxxam Analytics Inc. for chemical analysis. Maxxam is accredited with the Standards Council of Canada. Three of the six samples (GQ 02, GQ 25, and GQ 50; **Figure 6.6-7**) were analyzed for parameters listed in **Appendix J**.

6.6.2.2 *Results*

This section summarizes key aquatic features within the Project Area. All data collected in the desktop analysis and field investigations are used to provide a description of marine ecosystems.

Marine Environment

The marine environment is characterized using information from existing reports and supplemented by field investigations. As noted water depth in Chedabucto Bay is approximately 108 m at the mouth near Canso. Chedabucto Bay is classified as an intermediate pelagic bay with a drainage area of 2,148 km^2. The intertidal and adjacent sublittoral areas are subject to the effects of scouring by winter ice and shifting cobblestone material. Chedabucto Bay supports productive and diverse fisheries (Gromack *et al.* 2010).

Substrate type and vegetative cover are key components that contribute to the ecological structure of the marine environment. Substrate type and percentage of cover facilitate development and growth and thus influence the diversity and abundance of floral and faunal species. Within the area of potential Project impact, the marine substrate is dominated by coarse materials including cobble, rock, and large boulders (**Figure 6.6-7)**. Small areas of finer grained substrates consisting primarily of sand were documented along certain transects.

Within the Project Area, algal cover was sparse (0-10%) in deeper waters and increased to 50-90% cover in the near shore areas. The algal canopy is dominated by the brown algal species black whip weed (*Chordaria flagelliformis*), bladderwrack (*Fucus sp.*), and sea colander (*Agarum clathratum*). Other species present in lesser densities included sugar kelp (*Laminaria saccharina*), tube weed (Polysiphonia lanosa), an encrusting red alga (*Leptophyllum sp.*), Irish moss (*Chondrus crispus*), a brown alga (*Pilayella littoralis*), a green alga (*Acrosiphonia arcta*), and a red alga (*Plumaria plumosa*). Of note, green fleece (*Codium fragile*), an invasive species in Nova Scotia (Invasive Species Alliance of Nova Scotia, 2011), was noted along T2. This species has been previously reported around the Canso area (Watanabe *et al.* 2010).

6.6.2.3 *Benthic Habitat and Communities*

The results of the six benthic samples reflect a benthic community dominated by annelid worms (polychaetes) and mollusks (gastropods). The most common identified polychaetes include the worm *Aricidea* (syn. *Acmira*) catherinae, sinistral spiral tubeworm (*Spirobis borealis*) and cirratulids (*Tharyx spp.*). The dominant bivalves included the common tortoiseshell limpet (*Tectura testudinalis*) and interrupted turbonille (*Turbonilla interrupta*). A complete list of identified species at the six sampled locations is included in **Appendix J**.

The benthic invertebrate assemblage was highest at Station 2 (GQ 25) and lowest at Station 4 (GQ 31): 318 and 109 individuals respectively. The benthic invertebrate assemblage at Station 1 (GQ 02) contained the greatest number of taxa and Station 4 contained the lowest number of taxa (GQ31); 47 and 17 taxa respectively. Station 2 is the deepest of the 6 Stations. Due to the presence of a diverse community assemblage collected at this site, dissolved oxygen content and food sources are likely not limiting factors.

6.6.2.4 *Marine Sediment Quality*

As noted above, results of sediment quality data collections were compared against the relevant CEPA, CCME, SQGs, RBCA sediment quality guidelines. Three of six collected sediment samples were analyzed. The results of the analysis are summarized in **Appendix J**. The complete set of analytical results, including laboratory Quality Assurance/Quality Control and Certificates of Analyses for all parameters tested are provided in **Appendix J**.

No exceedance was noted for any of the above mentioned guidelines for any parameters in the three samples. Two samples (GQ 25 and GQ 50) were predominantly gravel (76-82%) with lesser amounts of sand (16-19%), silt (1-3%), and clay (<1-1%). Sample GQ 02 was a mix of gravel (51%) and sand (42%) with lesser amounts of silt (5%) and clay (3%). Total carbon content in the three samples collected and analyzed ranged from 0.6 to 1.62 g/kg (AMEC 2011 in **Appendix J**).

6.6.2.5 *Fish Community*

Chedabucto Bay is a cool water marine environment which supports a diverse fish community. A number of fish species reside within the Bay, and additional species migrate from nearby water bodies such as the Strait of Canso and St Georges Bay to feed or spawn. The fish and fish habitat within Chedabucto Bay are valued for their ecological services as well as economic benefits. Fishing is regulated to fixed gear only in Chedabucto Bay (except for scallops) in order to preserve the high marine diversity and productivity. A number of species listed under SARA

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and assessed by COSEWIC are found in the Bay (Gromack *et al.* 2010). Please see Section 6.7 for a description of marine Species at Risk.

Chedabucto bay supports shellfish, demersal fish, and pelagic fish populations (**Appendix J**). Demersal fish are those that occupy habitat near the sea bottom, while pelagic fish are associated with habitat within the water column and closer to the surface. The Bay supports more than 50 fish species, however only two fish species were noted along the transects during field investigations. Species present in the Project Area included Cunner (*Tautogolabrus adspersus*) and Shorthorn Sculpin (*Myoxocephalus scorpius*). Cunner and Sculpin are demersal fish and often congregate around wharves. Neither of these species are part of a recreational, commercial or Mi'kmaq fishery. Fox Island Beach, located several kilometers east of the Project area, was sampled in 2005 and 2006 for fish abundance and diversity of juvenile fish. This sampling resulted in the capture of Sand Lace, Hake species, and Grubby. These species are typically associated with sand substrates, which are more or less absent from the immediate Project Area location. For a complete list of species found in the Bay, please refer to **Appendix J**.

The hard bottom and algal cover present within the Project Area provides habitat for many invertebrate species (Table 6.6-4). The most common species noted from the video transects include deep sea scallop (*Placopecten magellanicus*), blue mussel (*Mytilus edulis*), green sea urchin (*Strongylocentrotus droebachiensis*), and American lobster (*Homarus americanus*). Other invertebrate species observed along the transects included American oyster (*Crassostrea virginica*), northern rock barnacle (*Semibalanus balanoides*), Bowerbank's halichonidria (*Halichondria bowerbanki*), frilled anemone (*Metridium senile*), periwinkle (*Littorina sp.*), sea cucumber (*Cucumaria frondosa*), sea peach (*Holacynthia pyriformis*), sea star (*Asterias sp.*), and waved whelk (*Buccinum undatum*). Due to the depths of the surveyed areas divers had to move at speed greater than optimal for characterization. The combination of the speed of the diver's movement and a cobble bottom resulted in difficulty discerning the presence of small invertebrates such as periwinkles.

Table 6.6-5:
Invertebrate Occurrence in Strait of Canso – Inhabitants Bay – Chedabucto Bay Area

Common Name	*Scientific Name*	Present During Field Investigations (AMEC 2011)
American Lobster	*Homarus americanus*	✓
Sea Scallop	*Placopecten magellanicus*	
Snow Crab	*Chionoecetes opilio*	
Rock Crab	*Cancer irroratus*	
Hermit Crab	*Pagurus bernhardus*	
Green Crab	*Carcius maenas*	
Pink Shrimp	*Penaeus duorarum*	
Northern Shrimp	*Pandulus borealis*	
American Oyster	*Crassostrea virginica*	✓
Soft shell clams	*Mya arenaria*	
Bar clams	*Spisula solidissima*	
Blue mussel	*Mytilus edulis*	✓

Horse mussel	*Modiolus modiolus*	
Green Sea Urchin	*Strongylocentrotus droebachiensis*	
Northern Rock Barnacle	*Balanus balanoides*	
Bowerbank's Halichonidria	*Halichondria bowerbanki*	✓
Frilled Anemone	*Metridium senile*	✓
Periwinkle	*Littorina sp.*	✓
Sea Cucumber	*Cucumaria frondosa*	✓
Sea Peach	*Holacynthia pyriformis*	✓
Sea Star	*Asterias sp.*	✓
Waved Whelk	*Buccinum undatum*	✓

6.6.2.6 *Species at Risk*

No freshwater fish Species at Risk were encountered within the Project area during field investigations. Marine Species at Risk including fish and marine mammals are described in full in Section 6.7.

6.6.3 Ecological Summary

Hastings *et al.* (2014) summarize the ecologically and biologically significant attributes of the Canso Ledges ESBA. Although the ESBA wraps around the Canso peninsula and thus includes areas along the south shore of the peninsula that are outside of the area potentially impacted by the Project, many of these attributes specifically reference Chedabucto Bay. The attributes below are extracted from Hastings *et al.* (2014):

Uniqueness

- Chedabucto Bay is unique in its size and depth.
- A tongue of deep water is present on northern shore of the peninsula.
- The Bay supports rare coastal habitat for Northern Shrimp.

Aggregation

- The mouth of Chedabucto Bay has been noted for its abundance and diversity of fish.
- Historic importance for Atlantic Cod (Endangered – COSEWIC). May still be important area for this species.
- Aggregations of Atlantic Wolffish (Special Concern – SARA), Thorny Skate (Special Concern – COSEWIC), and Winter Skate (Threatened – COSEWIC).
- Inshore concentration of Fin Whale (Special Concern – SARA).
- Significant aggregations of scoter spp., merganser spp., American Black Duck, Common Eider, and Purple Sandpiper.
- High concentrations of the rockweed *Fucus* spp around the Canso peninsula and into Chedabucto Bay.
- Because of its strong depth gradient, the Bay is a hotspot for invertebrate diversity.

Fitness Consequences

- The Bay is potentially important juvenile areas for sand lance spp., hake spp., and Grubby.

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- Formerly a significant spring and fall spawning area for Atlantic Herring.
- Overwintering area for Atlantic Herring.

6.7 Species at Risk and Species of Conservation Concern

Under the federal *Species at Risk Act (SARA)*, the COSEWIC determines whether a species is at risk. Following a period of public and stakeholder review, the Governor in Council may recommend to the Minister of Environment whether the species will be protected under *SARA*. Species at Risk (SAR) are those classified as Extirpated, Endangered, Threatened, or Special Concern in SARA Schedule 1. Once listed, measures for protection and recovery of the species are implemented. Under *SARA* (*SARA* section 32 and 33), prohibitions apply to species listed in Schedule 1 except for the species of Special Concern. As of September 1 2014, there were 42 species listed under SARA (Schedule 1) for NS (www.sararegistry.gc.ca).

On the provincial level, species listed as Endangered, Threatened, or Vulnerable under the *Nova Scotia Endangered Species Act* (*NSESA*) are also considered to be SAR. Since the latest amendment to the list of protected species in July 2013, there are 51 species listed as SAR under the *NSESA*.

Other organizations apply their own criteria to species considered threatened by human activity. These include species which are ranked in the General Status of Wild Species in Canada for Nova Scotia (GSWSC-NS, www.wildspecies.ca) as 1 (At-Risk), 2 (May be at Risk) or 3 (Vulnerable). Such species are often referred to as Species of Conservation Concern (SOCC), not SAR, since they may be at risk but are not yet legally protected federally or provincially. The Atlantic Canada Conservation Data Centre (ACCDC) also provides ranks (known as S-ranks) for species occurring in the Atlantic Provinces.

Descriptions of the ranking systems used by COSEWIC, *SARA*, NSESA, the GSWSC, and ACCDC are provided in **Appendix N** (Attachment A).

SAR and SOCC belong to numerous taxonomic groups, including lichens, vascular plants, fish, amphibians, reptiles, mammals, birds, molluscs, odonates, and butterflies. To obtain data on SOCC potentially occurring in the area, data requests were submitted to the ACCDC and the Nova Scotia Museum of Natural History (NSMNH). Data provided in 2010 for a standard 100 km radius around Black Point by the ACCDC indicated the potential for occurrence of a number of SAR and numerous SOCC in the region (**Appendix N** Attachment B) though few have actually been observed in the Project area (Section 6.4- **Appendix E**). An updated data request in 2014, using the new five km radius as required by NSDNR, resulted in only 4 SOCC from the area (**Appendix N** Attachment C**)**. Data requests to the NSMNH resulted in reports of two plant and 21 bird species of conservation concern in the area around the Black Point site (**Appendix N** Attachment D).

To examine the potential for SAR and SOCC species in the area encompassing the Black Point site, species listed as SAR or SOCC in NS under *SARA*, COSEWIC, *NSESA*, or the GSWSC for Nova Scotia or the Atlantic Ocean (marine species) were summarized by taxonomic group in a "Priority Species List" (Step 1, NSE 2009). Note that the General Status of Wild Species in Canada for Nova Scotia list has replaced the NSDNR colour ranking system, and is to be used in its stead (M. Elderkin, NSDNR 2013, pers. comm.). Also, while the ACCDC determines status rankings for species in the Atlantic Canadian provinces, these ranks are not considered when preparing the Priority List, as directed by NSE (2009). Instead, ACCDC data is used late in this process as a source of information on uncommon or rare species reported from the area.

In order to determine the potential for occurrence of these species in the Project area, a two-step evaluation process according to NSE (2009) including habitat modelling was carried out as described below.

Species Distribution

Priority species were evaluated concerning their presence in the broad geographic area of the proposed Project (Step 2, NSE 2009), using information on previously recorded sightings obtained from COSEWIC, NSMNH, ACCDC, and NBSDNR's Significant Habitats (SigHab) databases (when applicable). Sources also included previously completed reports that summarized published and unpublished listings of occurrences of rare species and distribution maps from a variety of literary sources such as *Roland's Flora of Nova Scotia* (Zinck 1998). Data received from ACCDC for a five km radius in 2014 and a 100 km radius in 2010 is provided in (**Appendix N** Attachments B and C**)**, and data received from the NSMNH for the area of the Black Point site in (**Appendix N** Attachment D**)**.

All data was then used to compile a Short List of Priority Species that occurs in the general geographical area of the Project, i.e., Eastern NS (**Appendix N** Attachment E**)**. Species whose known distribution range does not include eastern NS were excluded from the short list.

Habitat Preferences

The species listed in the Short List of Priority Species were then reviewed with respect to their habitat requirements (Step 3, NSE 2009). Those species which exist in, or utilize habitat types found within the Project footprint or immediate surrounding areas, were summarized by taxonomic group as "species with potential to be present at the Project site" (see below). Suitable habitat was scanned for indications of the presence of these priority species during field surveys as indicated below. Results of the priority species evaluation process are provided in the following sections.

It should be noted that it is possible that other species of concern exist within the area without previously recorded sightings. Therefore, the potential presence of other priority species for which suitable habitat occurred within the Project area was considered during field surveys.

6.7.1 Terrestrial SAR and SOCC

Terrestrial species groups assessed within this document include vascular plant, lichens, terrestrial mammals, reptiles, amphibians, birds, and select invertebrates (Lepidopterans and Odonates). Each of these groups is discussed in the following subsections.

The ACCDC was consulted for records species of conservation concern from the area encompassing the project sites. In 2010, when the initial field work for this project was done, NSDNR required all such databases searches utilize a 100 km radius around the Project site. In 2014, however, when an updated ACCDC search was requested, this requirement had been reduced to only a 5.0 km radius, and therefore the more recent list is much shorter.

6.7.1.1 *Vascular Plant SAR and SOCC*

A total of 295 species, subspecies and varieties of vascular plants are considered to be SAR in NS (i.e., listed under *SARA*, COSEWIC (2013) or the *NSESA*), or are listed as SOCC (i.e.,

ranked as 1, 2, or 3 in the GSWSC for Nova Scotia). For definitions of the conservation rankings, see **Appendix N** Attachment A**)**.

A short-list of Priority Flora Species (SARA, COSEWIC, NSESA, and Canada General Status List for Nova Scotia) was assembled based on known geographic distribution of priority species in the geographic region around the Project area, using data received from ACCDC, the NSMNH and distribution maps in Zinck's *Flora of Nova Scotia* (1998). The NSDNR Significant Habitats database no longer contains information on vascular plant and lichen SAR and SOCC within NS any longer (NSDNR 2012), so this was not consulted.

A total of 80 vascular plant priority species, subspecies and varieties were identified as having potential to occur in the region of eastern NS (Step 2, NSE (2009b)) (**Appendix N** Attachment E**)**. The 2014 ACCDC database search provided no records of any vascular plant species of conservation concern for a radius of five km around the Project site (**Appendix N** Attachment C).

6.7.1.1.1 Vascular Plant SAR and SOCC Potentially Occurring on the Black Point Site

Habitat modelling was applied in order to estimate the potential presence of the 80 short-listed vascular plants in the Project footprint or immediate surrounding areas (Step 3, NSE (2009); see **Appendix E**). Based on information in Zinck (1998) and Hinds (2000), suitable habitat appears to be available on the Black Point site for over half (48 of 80) of the short-listed vascular plant species.

No priority species were reported by ACCDC within five km of the Black Point site in 2014 (**Appendix N** Attachment C**)**. The NSMNH provided records of two vascular plant SOCC for the area around the Project footprint (**Appendix N,** Attachment D**)**.

Priority species with habitat requirements which may be met by habitats on the Project site are listed in Table 6.7.1.

Table 6.7-1:
Priority Vascular Plant Species Potentially Present

	SCIENTIFIC NAME	COMMON NAME	STATUS LISTS	HABITAT[1]
1	*Ageratina altissima*	White Snakeroot	GSWSC-NS= 2 (May Be At Risk)	Clearings, thickets, and moist woods.
2	*Betula michauxii*	Newfoundland Dwarf Birch	GSWSC-NS= 3 (Sensitive)	Peat and sphagnous bogs.
3	*Botrychium simplex*	Least Moonwort	GSWSC-NS= 3 (Sensitive)	Lakeshores, or mossy edges of streams or waterfalls.
4	*Cardamine pratensis*	Cuckoo Flower	GSWSC-NS= 2 (May Be At Risk)	Meadows, low fields and moist areas.
5	*Carex adusta*	Lesser Brown Sedge	GSWSC-NS= 3 (Sensitive)	Dry open woods, gravels, rocks, and clearings. Also in acidic soils.
6	*Carex alopecoidea*	Foxtail Sedge	GSWSC-NS= 2 (May Be At Risk)	Moist, overgrown, clear-cut woods near coast
7	*Carex castanea*	Chestnut Sedge	GSWSC-NS= 2 (May Be At Risk)	Swamps and wet meadows, cliff crevices and ledges.
8	*Carex comosa*	Bearded Sedge	GSWSC-NS= 3 (Sensitive)	Rich marshes
9	*Carex haydenii*	Hayden's Sedge	GSWSC-NS= 2 (May Be At Risk)	Wet Meadows and rocky shores.

	SCIENTIFIC NAME	COMMON NAME	STATUS LISTS	HABITAT[1]
10	*Carex peckii*	Peck's Sedge	GSWSC-NS= 2 (May Be At Risk)	Uncommon on rocky slopes, clearing and dry woods, often on calcareous soils.
11	*Carex rostrata*	Narrow-leaved Beaked Sedge	GSWSC-NS= 2 (May Be At Risk)	Wet meadows, swales and around boggy pond margins.
12	*Carex tenera*	Tender Sedge	GSWSC-NS= 3 (Sensitive)	Meadows, woodlands, moist or dry openings.
13	*Comandra umbellata*	Bastard's Toadflax	GSWSC-NS= 2 (May Be At Risk)	Damp, sandy areas, dunes and exposed headlands; Open coniferous woods.
14	*Cornus suecica*	Swedish Bunchberry	GSWSC-NS= 3 (Sensitive)	Sphagnous depressions in barrens, gravelly shores, and dry exposed headlands.
15	*Crassula aquatic*	Water Pygmyweed	GSWSC-NS= 3 (Sensitive)	Brackish, muddy shore and muddy flats and borders of muddy ponds near the coast.
16	*Eleocharis flavescens*	Yellow Spikerush	GSWSC-NS= 3 (Sensitive)	Bogs, cold springs, dry stream banks, lake and pond margins, maritime mud flats, marshes, moist meadows, swamps;
17	*Eleocharis ovate*	Ovate Spikerush	GSWSC-NS= 3 (Sensitive)	Fresh, often drying shores, lake and stream beds, bogs, tidal estuaries, disturbed places;
18	*Empetrum eamesii*	Pink Crowberry	GSWSC-NS= 3 (Sensitive)	Exposed headlands on top of lichen-bearing rocks with thin soil.
19	*Epilobium coloratum*	Purple-veined Willowherb	GSWSC-NS= 3 (Sensitive)	Low-lying ground, springy slopes, and similar locations.
20	*Eriophorum gracile*	Slender Cottongrass	GSWSC-NS= 3 (Sensitive)	Wet peat and inundated shores.
21	*Fallopia scandens (syn. Polygonum scandens)*	Climbing False Buckwheat	GSWSC-NS= 3 (Sensitive)	Low habitats
22	*Fraxinus nigra*	Black Ash	GSWSC-NS= 3 (Sensitive), NSESA= Threatened	Low ground, damp woods, and swamps.
23	*Fraxinus pennsylvanica*	Red Ash	GSWSC-NS= 2 (May Be At Risk)	Near lakes and pond or in other low lying areas.
24	*Goodyera repens*	Lesser Rattlesnake-plantain	GSWSC-NS= 3 (Sensitive)	Under conifers, typically occurring singly.
25	*Hypericum dissimulatum*	Disguised St John's-wort	GSWSC-NS= 3 (Sensitive)	On shores and in damp open areas (Hinds, 2000); mostly shores.
26	*Hypericum majus*	Large St. John's-wort	GSWSC-NS= 2 (May Be At Risk)	Wet or dry open soil. (Hinds 2000: damp open areas)
27	*Iris prismatica*	Slender Blue Flag	GSWSC-NS= 2 (May Be At Risk)	Wet ground near the coast.
28	*Isoetes acadiensis*	Acadian Quillwort	GSWSC-NS= 3 (Sensitive)	Water up to 1 m deep, bordering lakes or ponds, and occasionally along rivers.
29	*Juncus alpinoarticulatus*	Alpine Rush	GSWSC-NS= 2 (May Be At Risk)	Wet meadows, sandy and gravelly, often calcareous shores, fens, and clayey pools over rock
30	*Listera australis*	Southern Twayblade	GSWSC-NS= 2 (May Be At Risk)	Sphagnum moss bogs or damp woods. Always near small spruce or tamarack.
31	*Malaxis monophyllos*	White Adder's-mouth	GSWSC-NS= 2 (May Be At Risk)	Moss cushions and wet, mossy cliff edges, where there is little competition from other plant species
32	*Pedicularis palustris*	Marsh Lousewort	GSWSC-NS= 2 (May Be At Risk)	Marshes and meadows.
33	*Platanthera macrophylla (syn. Platanthera orbiculata var, macrophylla)*	Large Round-leaved Orchid	GSWSC-NS= 3 (Sensitive)	Damp woods in deep shade

	SCIENTIFIC NAME	COMMON NAME	STATUS LISTS	HABITAT[1]
34	*Potamogeton nodosus*	Long-leaved Pondweed	GSWSC-NS= 2 (May Be At Risk)	Pond and streams
35	*Proserpinaca pectinata*	Comb-leaved Mermaidweed	GSWSC-NS= 3 (Sensitive)	Wet savannahs, sphagnous swales, and the sandy, gravelly, or muddy borders of lakes or ponds
36	*Ranunculus pensylvanicus*	Pennsylvania Buttercup	GSWSC-NS= 2 (May Be At Risk)	Muddy shores and moist meadows (Hinds 2000). Richer moist shores and sometimes disturbed ground.
37	*Rudbeckia laciniata*	Cut-leaved Coneflower	GSWSC-NS= 3 (Sensitive)	Swales, the edges of swamps or in gullies, in small colonies.
38	*Salix pedicellaris*	Bog Willow	GSWSC-NS= 3 (Sensitive)	Swampy thickets, poorly drained soils, bogs, and heavy soils.
39	*Schoenoplectus americanus (SYN. Scirpus americanus)*	Olney's Bulrush	GSWSC-NS= 3 (Sensitive)	Brackish marshes, and sometime in bogs near the coast. Forms colonies on wet sand around depressions were sand is rather salty.
40	*Senecio pseudoarnica*	Seabeach Ragwort	GSWSC-NS= 3 (Sensitive)	Gravelly seashores.
41	*Sparganium hyperboreum*	Northern Burreed	GSWSC-NS= 3 (Sensitive)	Peaty pools.
42	*Symphyotrichum boreale*	Boreal Aster	GSWSC-NS= 3 (Sensitive)	Gravelly soil and lake beaches, along streams and the edges of bogs.
43	*Teucrium canadense*	Canada Germander	GSWSC-NS= 3 (Sensitive)	Gravel seacoasts, the crest of the beach, beyond the reach of the tide.
44	*Vaccinium boreale*	Northern Blueberry	GSWSC-NS= 2 (May Be At Risk)	Exposed headlands and barrens.
45	*Vaccinium caespitosum*	Dwarf Bilberry	GSWSC-NS= 3 (Sensitive)	Rocky cliffs and crevices. Dry or wet acidic sites from sea level to 3800 m.
46	*Vaccinium avolifolium*	Oval-leaved Bilberry	GSWSC-NS= 2 (May Be At Risk)	Moist coniferous woods to an elevation of 2100 m.
47	*Vaccinium uliginosum*	Alpine Bilberry	GSWSC-NS= 3 (Sensitive)	Dry or wet, organic or inorganic acid soils. Tolerant of high copper concentrations.
48	*Viola nephrophylla*	Northern Bog Violet	GSWSC-NS= 3 (Sensitive)	Cool mossy bogs. Borders of streams, and damp woods.

[1] Sources are Zinck (1998), Hinds (2000) and personal communications (2013) from Sean Blaney, ACCDC

6.7.1.1.2 Vascular Plant SAR and SOCC Confirmed to Occur on the Black Point Site

Field surveys of a variety of habitats in the Project area were carried out in 2010 and 2014 in order to identify vascular plant SAR and SOCC with early and late phenology. A vascular plant inventory based on those surveys amended by current (2014) conservation ranks is provided in Section 6.4, **Appendix E**. During the field surveys, only two vascular plant SOCC were found (Table 6.7.2).

Table 6.7-2:
Vascular Plant SOCC Confirmed to Occur on the Site

	Common Name	Scientific Name	Status	Habitat Preferences[1]
1	Northern Commandra	*Geocaulon lividum*	Canada General Status List of Wild Species= 3 (Sensitive)	Sterile soils and damp sands, in acid or peaty areas.
2	Southern Twayblade	*Listera australis*	Canada General Status List of Wild Species= 2 (May be at Risk)	Sphagnum moss bogs or damp woods. Always near small spruce or tamarack.

[1] Sources are Hinds (2000) and personal communications from Sean Blaney, ACCDC

6.7.1.2 *Lichen (Non-vascular Flora) SAR and SOCC*

According to ACCDC, Southern Twayblade (*Listera australis*) was reported four times within a 100 km radius, with the closest location being 24 +/-10 km away. Note that ACCDC does not provide exact locations in order to protect uncommon species. ACCDC has a single record for Northern Commandra (*Geocaulon lividum*), also 24 +/-10 km from the Black Point site (ACCDC 2010, **Appendix N** Attachment B).

A total of 65 species of lichens are considered to be SAR, *i.e.*, listed under SARA, COSEWIC (2013) or the *NSESA*), or listed as SOCC (i.e., ranked 1, 2, or 3 in the Canada General Status List for NS. For definitions of the conservation rankings see **Appendix N** Attachment A.

A short-list of priority species was assembled based on known occurrences of priority species in the geographic region, using data received from ACCDC and the NSMNH and professional knowledge (Step 2, NSE 2009). Lichens are no longer listed in the NSDNR SigHab database (NSDNR 2012c). The resulting table listing the 46 lichen species with potential to occur in eastern Nova Scotia, along with their habitat requirements is provided in **Appendix N** Attachment E. While *Sclerophora peronella* is unlikely to occur in the Project area because its known distribution is limited to Cape Breton Highlands National Park, it was retained in the short-list using a precautionary principle.

ACCDC had no records for any lichen SOCC within a five km radius of the Black Point site (ACCDC 2014, **Appendix N** Attachment C). An earlier ACCDC request conducted in 2010 resulted in 31 records of a single lichen species (Boreal Felt Lichen) considered to be of conservation concern within a radius of 100 km around the Project site (ACCDC 2010, **Appendix N** Attachment B). The NSMNH does not have any records for rare lichens in the Project area (**Appendix N** Attachment D).

6.7.1.2.1 Lichen SAR and SOCC Potentially Occurring on the Black Point Site

Of the 47 lichen priority species identified for the region (Step 2), thirteen have the potential to occur on site (Step 3, NSE 2009) based on their habitat requirements. These are outlined in Table 6.7.3. The lichen priority species encompass ground-dwelling (terricolous), rock-dwelling (saxicolous) and tree-dwelling (corticolous) lichens.

Table 6.7-3:
Priority Lichen Species with Potential to Occur in the Area

	Common Name	Scientific Name	Status	Habitat Preferences[1]
1	*Polychidium muscicola*	Eyed Mossthorns Woollybear Lichen	GSWSC-NS = 2 (May be at Risk)	Among mosses on exposed or shaded rocks. Occasionally on ground or at base of trees
2	*Punctelia appalachensis*	Appalachian Speckleback Lichen	GSWSC-NS = 3 (Vulnerable)	On deciduous trees
3	*Ramalina thrausta*	Angelhair Ramalina Lichen	GSWSC-NS = 3 (Vulnerable)	On trees, rarely rocks
4	*Sticta fuliginosa*	Peppered Moon Lichen	GSWSC-NS = 3 (Vulnerable)	Mossy bark, rarely mossy rock
5	*Sticta limbata*	Powdered Moon Lichen	GSWSC-NS = 2 (May be at Risk)	Mossy bark and rock, especially in coastal forest
6	*Umbilicaria polyphylla*	Petaled Rocktripe Lichen	GSWSC-NS = 3 (Vulnerable)	On nutrient -encrusted siliceous rocks
7	*Usnea ceratina*	Warty Beard Lichen	GSWSC-NS = 3 (Vulnerable)	Usually on trees, occasionally rocks, near moist lakesides, wetlands or coastal habitats
8	*Usnea flammea*	Coastal Bushy Beard Lichen	GSWSC-NS = 3 (Vulnerable)	On trees and rocks
9	*Usnea flavocardia*	Blood-splattered Beard Lichen	GSWSC-NS = 3 (Vulnerable)	On trees, usually in coastal areas
10	*Usnea mutabilis*	Bloody Beard Lichen	GSWSC-NS = 3 (Vulnerable)	On trees in deciduous and pine forests.
11	*Usnea scabrata*	Straw Beard Lichen	GSWSC-NS = 3 (Vulnerable)	On conifers in forests or open habitat
12	*Usnea substerilis*	Embossed Beard Lichen	GSWSC-NS = 2 (May be at Risk)	On trees
13	*Usnocetraria oakesiana (syn. Cetraria/Allocetraria oakesiana)*	Yellow Band Lichen	GSWSC-NS = 2 (May be at Risk)	On both conifers and some hardwoods, occasionally on rocks

[1] Sources are Brodo *et al*. (2001), Hinds and Hinds (2000)

Of the 13 remaining lichen Priority Species, one species, Boreal Felt Lichen (*SARA*, COSEWIC and *NSESA* Endangered, GSWSC= 1 (At Risk)) is considered most likely to occur in the general area, because ACCDC has reported 31 observations within 100 km distance (ACCDC 2010, see **Appendix N** Attachment B).

Boreal Felt Lichen

Boreal Felt Lichen grows on the bark of mature Balsam Fir trees in cool, humid habitats. Wet coniferous forests, usually in or near wetlands, on north to east facing slopes near the coast are preferred (Cameron and Neily 2008). NSE Protected Areas Branch has prepared predictive maps indicating polygons of potential BFL habitat in Nova Scotia based on a heuristic model (NSE 2008). These potential habitats categorize potential Boreal Felt Lichen habitat according to level of suitability (Low, Medium, and High). The maps indicate that there is no potential Boreal Felt Lichen habitat within the footprint of the Black Point site. However, there are nine small polygons of potential Boreal Felt Lichen habitat within a two km radius of the Project site (Figure 6.7.1). One polygon of high suitability (Category 1) habitat is located about 500m south of the Project site. Five areas of Medium suitability and four of low suitability also occur within

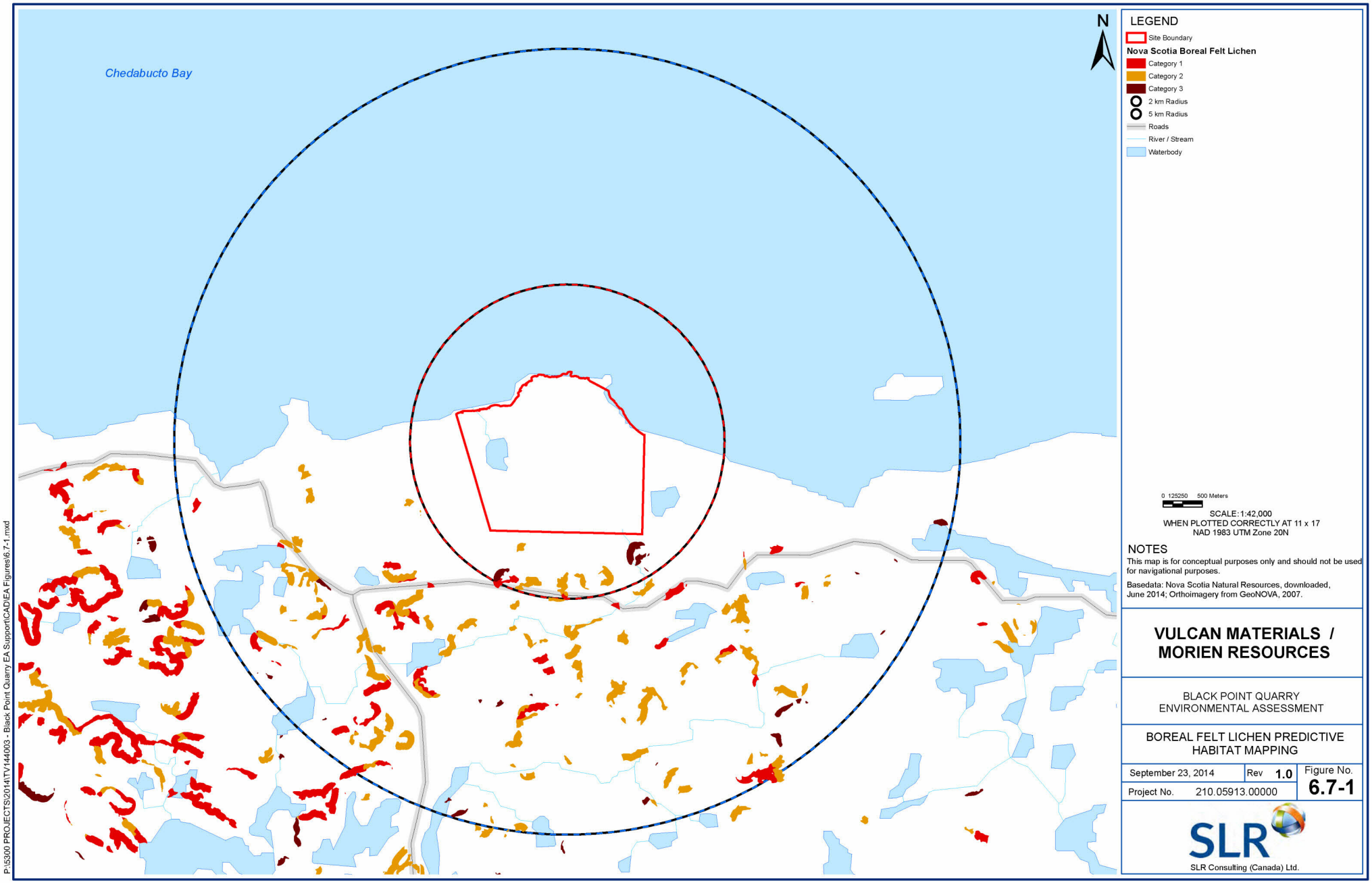
about 700 m of the southern boundary of the Project site. All of these areas are considered to be well out of range of dust or other potential effects of quarry activities.

In addition to looking for Boreal Felt Lichen on the site directly, the available habitat was evaluated concerning suitability as habitat for this species. Balsam fir, the preferred host species for Boreal Felt Lichen occurs on the Project site, however, the microclimatic conditions required by this species apparently were not met at the Black Point site. Wet forests on north to east facing slopes were not encountered. No Boreal Felt Lichen was found on the site during targeted lichen surveys in 2010 or 2014 (Section 6.4 and **Appendix E**).

6.7.1.2.2 Lichen SAR and SOCC Confirmed to Occur on the Black Point Site

A lichen survey of the Black Point site was carried out in August 2010 and again in August 2014 targeting all lichen SAR or SOCC in all potential habitats on the Project site. In addition, indicator species and any cyanolichens were of interest and were included in the surveys, as their habitat requirements are similar to the habitat requirements of the priority species as indicated in **Appendix E**. Survey methods and photos are provided in Section 6.4 and **Appendix E**.

A total of four lichen SOCC were found on the Black Point site in 2010 and 2014. Much of the observed forest habitat is likely not conducive to the presence of rare lichen species due to previous disturbance. The four lichen SOCC occurring on the Project site are outlined in Table 6.7.4.


Chedabucto Bay
N
LEGEND
Site Boundary
Nova Scotia Boreal Felt Lichen
Category 1
Category 2
Category 3
2 km Radius
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Roads
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Waterbody
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WHEN PLOTTED CORRECTLY AT 11 x 17
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NOTES
This map is for conceptual purposes only and should not be used for navigational purposes.
Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.
VULCAN MATERIALS / MORIEN RESOURCES
BLACK POINT QUARRY
ENVIRONMENTAL ASSESSMENT
BOREAL FELT LICHEN PREDICTIVE HABITAT MAPPING
September 23, 2014
Rev 1.0
Figure No. 6.7-1
Project No. 210.05913.00000
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Table 6.7-4:
Lichen SOCC Confirmed to Occur on the Site

	Common Name	Scientific Name	General Status of Wild Species in Canada-NS 2010 Rank	Habitat Preferences[1]
1	*Cladonia stygia*	Black-footed Reindeer Lichen	3- Vulnerable	Open bog
2	*Nephroma bellum*	Naked Kidney Lichen	3- Vulnerable	Forested wetlands on Red Maple
3	*Usnea flammea*	Coastal Bushy Beard Lichen	3- Vulnerable	Conifers
4	*Ramalina thrausta*	Angel Hair Ramalina Lichen	3- Vulnerable	On trees, rarely rocks

[1] Sources are Brodo *et al*. (2001), Hinds and Hinds (2000).

Note that the 2010 fieldwork summary report prepared for this Project (**Appendix E**), another lichen species thought to be of conservation concern was reported. However, this species, *Peltigera leucophlebia*, which was yellow listed by the now-discarded NSDNR General Status List, is currently listed as Secure on the Canada General Status of Wild Species List for Nova Scotia, and, as it is not listed on other conservation status lists for NS, is no longer considered a SOCC.

All four lichen SOCC species likely occur within the Project footprint.

6.7.1.3 *Avifauna SAR and SOCC*

A total of 93 species of birds are listed as SAR in NS under *SARA*, COSEWIC, *NSESA*, or listed as SOCC by the GSWSC for NS (updated in 2010). All of these were included in the initial Priority Species List. For definitions of the conservation rankings see **Appendix N** Attachment A. In addition, all raptors are protected under the *Nova Scotia Wildlife Act* (*NSWA*). While a number of the priority species have not been recorded in eastern NS, there is potential for many of the priority species to be found in the Project area based on available habitat, either as breeding birds or during migration. A list of bird species of conservation concern (81 in total) that have potential to occur in the Project area based on habitat requirements and distribution is provided in **Appendix N** Attachment E.

6.7.1.3.1 Avifauna SAR and SOCC Potentially Occurring on the Black Point Site

To gain further information on bird species potentially occurring on the Black Point site, records of bird SAR and SOCC in the Project area were obtained from field surveys conducted in 2010 and from existing databases. Data were obtained from the Maritimes Breeding Bird Atlas and Environment Canada's Canadian Wildlife Service (EC-CWS), while the NatureCounts database was consulted for additional information sightings on rare and colonial species. The NSMNH provided information on twenty-one avifauna priority species reported to occur in the area surrounding the Project site.

ACCDC results for priority species within a five km buffer around the Project area were obtained in 2014, while records for a wider radius (100 km) were obtained in 2010. Records of wintering

waterfowl and seabird colonies were obtained from EC-CWS. EC-CWS also provided information regarding records of American Oystercatcher (*Haematopus palliatus*) breeding on Grassy Island (EC-CWS pers. comm. 2014).

Of the 81 avian SOCC potentially occurring in the Project area (eastern mainland NS), just over half (43) are considered to have suitable habitat available on the Black Point site. These are listed in Table 6.7.5.

Table 6.7-5:
Avian Priority Species Potentially Present in the Area.

	Scientific Name	Common Name	Status Lists	Habitat Preferences[1]
1	*Actitis macularius*	Spotted Sandpiper	GSWSC-NS=3 (Sensitive)	Breeds near water in a variety of habitats, including shorelines, grasslands and forests. Found in both coastal and freshwater habitats during migration.
2	*Asio flammeus*	Short-eared Owl	COSEWIC=Special Concern SARA=Special Concern / Schedule 1 GSWSC-NS=2 (May Be At Risk)	Usually found in open country supporting cyclic small mammals (voles, lemmings), large expanses of grasslands, heathlands, shrub-steppe, tundra or agricultural areas. Nesting: dry sites with enough vegetation to conceal incubating female.
3	*Bucephala islandica*	Barrow's Goldeneye	COSEWIC=Special Concern SARA=Special Concern / Schedule 1 GSWSC-NS=1 (At Risk)	Breeding appear to be restricted to high elevation lakes north of St. Lawrence Estuary and Gulf. Eastern Canada populations have dwindled in recent years as a result of habitat loss due to fish introduction, logging and contamination.
4	*Calidris maritima*	Purple Sandpiper	GSWSC-NS=3 (Sensitive)	Coastal environments.
5	*Calidris pusilla*	Semipalmated Sandpiper	GSWSC-NS=3 (Sensitive)	Breeds in subarctic tundra; found in coastal habitats during migration.
6	*Cardellina (syn. Wilsonia) canadensis*	Canada Warbler	COSEWIC=Threatened SARA=Endangered/ Schedule 1 NSESA=Endangered GSWSC-NS=1 (At Risk)	Most abundant in moist, mixed forests with a well-developed understory, dense nest site cover. Often near open water. Nesting: Typically on or near the ground, often on slopes, knolls, in earthen banks, or rocky areas.
7	*Cathartes aura*	Turkey Vulture	GSWSC-NS=3 (Sensitive)	Preferred habitat includes farmland with pasture and abundant carrion close to undisturbed forested areas for perching, roosting, and nesting. This species nests in dark recesses beneath boulders, on cliff ledges, in hollow trees, logs, and stumps, and in abandoned buildings

	Scientific Name	Common Name	Status Lists	Habitat Preferences[1]
8	*Charadrius vociferus*	Killdeer	GSWSC-NS=3 (Sensitive)	A variety of open habitats, including sandbars, mudflats, heavily grazed pastures, cultivated fields, athletic fields, airports, golf courses, gravelled lots, and gravelled rooftops
9	*Chordeiles minor*	Common Nighthawk	COSEWIC=Threatened SARA=Threatened/ Schedule 1 GSWSC-NS=1 (At Risk)	Coastal sand dunes and beaches, logged or slash-burned areas of forest sites, woodland clearings, grassland habitat, farm fields, open forests, rock outcrops, and flat gravel rooftops. Nesting: Nests in open areas on the ground.
10	*Contopus cooperi*	Olive-sided Flycatcher	COSEWIC=Threatened SARA=Threatened /Schedule 1 NSESA=Threatened GSWSC-NS=1 (At Risk)	Along forest edges and openings with tall snags for foraging and singing. Nesting: generally well out toward tip of horizontal branch in coniferous tree.
11	*Contopus virens*	Eastern Wood Peewee	COSEWIC=Special Concern GSWSC-NS=3 (Sensitive)	Damp boreal forests, spruce bogs, swamps, coniferous forests, wet areas with sphagnum-moss ground cover
12	*Dendroica castanea*	Bay-breasted Warbler	GSWSC-NS=3 (Sensitive)	Spruce-fir forests
13	*Dendroica striata*	Blackpoll Warbler	GSWSC-NS=3 (Sensitive)	Deciduous and mixed forests, damp woodlands
14	*Dendroica tigrina*	Cape May Warbler	GSWSC-NS=3 (Sensitive)	Mixed and deciduous forests with thick undergrowth, rhododendron thickets, beech and maple forests
15	*Dumetella carolinensis*	Gray Catbird	GSWSC-NS=2 (May Be At Risk)	Open woodlands, suburban areas, thickets
16	*Empidonax flaviventris*	Yellow-bellied Flycatcher	GSWSC-NS=3 (Sensitive)	Birch forests, bogs, edges of marshes, damp thickets of alder or willows
17	*Euphagus carolinus*	Rusty Blackbird	COSEWIC=Special Concern SARA=Special Concern /Schedule 1 GSWSC-NS=2 (May Be At Risk)	Frequents cool habitats in forest openings, including spruce bogs, swamps, and damp alder swales. Nesting: In trees and shrubs, 0.5 m to 6 m above ground or over water.
18	*Gallinago delicata (form. G. gallinago)*	Wilson's Snipe	GSWSC-NS=3 (Sensitive)	Sedge bogs, fens, alder or willow swamps, and pond and river edges.
19	*Gavia immer*	Common Loon	GSWSC-NS=2 (May Be At Risk)	Prefers lakes larger than 24 ha with clear water, an abundance of small fish, numerous small islands, and an irregular shoreline. Nesting: ground-nesting; prefers to nest on islands.

	Scientific Name	Common Name	Status Lists	Habitat Preferences[1]
20	*Haematopus palliatus*	American Oystercatcher	GSWSC-NS=5 (Undetermined)[2]	Tied to coastal areas during breeding and non-breeding intervals, bound by prey specialization on shellfish and other marine invertebrates. Nests primarily on sand and shell beaches, dunes, salt marsh, and occasionally rock or other surfaces, in areas with little to no vegetation. Known to breed on Grassy Island in Guysborough County (one of two known nesting areas in Canada)
21	*Histrionicus histrionicus*	Harlequin Duck	COSEWIC=Special Concern SARA=Special Concern / Schedule 1 NSESA=Endangered GSWSC-NS=1 (At Risk)	Favour marine environments, but move inland to breed. In winter, occurs along headlands where surf breaks against rocks. Feed close to rocky shorelines or skerries. Few breeding records in NS
22	*Numenius phaeopus*	Whimbrel	GSWSC-NS=3 (Sensitive)	Arctic tundra, bogs, marshes at edge of boreal forests
23	*Perisoreus canadensis*	Gray Jay	GSWSC-NS=3 (Sensitive)	Nests in often large colonies, under rock ledges, highway culverts, bridges, and buildings
24	*Phalacrocorax carbo*	Great Cormorant	GSWSC-NS=3 (Sensitive)	Rocky islands, cliffs facing water, stands of trees near water
25	*Pheucticus ludovicianus*	Rose-breasted Grosbeak	GSWSC-NS=3 (Sensitive)	Woodland edges, weedy fields, thickets
26	*Picoides arcticus*	Black-backed Woodpecker	GSWSC-NS=3 (Sensitive)	Open woodlands, mature forests
27	*Pinicola enucleator*	Pine Grosbeak	GSWSC-NS=2 (May Be At Risk)	Open woodlands, conifer forests
28	*Poecile hudsonicus*	Boreal Chickadee	GSWSC-NS=3 (Sensitive)	Boreal forests
29	*Riparia riparia*	Bank Swallow	COSEWIC= Threatened GSWSC-NS=2 (May Be At Risk)	Along rivers, streams, lakes, and coasts. Nesting: burrows in banks, cliffs and bluffs; may also use artificial sites such as sand and gravel quarries and road cuts.
30	*Regulus calendula*	Ruby-crowned Kinglet	GSWSC-NS=3 (Sensitive)	Coniferous and mixed forests.

	Scientific Name	Common Name	Status Lists	Habitat Preferences[1]
31	*Regulus satrapa*	Golden-crowned Kinglet	GSWSC-NS=3 (Sensitive)	Coniferous forests during breeding season; in winter, may be found in coniferous, mixed and deciduous forests.
32	*Sayornis phoebe*	Eastern Phoebe	GSWSC-NS=3 (Sensitive)	Open deciduous and coniferous woodlands
33	*Spinus pinus*	Pine Siskin	GSWSC-NS=3 (Sensitive)	Generally inhabits coniferous or mixed coniferous-deciduous forests
34	*Sterna dougallii*	Roseate Tern	COSEWIC=Endangered SARA=Endangered /Schedule 1 NSESA=Endangered GSWSC-NS=1 (At Risk)	Colonies sparsely scattered on southern shore of NS (Brothers Islands, Grassy Island, and Country Island Complex)
35	*Sterna hirundo*	Common Tern	GSWSC-NS=3 (Sensitive)	Throughout NS, particularly the southern coast and Cape Breton.
36	*Sterna paradisaea*	Arctic Tern	GSWSC-NS=2 (May Be At Risk)	Lower Bay of Fundy, south shore of mainland NS, south and east shores of Cape Breton Island
37	*Sturnella magna*	Eastern Meadowlark	COSEWIC=Threatened GSWSC-NS=3 (Sensitive)	Grassland habitats
38	*Tachycineta bicolor*	Tree Swallow	GSWSC-NS=3 (Sensitive)	Open fields, meadows, marshes. Nesting: Typically in standing dead trees, or nest boxes where available.
39	*Tringa melanoleuca*	Greater Yellowlegs	GSWSC-NS=3 (Sensitive)	Breeds in muskeg, wet bogs with small wooded islands, and forests (usually coniferous) with abundant clearings. During migration, uses a variety of coastal habitats and wetlands.
40	*Tringa semipalmata*	Willet	GSWSC-NS=2 (May Be At Risk)	Breeds most commonly on salt marshes, barrier islands, and barrier beaches; also pastures and farmlands in Nova Scotia
41	*Tyrannus tyrannus*	Eastern Kingbird	GSWSC-NS=3 (Sensitive)	Open habitats, frequently along woodland edges.
42	*Vermivora peregrina*	Tennessee Warbler	GSWSC-NS=3 (Sensitive)	Open woodlands, brushy areas, cut-over and burned woods, second-growth woodlands, edges of bogs
43	*Wilsonia pusilla*	Wilson's Warbler	GSWSC-NS=3 (Sensitive)	Undergrowth in moist mature forests, dense woodlands near streams or swamps

[1] Source TBNAO (2014)

[2] Though not technically a SAR or SOCC, American Oystercatcher is included here at the request of EC-CWS, due to the reported presence of breeding individuals on Grassy Island, approximately 12 km east of the Project site off the town of Canso.

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Although habitat may be available to these species, many have no suitable breeding or nesting habitat within the Project area; nonetheless, individuals may potentially migrate through or over-winter in the area.

6.7.1.3.2 Avifauna SAR and SOCC Confirmed to Occur on the Black Point Site

A total of 14 avian SAR and SOCC are known to occur on the Project site, having been detected on the site during filed survey by AMEC in 2010 and/or AECOM in 2011. A list of these species is provided in Table 6.7.6, along with the species status and information on known presence in the Project area. A single species, the Rusty Blackbird (*Euphagus carolinus*) is a legally-protected *SAR* species.

Table 6.7-6:
Priority Avian Species Recorded on the Site

Scientific Name	Common Name	Status Lists	Comments
Dendroica castanea	Bay-breasted Warbler	GSWSC-NS=3 (Sensitive)	Possible breeder.
Picoides arcticus	Black-backed Woodpecker	GSWSC-NS=3 (Sensitive)	Confirmed breeding in Project area.
Dendroica striata	Blackpoll Warbler	GSWSC-NS=3 (Sensitive)	Possible breeder.
Poecile hudsonicus	Boreal Chickadee	GSWSC-NS=3 (Sensitive)	Possible breeder, found year-round in Project area.
Gavia immer	Common Loon	GSWSC-NS= 2 (May Be At Risk)	Heard during spring surveys, outside of breeding season.
Regulus satrapa	Golden-crowned Kinglet	GSWSC-NS= 3 (Sensitive)	Possible breeder, found year-round in Project area.
Perisoreus canadensis	Gray Jay	GSWSC-NS= 3 (Sensitive)	Possible breeder; also observed during winter surveys.
Phalacrocorax carbo	Great Cormorant	GSWSC-NS= 3 (Sensitive)	Observed during winter surveys.
Tringa melanoleuca	Greater Yellowlegs	GSWSC-NS= 3 (Sensitive)	Observed in fall surveys along coast.
Regulus calendula	Ruby-crowned Kinglet	GSWSC-NS= 3 (Sensitive)	Possible breeder.
Euphagus carolinus	Rusty Blackbird	*SARA*= Special Concern/ Schedule 1 COSEWIC= Special Concern *NSESA*= Endangered GSWSC-NS= 2 (May Be At Risk	Possible breeder.
Calidris pusilla	Semipalmated Sandpiper	GSWSC-NS= 3 (Sensitive)	Observed in fall surveys

			along coast.
Actitis macularius	Spotted Sandpiper	GSWSC-NS= 3 (Sensitive)	Observed in fall surveys along coast.
Empidonax flaviventris	Yellow-bellied Flycatcher	GSWSC-NS= 3 (Sensitive)	Possible breeder.

Landbirds (Including Raptors and Passerines)

Breeding evidence has been recorded in the Project area for Rusty Blackbird, Boreal Chickadee, Blackpoll Warbler, Bay-breasted Warbler, Black-backed Woodpecker, Gray Jay, Golden-crowned Kinglet, Ruby-crowned Kinglet and Yellow-bellied Flycatcher (Table 6.7.6). Potential breeding habitat exists in the Project area for other landbird species of special status that were not directly observed, including Common Nighthawk, Eastern Phoebe, Pine Grosbeak, Short-eared Owl, Tennessee Warbler, Tree Swallow and Wilson's Warbler. Potentially suitable habitat exists for Black-billed Cuckoo and Willow Flycatcher, although these species are considered unlikely to occur in the Project area due to their geographic distributions.

Shorebirds

Spotted Sandpiper and Greater Yellowlegs have each been observed along the coastline in the Project area during fall migration surveys, and while both of these species may breed in the area, no breeding evidence was observed in field surveys of the Project area or in the MBBA. Fogherty Lake does not appear to provide good breeding habitat for these species, as the bank vegetation is dense and shrubby, and there are no shallow areas for wading.

The Purple Sandpiper has been reported in the general area by ACCDC (2010), the Strait of Canso CBC (National Audubon Society 2014) and during winter waterfowl surveys conducted by EC-CWS (A. Hicks, pers. comm. 2014). Purple Sandpipers breed in the Arctic; however, in the winter months, this species feeds on invertebrates along rocky shorelines throughout the province, and may be found on the coastline of the Project area.

Waterfowl and Seabirds

The Common Loon has potential to breed in freshwater lakes in the Project area; however, because Fogherty Lake is not productive and does not appear to support fish, it is considered unlikely. During the surveys for the Project, Common Loons were heard at a distance, but no breeding evidence was observed. They may utilize marine habitats off the Black Point site in winter.

Common Tern and Arctic Tern nest on coastal islands, the closest colony being on Half Island, located approximately 3 km from the Project area (EC-CWS 2014). A large tern colony supporting a significant number of breeding Roseate Terns exists in the Country Island Complex IBA (IBA 2014); this complex is composed of a number of islands and while the nearest point of this IBA is 13 km away, Country Island itself (which supports the largest number of Roseate Terns) is approximately 40 km away. Rock and Shervill (2012) state that between 18 and 53 pairs of Roseate Terns per year have been reported nesting on Country Island since surveys at this colony began in 1996, although surveys conducted in 2014 indicated that there were just 15 breeding pairs (J. Rock, pers. comm. 2014). While they do not breed in the Project area, there is slight potential for Roseate Terns to forage in the area.

One species of special status was identified during EC-CWS winter waterfowl surveys in Block 226: in 2006, two Harlequin Ducks were observed (A. Hicks, pers. comm. 2014). It is possible that some of the unidentified Goldeneye reported is Barrow's Goldeneye, which winter in small numbers off the coast of NS. The Common and Barrow's Goldeneye are very similar in appearance, and mixed flocks of the two species are known to occur. Both Barrow's Goldeneye and Harlequin Duck have been reported in the Strait of Canso CBC (National Audubon Society 2014), and both species are considered to potentially winter in the waters off the Project area.

To date, a single SAR species, the Rusty Blackbird, has been detected on the Black Point site. Rusty Blackbird was detected during a June breeding survey in 2010 by AMEC.

6.7.1.4 *Mammal SARR and SOCC*

6.7.1.4.1 Mammal SARR and SOCC Potentially Occurring on the Black Point Site

A total of nine terrestrial mammalian SAR or SOCC are listed by *SARA*, COSEWIC, *NSESA*, and GSWSC for NS (**Appendix N** Attachment E), of which four have potential to occur at the Project site, based on known distributions and habitat preferences (Table 6.7.7).

Table 6.7-7:
Priority Mammal Species Potentially Present on/near the Site

	Scientific Name	Common Name	Status	Habitat[1]
1	*Alces alces americana*	Eastern Moose- Mainland NS Population	*NSESA* Endangered GSWSC-NS= 1 (At Risk)	Second-growth forest, openings, swamps, lakes and wetlands
2	*Martes penannti*	Fisher	GSWSC-NS= 3 (Sensitive)	Mixed forests
3	*Myotis lucifugus*	Little Brown Myotis	COSEWIC, SARA, NSESA Endangered GSWSC-NS= 1 (At Risk)	Forests, especially near wetlands. Hibernates in caves in colonies.
4	*Myotis septentrionalis*	Northern Myotis/ Northern Long-eared Myotis	COSEWIC, SARA, NSESA Endangered GSWSC-NS= 1 (At Risk)	Dense forest caves. Hibernates in caves.

[1] Sources are Banfield (1977), Parker (2003), Barbour and Davis (1969)

The 2014 ACCDC database request report had no records of any mammal SOCC occurring within five km of the Project area (**Appendix N** Attachment C). An earlier ACCDC request had records of two mammal SOCC occurring within the formerly required 100 km radius of the Project area (**Appendix N** Attachment B). These were mainland Moose (*Alces americanus*, 11 records within 89 km), and American Marten (*Martes americana,* three records within 92 km). Other data sources indicate that moose or signs of moose have been reported within 5 km of the centre of the Project site on 11 occasions since 1999 (M. Pulsifer, pers. comm. 2014), including visual sightings of multiple moose within the Property boundary in 2004.

The NSMNH does not have any records of mammal species of concern in the general Project area (**Appendix N** Attachment D), although they suggested the surrounding area should be evaluated for potential bat hibernacula. They also suggested that the Proponent consult with NSDNR regarding mainland Moose and Canada Lynx.

Although not reported by ACCDC or the NSMNH for the area, based on its habitat preferences and reported range in the province, the Fisher (*Martes pennanti*) may possibly occur in the region as well.

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Moose

As only very low numbers of Moose occur in Eastern mainland NS, many of the Moose sightings recorded within the 100 km radius are likely from the large Cape Breton population, which is a different subspecies from western Canada (*Alces alces andersonii)* and has been introduced by humans (Parker 2003). Only the mainland population of Moose in NS is listed as Endangered by NSESA. Nonetheless, this species was retained in the short-list and subjected to the review of habitat requirements.

Moose inhabit second-growth forest, openings, swamps, lakes and wetlands (NatureServe 2013), and suitable Moose habitat occurs within the Project area. Therefore, this species is considered to have potential for presence within the Project site, and moose tracks and scat have been observed on the Project site as noted below in 6.7.1.3.2.

Fisher

Fisher (*Martes pennanti*) is listed as Vulnerable (3) by the General Status of Wild Species in Canada for NS (2010). Although not reported by ACCDC for the area, a small numbers of fishers were captured by fur harvesters in Guysborough County in 2012-2013, according to NSDNR (2014a). Fishers, though not abundant, are widespread in the province and occur in mixed and coniferous forests, typically in proximity to watercourses (Banfield 1974). Their diet consists primarily of small mammals, and they are one of the few natural predators of porcupines.

No sign of fisher was observed during surveys for this Project in 2010 or 2014. However, because there is suitable fisher habitat and abundant food (including porcupine) within the Project area, the occurrence of fisher is considered possible.

Little Brown Myotis

The Little Brown Myotis, also known as the Little Brown Bat, is a small non-migratory species which is probably the most common bat species in North America, ranging from Alaska to California (Barbour and Davis 1969). Throughout their range, Little Brown Myotis are usually abundant in forested areas, and are often associated with human settlement. In summer, reproductive females may form nursery colonies containing hundreds, sometimes thousands of individuals in buildings, attics, and other man-made structures. In late summer, Little Brown Myotis may travel hundreds of kilometres to swarm around caves and abandoned mines (Fenton and Barclay 1980). In NS, this species is known to hibernate in several caves or abandoned mine openings (AMOs) (Moseley 2007).

This species has been shown to be seriously affected by White-Nose Syndrome in NS and other parts of its range, and may be at risk of rapid extirpation in the Northeast US within 20 years, due to White-Nose Syndrome mortality (Frick *et al.* 2010). Due to this threat, the Little Brown Myotis was recently listed as Endangered under the *NSESA* (*NSESA* 2013). The Little Brown Myotis was also one of three bat species recently listed as Endangered in Canada by COSEWIC, under a rare emergency listing spurred on by the White-Nose Syndrome issue (COSEWIC 2012a), and has subsequently been listed as Endangered under *SARA* (SARA 2014).

The Project site provides much forested and wetland area which may be used as roosting and foraging habitat by Little Brown Myotis. The town of Canso, located 12 km to the east of the site, reportedly supports a large concentration of bats (Nova Scotia Bat Conservation 2014). However, a search of the Nova Scotia Abandoned Mine Openings (AMOs) database NSDNR 2014b revealed no unfilled openings within at least 33 km of the site, and there are no documented caves or mines used by bats within 75 km (Moseley 2007). There is no known hibernating or swarming caves in the vicinity of the Black Point site.

Northern Long-eared Myotis

The Northern Long-eared Myotis, also known as the Northern Myotis, is a small non-migratory forest-interior species of bat (Broders *et al.* 2006; Caceres and Barclay 2000; Henderson and Broders 2008; Sasse and Pekins 1996; Jung *et al.* 1999) which feeds on insects and occurs in both hardwood and softwood forests (Foster and Kurta 1999). Northern Long-eared Myotis are known to forage under the forest canopy (Laval *et al.* 1977; Broders *et al.* 2006) often near vernal pools and forest streams (Brooks and Ford 2005). They roost preferentially in deciduous trees (Sasse and Pekins 1996; Menzel *et al.* 2002; Carter and Feldhamer 2005). This species swarms around mines and caves in the fall, and hibernates in many of these same spaces, although not in large numbers.

Due to the current White-Nose Syndrome epidemic mentioned above, the Northern Long-eared Myotis was recently listed as Endangered under the *NSESA* (NSESA 2013), and was one of three bat species recently listed as Endangered in Canada by COSEWIC, under a rare emergency listing spurred on by the White-Nose Syndrome issue (COSEWIC 2012b), and has subsequently been listed as Endangered under *SARA* (SARA 2014).

The Project site provides much forested and wetland area which may be used as roosting and foraging habitat by Northern Long-Eared Myotis. The town of Canso, located 12 km to the east of the site, reportedly supports a large concentration of bats (Nova Scotia Bat Conservation 2014). However, a search of the Nova Scotia Abandoned Mine Openings (AMOs) database NSDNR 2014b revealed no unfilled openings within at least 33 km of the site, and there are no documented caves or mines used by bats within 75 km (Moseley 2007). There is no known hibernating or swarming caves in the vicinity of the Black Point site.

6.7.1.4.2 Mammal SOCC Confirmed to Occur on the Black Point Site

To date, a single mammal SAR, Mainland Moose, has been confirmed to occur on the Black Point site.

Mainland Moose

As only very low numbers of Moose occur in Eastern mainland NS, many of the Moose sightings recorded within the 100 km radius in 2010 are likely from the large Cape Breton population, which is an introduced Albertan subspecies (Parker 2003). Only the mainland population of Moose, which is the native Atlantic subspecies, is listed as Endangered by the *NSESA,* and as 1 (At Risk) by the General Status of Wild Species in Canada for Nova Scotia (2010).

However, mainland moose inhabit second-growth forest, openings, swamps, lakes and wetlands (NatureServe 2013), and suitable Moose habitat occurs within the Project area.

Evidence of moose presence on the Black Point site was observed during wetland surveys conducted by AMEC staff in August 2014. Field surveys targeting mainland Moose were then conducted by AMEC personnel, accompanied by a Mi'kmaq hunter experienced in tracking Moose and other wildlife, in late September 2014. Results are provided in **Appendix N** Attachment F. A winter survey is also planned for early 2015 (comprising two survey events) in order to build upon existing data regarding the use of the Project Area and Adjacent Areas by Moose and a follow-up pellet grouping study is planned for spring, 2015.

6.7.1.5 *Herpetile SOCC*

The term herpetile refers to an artificial grouping which includes both reptiles and amphibians.

6.7.1.5.1 Herpetile Priority Species Potentially Occurring on the Black Point Site

Four species of reptiles at risk are listed by *SARA*, COSEWIC, *NSESA* and/or GSWSC in NS. There are currently no species of amphibian at risk listed by *SARA*, COSEWIC, *NSESA* and/or GSWSC in NS. Of the four herpetile priority species in NS, only the Wood Turtle and Snapping Turtle (*Chelydra serpentina*) have potential to occur in the Project area, and are included in the Shortlist of Priority Fauna Species (**Appendix N** Attachment E). The other two species, Blanding's Turtle (*Emydoidea blandingii*) and Northern Ribbonsnake (*Thamnophis sauritus septentrionalis*), are restricted to southwestern NS, in the general area of Kejimkujik National Park in Queens and Lunenburg Counties (Gilhen 1984) and are not expected to occur on the Project site.

NSMNH (2014) does not list any terrestrial reptile or amphibian species of concern as occurring with the general area of the Project site, though it does state that marine turtles may occur in nearby marine environments. Marine turtle SAR are discussed further in Section 6.7.3.3.

The two species potentially occurring on the site are discussed below.

Wood Turtle

According to data provided by ACCDC in 2010 the Wood Turtle (COSEWIC and *SARA* Threatened, *NSESA* Threatened, GSWSC-NS 3 (Sensitive) has been recorded within 100 km of the Project area (**Appendix N** Attachment B). The largest known wood turtle population in NS occurs in the St. Mary's River (MacGregor and Elderkin 2003), which is approximately 70 km west of the Project area. For most of the year, Wood Turtles live along permanent streams, but in summer months they roam widely over a large variety of terrestrial habitats adjacent to streams, including deciduous forest, fields, woodland bogs and marshy pastures. For nesting, Wood Turtles require fairly moist but well-drained, unshaded, vegetation-free sites with loose substrate, such as sandy or gravely stream banks or sand-gravel bars in streams (MacGregor and Elderkin 2003, NatureServe 2013). They also use such banks for basking and will utilize clearings created by humans for basking or breeding (NatureServe 2013). They prefer hard-bottomed streams and rivers composed of sand or gravel, and avoid streams with clay or mucky substrate; clear rivers and streams of medium size (between 2 m and 30 m wide) are considered ideal (MacGregor and Elderkin 2003).

All the streams on the Project site are very small, almost ephemeral, and their banks are vegetated, and therefore do not meet the species' nesting habitat requirements. Wood Turtles are not likely to overwinter in the very small, shallow streams in the Project area. Although

there is potential foraging habitat during summer months, Wood Turtles are highly unlikely to nest within the proposed site.

Snapping Turtle

According to data provided by ACCDC (2010), snapping turtles (*SARA* and COSEWIC Special Concern, NSESA Vulnerable, GSWSC= 4 (Secure)) have not been recorded within 100 km of the Project area (**Appendix N** Attachment B). However, Guysborough County is known to be poorly surveyed for many fauna groups, and the lack of snapping turtle reports could be due to a lack of reporting, rather than an actual lack of this species' presence in the region. MacAlpine (2010) states that it is unclear whether snapping turtles inhabit the Atlantic Coast zone in which the Black Point Project site is located. It is reported to occur in the two neighbouring ecozones, the South Central Nova Scotia Uplands and the Nova Scotia Highlands. It is included in this report as a precaution.

Snapping Turtles utilize a wide variety of aquatic habitats, preferring those with a soft muddy or sandy bottom. They are highly aquatic, seldom emerging from the water even to bask, and they are able to tolerate brackish water. Nest sites are often far from water, and may include banks, lawns, gardens, road embankments, or even Muskrat burrows. Snapping Turtles are omnivorous, feeding on invertebrates and plants as well as fish, frogs, and other small vertebrates. They hibernate on the bottom of lakes and rivers. Foraging habitat is marginal for Snapping Turtles on the Project site, though suitable nesting habitat may occur.

Herpetile (reptile and amphibian) surveys were conducted simultaneously with surveys for other taxonomic groups and wetlands on the site throughout the 2010 field season. No evidence of any herpetile SOCC was observed.

No reptile or amphibian SOCC has been confirmed to occur on the Black Point site.

6.7.1.6 *Invertebrate SOCC - Odonates and Lepidopterans*

This section discusses Odonates (dragonflies and damselflies) and Lepidopterans (Butterflies).

The Odonata, or dragonflies and damselflies, are large predatory insects which complete their larval development in aquatic environments before emerging as flying adults. All rely on aquatic habitats for reproduction, and some have very specific habitat requirements. Currently, there are 26 species of odonates listed as 1 (At Risk), 2 (May Be At Risk), or 3 (Sensitive), in the Canadian General Status of Wild Species list for NS. No odonate species are listed under *SARA*, COSEWIC or the *NSESA*. The distribution of odonates in NS has not received much study until the last few decades, and Guysborough County is the least studied county in NS (P. Brunelle, pers. comm. 2010). As there are very few odonate experts in eastern Canada, odonate distribution and populations within the province are not as well documented as for other more-easily identified groups.

6.7.1.6.1 Invertebrate Priority Species Potentially occurring on the Black Point Site

Odonates

A review of the known geographic distributions of these species indicates that 23 species of Odonata of conservation concern have potential to occur in eastern NS, and so are included in

the Shortlist of Priority Fauna Species (**Appendix N** Attachment E). Of these, 20 are considered to have potential to occur on the Project site, based on known habitat preferences. These are outlined in Table 6.7.8.

Table 6.7-8:
Odonate Priority Species with Potential to Occur on the Site

	Scientific Name	Common Name	GSWSC-NS[1]	Habitat[2]
1	*Boyeria grafiana*	Ocellated Darner	3- Sensitive	Lotic obligate; found near rapid forest streams and lakes with rocky substrate. Flight period: early June to late September.
2	*Coenagrion interrogatum*	Subarctic Bluet	2- May Be At Risk	Peatland obligate. Found in open marshes and bogs with cool water, abundant aquatic mosses. Flight period: early June to early August
3	*Coenagrion resolutum*	Taiga Bluet	2- May Be At Risk	Ponds, marshes, sphagnum pools. Flight period: late May to late July.
4	*Enallagma signatum*	Orange Bluet	2- May Be At Risk	Lentic habitats, including ponds and lakes. Flight period: late June to early September.
5	*Enallagma vesperum*	Vesper Bluet	3- Sensitive	Lentic habitat; found in small lakes with lots of floating vegetation and occasionally slow-moving streams.. Flight period: early July to mid August.
6	*Gomphaeschna furcillata*	Harlequin Darner	3- Sensitive	Found in bogs and swamps, including alder swamps. Flight period: mid May to late July.
7	*Gomphus descriptus*	Harpoon Clubtail	3- Sensitive	Breeds in clear, rapid rocky streams with sandy or silty bottoms. Feeds in clearings and along forest edges. Flight period: early June to mid July.
8	*Leucorrhinia patricia*	Canada Whiteface	2- May Be At Risk	Peatland obligate. Found in bogs, fens, and lakes with mats of floating moss or shallow pools. Flight period: early June to mid July.
9	*Pantala hymenaea*	Spot-winged Glider	3- Sensitive	Peatland obligate; found in fresh and brackish temporary pools and ponds. Flight period: late June to mid August.
10	*Somatochlora brevicincta*	Quebec Emerald	2- May Be At Risk	Peatland obligate; found in grassy bogs, poor fens and acid fens. Flight period: late June to mid September.
11	*Somatochlora forcipata*	Forcipate Emerald	2- May Be At Risk	Lentic habitat; found in small spring-fed streams and alder swamps. Flight period: early June to mid August.
12	*Somatochlora franklini*	Delicate Emerald	3- Sensitive	Peatland obligate; found in shallow, mossy bogs and fens with short sedges or horsetails. Flight period: early June to early August.
13	*Somatochlora*	Kennedy's Emerald	2- May Be At Risk	Slow open streams in wetlands, boreal swamps, and

	Scientific Name	Common Name	GSWSC-NS[1]	Habitat[2]
	kennedyi			cool, shady bog ponds. Feeds over roads and streams. Flight period: late May to early September.
14	*Somatochlora williamsoni*	Williamson's Emerald	2- May Be At Risk	Slow streams and lakes including bog lakes, usually with clear water. Flight period: mid June to mid September.
15	*Ophiogomphus mainensis*	Maine Snaketail	2- May Be At Risk	Feeds in fields, and breeds in clear, moderately rapid rocky forest streams, often draining lakes or swamps. Flight period: late May to early August.
16	*Ophiogomphus aspersus*	Brook Snaketail	2- May Be At Risk	Feeds in fields and along forest trails, and near water. Breeds in clear open streams with brushy banks and sand, gravel or rock riffles. Flight period: early June to early September.
17	*Stylurus scudderi*	Zebra Clubtail	2- May Be At Risk	Clear forest streams, small rivers. Forages along forest edges and in clearings. Flight period: late June to early October.
18	*Sympetrum danae*	Black Meadowhawk	3- Sensitive	Bogs, fens and marshes; occasionally saline or moving water. Flight period: late July to late October
19	*Tramea lacerata*	Black Saddlebags	2- May Be At Risk	Ponds (including temporary ponds), lakes and ditches without fish. Flight period: mid May to mid October.
20	*Williamsonia fletcheri*	Ebony Boghaunter	2- May Be At Risk	Bog pools and forest fens. Flight period: late May to early July.

1= General Status of Wild Species in Canada- Nova Scotia rank; 2= Sources are Dunkle (2000) and BugGuide (2014)

See Section 6.4.3.3 for a description of the odonate surveys conducted on the Project site in 2010; odonate surveys were conducted by Mr. Paul Brunelle, a well-known expert of Odonata of the Maritimes. He conducted his initial surveys in June and July of 2010, and AMEC staff collected additional specimens in August and September of 2010, in order to accurately characterize the odonate fauna of the site. Mr. Brunelle's report is provided in Section 6.4-**Appendix E**.

According to ACCDC (2010), six odonate priority species have been reported within a 100 km radius around the Project area (Appendix N2). These were Williamson's Emerald, Maine Snaketail, Brook Snaketail, Black Meadowhawk, Harlequin Darner, and Ocellated Darner. No odonates were listed within five km of Black Point in the 2014 ACCDC report (**Appendix N** Attachment C).

The NSMNH does not have any records of odonate species of concern in the general Project area (**Appendix N** Attachment D), and no Significant Habitat areas for odonates are listed by NSDNR within 20 km of the Project site (NSDNR 2012).

The Project area contains several types of aquatic habitats which are potential breeding sites for odonates such as streams, bogs, ponds, and marshes. Based on habitat requirements

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(**Appendix N** Attachment E), potential breeding habitat exists for most odonate priority species on the short-list.

Lepidopterans

Ten butterfly and moth species are listed as SAR or SOCC in NS by *SARA*, COSEWIC, *NSESA*, and/or the General Status of Wild Species in Canada, and are known to occur in NS. Of these, nine are considered to have potential to occur on the Project site based on known habitat preferences (**Appendix N** Attachment E). These are listed in Table 6.7.9.

Table 6.7-9:
Lepidopteran Priority Species with Potential to Occur on the Site

	Scientific Name	Common Name	GSWSC-NS Status	Habitat[1]
1	*Boloria chariclea*	Arctic Fritillary	3- Sensitive	Boreal forest clearings and transmission lines; bogs and boggy trails. Frequently visits flowers including daisies and spreading dogbane. Host plant: Various willows; possibly violets.
2	*Callophrys lanoraieensis*	Bog Elfin	2- May Be At Risk	Bogs, wood roads and sandy pine forests with black spruce. Host plant: Black spruce.
3	*Danaus plexippus*	Monarch	3- Sensitive	Found in a variety of open habitats; in late summer, congregates in coastal areas to feed on thistle and prepare for migration to Mexico. Host plant: Swamp milkweed and Kansas milkweed.
4	*Oeneis jutta*	Jutta Arctic	2- May Be At Risk	Colonial, found in bogs and fens. Host plant: Various sedges, including *Carex* spp. and tussock cotton-grass.
5	*Papilio brevicauda*	Short-tailed Swallowtail	3- Sensitive	Found on coastal marshes, dunes and headlands. Usually seen within 100 m of the ocean. Host plant: Scotch lovage and other members of the Carrot family.
6	*Pieris oleracea*	Mustard White	3- Sensitive	Along roadsides and in open spaces in forested areas. Host plant: Various members of the Mustard family, particularly rock cresses and toothworts.
7	*Polygonia gracilis*	Hoary Comma	3- Sensitive	Often seen visiting flowers (such as Pearly Everlasting), unlike most Commas. Host plant: Various currants (*Ribes* spp.)
8	*Polygonia satyrus*	Satyr Comma	3- Sensitive	Woodland species often seen sitting on roads and trails; like most Commas, attracted to animal droppings, carrion, sap and fermented fruit. Host plant: Stinging nettle.
9	*Thorybes pylades*	Northern Cloudywing	3- Sensitive	Inhabits a variety of open forest and meadow habitats. Host plants: Various legumes, including vetch and beach pea.

[1]= Source= Maritime Butterfly Atlas 2014

Three of these priority species have known occurrences within 100 km of the Project area (**Appendix N** Attachment B): Monarch, Short-tailed Swallowtail, and Hoary Comma. No lepidopteran SOCC were listed within five km of Black Point in the 2014 ACCDC report (**Appendix N** Attachment C), and none were observed during the field surveys conducted at the Site. To date, no butterfly Priority Species have been reported to the Maritimes Butterfly Atlas in the 10 km by 10 km atlas square in which the Project area is situated or in any of the adjacent atlas squares (Maritimes Butterfly Atlas 2014).

According to the Maritimes Butterfly Atlas, Hoary Comma has only been reported in northern NB, and the only NS sighting of Short-tailed Swallowtail was at St. Paul Island, off the northern tip of Cape Breton (Maritimes Butterfly Atlas 2014). Jutta Arctic, which had not been recorded in mainland NS prior to initiation of the ongoing Maritimes Butterfly Atlas, has since been reported in Guysborough County (Maritimes Butterfly Atlas 2014). Monarch, Northern Cloudywing and Mustard White have also been recorded in Guysborough County (Maritimes Butterfly Atlas 2014). Based on known distributions and habitat preferences, Monarch, Northern Cloudywing, Mustard White and Jutta Arctic have been retained in the short list of priority species (**Appendix N** Attachment E).

A review of habitat requirements for the butterfly species includes the consideration of larval food-plants. Butterflies depend on plants as a food source for the juvenile stage, the caterpillar. Many species are very specialized on one or a few plant species. Adults are mobile and are expected to be able to search for nectar producing plants in larger, though somewhat limited areas, thus avoiding areas unsuitable due to Project activities. However, presence or absence of larval food-plants ultimately determines the potential for presence of these species in the Project area, as well as the possibility of negative impacts caused by Project activities.

During the breeding season, Monarch butterflies (*SARA* and COSEWIC: Special Concern; GSWSC-NS = 3 Sensitive) utilize habitats such as meadows, weedy fields and watercourses, where milkweed, the larval food plant, is present. Monarchs can occur almost anywhere in NS during spring migration, and in the breeding season near the food plants. Monarchs are common to abundant during the fall migration, particularly along the Atlantic coast; however, most of these fall migrants are thought to originate from outside the province. Small numbers are resident. During the field surveys, no milkweed plants were found. Therefore, breeding Monarchs are unlikely to be present on the Project site.

Jutta Arctic, though relatively widespread in New Brunswick is uncommon in NS (GSWSC-NS = 2 May Be At Risk). This species is typically observed around margins of bogs and fens. Host plants include a variety of sedges, including *Carex* spp. and Tussock Cotton Grass. As suitable habitat and host plants occur in the Project area, breeding Jutta Arctic may be present.

Northern Cloudywing (GSWSC-NS = 3 Sensitive) utilizes a variety of open forest and meadow habitats where it is frequently observed visiting flowers. This species is highly colonial, and may be locally common. All but one of the Atlas records for the province all are from Guysborough and Antigonish Counties. Suitable habitat exists and at least one of the host plant species, Beach Pea, has been found in the Project area; therefore, it is possible that Northern Cloudywing may breed in the Project area, although none were observed during field surveys.

Mustard White (GSWSC-NS=3 Sensitive) is found in forest openings and along roadsides, and utilizes a variety of members of the mustard family (Brassicaceae), such as rock cresses and toothworts, as its host plants. The species is uncommon but widespread in the Maritimes. Suitable habitat for the Mustard White is present in the Project area, and so it is considered to possibly breed there, although none were observed during field surveys on the Site.

6.7.1.6.2 Invertebrate SOCC Confirmed to Occur on the Black Point Site

Only one priority species of invertebrate has been detected on the site to date, the Spot-winged Glider (*Pantala hymenaea*).

The spot-winged glider is a large dragonfly species which is migratory in north-eastern North America (Paul Brunelle, pers. comm. 2010). It is listed as 3 (Sensitive) by GSWSC-NS, meaning it is not believed to be at risk of immediate extirpation or extinction within the province but may require special attention or protection to prevent it from becoming at risk. A specimen was observed near shallow bog pools in Wetland 11, engaging in mating behaviour. However, it is not known if such bog pools are suitable for larval development of the fast-growing larvae of this genus (Paul Brunelle, pers. Comm. 2010.) See the Odonate report in Section 6.4, **Appendix E** for further details.

No SOCC butterfly species have been detected on the Black Point site to date.

6.7.2 Freshwater SAR and SOCC

6.7.2.1 *Freshwater Fish SAR and SOCC*

A total of 10 species, representing 17 populations of freshwater and/or anadramous fish species are listed as SAR/SOCC by *NSESA, SARA*, COSEWIC, and GSWSC-NS. Note that different populations of a species are often treated separately due to differing environments and threats, a good example being the various Salmon populations in NS.

Fish species which spend portions of their life histories in both fresh and salt water will be discussed in both of these sections, and impacts to either one of these environments can have impacts on these species.

6.7.2.1.1 Freshwater Fish SOCC Potentially Occurring on the Black Point Site

A review of the known geographic distributions of these freshwater fish species and populations of concern in NS indicates that nine species of freshwater, anadromous, or catadromous fish species of conservation concern have potential to occur in eastern NS, and so are included in the Short-list of Priority Fauna Species (**Appendix N** Attachment E). These are listed in Table 6.7.10.

Table 6.7-10:
Freshwater Fish SOCC and their Potential to Occur on the Site

Scientific Name	Common Name	GSWSC-NS Status	COSEWIC/ SARA Status	Potential in Region	Potential in Freshwater Habitats on Project Site
Salmo salar	Atlantic Salmon (NS Southern Upland Population)	2-May Be At Risk	Endangered /No status	YES	Unlikely*
Acipenser oxyrhynchus	Atlantic Sturgeon	2-May Be At Risk	Threatened /No status	YES	Unlikely*
Alosa pseudoharengus	Gaspereau (Alewife)	3-Sensitive		YES	Unlikely*
Salvelinus fontinalis	Brook Trout (Char)	3-Sensitive		YES	Unlikely
Margariscus margarita	Pearl Dace	3-Sensitive		YES	Unlikely
Culaea inconstans	Brook Stickleback	3-Sensitive		YES	Unlikely
Anguilla rostrata	American Eel	2-May Be At Risk	Threatened /No status	YES	Unlikely*
Morone saxatilis - Southern Gulf of St. Lawrence population	Striped Bass	1-At Risk	Special Concern/No Status	YES	Unlikely*
Salvelinus namaycush	Lake Trout	3-Sensitive		YES	Unlikely

Note:

*See discussion in Marine Fish SAR section

None of these species are expected to utilize any of the freshwater habitats on the Project site. While one small lake (Foghertys Lake) and three small unnamed watercourses are present, none of these are considered suitable fish habitat, as the pH is very low (<3). Gillnetting and electrofishing surveys conducted on the site in 2010 found no evidence of any fish species. No suitable habitat for any of the freshwater fish SOCC occurs on the Project site.

6.7.2.2 *Freshwater Invertebrate SOCC*

Freshwater invertebrates assessed for this document include the freshwater mussels. Currently, six species of freshwater mussels are considered to be SAR or SOCC in Nova Scotia by SARA, COSEWIC, NSESA, and/or GSWSC for Nova Scotia.

6.7.2.2.1 Freshwater Mussel SOCC Potentially Occurring on the Black Point Site

Six species of freshwater mussel SOCC occur in Nova Scotia. Five of these six Priority species are included in the Shortlist of Priority Fauna Species based on known occurrences (**Appendix N** Attachment E) and are listed in Table 6.7.11. The sixth species, the Yellow Lampmussel

(*Lampsilis cariosa)*, occurs in only a single NS location, the Sydney River system on Cape Breton Island. Therefore, this species is not expected to be present within the Project area, and is not included in the habitat evaluation.

Table 6.7-11:
Freshwater Mussel SOCC Occurring in Nova Scotia

	Common Name	Scientific Name	*SARA* Status & Schedule	*NSESA*	COSEWIC Status	GSWSC-NS
1	Creeper	*Strophitus undulatus*				2- May Be At Risk
2	Delicate Lampmussel (Tidewater Mucket)	*Leptodea ochracea (*formerly *Lampsilis ochracea)*				3- Sensitive
3	Yellow Lampmussel	*Lampsilis cariosa*	Special Concern / Schedule 1	Threatened	Special Concern	2- May Be At Risk
4	Brook Floater (Swollen Wedge Mussel)	*Alasmidonta varicosa*	Special Concern / Schedule 1	Threatened	Special Concern	3- Sensitive
5	Eastern Lampmussel	*Lampsilis radiata*				3- Sensitive
6	Eastern Pearlshell	*Margaritifera margaritifera*				3- Sensitive

No freshwater mussel SOCC was listed in the 2014 ACCDC database search within a five km radius of the Black Point Site (**Appendix N** Attachment B). The 2010 ACCDC report listed three species of concern within a 100 km radius from the Project area (Triangle Floater *Alismadonta undulata* (4 records); Brook Floater *A. varicosa* (6 records), and Eastern Lampmussel Lampsilis *radiata* (15 records)). None were within a 20 km radius of the proposed Project footprint. Distribution maps show that the Triangle Floater, Brook Floater and Delicate Lamp Mussel have occurrences in Guysborough County (Clarke 1981). In addition to these three species, Martel *et al.* (2010), in their summary of the known distributions of freshwater mussel species within Atlantic Maritime Ecozone, state that an additional freshwater mussel SOCC, the Eastern Pearlshell *Margaritifera margaritifera*, also occurs in the drainage system encompassing the Black Point site.

None of these species are expected to occur on the Black Point site, as the water in the aquatic habitats present is too acidic to support fish, which several of these species depend upon as hosts in the larval stage. Some studies have also shown dissolution of the shell periostracum layer in freshwater mussels at pH levels below 3.9 (Mäkelä and Oikari 1992).

No freshwater mussel shells were noted during field surveys in 2010 and 2014 by AMEC staff.

6.7.3 Marine SAR and SOCC

A review of the COSEWIC database, the SARA public Registry listings, and the Canada General Status of Wild Species for NS and the Atlantic Ocean found a total of 39 marine SAR or SOCC (29 fish, 7 mammals, 2 reptiles, 1 mollusc) which are known to occur in the northwestern Atlantic Ocean around Nova Scotia (**Appendix E**; **Appendix N,** Attachment E). This includes species that are fully marine, such as whales, as well as species which rely on marine habitats for only a portion of their life cycle, such as anadramous fishes. Note that marine birds are not included within this section, see Section 6.7.1.3 for a discussion of coastal and seabird species. The habitat preferences of the listed marine SOCC were compared with the known habitats occurring within the planned Black Point footprint to determine the likelihood of their occurrence. Of the 39 SAR or SOCC occurring in this region, 17 are known to occur or have potential to occur within the area encompassing the Project site. These species are discussed in detail in the following subsections.

The single marine mollusc SOCC, the Atlantic Mud-piddock (*Barnea truncata,* COSEWIC Threatened), is a sedentary boring species which occurs only within a specific geological formation in the Minas Basin (COSEWIC 2009a). It is not expected to occur in eastern mainland Nova Scotia, and so is not discussed further in this document.

Note that there is little information available on marine species' distribution in some cases.

6.7.3.1 *Marine Fish SOCC*

A review of the COSEWIC database and the SARA Public Registry listings for NS and the Atlantic Ocean found a total of 29 marine or diadromous fish SOCC which occur in the northwestern Atlantic Ocean (full list provided in **Appendix N** Attachment E). Distribution ranges and habitat preferences of these species were compared to the site location and the habitat types known to occur off the Black Point site to determine species with potential to occur in the waters at and near the Project site. The species considered to have potential to occur in the region are outlined in Table 6.7.12. Note that a few species occur in both freshwater and marine environments, and so, for the sake of completeness, are discussed in both the Freshwater and Marine SAR sections.

6.7.3.1.1 Marine Fish SOCC Potentially Occurring on the Black Point Site

A total of 15 marine fish SAR or SOCC which utilize marine habitats are deemed to have potential to occur in the waters at and near the Project site. A brief description of the habitat and life history of each of these fish species, along with its current designation under COSEWIC and/or SARA is provided below in Table 6.7.12.

Table 6.7-12:
Marine Fish SOCC with the Potential to Occur at/near the Site

	SCIENTIFIC NAME	COMMON NAME	STATUS LISTS	POSSIBLE OCCURRENCE IN HABITATS AT/NEAR SITE
1	*Acipenser oxyrinchus*	Atlantic Sturgeon	COSEWIC= Threatened GSWSC-NS=2 (May Be At Risk)	Possible
2	*Anguilla rostrata*	American Eel	COSEWIC= Threatened GSWSC-NS=2 (May Be At Risk)	YES
3	*Gadus morhua*	Atlantic Cod-Southern population	COSEWIC =Endangered, GSWSC-NS=3 (Sensitive)	YES
4	*Hippoglossoides platessoides*	American Plaice- Maritimes population	COSEWIC= Threatened GSWSC-NS=2 (May Be At Risk)	YES
5	*Hippoglossus hippoglossus*	Atlantic Halibut	GSWSC-NS=2 (May Be At Risk)	YES
6	*Lamna nasus*	Porbeagle	COSEWIC= Endangered GSWSC-NS= 1(At Risk)	Possible
7	*Leucoraja ocellata*	Winter Skate - Eastern Scotian Shelf population	COSEWIC= Threatened GSWSC-NS= 3 (Sensitive)	Possible
8	*Pollachius virens*	Pollock	GSWSC-NS= 3 (Sensitive)	YES
9	*Salmo salar*	Atlantic Salmon - NS Southern Upland Population	COSEWIC= Endangered GSWSC-NS= 1 (At Risk)	YES
10	*Squalus acanthias*	Spiny Dogfish	COSEWIC= Special Concern GSWSC-NS= 3 (Sensitive)	Possible
11	*Thunnus alalunga*	Albacore	GSWSC-NS= 3 (Sensitive)	Possible
12	*Thunnus albacares*	Yellowfin Tuna	GSWSC-NS= 3 (Sensitive)	Possible
13	*Thunnus obesus*	Bigeye Tuna	GSWSC-NS= 3 (Sensitive)	Possible
14	*Thunnus thynnus*	Atlantic Bluefin Tuna	COSEWIC= Endangered, GSWSC-NS= 2 (May Be At Risk)	Likely - Fished Nearby
15	*Urophycis tenuis*	White Hake-Atlantic and Northern Gulf of St. Lawrence population	COSEWIC= Threatened GSWSC-NS= 2 (May Be At Risk)	Possible

Each of these species is discussed briefly in the following paragraphs.

Atlantic Sturgeon

Atlantic Sturgeon are large, slow-growing armoured fish which live and mature in the sea, but spawn in freshwater, where some juvenile rearing also occurs. They occur in rivers, estuaries, nearshore marine environments and shelf regions to at least 50 m depth along the Atlantic Coast of North America (COSEWIC 2011a). They are listed as Threatened by COSEWIC and as 2 (May Be At Risk) on the GSWSC list for the Atlantic Ocean (www.wildspecies.ca). Breeding populations are known from the St Lawrence and Saint John Rivers and possible in other rivers flowing into the Bay of Fundy and the Gulf of St Lawrence. Adults spend most of their time at sea, but generally remain close to shore (COSEWIC 2011a).

While Atlantic Sturgeon was not listed in the 2010 ACCDC screening conducted for this Project, reliable sightings of a small group (4-5) of juvenile Atlantic Sturgeon were noted in 2009 within Guysborough County by a qualified AMEC biologist (Cameron-MacMillan, M., pers. comm. 2013). These records have recently been reported to ACCDC. The lake and watercourses on the Project site are unsuitable for Atlantic Sturgeon, but it is possible that adults may occasionally forage in the marine portion of the footprint. No critical habitat is present.

American Eel

The American Eel spawns and hatches in the marine environment, but grows to maturity in freshwater. Adults and early larval stages likely utilize the marine portion of the Project footprint as they migrate to and from streams in Guysborough County. While Eels are still relatively abundant in eastern Canada, population decreases in Ontario and Quebec have led to COSEWIC recently listing the American Eel as a Threatened species (COSEWIC 2012a). It is also listed as 2 (May Be At Risk) on the GSWSC list for the Atlantic Ocean (www.wildspecies.ca). Eels continue to be a significant species to Mi'kmaq people in eastern Canada.

The lake and watercourses on the Project site are unlikely to support American Eel, as they are very acidic, but it is quite likely that adults and early larval stages forage in the marine portion of the Project footprint. No critical habitat is present.

As a catadromous species, American Eel is also discussed in Section 6.7.2.1.1.

Atlantic Cod-Southern Population

The Atlantic Cod is a marine fish species which has historically been extremely important as a commercial species in eastern Canada, but is now at very low levels and only limited fishing is permitted. The Southern population, which encompasses the Project site, is now listed by COSEWIC as Endangered (COSEWIC 2010a) and as 3 (Sensitive) on the GSWSC list for the Atlantic Ocean (www.wildspecies.ca). Knowledge of the habitat requirements of Atlantic Cod is rather poor, and it has been suggested that habitat requirements change with age (COSEWIC 2010a). Cod are known to occur in inshore waters along the Guysborough coast, and Atlantic Cod likely forage within the Project footprint, though no habitat critical to this species is present.

American Plaice- Maritimes Population

American Plaice is a species of flounder which burrows in sediments to escape predators and ambush prey. Juvenile American plaice prefer depths of 100 to 200 m, but adults are less particular regarding habitat and could potentially occur within the Project footprint. The Maritime

population was designated as Threatened by COSEWIC in 2009 (COSEWIC 2009b) and as 2 (May Be At Risk) on the GSWSC list for the Atlantic Ocean (www.wildspecies.ca). Abundance of mature individuals has declined about 67% on the Scotian Shelf within the last few generations. It is reasonable to assume that adult American Plaice may occasionally forage within the Project footprint, though no critical habitat is present.

Atlantic Halibut

The Atlantic Halibut is the largest of the flatfishes and can be found in cool boreal and subarctic waters on both sides of the North Atlantic (Scott and Scott 1988). In the summer the Atlantic Halibut inhabits shallow waters and in the winter it moves into deeper waters, preferring temperatures above 2.5 ºC. The migratory patterns of the halibut can be strong and may migrate great distances at times however they are not classified as highly migratory. Depending on the Atlantic Halibut's size, the food sources are invertebrates, mainly marine annelid worms and crustaceans, and other fishes. The Atlantic Halibut is ranked as 2 (May Be At Risk) on the GSWSC list for the Atlantic Ocean (www.wildspecies.ca).

Porbeagle

The Porbeagle is a large cold-temperate coastal and oceanic shark which tends to be more common on continental shelves, but is occasionally found close inshore (Scott and Scott 1988; Compagno 2001). It feeds on wide variety of species, especially bony fishes and Squid (Joyce *et al.* 2002). Porbeagle abundance has declined greatly since Canada began fishing them in the 1990s. This species was listed by COSEWIC as Endangered in 2014 (COSEWIC 2004) and is listed as 1 (At Risk) on the GSWSC list for the Atlantic Ocean (www.wildspecies.ca). It is possible that Porbeagles may occasionally forage within the waters at or near the Project site. No critical habitat is present.

Winter Skate

Winter Skate **(***Leucoraja ocellata***)** is a bottom-dwelling skate species, which is usually found on sand and gravel. The Project site falls within the region home to the Eastern Scotian Shelf population of this species, which is subject to a small directed fishery. Very little is known about the biology of Winter Skate; however, this species' delayed age at maturity, large size at birth, long generation time, low fecundity, and consequently slow population growth rate have led to COSEWIC listing this species as Threatened (COSEWIC 2005) and as 3 (Sensitive) on the GSWSC list for the Atlantic Ocean (www.wildspecies.ca). Winter Skate are also at risk of bycatch in fisheries for other groundfish species and/or scallops. Habitat within the marine footprint of the Project is likely marginal foraging habitat for winter skate. No critical habitat is present.

Pollock

Pollock occur on both sides of the North Atlantic and inhabit a broad depth range from 37 to 364 m, with a preferred depth of 110 to 181 m. Juvenile Pollock move inshore in summer and offshore in winter while adult Pollock are more commonly found in deeper water near shore, or on offshore banks. Pollock can endure temperatures as low as zero degrees Celsius but are more commonly found in higher temperatures, although not above 15.5 to 18.3 º C. Pollock feed on crustaceans and fish in mainly equal proportions, however larger Pollock tend to eat more fish than smaller Pollock (Scott and Scott 1988). Pollock is ranked as 3 (Sensitive) on the

GSWSC list for the Atlantic Ocean (www.wildspecies.ca). It is possible that juvenile Pollock may occur within the Project's marine footprint in summer.

Atlantic Salmon

Atlantic salmon prefer rivers or streams that are generally clear, cool and well-oxygenated for reproduction and the first few years of rearing, but undertakes lengthy feeding migrations in the North Atlantic Ocean as older juveniles and adults. The Southern NS Upland population, which encompasses the Black Point site, breeds in rivers from north-eastern mainland Nova Scotia, along the Atlantic coast and into the Bay of Fundy. Atlantic Salmon have historically supported important fisheries in eastern Canada; however, most populations are now listed as Endangered by COSEWIC (2010b) and as 1 (At Risk) on the GSWSC list for the Atlantic Ocean (www.wildspecies.ca). The number of mature individuals has declined over the past few generations by about 61%. In addition, recent surveys have only found juvenile Salmon in 20 of 51 known historic spawning rivers in NS (COSEWIC 2010b). Human influences, such as dam construction, pollution and logging, have eliminated and/or degraded freshwater spawning and foraging habitats. Acidification of freshwater habitats brought about by acidic precipitation is another ongoing threat to this species' survival.

It is likely that adult Atlantic Salmon may occasionally forage within the marine portion of the Project footprint, though no critical habitat is present.

As an anadromous species, Atlantic Salmon is also discussed in Section 6.7.2.1.1.

Spiny Dogfish

The Spiny Dogfish *(Squalus acanthias)* is a small shark which occurs world-wide on the continental shelf, from the intertidal to the shelf slope, in temperate and boreal waters. While still relatively abundant in Canadian waters, this species' low fecundity, long generation time, and vulnerability to overfishing in nearby US waters, have led to it being listed as a species of Special Concern by COSEWIC (2010c) and as 3 (Sensitive) on the GSWSC list for the Atlantic Ocean (www.wildspecies.ca). Habitat within the marine footprint of the Project is likely suitable foraging habitat for Spiny Dogfish. No critical habitat is present.

Albacore Tuna

Albacore is a deep swimming tuna species which occurs worldwide in tropical and temperate seas. It can withstand temperatures as low as 9.5 ºC but prefers between 13.5 and 25.2 º C (Scott and Scott 1988). They do not breed in Canadian waters. Albacore is ranked as 3 (Sensitive) on the GSWSC list for the Atlantic Ocean (www.wildspecies.ca). Albacore can occur off NS during the late summer and fall months, and could potentially occur within the marine footprint of the Project site.

Yellowfin Tuna

Yellowfin Tuna is a slender, large fish which can be found in the Atlantic, Pacific, and Indian oceans. It prefers warmer temperatures, ranging from 18 to 31º C. The Yellowfin Tuna occurs along the continental shelf off Nova Scotia southward, into the Caribbean Sea and Gulf of Mexico, to southern Brazil (Scott and Scott 1988). They do not breed in Canadian waters. Yellowfin Tuna is ranked as 3 (Sensitive) on the GSWSC list for the Atlantic Ocean (www.wildspecies.ca) and can occur off NS during the late summer and fall months. Yellow

Tuna could potentially occur within the marine footprint of the Project site but none have been reported.

Bigeye Tuna

Bigeye Tuna occur worldwide, from Portugal to South Africa in the eastern Atlantic, and from off the Scotian Shelf to northern Brazil in the western Atlantic. This species occur in more temperate waters, ranging from 7.8 to 18.4 degrees Celsius (Scott and Scott 1988). Bigeye Tuna is ranked as 3 (Sensitive) on the GSWSC list for the Atlantic Ocean (www.wildspecies.ca) and can occur off NS during the late summer and fall months. Bigeye Tuna could potentially occur within the marine footprint of the Project site but none have been reported.

Atlantic Bluefin Tuna

Atlantic Bluefin Tuna is a large predatory fish species which spawns in the Gulf of Mexico. Adults and large juveniles move northward to forage on smaller schooling fish species in warm Canadian waters in the summer and fall (COSEWIC 2011b). They are ranked as Endangered by COSEWIC and as 2 (May Be At Risk) on the GSWSC list for the Atlantic Ocean (www.wildspecies.ca). Despite large population decreases, Atlantic Bluefin Tuna are still fished commercially off Guysborough County (see Section 6.11), and it is likely that adults may forage within the waters at or near the Project site, though no critical habitat is present.

White Hake-Atlantic and Northern Gulf of St. Lawrence population

The White Hake occurs in cold water over deep mud bottom on the continental shelf and upper continental slope. In Canadian waters it occurs from southern Labrador into the Strait of Belle Isle and throughout the Gulf of St Lawrence, around Newfoundland, Scotia Shelf, Bay of Fundy, Passamaquoddy Bay, and Georges Bank. It can be found in deep parts of the Laurentian and Fundian channels and on the continental slope off Nova Scotia. White Hake are mainly found below 200 m moving progressively into deeper waters. White Hake feed heavily on fish, such as clupeids and gadoids, and less frequently, crustaceans (Scott and Scott 1988). This species was designated as Threatened by COSEWIC in 2013 and as 2 (May Be At Risk) on the GSWSC list for the Atlantic Ocean (www.wildspecies.ca). It is possible that adults may occasionally forage within the Project's marine footprint although no reports of this species have been collected within the Project Area.

6.7.3.2 *Marine Mammal SOCC*

Marine mammals potentially occurring off NS include whales, dolphins, porpoises and seals. A review of the COSEWIC database, the SARA Public Registry listings for NS, and the Canada General Status of Wild Species lists for the Atlantic Ocean found a total of seven marine mammals SAR or SOCC listed for the marine environment off Nova Scotia.

6.7.3.2.1 Marine Mammal SOCC Potentially Occurring at/near the Black Point Site

The NSMNH Screening states that the marine waters adjacent to the Project site may support resident or migratory species of cetaceans (whales) during the appropriate season. Habitat preferences of the species in Table 6.7.13 were compared to the site location and the habitat types known to occur in the waters at or near the Black Point site to determine species with potential to occur in the area of the Project site. All seven of these marine mammals SOCC are known to occur in the northwestern Atlantic Ocean off eastern Nova Scotia (**Appendix N**

Attachment E). Of these seven, only a single species, the Harbour Porpoise, is considered to have potential to occur in Project site waters. This species is discussed in the following paragraphs.

Table 6.7-13:
Marine Mammal SOCC with the Potential to Occur in Site Waters

Common Name Population	Species Name	COSEWIC Status /SARA Status & Schedule/ GSWSC- Atlantic	Potential in Site Waters
Blue Whale Atlantic	*Balaenoptera musculus*	SARA= Endangered (Schedule 1) COSEWIC = Endangered GCWSC-ATL= 1 (At Risk)	Unlikely
Fin Whale Atlantic	*Balaenoptera physalus*	SARA = Special Concern (Schedule 1) COSEWIC = Special Concern GCWSC-ATL = 3 (Sensitive)	Unlikely
Harbour Porpoise Northwest Atlantic	*Phocoena phocoena*	COSEWIC Special Concern GCWSC-ATL = 3 (Sensitive)	Possible
Killer Whale Northwest Atlantic	*Orcinus orca*	COSEWIC = Special Concern GCWSC-ATL = 3 (Sensitive)	Unlikely
North Atlantic Right Whale	*Eubalaena glacialis*	SARA = Endangered (Schedule 1) COSEWIC = Endangered	Unlikely
Northern Bottlenose Whale Scotian Shelf	*Hyperoodon ampullatus*	SARA = Endangered- (Schedule 1) COSEWIC = Endangered GCWSC-ATL = 3 (Sensitive)	Unlikely
Sowerby's Beaked Whale	*Mesoplodon bidens*	SARA= Special Concern (Schedule 1) COSEWIC = Special Concern GCWSC-ATL = 3 (Sensitive)	Unlikely

Harbour Porpoise

The Harbour Porpoise (*Phocoena phocoena*) is one of the smallest marine mammals, reaching a maximum of about 1.9 m in length and 76 kg. They occur primarily on continental shelves, and eat mostly small schooling fish (such as Herring, Capelin, Sprat, and Silver Hake), but also Squid (Waring *et al.* 2009). They are often spotted in harbours and bays. While currently abundant, this species is considered a species of Special Concern in Canada (COSEWIC 2006) and is listed as 3 (Sensitive) on the CGSWS list for the Atlantic Ocean. The Harbour Porpoise is also protected under the *Marine Mammal Regulations* of the *Fisheries Act*, which prohibits harvest. A major source of mortality for Harbour Porpoises is by-catch from fishing gear (especially gillnets) (COSEWIC 2006).

The marine footprint of the Project contains suitable foraging habitat for Harbour Porpoises, however this is not considered critical habitat.

6.7.3.3 *Marine Reptile SOCC*

A review of the COSEWIC database, the Species at Risk Public Registry listings, and the CGSWS status listings for NS and the Atlantic Ocean found a total of two marine reptiles SAR or SOCC which are known to occur in the northwestern Atlantic Ocean off eastern NS.

Distribution ranges and habitat preferences of these species were compared to the site location and the habitat types known to occur off Black Point to determine species with potential to occur in the waters at or near the Project site.

6.7.3.3.1 Marine Reptile SOCC Potentially Occurring on the Black Point Site

The NSMNH Screening states that the marine waters adjacent to the site may seasonally support migratory species of sea turtles in the appropriate season (**Appendix N** Attachment D). Only a single species, the Atlantic Leatherback (*Dermochelys coriacea coriacea*), is considered to have potential to occur in Project site waters (**Appendix N** Attachment E). A second marine turtle species, the Atlantic Loggerhead (*Caretta caretta*), is also listed by COSEWIC (2010d) as Endangered, but this species only occurs as juveniles far offshore, and is not expected to occur on or near the Project site.

Atlantic Leatherback

The Atlantic Leatherback (*Dermochelys coriacea coriacea*) is a large, slow-growing, long-lived migratory sea turtle species, which comes ashore only to lay eggs. This species breed in tropical or subtropical waters and moves to temperate waters in search of food (chiefly jellyfish) at other times of the year. While they do not breed in Canada, adult leatherbacks are a regular part of the Nova Scotian marine fauna in the summer and fall (James *et al.* 2006; Witzell 1999). Leatherbacks in Atlantic Canada occur in both offshore and coastal waters. The Atlantic Leatherback Turtle is listed by COSEWIC as Endangered (COSEWIC 2012d). Globally, this species is estimated to have declined by more than 70%. In the Atlantic, this species continues to be impacted by fisheries bycatch, coastal and offshore resource development, marine pollution, poaching of eggs, changes to nesting beaches and climate change (COSEWIC 2012d). Canadian waters provide an important foraging area for these turtles, however, entanglement in longline and fixed fishing gear remains a significant threat to Atlantic Leatherbacks in Canadian waters (COSEWIC 2012d).

It is possible that adult Atlantic Leatherbacks may forage within or near the marine portion of the Project footprint; however, no critical habitat for Atlantic leatherbacks is present.

For an assessment of the interaction between the Project and the herein described environment, refer to Section 7.12.

C 1340-416

6.8 Socio-Economic Conditions

6.8.1 Nova Scotia Economic Outlook

The economic growth of Nova Scotia has been slower than the Canadian average (slowest of any province) for the past two decades (1990-2012). Demographic conditions have been the major driver for this slow growth rate: over the same time period, the population of Nova Scotia only grew by 0.2 %/year vs. the national population growth of 1%/year (GNS 2014a).

The economy of Nova Scotia was relatively stable during the global financial crisis (2008-2009). However, growth has been slow in subsequent years. The Gross Domestic Product (GDP) in 2012 declined due to reductions (-18.7%) in investments in machinery and equipment (end of Deep Panuke platform construction), reductions in natural gas production and the forestry sector restructure, which resulted in lowered exports from this sector (GNS 2014a).

Increased natural gas production, a more robust economy in the United States and a lower Canadian dollar value are expected to result in growth in 2014. The Department of Finance and Treasury Board estimates a real GDP growth of 1.4% in 2014 and 1.9 % in 2015 (GNS 2014a).

Nova Scotia's longer term economic outlook will be driven by large projects such as the national shipbuilding procurement strategy, the Maritime Link to Lower Churchill hydroelectric power, wind energy developments, MacDonald Bridge re-decking, offshore energy exploration and the completion of the Halifax Convention Centre (GNS 2014a).

6.8.2 Local Socio-Economic Conditions

6.8.2.1 Social Environment

Population and Demographics

The Project area is located in the Municipality of the District of Guysborough (MODG); approximately 10 km west of Canso, along the south shore of Chedabucto Bay. Since the collapse of the ground fishery in the 1990s, significant changes have occurred in the population of the region. Guysborough County as a whole has the fourth largest proportion of out-migration patterns in Nova Scotia (ACOA 2009). Canso has experienced a dramatic population loss and shift in demographic profile. From 1996 to 2006, its population declined 19%, from 1,127 to 915 compared to a population gain of 0.5% for the Province of Nova Scotia as a whole (Gardner Pinfold 2011). Similarly, the population of MODG decreased by 19% between 2001 and 2011, to a population of 4,990 (Gardner Pinfold 2011).

The age distribution in the MODG indicates an older population with a median age of 53.9, compared to the Province of Nova Scotia of 43.7. In 2011, 15.5% of the population was under the age of 20, and 27.4% of the population was 65 years or older (SC 2011). The age distribution in the MODG indicates an older population with a median age of 53.9, compared to the Province of Nova Scotia of 43.7. In 2011, 15.5% of the population was under the age of 20, and 27.4% of the population was 65 years or older (SC 2011).

In 2011 the population of Canso was 1,326. This is a 21.8% decline from 2001. During this time, 18.1% of the population was under the age of 20 and 22.4% was 65 years or older (GNS 2014b).

The cultural origins of the populations of Guysborough County and Canso in 2011 are presented in Table 6.8-1.The majority of the population of both Guysborough County and Canso are of European origins (60% and 69% respectively). North American and North American Aboriginal were the next highest ethnic origins identified by the populations of Guysborough County and Canso. Note that as part of the National Household Survey, respondents may have identified only a single ethnic origin or multiple ethnicities.

Table 6.8-1:
Cultural Origins of Guysborough County and Canso in 2011

Origin	Guysborough County		Canso	
	Number	%	Number	%
European	6110	60%	1026	69%
North American	3080	30%	394	26%
North American Aboriginal	610	6%	36	2%
African	270	3%	12	0.8%
Asian	40	0.4%	20	1.3%
Caribbean	15	0.1%	0	0%
Latin/Central/South American	0	0%	0	0%
Oceania	0	0%	0	0%

Source: GNS 2014b and SLR interpretation

Recreation and Leisure

The nearest recreational facility is the Canso SportsPlex, which houses an arena, pool, and several sports fields. Other outdoor multi-purpose facilities in the MODG are located in Larry's River, Little Dover, Country Harbour, and St. Francis Harbour.

There are several fitness centers located within the MODG that offer a variety of fitness activities and programs: Chedabucto Fitness Centre in Guysborough, The Fanning Fitness Centre in Hazel Hill, and Community Fitness Centres in Isaac's Harbour Medical Centre, Whitehead (at the old Fire Hall), New Harbour Community Centre, and the Queensport Fire Hall (MODG 2014a).

There are two seasonal outdoor heated pools, one is located at the Canso Sportsplex and the other is part of the Chedabucto Family of Schools in Guysborough. Other outdoor recreational activities/facilities include a nine-hole golf course (Osprey Shores Resort) and two lighted outdoor tennis courts in Guysborough and outdoor skating rinks are located in Guysborough, Queensport, Little Dover, Larry's River, and Country Harbour and a curling club in Hazel Hill (MODG 2014a).

Hunting and fishing are popular activities in the MODG with big game hunting of deer and bear and inland and deep sea fishing. The area is popular for fishing blue fin tuna, shrimp, ground fish, scallop, snow crab and Atlantic Mackerel (GCIFA 2014a). Recreational boaters use community wharfs or serviced marina located in Canso and Guysborough, Auld's Cove and Ballantyne's Cove. There is no recreational fishing occurring in any of the freshwater sites located on the Project site. The water does not provide suitable habitat for any fish species

(Section 6.5.2). No recreational ocean fishing is conducted from the Project site as there is no safe access to the ocean due to the cliffs on the northern edge of the property.

Health and Social Services

The Project site is located within the district health authority of Guysborough Antigonish Strait Health Authority (GASHA). Within Guysborough County the GASHA operates two hospitals near the Project site (Table 6.8-2). Both hospitals operate a 24-hour emergency service and a variety of outpatient services.

Table 6.8-2:
Hospitals Near the Project Site

Hospital Name	Location	Number of Beds	Services
Eastern Memorial	Canso	8	Diagnostic Imaging, EKG, Emergency Services, Laboratory Services, Mental Health Outpatient Services, Physiotherapy, Social Work Services, Cancer and Supportive Care
Guysborough Memorial	Guysborough	10	Diagnostic Imaging, EKG, Emergency Services, Laboratory Services, Mental Health Outpatient Services, Physiotherapy, Nutrition and Dietetic Counselling, Physiotherapy, Social Work Services

Source: GASHA 2014.

There is a nursing home in Canso (Seaside Manor) and a special care facility in Guysborough (Milford Haven). Social services can be found throughout the MODG and those available near the Project site are presented in the Table 6.8-3.

Table 6.8-3:
Social Services Located Within the MODG

Service	Location(s)
Mental Health	Eastern Hospital in Canso and Guysborough Memorial Hospital in Guysborough
Addiction Support	Eastern Hospital in Canso and Guysborough Memorial Hospital in Guysborough
Alzheimer Support	Eastern Hospital in Canso and Guysborough Memorial Hospital in Guysborough
Cancer Support Care	Eastern Hospital in Canso and Guysborough Memorial Hospital in Guysborough
Health Education,	Eastern Hospital in Canso and Guysborough Memorial Hospital in Guysborough
Prenatal Classes	Eastern Hospital in Canso and Guysborough Memorial Hospital in Guysborough
Social Work – Acute Care	Eastern Hospital in Canso and Guysborough Memorial Hospital in Guysborough
Addictions, gambling, mental health hotlines	NA
Career and Job Counselling	Canso, Guysborough

Service	Location(s)
Literacy and Adult Learning	Guysborough
Clothing Bank	Guysborough
Food bank	Half Way Cove, Canso and Guysborough

Sources: GASHA 2014; GALA 2012

There are the churches in Canso and seven in Guysborough, including Baptist, Catholic, and United, with many more throughout the MODG (CCD 2014).

Crime and Public Safety

The Royal Canadian Mounted Police are responsible for policing Guysborough County, with detachments located in Canso, Guysborough and Sherbrooke (RCMP 2014). The 2012 crime statistics for Guysborough County and the province of Nova Scotia are presented in Table 6.8.4.

Table 6.8-4:
2012 Crime Statistics for Guysborough County and Nova Scotia

Location	Total # of Crimes	Crime rate/10,000 population	Violent Crimes	Violent Crime/10,000 population	Property Crime	Property Crime/10,000 population	Other Crime	Other Crime/10,000 population
Guysborough County	220	293	54	72	129	172	37	49
Guysborough County Youth	8	174	7	153	1	22	0	0
Nova Scotia	60,042	633	12,954	137	37,307	393	9,781	103
Nova Scotia Youth	5,492	882	1,715	276	2,667	428	1,110	178

Source: GNS 2014b

The crime rate, violent crime, property crime and other crime (per 10,000 people) in Guysborough County is generally half of the corresponding provincial crime rate (per 10,000 people) (Table 6.8-4). Crimes that do occur in Guysborough County are mostly non-violent and are usually related to property crime, which is similar to what is observed on a provincial scale. The crimes committed by the youth of Guysborough County are predominately violent, whereas the type of crime predominately committed by the youth of Nova Scotia is non-violent property crimes (Table 6.8-4).

Community Health

In 2010 the Guysborough County Community Health Board randomly surveyed 370 residents over the age of 15. The survey questions about personal health and well-being were derived from the Canadian Community Health Survey administered by Statistics Canada. The key findings of this survey are summarized in Table 6.8-5, which also includes the results for the Guysborough Antigonish Strait Health Authority (GASHA) region. The GASHA region includes Antigonish County, Guysborough County and the Strait Richmond.

Table 6.8-5:
2010 Indicators of Community Health for Guysborough County and Canada

Indicator	Guysborough County	Canada
Physically Inactive	46%	51%
Adult incidence of Over Weight/Obesity*	74%	51%
Consumed Alcohol in past 12 months	73%	NA
Currently Smoking*	22%	23%
Tried Illicit Drugs	37%	NA
Incidence of Cancer	1%	2%*
Incidence of Diabetes	9%	7%
Incidence of Heart Attacks	4%	NA
Incidence of Heart Disease	6%	7%
Incidence of Asthma	12%	9%
Incidence of cataracts or glaucoma	9%	NA
Incidence of Arthritis/Rheumatism	32%	21%
Consider Daily Life Stressful	49%	57%

*Nova Scotia %, as National value not available.

Generally speaking, the people of Guysborough County find daily life less stressful than the average Canadian does. They are less physically active than the rest of Canada, which could be in part why they also have a much higher incidence of overweight/obesity. For several indicators Guysborough County is the same/similar to the rest of Canada (incidence of smoking, cancer, diabetes and heart disease) but has a higher incidence of asthma and arthritis/rheumatism.

6.8.2.2 Infrastructure and Services

Private Residences

The total number of occupied dwellings in Guysborough County in 2011 was 3,685. The majority (84%) of these occupied dwellings were single detached homes. Other types included moveable homes (11%), apartments (3%) and semi-detached/ row/duplex (2%) (GNS 2014b). The total number of occupied dwellings in Canso in 2011 was 593. The breakdown was similar to the County, with the majority (75%) of the occupied dwellings were single detached homes, then moveable homes (15%), apartments (5%) and semi-detached/ row/duplex (4%) (GNS 2014b).

Temporary Housing

A list of bed and breakfasts, motels and campgrounds located in Guysborough County are identified in Table 6.8-6.

Table 6.8-6:
Temporary Housing in Guysborough County

Name of Temporary Housing	Location
The DesBarres Manor Country Inn	Guysborough
Foxberry-by-the-Sea Bed and Breakfast and Cottages	Whitehead
Pepperlane Manor	Guysborough
On the Harbour Bed and Breakfast	Isaac's harbour
Seawind Landing Country Inn	Charlos Cove
Last Port Motel	Canso
Lonely Rock Seaside Bungalows	New Harbour
Osprey Shores Golf Resort	Guysborough
Seabreeze Campground and Cottages	Fox Island
Shore To Sea Cottage	Phillips Harbour
Boylston Provincial Park	Boylston
Cape Canso RV Park & Marina	Canso
Salsman Provincial Park	Country Harbour

Source: MODG 2014b

The 2011 average value of dwellings in Canso, Guysborough County and Nova Scotia are presented in Table 6.8-7. (GNS 2014b).

Table 6.8-7:
Average Value of Dwellings in 2011

Location	Average Value
Canso	$94,651
Guysborough County	$110,604
Nova Scotia	$201,991

The 2011 average value of dwellings in Canso and Guysborough County were 47% and 55%, (respectively) of the provincial average value of dwellings.

Potable Water, Wastewater and Solid Waste Management

The Project site is currently undeveloped and therefore services such as potable water, wastewater and solid waste management will be addressed during the Project development.

The Town of Guysborough and the community of Canso have municipal water and sewer systems. Little Dover has municipal sewer service and Hazel Hill and the Tickle have municipal water service (MODG 2014a).

The closest solid waste management facility to the Project site is the Guysborough Waste Management facility located in Boylston, approximately 39 km from the Project site (MODG 2014a).

6.8.2.3 Cultural Heritage

Several cultural performance spaces are located in Guysborough: Chedabucto Place Performance Centre, Guysborough Masonic Hall, and the Mulgrave Road Theatre Centre, (MODG 2014a, MRT 2014).

Cultural events that occur proximal to the Project site include:

- Stan Rogers Folk Festival (located within Canso) which usually occurs for several days during the month of July. This festival celebrates Stan Rodgers and his contribution to folk music and East Coast music;
- Queensport Mackerel Derby which occurs late August (http://www.authenticseacoast.com); and
- At the Guysborough Marina local fiddlers & step dancers perform every Wednesday evening in August.

6.8.2.4 Economic Environment

Employment and Wages

The 2011 average family income for Canso, Guysborough County and Nova Scotia are presented in Table 6.8-8.

Table 6.8-8:
Average Family Income in 2011

Location	Family Income
Canso	$57,697
Guysborough County	$62,136
Nova Scotia	$79,838

Source: (NSb 2014)

The average family incomes in Canso and Guysborough County were 72% and 78% (respectively) of the average family income of Nova Scotia.

Guysborough County has significant challenges to economic development in the region. Guysborough is primarily rural with a relatively low education level, compared to the provincial average. High unemployment levels, combined with high out-migration, dependency on traditional resource sectors, and weak infrastructure are negatively impacting local economic development. Local stakeholders are working to improve economic development on multiple fronts. Projects to develop exportable products, develop aquaculture, improve tourism infrastructure, enhance training opportunities, and a range of other initiatives are continuing (ACOA 2009).

Labour Force and Business Activity

In 2001 Canso's labour participation rate was at 60.5% close to the provincial average of 61%, by 2006 the number of people participating in the job market dropped to 44%, a decline of nearly one-third from 2001 (Gardner Pinfold, 2011) which is indicative of significant out-migration and an aging population.

The overall volatility in employment in Canso from 1996 to 2006 was reflected in notable changes across a number of key industries. The hardest hit sector over the ten-year period was manufacturing, which saw a near total loss of employment (-86%) attributable to the decline and closure of the local fish processing plant, the town's major employer. A number of other sectors experienced major declines in employment over the same period, including transportation and storage (-67%); other services (-63%); and accommodation, food and beverage (-50%) (Gardner Pinfold 2011).

The unemployment rate for May 2014 in the North Shore Economic Region, which includes Guysborough County, was 11.7%, which was higher than the provincial rate of 9.5%. The employment rate for the North Shore Economic Region was 53% which is lower than the provincial rate of 56.7% (SC 2014).

The labour force by industry (%) for Canso, Guysborough County and Nova Scotia is presented in Table 6.8-9.

Table 6.8-9:
Labour Force (%) by Industry in 2011

Location	Agriculture/Forestry/Fishing and Hunting	Mining/quarrying and Oil and Gas	Utilities	Construction	Manufacturing	Wholesale Trade	Retail Trade	Transportation and Warehousing	Information and Cultural Industries	Finance and Insurance
Canso	28.9	0	0	9.3	7.5	0	12.5	2.7	0	0
Guysborough County	18	2.1	0.5	10.6	6.7	0.8	9.6	3.7	0.5	1.5
Nova Scotia	3.8	0.8	0.6	6.7	7	3.2	12.6	4	2	3.2

Location	Real Estate, Rental and Leasing	Professional/ Scientific and Technical Services	Management of Companies and Enterprises	Administrative and Support/waste	Educational Services	Health Care and Social Assistance	Arts and Entertainment	Accommodation and Food Services	Other Services (except Public Administration)	Public Administration
Canso	0	1.6	0	0	1.3	6.7	0	2.7	0	10.7
Guysborough County	1.3	1.3	1.3	3.5	6.8	11.2	3.6	4.7	4.3	7.8
Nova Scotia	1.4	4.9	0.1	4.9	8	12.3	2	6.5	4.2	9.7

Source: (GNS 2014b).

Although unemployment in the region remains high, in 2011, the majority of working people in Canso and Guysborough County were employed through farming, forestry, fishing or hunting (Table 6.8-9a & 6.8-9b). The majority of the people of Nova Scotia were working retail trade or are in the health care/social assistance industry. Employment through retail trade is also high in Canso, followed closely by public administration. Health care and social services is a common industry of employment for Canso and Guysborough County. The area also has an emerging oil and gas industry, namely the Goldboro Gas Plant, which provides a significant tax base to the region (MODG 2014a).

In 2008, the major employers of Guysborough County were: Ocean Nutrition, St. Mary's River Smokehouses, Liscombe Lodge, Historic Sherbrooke Village, Nova Scotia Government, Local Inshore Fishery and Martin Marietta Materials (IRNS 2008).

The 2011 educational attainment of the population 15 years and older in Canso, Guysborough County and Nova Scotia are presented in Table 6.8-10. (GNS 2014b).

Table 6.8-10:
Educational Attainment of Population (%) 15 years or older in 2011

Location	No certificate, diploma or degree	High School	Post Secondary
Canso	50.6	20.3	29.9
Guysborough County	39.3	17.7	43.2
Nova Scotia	22.3	23.9	53.8

Canso had a higher percentage of the population with no certificate, diploma or degree than Guysborough County and considerably more than the province. The percentage of the population with a high school level of education was similar between Canso, Guysborough County and the province. Although Canso had the lowest percentage of population with a post secondary education when compared to Guysborough County and the province, it did however have a higher percentage of its population with a post secondary education than a high school education.

Municipal Economic Health

Due to the extensive amount of out-migration, mostly due to the loss of fisheries related employment, the economies of Guysborough County and Canso are stressed (CBDC 2013; Gardner Pinfold 2011). However, new employment opportunities are arising in the natural gas, mining and shipping industries (CBDC 2013).

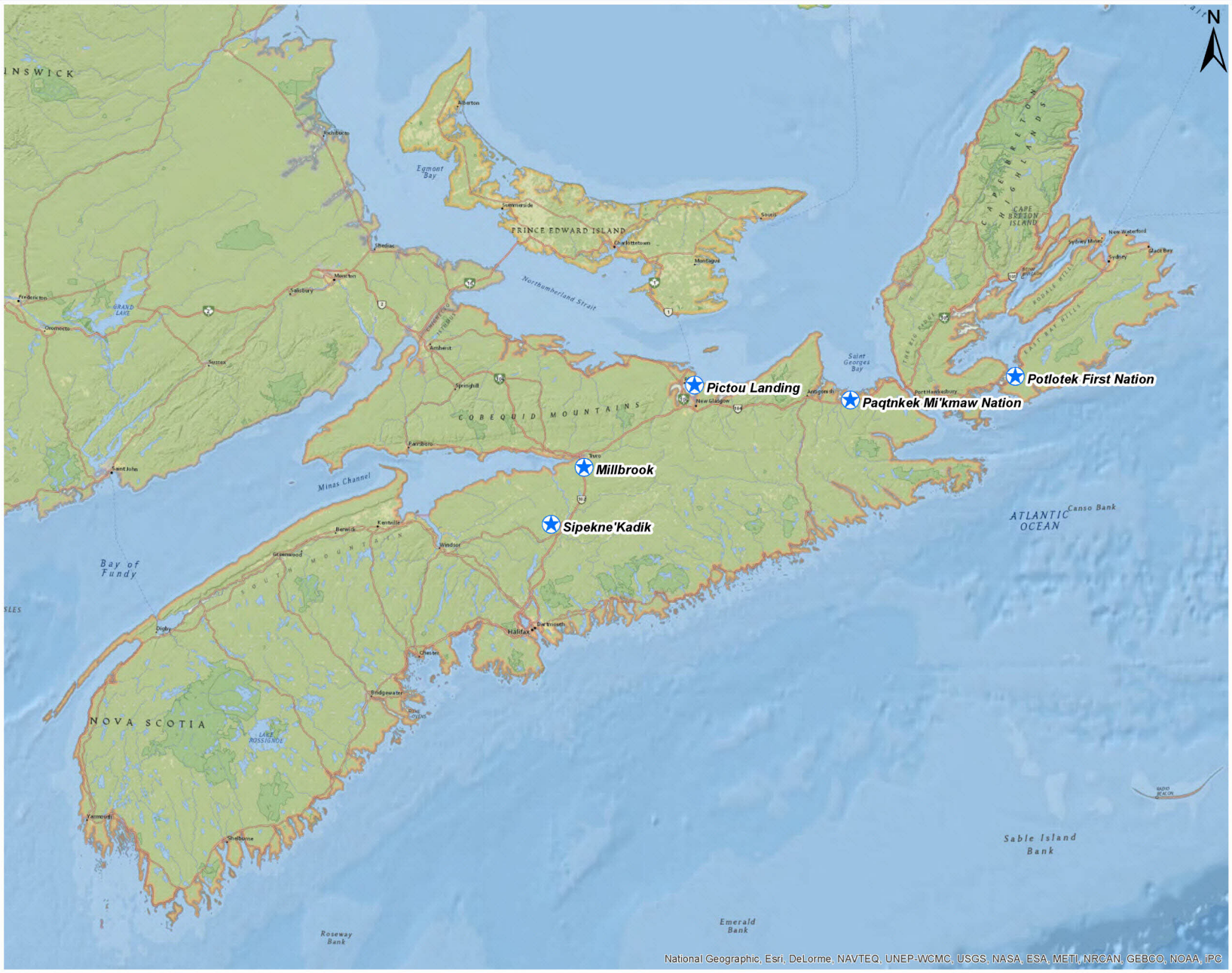
The 2011 – 2016 Strategic Plan of the Municipality of the District of Guysborough includes the following goals with the objective to balance economic opportunity and quality of life (MODG n.d.):

- To reverse the trend of population decline and have a 2% increase by 2015;
- To increase the establishment of new businesses; and create 200 new employment opportunities by 2015;
- To increase tax revenue by increasing the assessment base and increasing revenues from other sources;

- To maintain the quality of life for rate payers that may be affected as a result of potential dissolution of the Town of Canso;
- Improve service offerings to advance MODG as a liveable, healthy and sustainable municipality; and
- Strengthen internal operations.

6.8.3 First Nations Communities

A brief summary of the First Nation communities in close proximity to the Project site (**Figure 6.8-1**), which are known to have undertaken resource harvesting activities in the area are briefly described in the following sections.



LEGEND

0 25 50 100
Kilometers

SCALE: 1:1,684,296
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

VULCAN MATERIALS / MORIEN RESOURCES

BLACK POINT QUARRY
ENVIRONMENTAL ASSESSMENT

NOVA SCOTIA
FIRST NATIONS

October 1, 2014	Rev 1.0	Figure No. 6.8-1
Project No. 210.05913.00000		

SLR Consulting (Canada) Ltd.

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6.8.3.1 *Paqtnkek First Nation*

The nearest mainland First Nation (Mi'kmaq) community is Paqtnkek First Nation (in Afton, NS). It is located 66 km northwest of Queensport in Antigonish County near Heatherton - mid way between the Canso Causeway and the Town of Antigonish.

The Paqtnkek First Nation has a registered population of 539, of which 376 live on Reserve. The Paqtnkek Band Council consists of six members. Paqtnkek First Nation administers three Reserve properties (Table 6.8-11).

Table 6.8-11:
Paqtnkek First Nation Reserve Properties

Reserve	Area	Location	Population	Date Established
Franklin Manor 22 (48% share with Pictou Landing First Nation)	212.5 ha (525 acres)	32 km. southeast of Amherst	0	March 3, 1865
Paqtnkek-Niktuek 23	218.1 ha (539 acres)	24 km. east of Antigonish	373	March 3, 1820
Welnek 38	43.4 ha (107 acres)	18 km. east of Antigonish	0	August 28, 1990

6.8.3.2 *Pictou Landing First Nation*

The Pictou Landing First Nation is located on the Northumberland Strait approximately 150 km from the project site. The community has a registered population of 649, of which 476 live on Reserve. The Pictou Landing Band Council consists of seven members. The Band Council administers 5 reserves (Table 6.8-12).

Table 6.8-12:
Pictou Landing First Nation Reserve Properties

Reserve	Area	Location	Population	Date Established
Boat Harbour West 37	98.2 hectares (243 acres)	8 km. north of New Glasgow	0	May 18, 1961
Fisher's Grant 24	142.7 hectares (353 acres)	10 km. north of New Glasgow	467	March 3, 1866
Fisher's Grant 24G	60 hectares (150 acres)	3.2 km. southeast of Pictou Landing	0	March 3, 1927
Franklin Manor 22 (part)	212.5 hectares (525 acres)	32 km. southeast of Amherst	0	March 3, 1865
Merigomish Harbour 31	14.2 hectares (35 acres)	12.8 km. east of New Glasgow	0	March 3, 1865

6.8.3.3 *Potolotek*

Located on Cape Breton Island, approximately 140 km from the Project site, the Potolotek First Nation (also known as Chapel Island First Nation) has a registered population of 710, of which

542 live on Reserve. The Potolotek Band Council consists of eight members. The Band Council administers two reserves (Table 6.8-13).

Table 6.8-13:
Potolotek First Nation Reserve Properties

Reserve	Area	Location	Population	Date established
Chapel Island 5	592.5 hectares (1,464 acres)	69 km. southwest of Sydney	481	July 1, 1792
Malagawatch 4 (1/5 share)	661.3 hectares (1,634 acres)	62 km. southwest of Sydney	0	August 2, 1833

6.8.3.4 *Millbrook Band*

The Millbrook Band is located near Truro, NS approximately 160 km from the project site). The Community, one of the larger Mi'kmaq communities in Nova Scotia has a 12 member Band Council. Millbrook First Nation administers seven Reserve properties (Table 6.8-14).

Table 6.8-14:
Millbrook First Nation Reserve Properties

Reserve	Area	Location	Population	Date established
Beaver Lake 17	49.4 ha (122 acres)	78.4 km southeast of Halifax	23	March 3, 1867
Cole Harbour 30	18.6 ha (46 acres)	9.6 km east of Halifax	194	March 3, 1880
Millbrook 27	302.0 ha (746 acres)	8 km south of Truro	847	March 3, 1886
Sheet Harbour 36	32.7 ha (81 acres)	91.2 km northeast of Halifax	15	March 3, 1915
Truro 27A	16.7 ha (41 acres)	Joined south of Truro town limit	0	March 3, 1904
Truro 27B	16.4 ha (41 acres)	Joined with 27A on south	0	March 3, 1907

6.8.3.5 *Sipekne'katik First Nation*

The Sipekne'katik First Nation is located near Shubenacadie, NS 240 km from the Project site. The Band has a registered population of 2,534 of which 1,222 reside on Reserve. Sipekne'katik has a 12 member Council which administers four Reserve properties (Table 6.8-15).

Table 6.8-15:
Sipekne'katik First Nation Reserve Properties

Reserve	Area	Location	Population	Date established
Indian Brook 14	1,234.2 ha (3,050 acres)	28.8 km southwest of Truro	1,084	July 8, 1820
New Ross 20	408.3 ha (1,009 acres)	64 km northwest of Halifax	0	March 3, 1820

Pennal 19	43.5 ha (107 acres)	67.2 km northwest of Halifax	22	March 3, 1858
Shubenacadie 13	412 ha (1,020 acres)	32 km north of Halifax	0	March 3, 1820
Dodds Lot	NA	NA	NA	NA
Wallace Hills	54.8 ha (135 acres)	NA	NA	NA

6.9 Land and Resource Use

6.9.1 Existing Land Use

The Project area is located in the Municipality of the District of Guysborough (MODG); approximately 10 km west of Canso, along the south shore of Chedabucto Bay. The Project area is bound to the north by Chedabucto Bay and to the south by a power transmission line. Provincial Route 16 runs parallel to the southern boundary of the site approximately 750 m away.

Lands immediately surrounding the Project area are largely undeveloped. In 2011 Guysborough County had a population of approximately 8,100 residences (GNS 2014b). The adjacent communities to the Project area, Half Island Cove, Fox Island Main and Upper Fox Island along Route 16, are rural in character and low in population density. Residential development in the vicinity of the Project is relatively sparse, with no residential structures within 500 m of the site boundary, 11 within 1 km, and fewer than 50 within 2 km. The nearest residence is located 700 m from the property boundary on the coast at the east end of Half Island Cove Road. The nearest residence on Route 16 is approximately 750 m from the property boundary. The separation between residences and blasting activity is even greater (and nowhere less than 800 m) considering the preliminary Project layout. For the first ten years or so of operation, the closest residence will be greater than 1.0 km from blasting since work will begin in the north end of the site and proceed in a southerly direction.

The Property is owned by the MODG and is relatively inaccessible, although ATV trails and the transmission line provide access to the granite highlands. Access to the lower coastal platform is more difficult but can be gained through footpaths or boats. An overgrown ATV trails can be used to access Black Point from the east.

Local residents report visiting the beaches, both east and west of Black Point, on an occasional basis (G. Krause pers. comm. 2014). The property has long been used for trapping by at least one local resident (J. Murphy pers. comm. 2014) and the presence of shotgun shell casings and a hunting blind suggests the site may be been used for hunting in the relatively recent past. Forestry is not actively practiced on the site, although forests to the east near Fox Island Main have recently been harvested; an activity mistakenly attributed to the Proponent.

6.9.2 Land Ownership and Tenure

The land hosting the quarry is owned by the Municipality of the District of Guysborough (MODG), as per a recently approved land exchange with the Province (Grant No. 23711) and expropriation of two private land parcels. The land is currently zoned Industrial Heavy I-2. The property is not now, nor has it ever been, used for a marine terminal. These lands have not been specifically designated for use as a marine terminal by the MODG.

6.9.3 First Nation Land and Resource Use

Current Land Use Activities

While it is known that the Project area was once occupied by Mi'kmaq families who frequented the area for its rich fishing, since the implementation of federal policies under the *Indian Act*, no Mi'kmaq communities (reserves) are located in or in close proximity to the Project area.

As noted in the Mi'kmaq Ecological Knowledge Study (MEKS) (MAPS 2013 – **Appendix K**), high mobility has always been a crucial characteristic of the land use patterns of Mi'kmaq individuals and families. However, as long as resources remained predictable, it was natural that hunters, fishers and harvesters of other natural resources tended to utilize areas that they are intimately familiar with and pass on this familiarity to their children. As a consequence, spatial land use patterns of Mi'kmaq families have in general remained fairly stable; despite the fact government policy was to centralize Mi'kmaq families onto a few discrete reserves. However motorized transportation and the associated infrastructure have enabled Mi'kmaq harvesters to have opportunity to conduct harvesting activities throughout the province.

A review of outstanding specific land claims was undertaken by Mi'kma'ki All Points Services during the preparation of the Mi'kmaq Ecological Knowledge Study (MAPS 2013). At the time of the study there were no specific claims pending within the Project area. This does not imply, however, that a specific land claim may not arise in the future.

It is understood that Crown consultation on new projects is conducted with all first Nations. This is due to the shared Rights of all Mi'kmaq to the resources upon which they have historically and are currently dependent. However, in keeping with the understanding of resource harvesting strategies (opportunistic) and centralization policies, it is likely that those most familiar with, and actively involved with resource use in the Project area will be located in the present day communities in closest proximity to the project site; the Paqtnkek, Potolotek, Pictou Landing, Millbrook and Sipekne'katik First Nations. This is consistent with the findings from the MEKS which noted that until the 1960s, the Project area and its resources were used by members of the three closest communities of Paqtnkek, Chapel Island (Potolotek) and Eskasoni (the largest Mi'kmaq community to which many families were relocated). It was also noted that families in Millbrook (to which many were located) had also lived in several communities in the Guysborough area.

Subsequently, as a result of Canada's centralization policies, there was diminished use of the area since harvesting activities began to focus on areas closer to the reserve lands. While it is understood that Mi'kmaq rights to harvest in all areas of Nova Scotia are important and protected, gradually there has been reduced involvement in the Project area by Eskasoni Band members with greater harvesting opportunities in the highlands and wilderness areas closer to the community and today the Project area sees little, if any, harvesting effort by community members.

The MEKS presented in **Appendix K** identifies lands and resources of use and interest to the Mi'kmaq of Nova Scotia in the Project area, and which may be potentially affected by Project development. Although no reports of on-going resource harvesting or use are recorded in the MEKS, the report notes the Property hosts certain resources that could be used by Mi'Kmaq, should they choose to do so. The MEKS report has been presented to the Mi'kmaq Chiefs through the KMK. It should be noted that during Project conceptualization the Proponent

initiated an ongoing comprehensive Aboriginal Community Engagement Strategy (see Section 11.11 below).

As noted above, in addition to Paqtnkek some Band members from the Millbrook and Sipekne'katik First Nations have been involved in the resource harvesting in the lands and waters near the Project area, and are, as a result familiar with the region. Two other Mi'kmaq communities are also in relatively close proximity (<150 km) from the Project Site; Pictou Landing and Potolotek. Motorized transportation such as all-terrain vehicles, snowmobiles, pick-up trucks, engine-powered boats put the Project Area`s resources within relatively easy reach from any of these reserve communities.

Site visits were conducted with Mi'kmaq Elders, harvesters, Chiefs, and organizational representatives on June 18, 2014, August 12, 2014 and October 27, 2014 with the objective of familiarizing community representatives with the Project, and to determine the level and extent of current use of the site for social, ceremonial or livelihood harvesting. Mi'Kmaq community members were reported to have harvested several freshwater fishes (salmon, trout and eel) and hunted moose and deer, as well as various small game species in the region of the Project site. It had been noted in the MEKS that Mi'kmaq trapping activities occur within the general study area as well.

Based on the information compiled through the MEKS and findings during site visits, it is concluded that there is currently no direct Mi'kmaq use of the Project site for subsistence harvesting of food or furbearing in animals.

Mi'kmaq has continued to harvest a variety of plant species throughout Nova Scotia and the Project region is no exception. Harvesting of trees and plants such as maple, ash, birch as well as birch bark for tools, crafts and decorative items continue wherever these resources are known to occur. This is also true for blueberries, cranberries, strawberries and foxi berries. The MEKS also noted that several species of medicinal plants continue to be collected in the Guysborough region.

6.9.4 Protected Areas, Nature Reserves and Parks

The Restricted and Limited Land Use database maintained by NSDNR shows the following features in proximity to the proposed Project:

- Three private beaches protected under the Beaches Protection Act (Lower Half Island Cove 2.7 km west and Half Island Cove 3.9 km west, Fox Island Main 3.7 km east);
- Two Wilderness Areas: the Bonnet Lake Barrens Wilderness Area (6.9 km southwest) and the Canso Coastal Barrens Wilderness Area (1.7 km south and east);
- Third Lake Operational Non-Designated Parks and Reserve 4.2 km south and west.
- Designated Water Supply Area: Walsh or Wilkins Lake 4.5 km south and east; and
- Natural Watershed Municipal Surface Water Supply 3.65 km south and east.

These features are shown on **Figure 1.0-1.** Significant habitats and Important Bird Areas are shown on **Figure 6.4-3.**

6.9.5 Tourism and Recreation

There are a number of hiking trails and beaches, parks and wilderness viewing areas, museums and historic sites as shown on **Figure 6.9-1** (MODG 2014a). Some of these areas, such as the Canso Coastal Barrens Wilderness Area, several protected beaches (Lower Half Island Cove,

Half Island Cove, and Fox Island Main) and the Out of the Fog Lighthouse Museum in Half Island Cove are located within 5.0 km of the Project site. Recreational activity (trapping, ATV and snowmobile use) was observed on the Project site at the time of the winter bird survey in January 2011.

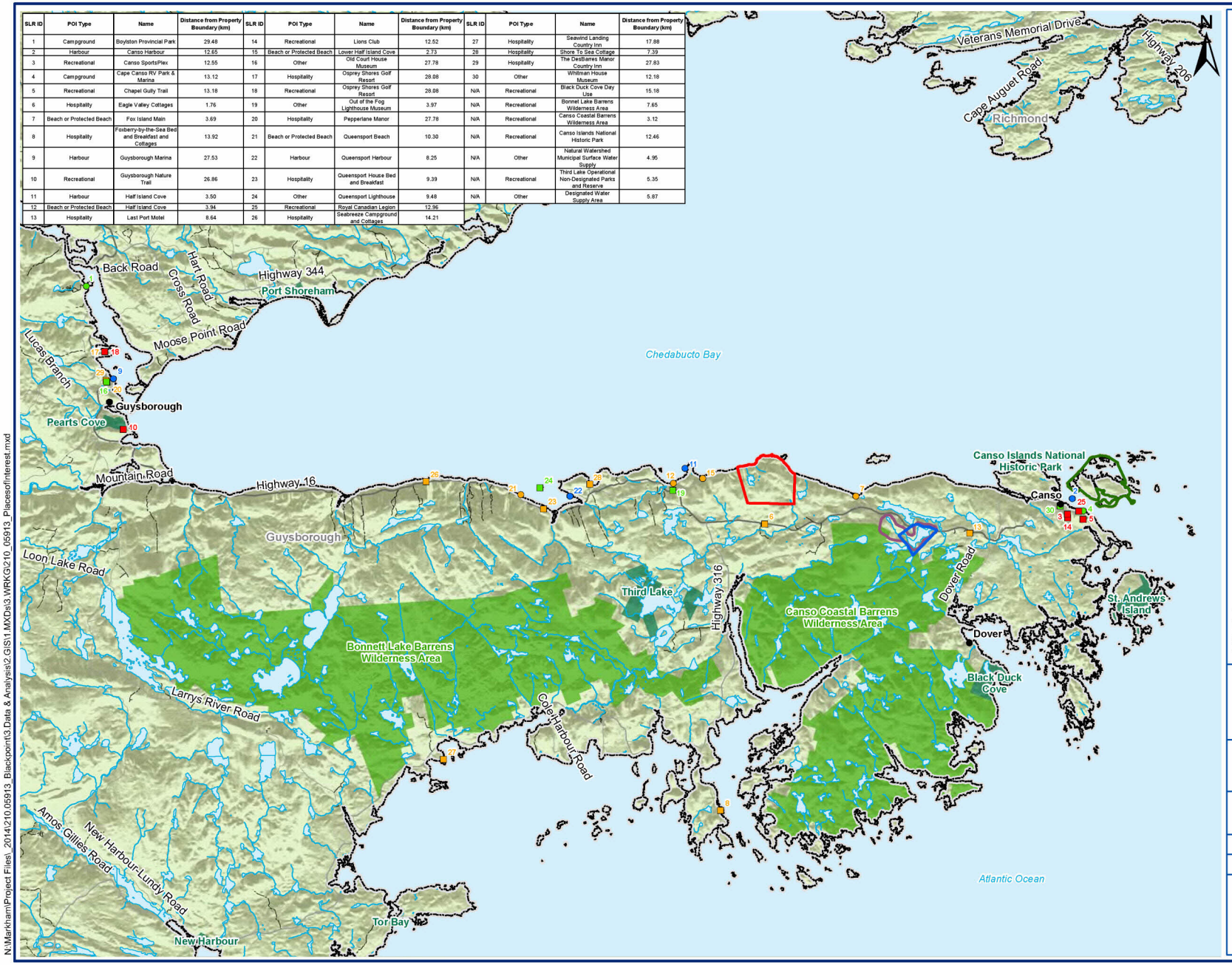
Activities located slightly further afield from the Project site include:

- Lighthouse Lookout and Park in Queensport (9.5 km east);
- the Whitman House museum (Nova Scotia 2014a) in the Town of Canso (10 km west) – provides visitors the history of Canso and eastern Guysborough;
- Queensport Beach (10 km west) – cobble beach with picnic tables overlooking the Queensport Lighthouse (GNS 2014e)
- Chapel Gully Trail (13 km east) – located in Canso, this 5 km trail allows for hiking and biking (GNS 2014f);
- Guysborough Nature Trail – Trans Canada Trail (26 km west)– a 44 km trail starting at Guysborough Harbour and is used for hiking, cross country skiing, snowshoeing and biking (Trail Peak 2014);
- Black Duck Cove Day Use Park (15 km south-east) – a 3.5 km shoreline hiking trail popular for birding (GNS 2014e);
- Canso Islands National Historic Park, located 15 km east of the Project site (http://threeshoresnovascotia.ca) - a National Historic Site, boat service is offered to the island to learn about the early European fishing port (PC 2011).
- Old Court House Museum (28 km west) - a museum for the local cultural heritage and an information centre for Guysborough County (GHS n.d.).

Hunting and fishing are popular activities in the MODG with big game hunting of deer and bear and inland and deep sea fishing. The area is popular for fishing blue fin tuna, shrimp, ground fish, scallop, snow crab and Atlantic mackerel (GCIFA 2014a).

The nearest recreational facilities include the Canso SportsPlex, which houses an arena, pool, and several sports fields. The Town of Canso also hosts a Royal Canadian Legion and a Lions Club. The Osprey Shores Golf Resort is located in Guysborough and is an all-encompassing resort with accommodation, food and beverage as well as a 2,691 yard, 9-hole golf course. The MODG has facilities to offer the community and visitors such as skating rinks, fitness centres, tennis courts etc. More information on local facilities can be found in Section 6.8. Guysborough is also home to local performing arts held in the Guysborough Masonic Hall, the Mulgrave Road Theatre Centre, Chedabucto Place Performance Centre and the Guysborough 300 seat performing arts space (MRT 2014).

SLR ID	POI Type	Name	Distance from Property Boundary (km)	SLR ID	POI Type	Name	Distance from Property Boundary (km)	SLR ID	POI Type	Name	Distance from Property Boundary (km)
1	Campground	Boylston Provincial Park	29.48	14	Recreational	Lions Club	12.52	27	Hospitality	Seawind Landing Country Inn	17.88
2	Harbour	Canso Harbour	12.65	15	Beach or Protected Beach	Lower Half Island Cove	2.73	28	Hospitality	Shore To Sea Cottage	7.39
3	Recreational	Canso SportsPlex	12.55	16	Other	Old Court House Museum	27.78	29	Hospitality	The DesBarres Manor Country Inn	27.83
4	Campground	Cape Canso RV Park & Marina	13.12	17	Hospitality	Osprey Shores Golf Resort	28.08	30	Other	Whitman House Museum	12.18
5	Recreational	Chapel Gully Trail	13.18	18	Recreational	Osprey Shores Golf Resort	28.08	N/A	Recreational	Black Duck Cove Day Use	15.18
6	Hospitality	Eagle Valley Cottages	1.76	19	Other	Out of the Fog Lighthouse Museum	3.97	N/A	Recreational	Bonnet Lake Barrens Wilderness Area	7.65
7	Beach or Protected Beach	Fox Island Main	3.69	20	Hospitality	Pepperlane Manor	27.78	N/A	Recreational	Canso Coastal Barrens Wilderness Area	3.12
8	Hospitality	Foxberry-by-the-Sea Bed and Breakfast and Cottages	13.92	21	Beach or Protected Beach	Queensport Beach	10.30	N/A	Recreational	Canso Islands National Historic Park	12.46
9	Harbour	Guysborough Marina	27.53	22	Harbour	Queensport Harbour	8.25	N/A	Other	Natural Watershed Municipal Surface Water Supply	4.95
10	Recreational	Guysborough Nature Trail	26.86	23	Hospitality	Queensport House Bed and Breakfast	9.39	N/A	Recreational	Third Lake Operational Non-Designated Parks and Reserve	5.35
11	Harbour	Half Island Cove	3.50	24	Other	Queensport Lighthouse	9.48	N/A	Other	Designated Water Supply Area	5.87
12	Beach or Protected Beach	Half Island Cove	3.94	25	Recreational	Royal Canadian Legion	12.96				
13	Hospitality	Last Port Motel	8.64	26	Hospitality	Seabreeze Campground and Cottages	14.21				



LEGEND

- Populated Place
- Beach or Protected Beach
- Campground
- Harbour
- Hospitality
- Other
- Recreational
- Property Boundary
- Wilderness Area
- Operational Non-Designated Parks and Reserves
- Canso Islands National Historic Park
- Designated Water Supply Area
- Natural Watershed Municipal Surface Water Supply
- County Boundary
- Waterbody
- Watercourse

0 2.5 5 Kilometers

SCALE:1:150,000
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

VULCAN MATERIALS / MORIEN RESOURCES

BLACK POINT QUARRY PROJECT

TOURISM / RECREATIONAL PLACES

September 25, 2014	Rev 1.0	Figure No. 6.9-1
Project No. 210.05913.00000		

SLR Consulting (Canada) Ltd.

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Cultural events that occur in the neighbouring communities to the Project site include the annual:

- Stan Rogers Folk Festival (located within the Town of Canso) which usually occurs for several days during the month of July in honour of Canadian folk singer Stan Rogers. The festival is a popular event and has an attendance of over 10,000 people ; and
- Queensport Mackerel Derby which occurs late August (http://www.authenticseacoast.com).

Nova Scotia's shoreline is a popular destination for tourists including boaters. There are four marinas within 28 km of the Project site. The closest is Half Island Cove, 3.5 km to the west, which consists of one jetty. Queensport Harbour is 8.25 km to the west of the Project site and Canso Harbour is approximately 12.5 km from the site. Guysborough Marina is the largest of these and is located in Guysborough, 27.5 km from the site. The Guysborough Marina provides boat rentals including canoes and kayaks and also has a retail shop.

There are a range of tourist style accommodations in the MODG including motels, cabins, bed-and-breakfasts and campgrounds. Table 6.9-1 provides a list of accommodations and their location within the MODG.

Table 6.9-1:
Accommodations within the District of Guysborough

Accommodation Type	Name	Location	Distance from Property Boundary (km)
B&B/Inn	The DesBarres Manor Country Inn	Guysborough	27.83
B&B/Inn and Cottages	Foxberry-by-the-Sea Bed and Breakfast and Cottages	Whitehead	13.92
B&B/Inn	Pepperlane Manor	Guysborough	27.78
B&B/Inn	Queensport House Bed and Breakfast	Guysborough	9.39
B&B/Inn	Seawind Landing Country Inn	Charlos Cove	17.88
Cottage/Motel	Eagle Valley Cottages	Canso	1.76
Cottage/Motel	Last Port Motel	Canso	8.64
Cottage/Motel	Osprey Shores Golf Resort	Guysborough	28.08
Cottage/Motel	Shore To Sea Cottage	Phillips Harbour	7.39
Cottage/Motel and Campground	Seabreeze Campground and Cottages	Fox Island	14.21
Campground	Boylston Provincial Park	Boylston	29.48
Campground	Cape Canso RV Park & Marina	Canso	13.12

Source: MODG 2014b, GNS 2014g

In 2010, Nova Scotia Tourism released the Visitor Exit Survey Community Report, which outlines the total visits (stopped or stayed) to Nova Scotia communities organized by tourist region, as well as "capture rates" of communities within these regions (Nova Scotia Department of Economic and Rural Development and Tourism, 2013). The communities of Canso and Guysborough were among the Eastern Shore communities examined. The Eastern Shore was visited by 7% of people during their trip to Nova Scotia. According to the 2010 Nova Scotia Visitor Exit Survey, the number one reason to visit the Eastern Shore was for a holiday, closely

followed by visiting friends or relatives. The activities most commonly undertaken were costal sightseeing, hiking, and beach exploring.

6.9.6 Forestry and Agriculture

Clear cutting forest harvests have occurred to the west and south of the Project area in small patches (NSDNR 2007b) and forest harvesting is currently occurring to the east of the Project site along Highway 16 near the intersection with Fox Island Road. The forest within the Project site is largely non-merchantable and soil conditions do not allow for a viable agricultural practice (Section 6.1). No forestry is currently practiced on the Project site. The MODG has approximately 2,300 hectares in agricultural production which amounts to 1% of Nova Scotia's land in agriculture. None of this agricultural land is located in the Project area or neighbouring land (GNS n.d.).

6.9.7 Mining

There are no active mines on or adjacent to the Project site but there is a large aggregate mining operation near Mulgrave on the Strait of Canso (Martin Marietta's Auld Cove quarry located approximately 76 km northwest of Black Point) (MODG 2014a). Closer to the Project site, Chedabucto Aggregates is located in Half Way Cove approximately 12 km west of the Project site. Chedabucto Aggregates blasts, crushes, screens and trucks Goldenville Formation quartzite for sale to local markets.

The MODG is currently experiencing an increase in gold and rare earth metals exploratory studies. It is predicted that mining in this region will intensify in the near future (MODG 2014a).

6.9.8 Water Use including Groundwater

Currently there is no residential water use on the Project site. Residential homes adjacent to the Project site derive their water from drilled and dug wells (Section 6.2.1). The surface water uses near the Project site include recreational ocean and freshwater fishing (Queensport and Canso), commercial fishing in Queensport, Canso, and Half Island Cove (see Section 6.10.1). There are Designated Water Supply Areas (Walsh or Wilkins Lake 4.5 km south and east of the Project site) and Natural Watershed Municipal Surface Water Supply area located 3.65 km south and east of the Project site.

6.10 Fisheries and Aquaculture

6.10.1 Regulatory Framework

Fisheries and Oceans Canada (DFO) is the federal agency responsible for fisheries and fish habitat conservation and protection. DFO manages commercial fishing, licensing, conservation and enforcement through the *Fisheries Act* and associated regulations and policies. Commercial fisheries are managed by way of Integrated Fishery Management Plans (IFMPs), which in turn are based on information provided by DFO's Canadian Science Advisory Secretariat (CSAS) and other sources. The IFMP describes the management objectives for each fishery, the measures used to achieve these objectives, and the criteria by which the objectives are measured (DFO 2012b).

Under the *Fisheries Act,* the Atlantic Fishery Regulations (1985) provide management measures and define management areas for Atlantic coast fisheries. The Northwest Atlantic

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Fisheries Organization (NAFO) Divisions are included in the Regulations, as are other fishing areas, such as Herring Fishing Areas, Crab Fishing Areas, Lobster Fishing Areas, Mackerel Fishing Areas and Shrimp Fishing Areas.

The Scotian Shelf comprises the main fishing grounds in Nova Scotia and has at least five zones and numerous stocks and sub-stocks. Chedabucto Bay is a component of NAFO fishing division 4W along the Scotian Shelf. The Project is located within NAFO Fisheries management Area 4Wd.

6.10.2 Commercial Fishing in Nova Scotia

At its peak in 2002-03, the landed value of commercial fisheries in the Scotian Shelf/Bay of Fundy region was $800 million. The landed value has since declined to $538 million in 2009 (DFO 2012b). A variety of fishing gears are used to capture over 30 different commercially saleable species, including bottom-contacting trawls and dredges, pots and traps, gillnets, seines and harpoons. Shellfish comprise about 80% of the fisheries by value (Gardner *et al.* 2009). The primary commercial shellfish species are lobster, scallop, snow crab and shrimp.

Groundfish contribute significantly to total landings (11% of landed value), but landings have drastically decreased since the 1970s and 1980s when this group accounted for over 50% of landed value. Cod, haddock, flatfishes and hake are now the leading commercial groundfish species (DFO 2012b).

Within the pelagic group (5% of landed value), herring, swordfish and tuna are the main species harvested. The relative importance of marine fisheries to the Nova Scotia economy has increased gradually over the past decade, with the contribution to the GDP rising from $235 million in 1995 to over $500 million in 2006 (Gardner *et al.* 2009; DFO 2012b).

6.10.3 Overview of the Guysborough County Commercial Fishery

In Guysborough County, the commercial fishing industry provides approximately 400 jobs in the form of small, independently owned businesses (GCIFA 2014b). There are over 200 registered fishing vessels ranging from 18 to 64.9 feet in Guysborough County, the majority of which are less than 34.9 feet in length (AMEC 2013). The core of the fishery is coastal, family-based, and uses small boats (SRSF 2001). In Guysborough, the estimated landed wharf value of all harvested species combined is over $65 million annually (GCIFA 2014b).

Within the Project area, DFO lists two “core” small craft commercial fishing harbours (Queensport and Canso), and one “non-core” small craft commercial fishing harbour (Half Island Cove). Canso and Queensport are also managed harbours; they both have Harbour Authorities: incorporated, not-for-profit organizations responsible for managing, operating and maintaining the public fishing harbours (DFO 2011a).

Although almost all license holders who fish along the south shore of Chedabucto Bay are multi-species license holders (G. Boudreau, pers. comm. 2014), the lobster industry is the backbone of the fishing industry in Guysborough County and a significant economic activity in many coastal communities. The Project area is located in Lobster Fishing Area (LFA) 31A, with over license holders that are permitted to fish from Ragged Head all the way around to Whitehead, Guysborough County (G. Boudreau, pers. comm. 2014).

A number of commercial species are taken in Chedabucto Bay. As noted, this includes lobster as well as shrimp, herring, mackerel, crab, scallop, tuna, squid and sea urchin (please see

below). Within Chedabucto Bay, fishers are allowed fixed gear only: herring nets, shrimp, lobster and crab traps. The only exception is applied to scallop fishers, who do not use fixed gear and tuna fishing.

Historically, cod, mackerel, and herring, were valued commercial species taken in Chedabucto Bay and the Bay was used as a spawning area by Atlantic cod and herring. Spawning may still occur, although herring spawning has not been documented in the area since 2009. Juvenile herring and hake use the Bay for nursery habitat. Mackerel and herring also utilize the Bay for over-wintering habitat (Gromack *et al.* 2010). In addition to spawning, and rearing habitat Chedabucto Bay is also an important feeding ground for herring.

Historic records indicate the Bay supported commercial fisheries for lobster, crab, shrimp, and shellfish. The area has supported lobster for many years, and in more recent years commercial landings have increased. The Bay also supports a healthy population of northern shrimp (Gromack *et al.* 2010).

6.10.4 First Nations Fisheries

Overview

In 1990, the Supreme Court of Canada's Sparrow decision upheld the Aboriginal right to fish for food, social and ceremonial purposes (DFO 2012b). In response, DFO initiated the Aboriginal Fisheries Strategy to provide a framework for the management of fisheries for food, social and ceremonial purposes (DFO 2003). In 1999, the Supreme Court affirmed a treaty right to hunt, fish and gather in pursuit of a "moderate livelihood" in its landmark Marshall decision (DFO 2012b; AFN 2011).

Since 1999 DFO has implemented several programs to promote the integration of First Nations into Atlantic Canadian fisheries. The Marshall Response Initiative (MRI) was created to provide Mi'kmaq and Maliseet First Nations with increased access to the commercial fishery through the provision of licenses, vessels and gear. The Aboriginal Aquatic Resource and Oceans Management (AAROM) program was instituted to facilitate the participation of Aboriginal groups in advisory and decision-making processes for oceans and fisheries resource management (DFO 2008c). The Atlantic Integrated Commercial Fisheries Initiative (AICFI) was developed to enhance corporate governance and business planning while offering a vehicle for future small scale fisheries asset acquisition (AFN 2011). Since the Marshall decision, Aboriginals throughout the Maritimes have participated in training, established administration, governance and business infrastructure, and have substantially increased their involvement in Atlantic commercial fisheries (APCFNC 2009).

Historically, First Nation fishers primarily exploited snow crab and lobster (Cooper *et al.* 2010) but considerable effort has been made in recent years to diversify the First Nation fishery. Currently, the most productive species in Atlantic Canada are bluefin tuna, lobster, scallop, shrimp and snow crab, with lobster and snow crab dominant in terms of licenses and shrimp and snow crab dominant in terms of economic return (AFN 2011; APCFNC 2009).

The landed value of Aboriginal fisheries tripled between 2000 and 2006, while fishing employment increased 60% between 2000 and 2007. In 2009, 11% of Aboriginal jobs in Atlantic Canada were in the fishing sector (APCFNC 2009). Aboriginal fishing licenses generated an economic return of approximately $35 million in 2009 compared to just over $4 million in 1999 (APCFNC 2009).

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At this time, it appears that fishing assets have been successfully transferred to First Nation communities, promoting employment opportunities and economic return to many groups. Cumulatively, these initiatives have resulted in quantitative improvements in terms of employment and revenue in First Nation communities. These programs have also reportedly developed a more knowledgeable and sophisticated appreciation of the industry, fisheries management, and corporate governance at the community level (AFN 2011).

The First Nation fishery has experienced considerable growth along with a number of challenges over the past decade. In 1999 (pre-Marshall decision) 316 fishing licenses were held by First Nations in Atlantic Canada. By 2009, this had increased to 1,238 (APFNC 2009). Challenges to the industry over this period included low market price for lobster, which has created pressures on the demand for licenses, and economic loss in the snow crab fishery (AFN 2011). Additional challenges emerged with respect to how these resources were managed, implemented and controlled (Cooper *et al.* 2010). Nevertheless, the commercial fishery continues to represent a long term, sustainable industry for many Nova Scotia Mi'kmaq communities (Cooper *et al.* 2010; APCFNC 2009).

Mi'kmaq Fisheries

Those communities which have been involved in the local commercial groundfish, lobster, snow crab, tuna, swordfish, and mackerel fisheries include: Acadia, Potolotek, Eskasoni, Sipekne'katik, Membertou, Millbrook, Wagmatcook, Waycobah, Pictou Landing and Paqtnkek. All the Nova Scotia bands and the Native Council of Nova Scotia in the Maritimes Region are authorized to harvest in this area for food, social and ceremonial (FSC) purposes.

The MEKS noted that marine resources were reported to be harvested along the Study Area portion of the Chedabucto coast. These include mackerel, herring, cod, haddock, urchins, mussels, oysters, clams, as well as snow crab in deeper waters. The sandbar extending between Fox Island and the mainland was also noted as a productive shellfish bed.

Several Mi'kmaq communities are currently fishing marine species for livelihood purposes. Some of this activity was apparently initiated following the Supreme Court of Canada's decision on the *R v Marshall* case that confirmed recognition of Mi'kmaq communal rights to fish for livelihood purposes. These efforts are managed under the Department of Fisheries and Oceans through communal commercial licenses, some of which are issued for the large fishery management areas along the Nova Scotia eastern shore.

Telephone interviews were conducted with the fishery managers from each of the communities which have licenses along the eastern shore to determine if any fishing effort is targeted in or near the Project site. Table 6.9-2 provides the findings from these interviews. Representatives from the Guysborough County Inshore Fishermen's Association were also contacted to determine local knowledge of fishing activity of Mi'kmaq fishers.

Table 6.9-2:
Project Area Mi'kmaq Commercial Fishing Activity

Band	Contact	Commercial Fishing activity – Eastern Shore
Millbrook	Adrian Gloade	1 sea urchin license 4 snow crab licenses Possible tuna fishing if fishery is not successful nearer Canso.
Shubenacadie	Brendan Maloney	No lobster licences in LFA 31
Waycobah	Phil Drennan	1 shrimp trap license in Chedabucto Bay Lobster licenses in Chedabucto Bay Elver fishery throughout area to Alder Point Snow crab fishery in Zone 24 Groundfish offshore: silver hake, redfish, hagfish, snow crab 1 offshore shrimp trawl license
Chapel Island	Charles Doucette	1 urchin license, 2 shrimp, 3 crab, 2 lobster
Eskasoni	Leonard Denny	10 mobile shrimp licenses, 14 snow crab license in Zones 23, 24
Membertou	Hubert Nichols	No active licenses in Guysborough- Canso area. They do fish tuna in the area. Remaining fisheries are far offshore.
Wagmatcook	Preston Bernard-	3 active snow crab licenses off shore. Also some tuna fishing in the area.
Paqtnkek	Marina Sark	No active licenses in the area.

6.10.5 Species Harvested in the Project Area

Lobster LFA 31A

Lobsters breed in summer to fall. Eggs hatch two years after breeding, generally in the July-August. Larvae swim in the water column for 4-6 weeks before settling to the bottom and seeking shelter. Six to nine years are required for lobsters to reach legal size. Mature lobsters generally move from shallow to deep water in the fall and from deep to shallow in late spring (DFO 2004).

As noted, the Project area is located within LFA 31A; the fishing season is currently April 29 to June 30. In 2011 there were 73 licenses within LFA 31A, each with a 250 trap limit (DFO 2011b); there are currently 68 actives licences (Table 6.10-1 reports 68 active licences in 2013).

Lobster prefer rocky seabed habitat. In the Project area, this habitat is generally confined to nearshore areas, typically within 250 m of the shore. Based on conversations with members of the GCIFA, in the vicinity of the Project site there are at least three lobster fishers who habitually the nearshore zone between Black Point and Gaulman Point.

Lobster fishermen are guided in their patterns of gear deployment not only by the abundance of lobster, but also by the weather and sea conditions, and levels of risk to gear, boats and human lives (Hatcher *et al.* 2013). Fishermen tend to deploy and redeploy gear throughout the season in response to weather patterns; the progressive depletion of catchable lobster; and the migration of lobster amongst various habitats. Despite these variations, the lobster fishermen tend to be conservative, typically fishing the same areas in the same fashion year after year (Hatcher *et al.* 2013).

A study of lobster fishing practices near the proposed Donkin mine in Cape Breton helps to provide a context for lobster fishing in Chedabucto Bay. Hatcher *et al.* (2013) note:

- The time-averaged average annual landings of per boat in the lobster fishery (near the Donkin mine) ranges from approximately 12,000 to 18,000 lbs (5,450 to 8,180 kg).
- Large (~25%) inter-annual variations in landings from the lobster fishery are not uncommon due to a variety of biological and environmental factors. For example, catch rates in the 2013 season were "exceptionally high" in comparison to the 2012 fishing season.
- On average, approx. 60% of each season's lobster catch is landed during the first half of the 2 month season, even though effort intensity (# pot-hauls per day) remains essentially constant throughout the season.
- The number of days fished declines towards the end of most seasons, and the proportion of undersize and spawn females increases markedly during the second half of the season. Prices paid to fishermen at the dock also tend to decrease as the season progresses.

Indicators of lobster stock health for in LFAs 28-32 are mainly positive (DFO 2011b). Landings in 2010 in LFAs 28-32 (3,866 t) and the mean for the last 3 years (4,224 t) were well above the median for 1985-2004 (822 t). An index of egg production for LFA 31A is currently high (DFO 2011b). Table 6.10-1 lists landings and licences in for LFA 31A from 2011 through 2013.

Table 6.10-1:
Lobster Selected Landings and Active Licenses - 2011-2013

License Species	Fishing Area	Year Landed	Active Licenses	Landings (kg)
Lobster	LFA 31A	2011	67	757,385
Lobster	LFA 31A	2012p	67	806,998
Lobster	LFA 31A	2013p	68	670,824

Note: Data for the years 2012 and 2013 is preliminary (p).

Source: DFO Maritimes Region, Policy and Economics Response to Data Request

The Guysborough County Inshore Fishermen's Association (GCIFA) is at the forefront of research regarding sustainable lobster fishing (GCIFA 2013). The GCIFA has partnered with St. Francis Xavier University, the Gulf Nova Scotia Bonafide Fishermen's Association (Lakevale), the Mi'kmaq Fish and Wildlife Commission (Afton), and the Interdisciplinary Studies in Aquatic Resources (Antigonish) to achieve a series of fisheries conservation objectives established by the Association.

Since the late 1990s, the GCIFA has undertaken a number of at-sea sampling programs on an annual basis. Research programs are monitoring and assessing a number of factors that contribute to the productivity of the fishery: size, sex, health, by-catch, weather, water temperature, egg development/release/retention larval survival and other parameters. These programs provide an overall index of the commercial catch as well as other species interactions by way of by-catch. The GCIFA provides their data sets to the Canadian Fisheries Research Network on lobster biology and health (GCIFA 2013; GCIFA 2014c).

Shrimp

The Scotian Shelf shrimp fishery occurs off Eastern Cape Breton and mainland Nova Scotia. In 2006, the industry supported 20-25 vessels (Gardner Pinfold 2006). In addition to the mobile shrimp fishery (i.e., mobile vessels that tow shrimp trawls along the ocean bottom), there is also an inshore trap fishery that uses baited wire mesh traps similar to lobster traps. This fishery was developed by inshore fishermen in Guysborough and Richmond Counties. All trap shrimp fishermen operating in Chedabucto Bay fish out of Canso (G. Boudreau, pers. comm. 2014).

Shrimp are found at depths of 150 - 600 m off the east coast of Nova Scotia, and in shallower waters in Chedabucto Bay. They are an important food source for Atlantic cod, Greenland halibut, skates, snow crab and harp seals (Garner Pinfold 2006). In the Study Area, based on conversations with fishermen who harvest in the area, shrimp are typically trapped south of the established shipping lanes and within the deeper water bounded by the 40 fathom depth contour (**Figure 6.10-1**). The proposed shipping route between the marine terminal and the established shipping lane has been modified to avoid these preferred shrimping grounds.

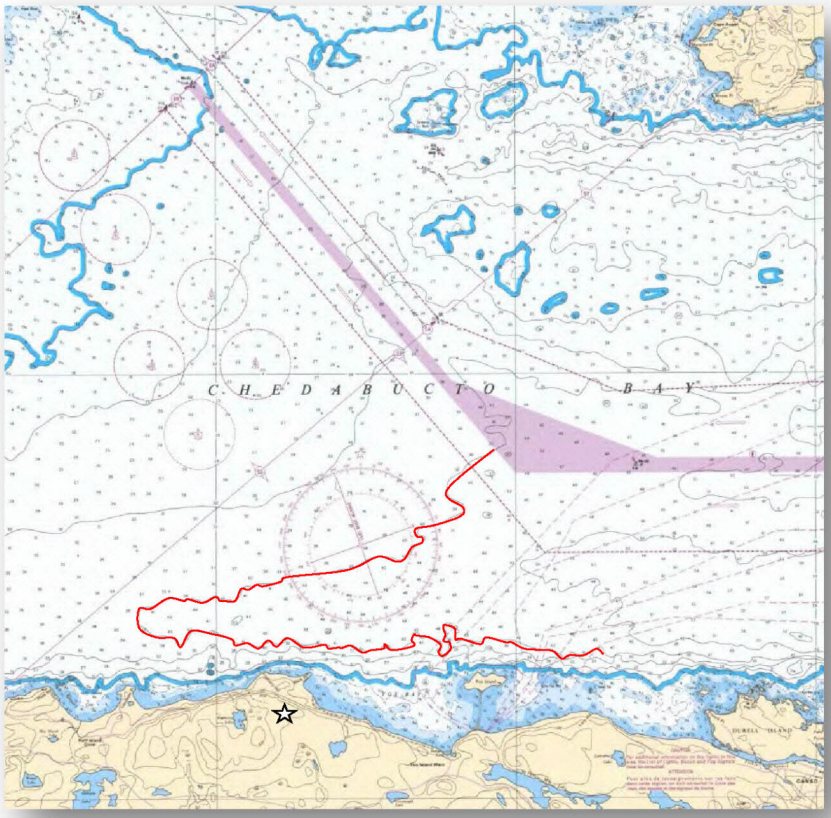

Figure 6.10-1:
40 Fathom Depth Contour Near the Project Site

Within Shrimp Fishing Area 15, there are 14 trap licences in total, with an allocation of 100 traps each (the total trap limit is 800). Five of the licences are located in the north of Chedabucto Bay, eight in the south, and one along the eastern shore just south of the bay. The trap fleet is active primarily from late fall through winter (DFO 2014b).

Within Chedabucto Bay, the shrimp fishery started in 1991 and currently employs six or seven active vessels (MacAndrew 2014). The fishing season is open year round but is most intensive from November through April when water temperatures are coldest. Shrimp prefer soft and muddy seafloor such as are found in central portions of Chedabucto Bay (MacAndrew 2014).

Fishermen set up to 100 hundred modified lobster traps in strings of 10, on the muddy bottom of the Bay in depths of 50 to 60 fathoms. These depths correspond to the approximate southern side of the primary shipping lane accessing the Strait of Canso. The traps are baited with herring; shrimp gain entry through a funnel on top of the trap. Smaller shrimp slip back out through the netting, ensuring no waste in by-catch, and a re-generation of the species (MacAndrew 2014).

Over the past several years, catches averaged about 800 pounds per day per vessel (ranging from 300 to 1000 pounds) over the winter season. In 2012, Chedabucto Bay shrimp fishers

landed 500,000 lbs of shrimp representing a value of $725,000.00 for this fishery (EAC 2012). Table 6.10-2 lists the landings and active licences for this species from 2011 through 2013.

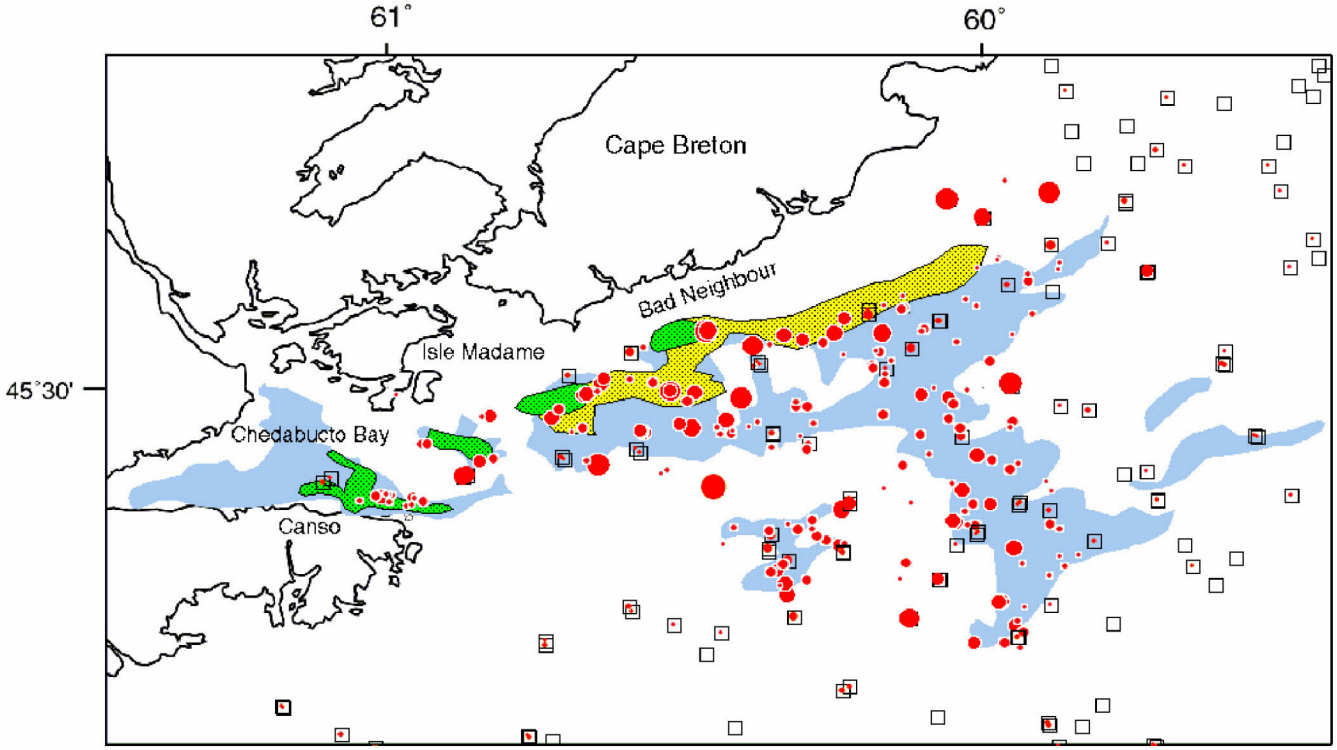

Figure 6.10-2:
Commercial Shrimp Trapping and Trawling; Relative Crab Catch Sizes

Source: Koeller *et al.* 2007 **(Note: Shrimp trapping areas in green, trawling in yellow and relative crab catches in red with larger circles representing larger catch sizes.)**

Note to Figure 6.10-2: Areas where commercial shrimp trapping (green shading) and trawling (yellow shading) are conducted in Chedabucto Bay and the Bad Neighbor, from log book data. Also shown are cumulative catches of DFO-industry shrimp surveys in June (1995-2006), DFO-industry crab surveys in fall (2004-2005) and DFO groundfish surveys in July (1999-2006) in relative numbers (red circles). Larger circles indicate larger catches, open squares indicate null catches. Shrimp habitat (La Have clay) is shown in light blue.

Table 6.10-2:
Shrimp Selected Landings and Active Licenses - 2011-2013

License Species	Fishing Area	Year Landed	Active Licenses	Landings (kg)
Shrimp, Pandalus Borealis	SFA 15 (4WD & 4WU only)	2011	23	797,893
Shrimp, Pandalus Borealis	SFA 15 (4WD & 4WU only)	2012p	19	680,423
Shrimp, Pandalus Borealis	SFA 15 (4WD & 4WU only)	2013p	23	540,696

Note: Data for the years 2012 and 2013 is preliminary (p).

Source: DFO Maritimes Region, Policy and Economics Response to Data Request

Herring and Mackerel

The Project area is located within Herring and Mackerel Fishing Areas 19. Mackerel, squid and herring are caught in the same type of trapnet, which is set in a fixed location. For this fishery, DFO assigns a fixed location for each mackerel trap or berth; typically a fisherman may operate from one to three berths. Mackerel are also caught locally using jiggers (GCIFA 2014a).

The herring fishery in Chedabucto Bay is subject to fishing restrictions (fishing season and quotas) outlined in the Canadian Atlantic Herring Southwest Nova Scotia Rebuilding Plan – Atlantic Canada 2013 (DFO 2014c). The fishing season in Chedabucto Bay (HFA 19) is November 1 to March 1.

A shared, Atlantic-wide quota is assigned to the mackerel fishery. Commercially caught mackerel must attain a conditional length established by DFO to qualify for harvest. Most mackerel is taken for use as bait for the lobster, shrimp and crab fishery, but there is also a food fishery for fall mackerel (GCIFA 2014a).

DFO landing and license data, as well as the exact trap locations for these species harvested in HFA 19 and LFA 19 were withheld to preserve stakeholder confidentiality. Local fishermen report that no trapnets are located within several kilometers of the Project Site. Trapnets are reported in Queensport Harbour (8 km west), Philips Harbour (7 km west) and near Fox Island in Indian Cove (5 km east).

Snow Crab

In 2005, many Crab Fishing Areas (CFAs) and subareas were merged. Formerly, CFA 24 East included Chedabucto Bay but this area is now contained within the larger South East Nova Scotia division (CSAS 2013).

On the Scotian Shelf, commercial size snow crab are typically found in deep, cold water at depths ranging from 60 to 280 m and temperatures from -1 to 6°C; they are fished on muddy or sand-mud bottoms (CSAS 2013). In the Project area, snow crabs are caught using wire conical traps set mainly in offshore waters extending to Sable Island (GCIFA 2014a).

The snow crab fishery has been in existence on the Scotian Shelf since the early 1970s. Total landings increased to record levels of approximately 10,000 t each year in the early 2000s and have surpassed these previous highs since 2009. Landings in 2012 for the South East Nova Scotia division were 11,707 t (CSAS 2013). Table 6.10-3 lists the landings and active licences for this species from 2011 through 2013. **Figure 6.10-2** above shows relative crab catch sizes within Chedabucto Bay.

Table 6.10-3:
Snow Crab Selected Landings and Active Licenses - 2011-2013

License Species	Fishing Area	Year Landed	Active Licenses	Landings (kg)
Crab, Snow	CFA 24 (4WD & 4WU only)	2011	26	1,380,906
Crab, Snow	CFA 24 (4WD & 4WU only)	2012p	33	1,610,928
Crab, Snow	CFA 24 (4WD & 4WU only)	2013p	29	1,645,730

Note: Data for the years 2012 and 2013 is preliminary (p). 4WU denotes effort within 4W without a sub-area selected.

Source: DFO Maritimes Region, Policy and Economics Response to Data Request.

Tuna

A prosperous bluefin tuna fishery is present in Chedabucto Bay, within NAFO division 4Wd. The bluefin tuna caught in Atlantic Canada are part of the western Atlantic stock. These migratory stocks are managed under the jurisdiction of the International Commission for the Conservation of Atlantic Tunas (GCIFA 2014a).

There are 10 license holders exploiting the Canso and Queensport areas as well as 40+ transient license holders from the Gulf of St. Lawrence and PEI (GCIFA 2014a). The bluefin tuna fishery uses rod-and-reel gear or tended hook and line, and this gear is restricted to a maximum of four lines per vessel and one hook per line (DFO 2014d).

The commercial fishing season extends from late spring into late fall with fishing period for individual fleets opening and closing at various dates. Traditionally, the fishery begins with the migration of bluefin into Canadian waters in early July and usually continues until mid-November. The majority of landings occur between late July and late September (DFO 2014d).

There are two tuna fleets each with GCIFA members that share the International Bluefin Tuna Quota:

1. Nova Scotia Fundy Based 4WD Tuna Fishery. This fishery has 10 licenses managed by the 4WD Tuna Fishery Association. The fishery is restricted to rod and reel gear and has a set percentage of the international quota that is fished competitively by the 10 license holders. The season is open from August 1st to December 31$^{st\ but}$ is typically fished in late August, September and October (GCIFA 2014a; G. Boudreau, pers. comm. 2014).

2. Gulf Nova Scotia Based Tuna Fishery. This fishery has 10 licenses that are managed under the Gulf Nova Scotia Tuna Association. It is also restricted to rod and reel gear but receives a percentage of the international quota that is competitively fished by all Gulf Based licenses (GCIFA 2014a).

The non-licensed (catch and release) tuna fishery also provides revenue for local charter boat operators and owners of lodges and other accommodations.

Table 6.10-4:
Bluefin Tuna Landings and Active Licenses - 2011-2013

License Species	Fishing Area	Year Landed	Active Licenses	Landings (kg)
Tuna, Bluefin	4WD	2011	28	14,178
Tuna, Bluefin	4WD	2012p	*	*
Tuna, Bluefin	4WD	2013p	*	*

Note: Data for the years 2012 and 2013 is preliminary (p).

* denotes data withheld by DFO to preserve stakeholder confidentiality

Source: DFO Maritimes Region, Policy and Economics Response to Data Request.

Scallop

Members of the GCIFA hold licenses for Scallop Fishing Area East of Baccaro for inshore scallop drag. The license holders have a quota per license and are managed by DFO through dockside monitoring, at sea trip logs. According to the GCIFA, many of the scallop licenses are inactive due to high cost of monitoring and low quota access (GCIFA 2014a). Table 6.10-5 lists the landings and active licences for sea scallop from 2011 through 2013. Scallop landings in and around Chedabucto Bay are shown on **Figure 6.10-3.**

Table 6.10-5:
Sea Scallop Selected Landings and Active Licenses - 2011-2013

License Species	Fishing Area	Year Landed	Active Licenses	Landings (kg)
Scallop, Sea	East of Baccaro (No SFA 29 West Landings)	2011	51	347,266
Scallop, Sea	East of Baccaro (No SFA 29 West Landings)	2012p	57	291,394
Scallop, Sea	East of Baccaro (No SFA 29 West Landings)	2013p	53	336,112

Note: Data for the years 2012 and 2013 is preliminary (p).

Source: DFO Maritimes Region, Policy and Economics Response to Data Request

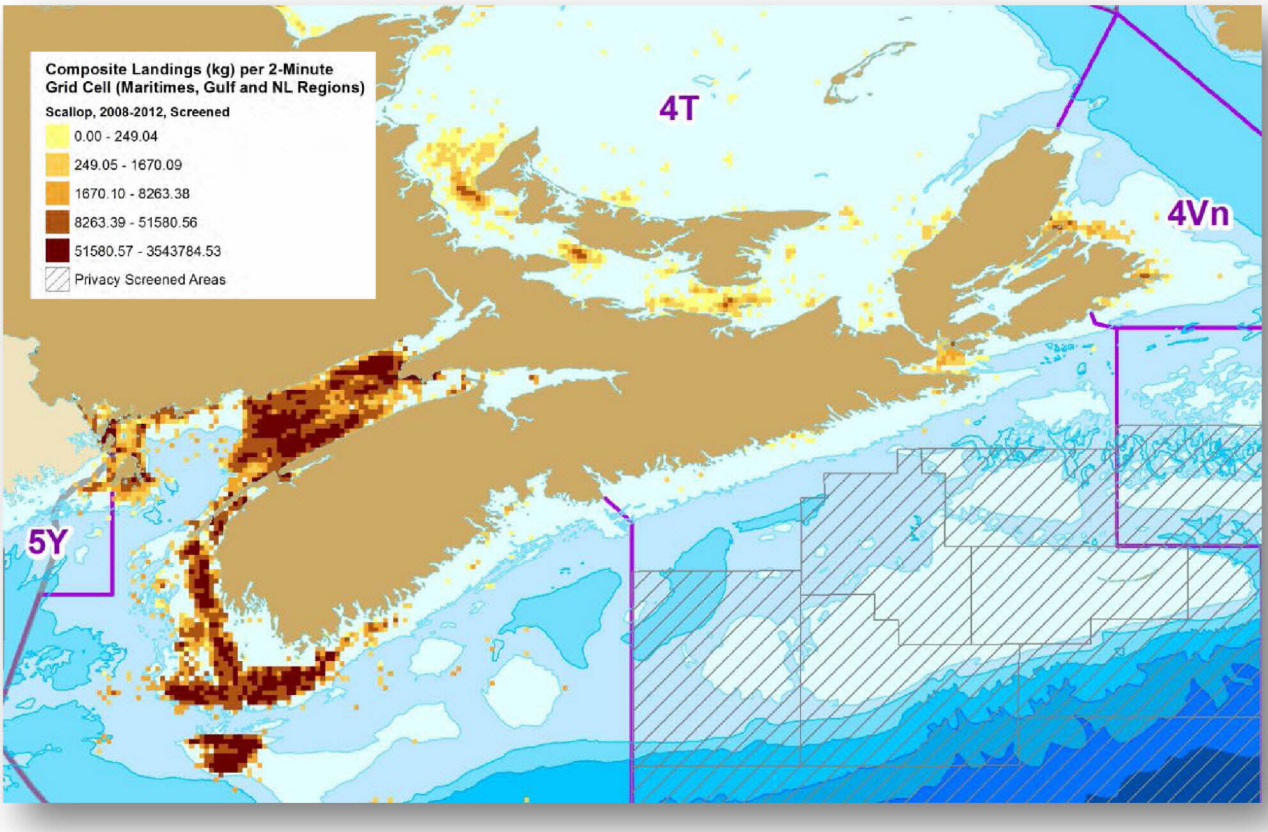

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Figure 6.10-3:
Scallop Landings 2008-1012 (kg)

Other Species - Sea Urchin, Rock Crab, Marine Plants, Eels

According to the GCIFA, fishermen based in Canso and along the south shore of Chedabucto Bay hold licences to harvest other species, such as sea urchin, rock crab, marine plants, and eels, but these licenses are not currently active (GCIFA 2014a).

To the extent that these data are available from DFO, Table 6.10-6 lists the landings and active licences for these other species from 2011 through 2013.

Table 6.10-6:
Other Species Selected Landings and Active Licenses - 2011-2013

License Species	Fishing Area	Year Landed	Active Licenses	Landings (kg)
Crab, Rock	LFA 31A	2011	*	*
Crab, Rock	LFA 31A	2012p	*	*
Crab, Rock	LFA 31A	2013p	*	*
Crab, Unspecified	N/A	2011	0	0
Crab, Unspecified	N/A	2012p	0	0
Crab, Unspecified	N/A	2013p	0	0
Eel	Guysborough County	2011	*	*
Eel	Guysborough County	2012p	*	*
Eel	Guysborough County	2013p	*	*
Elver	Guysborough County	2011	*	*
Elver	Guysborough County	2012p	*	*
Elver	Guysborough County	2013p	*	*
Sea Urchins	Guysborough County	2011	*	*
Sea Urchins	Guysborough County	2012p	*	*
Sea Urchins	Guysborough County	2013p	*	*

Note: Data for the years 2012 and 2013 is preliminary (p);

* denotes data withheld by DFO to preserve stakeholder confidentiality

Source: DFO Maritimes Region, Policy and Economics Response to Data Request

6.10.6 Recreational Fisheries

Mackerel is the primary salt-water recreational species in the area (GCIFA 2014a), but catch and release recreational bluefin tuna fishing is also popular with local residents and tourists from Europe and the United States.

In Guysborough County, the freshwater inland lakes and streams support recreational speckled (brook) trout, brown trout, rainbow trout, landlocked salmon, chain pickerel, white perch, and yellow perch fisheries. The fishing season generally runs from April 1 to September 30. Recreational fishing in tidal waters extends from April 15 to September 30, to protect sea-run speckled trout, brown trout, and Atlantic salmon populations (NSFA 2014b).

6.10.7 Aquaculture

There are no aquaculture sites currently active in Chedabucto Bay (NSFA 2014a). There are a number of active aquaculture sites in Whitehead Harbour, primary for blue mussel and sea scallops. The nearest aquaculture site is located near Upper Whitehead, approximately 7.0 km south of the Project site. Records indicate a license was issued in 2002 for a 1.25 ha sea urchin site in Canso Harbour off the coast of George Island, but this lease is not currently active (NSFA 2014a).

A joint project was undertaken in 2001 to develop a coastal aquaculture planning tool for the Guysborough County Regional Development Authority (Stantec 2009). The study consisted of a constraint mapping exercise using Geographic Information System (GIS) tools to identify areas for potential aquaculture site development. The constraint mapping was based on a range of criteria, including biophysical conditions such as temperature, salinity, depth, oxygen and turbidity, and other practical constraints such as navigation routes, parks, and closed areas (Stantec 2009).

6.11 Shipping and Navigation

6.11.1 Overview of Commercial Shipping

Commercial shipping over the Scotian Shelf consists primarily of tankers and general, bulk and containerized cargo carriers. The Shelf is also crossed by fishing vessels, cruise ships and government vessels. The primary commodities transiting the region include crude oil and gas, minerals and chemicals, paper and forest products, coal and coke, and a variety of containerized goods (DFO 2005).

For safety, the *Vessel Traffic Services Zones Regulations* under the *Canada Shipping Act* establish Vessel Traffic Services (VTS) zones along Canada's coasts (TC 2014). Shipping in these zones is monitored by the Canadian Coast Guard's Marine Communications and Traffic Services (MCTS). A Pre-Arrival Information Report (PAIR) is required to be filed 96 hours prior to arrival in Canadian waters, as per the *Marine Transportation Security Regulations* in accordance with the instructions set out in the Canadian Coast Guard's *Radio Aids to Marine Navigation*. The MCTS logs movements of larger vessels but non-reporting traffic includes a significant proportion of tugs, fishing and recreational vessels.

To receive clearance to enter Canadian waters, ships of 500 tonnes gross tonnage or more must report to an MCTS officer 24 hours before entering the VTS zone. The incoming vessel reports information about the ship and its intended route, including any defects and deficiencies relevant to potential marine pollution, as well as position, speed, destination, etc. This allows any safety or environmental concerns to be addressed before ships enter Canadian waters. Vessels within the zone must also make regular reports at specified calling-in points (TC 2014).

Vessel Traffic Services does not operate like air traffic control. It is the ship master's responsibility to safely guide the ship; however the master must comply with a direction given by a MCTS officer.

Figure 6.11-1 illustrates the main shipping routes over the Scotian Shelf and shows (in red) the entrance lanes to Halifax Harbour and Chedabucto Bay. The entrance lanes or "approaches" to Chedabucto Bay and the calling in points referenced above are shown in more detail on **Figure 6.11-3.**

There are four regional shipping traffic patterns on the Scotian Shelf (DFO 2005):

1. international shipping between Europe and the eastern seaboard of the US and Canada;
2. international and domestic shipping along the coast of Nova Scotia bound to and from the United States, Bay of Fundy, Gulf of St. Lawrence and Newfoundland;
3. shipping through the Cabot Strait and into the St. Lawrence Seaway; and
4. traffic associated with the major ports of Halifax, Saint John, Port Hawkesbury (Strait of Canso) and Sydney.

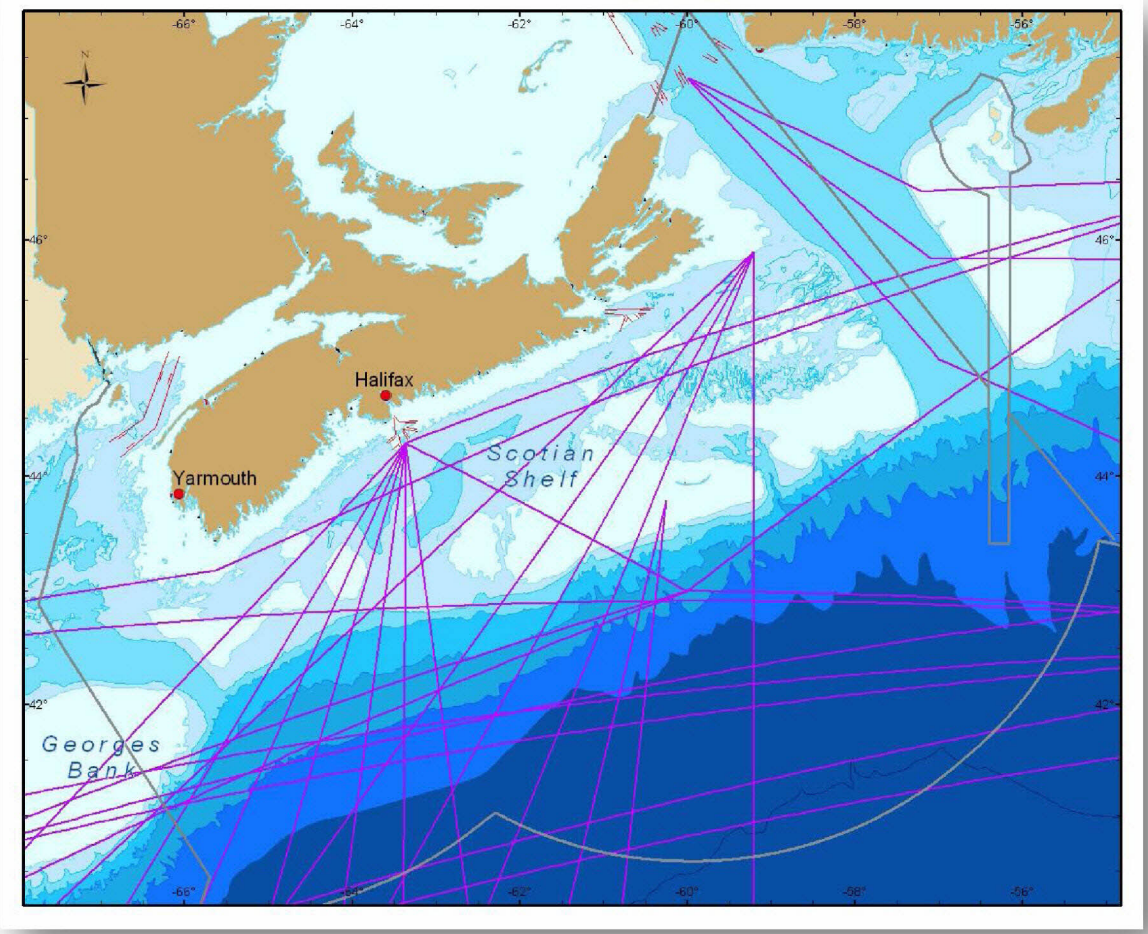


Figure 6.11-1:
Scotia Shelf Shipping Routes

Source: DFO 2005

On the Strait of Canso, the Strait Superport consists of the Mulgrave Marine Terminal and the Port Hawkesbury Pier. In 2011, it handled 23.8 million tonnes of cargo, slightly less than the most active year, 2009, when 33.5 million tonnes of cargo passed through the port (Strait Superport 2014). Most of the cargo is associated with the petroleum facility operated by Statia Terminals. Bulk exports of gypsum, paper products, aggregate and imports of coal make up the

balance. The Mulgrave Marine Terminal primarily services the offshore oil and gas industry (DFO 2011c).

Shipping density over the Scotian Shelf for the year 2000 is shown in Figure 6.11-2 (DFO 2005). The data were compiled by DFO and are taken from the Eastern Canada Vessel Traffic Services Zone (ECAREG) system. The Figure illustrates the relatively high density of traffic, shown in red transiting Chedabucto Bay.

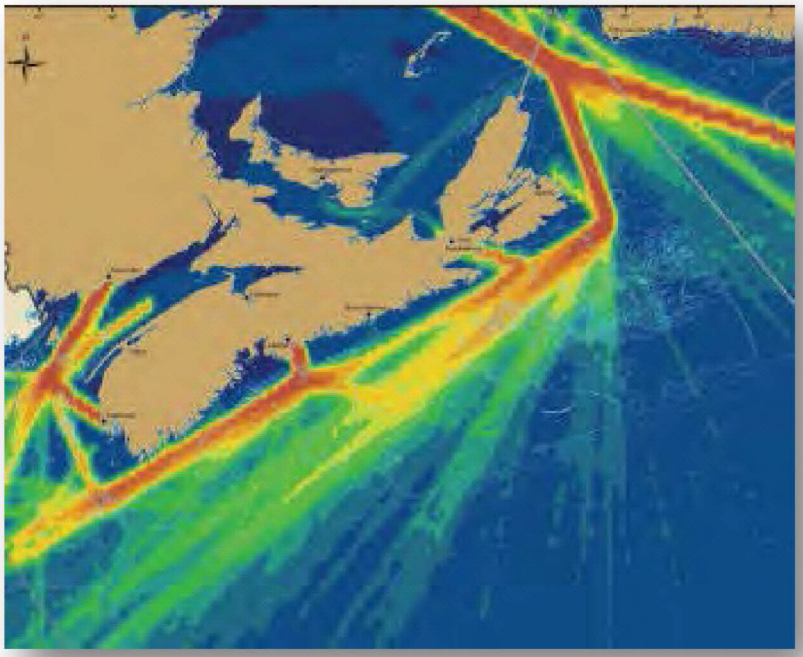


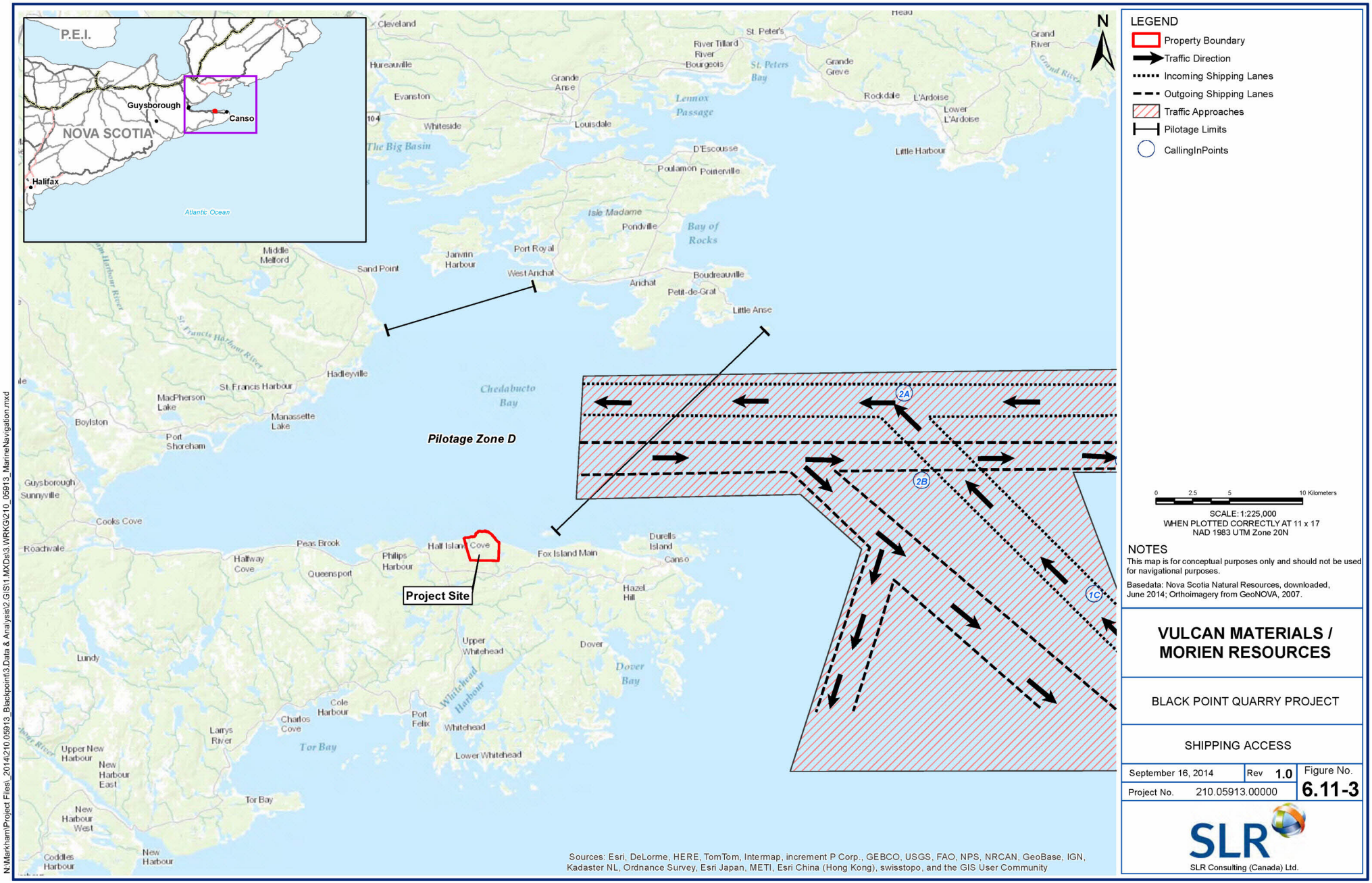
Figure 6.11-2:
Scotian Shelf Shipping Density (2000)

Source: DFO 2005

6.11.2 Accessing Chedabucto Bay

The Project site is located within Compulsory Pilotage Area Zone D as defined by the *Pilotage Act* (**Figure 6.11-3**). This means that incoming and outgoing vessels from the marine terminal must be attended by an experienced licenced pilot, who advises the ship master on navigational matters within the Pilotage Area.

The pilot boarding station that Proponent vessels will use for Chedabucto Bay is termed the "Southern Approach" and is located at 45º24'00N / 61º01'00W (APA 2013). The Southern Approach pilot station is assigned to vessels over 225.5 length overall (LOA). Proponent vessels will typically be on the order of 245 m LOA.



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VULCAN MATERIALS / MORIEN RESOURCES

BLACK POINT QUARRY PROJECT

SHIPPING ACCESS

September 16, 2014	Rev 1.0	Figure No. 6.11-3
Project No. 210.05913.00000		

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An MCTS officer contacts the incoming vessel to describe when the pilot will board, what speed to maintain, and on which side the pilot boat will approach. The pilot arrives at the pilot boarding station on the Atlantic Pilotage Authority (APA) pilot boat. The pilot boards the Proponent's vessel and discusses the passage plan with the master and the bridge team. A pilot's duties are to aid the ship master, and give advice on the passage. In effect, the navigational command of the vessel, issuing helm and engine orders to the bridge team is assumed by the pilot (AMEC 2013). Despite this, the ship master remains ultimately responsible for ship operation and safety.

When a Proponent's vessel is preparing to leave the Black Point marine terminal, a pilot will board the vessel at the terminal. Tugs will be used to guide the ship as it leaves the berth until it reaches a safe, outbound position. The pilot remains on board providing navigational advice then leaves once the outer pilot station is reached or at some other mutually agreed upon position. MCTS continues to monitor the progress of the vessel and the vessel continues to report until it is clear of the VTS zone.

6.11.3 Vessel Activity in Chedabucto Bay

The Strait of Canso area has four ports: Port Hastings, Port Hawkesbury Port Tupper and Mulgrave. These ports, as well as Inhabitants Bay, come under the Harbour Master's jurisdiction. Port Hawkesbury and Mulgrave are the busiest ports, while Inhabitants Bay and Chedabucto Bay usually have one or two vessels at anchor. During the fall through winter storm season it is not uncommon to see additional vessels at anchor in Chedabucto Bay, waiting for the poor weather to pass (G. Freer, pers. comm. 2014). With two mooring locations servicing vessels up to 400,000 DWT, Port Tupper is a deep water, ice free harbour with access to rail, road and airport services (NSBI 2015).

As noted in Section 6.10.3, there are over 200 registered fishing vessels ranging from 18 to 64.9 feet in Guysborough County, the majority of which are less than 34.9 feet in length. It is difficult to estimate the number of fishing and recreational vessels in Chedabucto Bay since some of these vessels do not need to report to the Harbour Master. A general estimate is approximately 30-35 vessels (G. Freer, pers. comm. 2014).

In 2013 there were 577 large vessels recorded in Chedabucto Bay (harbour tugs and pilot vessels are not included in this count). Tankers and bulk carriers comprise the majority of this traffic and approximately 80% of these vessels are pilot-assisted. In 2014 (to mid-September) 422 vessels were recorded. May, June and July are typically the busiest months (G. Freer, pers. comm. 2014). Included within this traffic count are pilot-assisted vessels anchored in the Bay engaging in ship to ship transfers of coal.

6.11.4 Ballast Water Exchange and Pollution Prevention

Ballast water taken aboard ships in foreign ports may contain organisms that are not native to Nova Scotia, and which could cause harm to local ecosystems. Under the *Ballast Water Control and Management Regulations*, all ships entering Canadian waters must exchange ballast water outside of the Exclusive Economic Zone (200 nautical miles from shore), treat their ballast water, discharge their ballast water to a reception facility, or retain their ballast water on board ship (TC 2011).

In addition, an international convention regarding ballast water has been adopted by the International Maritime Organization (IMO); this convention could enter into force as early as 2015 (G. Anderson pers. comm. 2014). Under IMO's International Convention for the Control and Management of Ships' Ballast Water and Sediments, all vessels will be required to report and treat ballast water using an IMO approved method.

The International Convention for the Prevention of Pollution from Ships (MARPOL) is the main international convention covering pollution prevention in the marine environment by ships from operational or accidental causes.

The MARPOL Convention was adopted by the IMO in 1973 and has been updated by amendments through the years. The Convention includes regulations aimed at preventing and minimizing pollution from ships - both accidental pollution and that from routine operations - and currently includes six technical Annexes. Special areas with strict controls on operational discharges are included in most Annexes:

Annex I: Regulations for the Prevention of Pollution by Oil. Covers prevention of pollution by oil from operational activities as well as from accidental discharges.

Annex II: Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk. Describes the discharge criteria and measures for the control of pollution by noxious liquid substances carried in bulk; no discharge of residues containing noxious substances is permitted within 12 miles of the nearest land.

Annex III: Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form. Contains general requirements for the issuing of detailed standards on packing, marking, labeling, documentation, stowage, quantity limitations, exceptions and notifications. For the purpose of this Annex, "harmful substances" are those substances which are identified as marine pollutants in the International Maritime Dangerous Goods Code or which meet the criteria in the Appendix of Annex III.

Annex IV Prevention of Pollution by Sewage from Ships. Contains requirements to control pollution of the sea by sewage; the discharge of sewage into the sea is prohibited, except when the ship has an approved sewage treatment plant or when the ship is discharging comminuted and disinfected sewage using an approved system at a distance of more than three nautical miles from the nearest land.

Annex V Prevention of Pollution by Garbage from Ships. Prohibits the discharge of all garbage into the sea.

Annex VI Prevention of Air Pollution from Ships. Sets limits on sulphur oxide and nitrogen oxide emissions from ship exhausts and prohibits deliberate emissions of ozone depleting substances; designated emission control areas set more stringent standards for SOx, NOx and particulate matter.

To enforce these IMO provisions and Canadian regulations, Transport Canada performs aerial surveillance to detect pollution from ships. In 2011-2012, crews observed more than 12,000 vessels and detected 135 pollution occurrences nationally, with an estimated total volume of 1,014 litres of oil (TC 2014). Transport Canada investigations have led to numerous successful prosecutions against marine polluters over the years, with some financial penalties reaching more than $100,000.

6.12 Archeological Resources

An archaeological resource impact assessment of the proposed Black Point Quarry Project was conducted by Davis MacIntyre & Associates Limited in 2011, followed by a second resource assessment in 2014 to address specific recommendations made in 2011 (**Appendix L**). Historical maps and manuscripts and published literature were consulted at Nova Scotia Archives and Records Management in Halifax. The Maritime Archaeological Resource Inventory, held at the Nova Scotia Museum's Heritage Division, was searched to understand prior archaeological research and known archaeological resources neighbouring the Project site. Additionally, two archaeological reconnaissance surveys of the Project site were conducted; the first in 2011 and the second in 2014.

6.12.1 Provincial

The history of human occupation in Nova Scotia has been traced back approximately 11,000 years to the Palaeo-Indian period or Sa'qewe'k L'nu'k (11,000 – 9,000 years before present or BP). The only significant archaeological evidence of Palaeo-Indian settlement in the province exists at Debert / Belmont in Colchester County. The Saqiwe'k Lnu'k period was followed by the Mu Awsami Kejikawe'k L'nu'k (Archaic period) (9,000 – 2,500 years BP) which was succeeded by the Woodland / Ceramic period or Kejikawek L'nu'k (2,500 – 500 years BP). The Woodland period ended with the arrival of Europeans and the beginning of recorded history (DMA 2011).

The initial phase of contact between First Nations people and Europeans, known as the Protohistoric period, was met with various alliances particularly between the Mi'kmaq and French. The Mi'kmaq inhabited the territory known as Mi'kma'ki or Megumaage, which included all of Nova Scotia and Cape Breton, Prince Edward Island, New Brunswick (north of the Saint John River), the Gaspé region of Quebec, part of Maine, and south-western Newfoundland. A historical Mi'kmaq presence is well documented in Guysborough County and specifically in the vicinity of Canso, less than 15 kilometres east of the Project site.

It is thought that the French began fishing off the coast of Nova Scotia as early as 1504 and possibly earlier (DMA 2011). Activity on land was coastal and seasonal, consisting of trade with the native Mi'kmaq and the use of beaches to dry fish for the long voyage back to France. The fishery continued to be profitable for centuries, supplying the French, English, and Basque seamen who sailed along these coasts.

6.12.2 Black Point

Prior to 1721, a British Government regulation decreed that all tracts of forest land containing trees suitable for ship masts should be set aside as Crown Reserves (DMA 2011). It is possible that this regulation is related to the surprising scarcity of land grants within the study area. Indeed, only two grants appear to have been made: the first to Michael Fogarty and the second to Peter James Lukeman (DMA 2011).

In 1820, William Timothy Fogarty and his wife arrived on the shores of the Chedabucto Bay, in the area now known as Fogherty Head, from Ireland. In 1821, their first son, Mickal (Michael), was born. In 1858, five years after the death of his father William, Michael sought a land grant from the Nova Scotia government for this area, which started succession of the land in the Fogarty family (Frank Fogarty, pers comm. May 2014).

Between 1820 and 1928, the area south of Fogherty Head was home to four generations of the Fogarty family. During this time, a number of children were born on the property from the original family line and the ensuing families. Given the number of births on the property, it is possible that there were multiple deaths at the property from a variety of causes for both young and old. Due to the poverty of the time, and the distance to Canso, it is also possible that burials could have occurred on the property (Fogarty Family 2014).

Until 1857 the "Stagecoach Road" between Crow Harbour and Canso ran along the coast, passing close to Fogarty Head and Black Point. The rocky nature of this road meant that passage in the summer by buggy or wagon was nearly impossible. However, it appears that in the 1870s at least two houses were located in or near the eastern end of the study area. When the new road was built farther inland it encouraged settlement along level and fertile ground off the hard coastline (DMA 2011).

Oral history recounts that Black Point had a vibrant settlement in the late nineteenth century. The settlement included the Black Point School, and one oral report suggests that a Roman Catholic Church may have been located in the area (DMA 2011). Another source stated that by the late 1800's, the area had both a church and a school, with the church being destroyed by fire in the 1930's resulting in the loss of all records (Fogarty Family 2014). Also, another clue that may corroborate a church having stood in the vicinity is a vital statistics record showing that Murdock McNeil and Bridget Eaton were married on July 2nd, 1891 at Black Point, Guysborough County under a Roman Catholic licence (NSHVS 1891).

Around 1890, Joseph Fogarty (2nd generation Fogarty) began a fishing operation at near Fogarty Head with his sons. After Joseph Fogarty's death, the fishing operation was continued by his son Vincent, and Vincent's sons. The fishing operation continued long after the Fogarty's moved to Hazel Hill in 1928, with Vincent and his sons commuting to the site, and even spending extended periods of time living south of Fogherty Head during fishing (Fogarty Family 2014).

Local residents also report that Martin Daley and his son Vincent were the last residents of Black Point. In his later years, Martin lived at nearby Fox Island or Fox Island Main during the week, working as a fisherman. On weekends, he would return to Black Point to live with his son. The two were farmers and fishermen, a type of dual employment that was not uncommon on the coast of Nova Scotia during the nineteenth and early twentieth century. Sometime after the 1930s, the Daley house and barn were demolished. Both were located in a meadow with a brook running down its centre, where one local resident reported pasturing his family horse in the summers (DMA 2011).

Sometime after all of the residents of Black Point had moved to Fox Island Main or further afield, John Rhynold and his son reportedly flew a flag on Black Point in memorial to John's mother, who was born at Black Point (DMA 2011). Additionally, a descendent of the Lukeman family kept a cabin on his family property at Fogherty Head, and used to visit the site each year (DMA 2011).

6.12.3 Project Site

As noted above, an Archeological Resource Assessment of the Project site was completed by archaeologists of Davis MacIntyre & Associates Limited in July, 2011 (**Appendix L Attachment A**). The goal of the study was to establish the layout and conditions of the Property in order to determine whether or not a complete walkover survey would be necessary. During

the assessment survey, no evidence of cultural activity was observed; however, the entire site was not accessed as is typical in a reconnaissance level survey (DMA 2011). The authors recommended that (a) the historic coastal road to Canso be further evaluated for archaeological resources and (b) the two on-site water bodies (the outlet of Fogarty Lake and the barachois[5] immediately south of Black Point) be examined for potential Mi'kmaq activity.

This Resource Assessment report was received and reviewed by the Nova Scotia Heritage Division. They found the report acceptable and agreed with the recommendations stated within (**Appendix L Attachment A**).

As a follow up to recommendations made in 2011, archeologists from Davis MacIntyre and Associates Ltd. revisited the site in October 2014. The study team also contacted the Fogarty family for additional background information and ultimately focused their efforts on the southern coastal platform where house foundations had been reported (Fogerty Family 2014; J. Murphy pers. comm. 2014). The 2014 Archeological Resource Assessment is presented in **Appendix L Attachment B**.

A number of items of historical interest that indicate past habitation of the coastal platform were recorded during the 2014 Resource Assessment. In total, six probable house foundations were identified, comprising three on the former Lukeman property, one on the former Fogarty property and two located in the center of coastal platform, possibly associated with the Daly family. Other historical artifacts include stone piles, apple trees and the remnants of an iron stove (**Appendix L**). No evidence of human burials was recorded (i.e., headstones, burial-like mounds or depressions, etc.) although the study team identified an area near the west coast of the Property that reportedly would have been suitable for burials. In addition, no evidence of Mi'kmaq use of the Property was observed; the archeological study team noted that for a variety of reasons the Property was likely not as attractive to Mi'kmaq peoples as other nearby areas. The study team also noted that beach areas that may have been used in passing by Mi'kmaq are high energy environments that typically do not preserve historical remains.

The Project layout as currently conceived will easily and effectively avoid historical foundations on the former Lukeman and Fogarty properties. Avoidance is the preferred follow-up activity when potential historical artifacts are discovered (DMA 2014). In contrast, the two probable house foundations located in the center of the coastal platform will undoubtedly be disturbed during site preparation in advance of processing plant construction. Recommendations to address these sites and other general mitigation measures to protect archeological resources are presented in Section 7.16.

[5] A **barachois** is a term used in Atlantic Canada to describe a coastal lagoon separated from the ocean by a sand or shingle bar. The "barrachois" near Black Point is a freshwater wetland rather than a coastal lagoon.

Black Point Quarry Project
Municipality of the District of Guysborough, NS

Environmental Impact Statement

PART 3 Section 7

Vulcan Materials Company

February 2015

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7.0 ENVIRONMENTAL EFFECTS ASSESSMENT

7.1 AIR QUALITY AND CLIMATE CHANGE

7.1.1 Overview

Air quality concerns associated with the generation of dust have been raised by community residents and the Mi'kmaw, and so Air Quality is identified as a VC. Air quality is also a pathway to the food chain via the transport of dust and deposition of contaminants on vegetation and surface water. Air quality within the quarry is of interest to provincial workplace health and safety regulators. Outside the Property boundary ambient air quality standards are established in the provincial *Air Quality Regulations* and enforced by NSE.

Vehicles and generators used at the Project site will produce greenhouse gases (GHGs) from the combustion of fuel. GHG emissions are associated with climate change and have been the subject of provincial regulation and policy initiatives.

7.1.2 Boundaries

The boundaries for the air quality assessment are based on the nature of the activities expected to generate air emissions at the Project. These activities mainly include site preparation, construction and operation of the processing plant, access road, marine terminal and quarry.

7.1.2.1 *Temporal Boundaries*

A summary of the activities associated with air emissions and the estimated duration of each activity is presented below. Initial quarrying south of the processing plant area will generate construction materials that will be used for surfacing the processing plant area and access road, and eventually for building the marine terminal.

- Pre-Mining Activities (Phase 1)
  - Establish access and haul roads, site preparation: 3 years (2017-2020)
  - Mobilization and set up of portable processing plant (Phase 1): 1 year (2017-2018)
- Mining Related Activities (Phases 2-5)
  - Commissioning of portable processing plant (Phase 2): 2 year (2018-2020)
  - Construction of marine terminal: 1 year (2019-2020)
  - Expansion of portable processing plant (Phase 3): 2 years (2020-2022)
  - Construction of fixed processing plant (Phase 4): 1 year (2021-2022)
  - Expansion of fixed processing plant (Phases 5): 4 years (2026-2030)
  - Operation of access and haul roads, marine terminal, quarry: end of construction to end of life (~2065)
- Closure, decommissioning, and final reclamation: estimated at 2 years but may be extended.

Quarrying will take place nine months out of the year weather permitting and ship loading will take place on a year-round basis. Operating hours will be 24 hours a day, with 16-hours of production (two 8-hour shifts) and one 8-hour maintenance shift per day. The specific hours each day that production will occur may vary. Blasting will be performed between 8 am and 6 pm. Blasting is expected to occur 2 – 3 times per week and will not occur on statutory holidays

or Sundays. Ship loading may occur 24 hours per day with a maximum anticipated duration of 2 days per week, and equipment maintenance may occur at any time during the day if needed, although most maintenance activities will be scheduled for the 8-hour maintenance shift.

The greatest emissions to the air are expected to occur several years following start-up of the full scale fixed operating plant in Phase 5 (2022). Based on forecasted sales, annual emissions will gradually increase from Operating Year 1 (2018) and reach the expected maximum annual rate no earlier than 2024.

With respect to climate change, the hydrological assessment incorporated possible climate change scenarios extending 70 years in the future; 70 years is thus adopted as the temporal boundary for the climate change aspects described here.

7.1.2.2 *Spatial Boundaries*

The spatial boundaries for the air quality assessment are threefold: the Project Area (within the Project property boundary where workplace health and safety regulations dominate), the Affected Area, where provincial ambient air quality standards must be met, and the larger Study Area, including the shipping routes between the marine terminal and established shipping lanes, where more diffuse Project impacts many be expected.

Climate change is a trans-boundary global issue, but the climate change assessment of this Project is related to provincial initiatives and emissions reduction targets.

7.1.2.3 *Administrative Boundaries*

Air quality within the Project site is regulated by the province through the *Workplace Health and Safety Regulations*, which establishes the air quality conditions needed to maintain worker health. Air quality outside of the Project site is also regulated by the province, which may set air quality emissions standards for industrial operations in the industrial operating permit. Maximum permissible ground level concentrations of various air pollutants, including Total Suspended Particulate (TSP or dust) are listed in Schedule A of Nova Scotia's *Air Quality Regulations*. Federal regulators may reference similar limits established under the *Canadian Environmental Protection Act.*

7.1.2.4 *Technical Boundaries*

Technical boundaries represent theoretical or actual limits to the Project team's ability to assess a VC, pathway or receptor. For the Air Quality and Climate Change VC, no technical boundaries were encountered. Prediction of ambient air quality changes is based on air dispersion modeling (**Appendix O**), experience with granite quarry design and operation, quantification of total potential emissions, existing climate and ambient air conditions, and proximity to nearby receptors.

7.1.3 Threshold for Determination of Significance

Particulate matter is the primary criteria air contaminant of concern for the Project.

Air contaminants that are of most concern from project operations include total suspended particulate (TSP), particulate matter less than 10 and 2.5 microns in diameter (PM10 and PM2.5, respectively), nitrogen oxides (NOx), carbon monoxide (CO) and sulphur dioxide (SO2).

The Nova Scotia Air Quality Regulations (179/2014) establishes limits on TSP, SO2, nitrogen dioxide and CO. In addition, the Canadian Council of Ministers of the Environment issues Canada-wide issued standards for particulate matter less than 2.5-micron in diameter ($PM_{2.5}$). These standards are used as thresholds for determination of significance and provided in Table 7.1-1.

A significant adverse effect is defined as an exceedance of the Nova Scotia or CCME ambient air quality standards at a residential or commercial location outside the property boundary, where the exceedance is due to emissions from the operation and the event occurs more than twice in the period of time that the standard is based.

Table 7.1-1:
Ambient Air Quality Standards

Jurisdiction	Pollutant	Averaging Time	Current Standard	Standard 2015	Standard 2020
NSE	TSP	24- Hour	120 µg/m^3	--	--
		Annual	70 µg/m^3	--	--
NSE	SO2	1-Hour	900 µg/m^3	--	--
		24- Hour	300 µg/m^3	--	--
NSE	NO2	1-Hour	60 µg/m^3	--	--
		Annual	400 µg/m^3	--	--
NSE	CO	1-Hour	34600 µg/m^3	--	--
		8Hour	12700 µg/m^3	--	--
CCME	$PM_{2.5}$	24- Hour	--	28 µg/m^3	27 µg/m^3
		Annual	--	10 µg/m^3	8.8 µg/m^3

A quarry, where the annual production exceeds 500,000 tonnes, is required to consider all National Pollutant Release Inventory (NPRI) substances for reporting to the NPRI, regardless of the hours worked by employees.

There are no national or province-wide Nova Scotia standards or limits for greenhouse gas emissions. In 2007, the Nova Scotia Government passed the *Environmental Goals and Sustainable Prosperity Act* (*EGSPA*), an innovative piece of legislation on sustainable development and economic prosperity. EGSPA contains the first hard caps of greenhouse gas (GHG) emissions in Canada. Among other actions, the *Act* requires a reduction in provincial GHGs of 10% below 1990 levels by the year 2020.

In order to lessen the province's dependency on imported fossil fuels and reduce greenhouse gas and air pollutant emissions, the Government of Nova Scotia in 2009 tabled *Toward a*

Greener Future - Nova Scotia's Climate Change Action Plan followed by the 2010 *Renewable Electricity Plan.* These reports describe an approach to integrate progressively larger amounts of low-emission renewable energy into the provincial electrical grid. The *Climate Change Action Plan* contains goals for meeting a target greenhouse gas reduction of 5 megatonnes annually in order to meet the 2020 GHG reductions regulated in *EGSPA*. To achieve these reductions, the Government of Nova Scotia has imposed emissions caps on electricity generation sector and worked to increase the efficiency of the transportation sector.

7.1.4 Effects of the Project on Air Quality

Dust emissions (total particulate matter [TPM], total suspended particulate [TSP], particulate matter up to particle size 10 microns [PM_{10}] and particulate matter up to particle size 2.5 microns [$PM_{2.5}$]) are the main air quality issue for quarry construction and operation. These particulate matters emissions have the potential to be transported off-site and if not mitigated may reduce visibility or contribute to a number of health problems, such as asthma, decreased lung function and coughing or difficulty breathing.

The dust emission sources associated with the Project are:

- wind erosion of material storage piles and exposed areas
- crushers
- screens
- material loading/unloading
- material conveyors and transfer
- blasting
- overburden removal, and
- vehicle traffic (haul roads).

Combustion emissions from equipment, vehicles, and ships occur during construction and operation of the Project. Criteria air contaminants associated with combustion emissions are sulphur dioxide (SO_2), nitrogen oxides (NO_X), volatile organic compounds (VOCs), carbon monoxide (CO), and particulate matter (PM). Fuel combustion in equipment, vehicles, and ships are sources of Project greenhouse gas emissions, which include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O).

On a temporary basis, a minimal amount of air pollutants are also generated from wind-blown dust and fuel combustion during the construction and decommissioning phases.

The emissions from the project are summarized in Table 7.1-2 below. These emission rates represent peak production anticipated for each phase.

Table 7.1-2:
Total Criteria Pollutant Emissions from Quarry and Processing Plant

	tonnes/year						
Project Phase	**Total Suspended Particulate (TSP)**	**Particulate Matter <10 microns (PM10)**	**Particulate Matter <2.5 microns (PM2.5)**	**Nitrogen Dioxide (NO2)**	**Carbon Monoxide (CO)**	**Volatile Organic Compounds (VOCs)**	**Sulfur Dioxide (SO2)**
Phase I	6.16	1.83	0.76	30.64	24.99	3.39	1.48
Phase 2	22.78	6.31	2.70	54.12	36.15	6.12	1.60
Phase 3	47.09	14.58	2.92	77.50	62.48	8.33	2.00
Phase 4	99.84	33.42	6.19	91.76	92.15	9.87	2.00
Phase 5	114.56	37.44	7.28	105.35	109.07	11.08	2.80

(source: Vulcan Materials Company)

These estimates were calculated using emissions factors from Environment Canada[1] and US EPA[2], and Tier 4 Off-Road engine emission standards from US EPA document Emissions Factors for Nonroad Engine Compression-Ignition Engines[3]. The emissions address the sources described previously for the quarry and processing plant. Greenhouse gas emissions are described in Sections 3.3.10 (Air Emissions) and 3.3.12 (Emissions to Atmosphere from Marine Operations).

Emissions from aggregate transport vessels while they are maneuvering for berthing and while berthed for loading are provided in Table 7.1.3. These emission levels are not significant as the ships operate on auxiliary power when berthed and are only in transit for berthing a short period of time.

[1] Website Archived Content –"Environment Canada – Pit and Quarries Guidance – NPRI Toolbox."

[2] U.S.EPA AP42, Fifth Edition, Volume I Chapter 11: Mineral Products Industry.

[3] US EPA NR-009d Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling Compression-Ignition, July 2010.

Table 7.1-3:
Total Criteria Pollutant Emissions from Marine Vessel Operations

	tonnes/year						
Project Phase	Total Suspended Particulate (TSP)	Particulate Matter <10 microns (PM10)	Particulate Matter <2.5 microns (PM2.5)	Nitrogen Dioxide (NO2)	Carbon Monoxide (CO)	Sulfur Dioxide (SO2)	Volatile Organic Compounds (VOCs)
Phase I	0.24	0.24	0.21	0.27	0.53	0.21	0.11
Phase 2	0.34	0.34	0.30	0.39	0.77	0.30	0.17
Phase 3	0.51	0.51	0.45	0.58	1.14	0.44	0.25
Phase 4	0.76	0.76	0.67	0.86	1.70	0.66	0.36
Phase 5	1.14	1.14	1.00	1.29	2.55	0.98	0.55

(source: Vulcan Materials Company)

In general, based on the source release type, emissions quantity, and meteorological conditions, concentrations will likely dissipate well below significant levels within 500 m of the source (see results from air dispersion modelling study below). This means most of the effects of the Project on air quality will be within the Project Area and may extend up to 500 m into the Affected Area. The processing plant sources and stock piles are located well within 500 m of the Property boundary. Quarrying may occur near the property boundary, but the nearest public receptors are 720 to 750 m away from the boundary and even farther from quarry face. The emissions from the shipping lane will be beyond the Project Area; however, the vessels are not significant sources of emissions and the impacts from these are expected to be insignificant.

The highest concentrations at the Property boundary from all fugitive dust sources (except wind erosion off disturbed areas and piles) are, somewhat counterintuitively, usually generated during times of low wind speeds when the air is calm. With respect to wind erosion, high winds may push dust further afield, but the additional turbulence keeps concentrations low. High wind speeds (winds greater than 8.8 m/s), which occur about 24% of the time, will cause greater wind erosion and dust transport. Nearly half of these winds come from west-northwest and northwest. However, it is just over 1 km to the nearest public receptor in this direction and additional mitigation will be implemented at wind speeds greater than 8.8 m/s. Low winds blowing during calm conditions to the east, west, and south produce the highest dust concentrations at the Property boundary; these wind conditions occur approximately 6% of the time (EC 2006a; 2009).

Fugitive dust emissions are greatest during hot and dry conditions. The proximity of the Project site to the ocean leads to relatively high moisture and low temperature; and both high and low speed winds blowing toward the ocean from the sea breeze effect. The hottest daily maximums (greater than 20° C) occur in July and August and the average rainfall during these months is still above 80 mm. The majority (over 50%) of the winds during these two months are blowing

from the south or southwest, carrying emissions into the Bay and away from the nearest receptors (residential buildings and roads).

In order to quantify air contaminant dispersion during quarry operations, an air dispersion modelling study was undertaken (**Appendix O**). Dispersion modeling was completed using AERMOD, developed by the American Meteorological Society (AMS) and United States Environmental Protection Agency (US EPA). AERMOD is the US EPA preferred model for regulatory air dispersion modelling of industrial sources and Nova Scotia Environment (NSE) has approved its use in various modelling projects to demonstrate compliance in Nova Scotia.

The air dispersion model simulated the transport of contaminants released from the quarry and compared the predicted concentrations at nearby residences to the applicable limits. The model captures the potential "worse case" operating scenario: Phase 5, which represents peak production and maximum vehicular traffic as well as Phase 3 when generators will be used before the electrical line is constructed. Vessel emissions are also included.

The modelling results demonstrate that even under worse case scenarios, Project-related air contaminants at the nearest residences are far below the maximum acceptable concentrations established by provincial and federal regulation. In particular, the predicted 1-hour and 24- hour maximum, and the annual average concentrations for nitrogen dioxide (NO2), sulphur dioxide (SO2), and particulate matter (including TSP, PM10 and PM2.5), as well as the 1-hour and the 8-hour maximum concentrations for carbon monoxide (CO) were found to be at least 50% below their respective objectives.

With respect to GHGs, calculations presented in Sections 3.3.10 (Air Emissions) and 3.3.12 (Emissions to Atmosphere from Marine Operations).

The Canadian National GHG Inventory for the 2012 calendar year shows the carbon dioxide equivalent emission levels for Nova Scotia to be 17,400 kt, of which the mining and oil and gas industrial category generated 201 kt of emissions, a very small proportion. The Project's total GHG emission level at the maximum generation rate during Phase 5 is estimated at 9,464 tonnes per year CO_2e (Sections 3.3.10 - Air Emissions). For comparison, this level would be roughly 0.05% of the Province's total GHG emissions for 2012.

Given these findings, changes to the atmospheric environment resulting from Project activities will not have a measureable effect on federal lands (i.e., the Canso Islands National Historic Site) or on area of federal jurisdiction (i.e., lands currently used by Aboriginal peoples).

7.1.5 Mitigation & Monitoring

7.1.5.1 *Mitigation*

The mitigation measures used to minimize and control the air pollutants from the construction, operations, and decommissioning activities are outlined in Table 7.1-4. Standard best management practices for air quality mitigation that apply to the entire Project site are:

- Regular maintenance of all equipment and emission control devices;
- Wet sprays on conveyor transfer points to reduce the fugitive releases of dust during the transfer of material;

- The application of water to the access and haul roads and aggregate stockpiles as needed. A water truck will be available on site to transport water where needed;

- Use of qualified blasting contractors with blast design plans that incorporate dust emission controls;

- Construction of the haul roads using material with low silt content;

- Use high quality low sulphur diesel or standard unleaded gasoline for mobile equipment; and

- Use of a binder substance within the dust suppression application (e.g. calcium chloride) during drier periods of the year to aid in keeping the roads moist for longer periods of time.

Additional controls will be implemented through the process of adaptive management. Adaptive management is an iterative process where future actions are taken based on observation and/or measurement. For example, dust generation from haul roads is related to moisture in the roadway and speed of the vehicle. Through adaptive management, the Proponent may learn that immediate dust reductions are possible through limiting vehicle speed so that water trucks can be used less often. The Proponent will use adaptive management to evaluate changing conditions at the operation due to weather such as temperature, wind speed and direction, sun intensity, time since last rain and snow cover as well as operating rates and location of mining activities at the time. This information will allow quarry managers to make decisions on how to adjust dust control techniques (such as rate of water application to haul roads and stock piles), and also modify operational parameters such as production levels and haul truck speeds to ensure dust generation is controlled.

Some of the control measures that will be implemented based on management determination of need include:

- Increase in watering frequency of haul roads and stock piles.
- Application of dust suppressants to the haul and access roads.
- Reduction in allowable speed on haul and access roads.
- Restriction or suspension of operation of part or all of the processing plant until dust can be controlled.
- Suspension or modification of overburden handling activities.
- Addition or modification of dust suppression systems to address specific points where dust is being generated, including spray nozzle additions and/or modifications.
- Modify operation and dust controls during high wind events (>30 km/h) to control dust, if it cannot be controlled suspend operation until it can.

The Proponent will take steps to reduce GHG emissions including purchasing of heavy off-road mining equipment that meet the US EPA and Canadian Tier 4 engine standards, operating mobile equipment with fuel efficiency in mind by eliminating unnecessary idling, shutting off equipment when parked unless this is precluded for safety or maintenance reasons, utilizing conveyors to reduce the need for mobile equipment, and through the use of marine vessels, which are much more energy efficient (and so produce less GHGs) than ground transportation options (Table 3.8).

7.1.5.2 *Monitoring*

Although air quality impacts are expected to be negligible, regular inspection and air quality monitoring (as needed) are typically used to ensure dust emissions are minimized. Additional monitoring programs are outlined on Table 7.1-4. For example:

- Perform daily visible emissions inspection at the property line. If visible emissions are observed or are reported off-site, the operator will investigate the condition and take appropriate corrective actions within the site to reduce dust emissions through measures such as wetting of dust sources with water, use of covers or other approaches. Records of the inspections and excess dust events will be kept, along with corrective actions taken which will be reported as appropriate to government agencies.
- To ensure that public concerns are part of daily management of the site the Proponent will have a telephone number at the site that can be used to report issues that the public may have with the facility, such as dust emissions observed beyond the Property boundary.
- If requested by Nova Scotia Department of Environment, measure Suspended Particulate Matter at the property line of the Project site or other location as directed.
- Monitor weather for conditions that contribute to adverse air quality in the area (e.g. inversions, high winds, dry) and take additional precautions to minimize emissions during these events.
- Monitoring of worker exposure to dust through the regular use of dust dosimeters carried by workers during the course of their shift.

Table 7.1-4:
Best Practice Mitigation for Air Quality

Project Activity	Mitigation	Record Keeping and Monitoring
Construction		
Site Preparation	• Prior to burning, explore options to reduce, reuse, or recycle as much material as possible. • Limit burning to periods with adequate atmospheric dispersion. • Apply water or chemical dust suppressant on all disturbed areas, as necessary. • Limit the amount of vegetation clearing to the smallest extent possible. • Suspend activities during periods of sustained high winds (> 30 km/h) if fugitive dust emissions cannot be controlled. • Compact the soil on disturbed areas that will not be surfaced with gravel or re-vegetate as soon as practicable following construction.	• Inspect burning pile for material that can be reused or recycled. • Record location and date of burning events. • Perform daily visible emissions inspection and maintain records. • If visible emissions are observed or reported, the operator will investigate the condition and take appropriate corrective actions. • Record hours of operation for the water truck and areas of the facility where water and/or chemical dust suppressants were applied. • Document sustained periods of high wind speeds.
Soil and Aggregate Handling and Storage	• Apply water on all disturbed areas, as necessary. • Locate piles in areas sheltered from wind where possible. • Minimize rock drop distances. • Minimize storage and handling of soil/aggregate. • Suspend soil/aggregate handling activities during sustained periods of high winds (> 30 km/h). • Restrict access to soil/aggregate piles during periods of inactivity using gates, fencing, and/or onsite security personnel.	• Perform daily visible emissions inspection and maintain records. If visible emissions are observed or are reported, the operator will investigate the condition and take appropriate corrective actions. • Record the application of water and/or chemical dust suppressant. • Document periods of high wind speeds.
Portable Processing Plant	• Ensure efficient operation of dust suppression equipment on portable units. • Minimize drop distances as far as practicable. • Water spray during non-freezing conditions. • Minimize transfers of material. • Suspend activities during periods of sustained high winds (> 30 km/h) if fugitive dust emissions cannot be controlled.	• Maintain a record of equipment maintenance and inspections of dust control equipment. • Document periods of high wind speeds. • As requested by NSE, install monitoring stations to record dust levels.

Project Activity	Mitigation	Record Keeping and Monitoring
Access Road/Haul Roads	• Utilize multi-passenger vehicles to transport crew when possible. • Reduce vehicle speeds. • Post speed limit signs in sensitive areas. • Apply water or dust suppressants during dry conditions. • Restrict traffic during unusually windy times when dust formation is enhanced. • Restrict vehicular access during periods of inactivity using gates, fencing, and/or onsite security personnel. • Ensure that water trucks are available when needed.	• Perform daily visible emissions inspection and maintain records. If visible emissions are observed exceeding opacity limits specified in the permit, or are reported, the operator will investigate the condition and take appropriate corrective actions. • Record the application of water and/or chemical dust suppressant. • Document location of residences and other sensitive areas.
Engines and Vehicles	• Maintain equipment regularly following manufacturer guidelines. • Maximize equipment use when running and minimize unnecessary idling of equipment. • Consider fuel efficiency when purchasing, upgrading, and maintaining the vehicle fleet. • Use high quality, ultra-low sulphur diesel fuels or standard unleaded gasoline. • Schedule and arrange construction activities to minimize transport time for vehicles and ensure that construction activities are sequenced in a manner to enhance vehicle use. • Turn off equipment that is idling and not in use.	• Maintain engine certifications for off-road equipment and diesel generators and compare against applicable provincial or national standards. • Check maintenance is up to date on each vehicle, equipment, and diesel generator based on the maintenance schedule. • Record date of any maintenance, inspections, and tuning of equipment.
Operation		
Drilling and Blasting	• Utilize drill rig that has dust suppression incorporated into its design. • Apply water to shot rock pile as needed to reduce emissions from loading and conveyance of material to the process. • Suspend blasting activities during periods of sustained high winds (> 30 km/hr).	• Record the number of blasts. • Record the application of water. • Document periods of sustained high wind speeds. • As requested by NSE, install monitoring stations to record dust levels.

Project Activity	Mitigation	Record Keeping and Monitoring
Access and Haul Roads	• Same as during construction	• Same as during construction
Permanent Processing Plant	• Same as with portable plant	• Same as with portable plant
Storage Piles	• Apply water or chemical dust suppressant on stockpiles, as necessary. • Locate piles in areas sheltered from wind where possible	• Perform daily visible emissions inspection and maintain records. If visible emissions are observed or are reported, the operator will investigate the condition and take appropriate corrective actions. • Record the application of water and/or chemical dust suppressant.
Exhaust Emissions from Equipment and Vehicles	• Maintain equipment following manufacturer guidelines. • Maximize equipment use when running and minimize unnecessary idling of equipment. • Consider fuel efficiency when purchasing, upgrading, and maintaining the vehicle fleet. • Ensure power generation via diesel generators meet applicable provincial standards. • Use multi-passenger vehicles to transport crew to site to the extent practical. • Use high quality, ultra-low sulphur diesel fuels or standard unleaded gasoline.	• Maintain engine certifications for off-road equipment and diesel generators and compare against applicable provincial standards. • Check maintenance is up to date on each vehicle, equipment, and diesel generator based on the maintenance schedule. • Look for excessive emissions (soot) from vehicle exhaust. • Record date of any maintenance, inspections, and tuning of equipment.
Marine Engines	• Ships must comply with International Marine Organization limits on NO_X, VOC, and SO_2. • Optimize load times to limit auxiliary engine idling on ships at dock.	• Record all emission tests/certifications. • Record fuel sulfur content of ships.
Decommissioning		
Decommissioning activities are expected to be comparable to construction activities. Therefore, the same mitigation and monitoring procedures will apply.		

7.1.1 Residual Effects and Significance

The Project is expected to have a minimal adverse residual impact on the local air shed. Table 7.1-5 provides a summary of the residual environmental effects and demonstrates the Project is not likely to have significant adverse effects on Air Quality and Climate Change.

Table 7.1-5:
Residual Environmental Effects for Air Quality and Climate Change

Project Environment Interaction	Potential Residual Environmental Effects A=Adverse P= Positive	Mitigation	Magnitude	Geographic Extent	Duration / Frequency	Reversibility	Ecological / Socio-Economic Context	Residual Effect	Significance of Residual Effect
Construction									
Site Preparation: dust and combustion emissions	A	See Mitigation Section	1	1	3/6	R	1	Dust and Combustion Emissions	Not Signif.
Soil and Aggregate Handling and Storage: dust and combustion emissions	A	See Mitigation Section	1	1	3/6	R	1	Dust and Combustion Emissions	Not Signif.
Portable Processing Plant: dust and combustion emissions	A	See Mitigation Section	1	1	3/6	R	1	Dust and Combustion Emissions	Not Signif.
Access Road/Haul Roads: dust emissions	A	See Mitigation Section	1	1	3/6	R	1	Dust Emissions	Not Signif.
Engines and Vehicles: combustion emissions	A	See Mitigation Section	1	1	3/6	R	1	Combustion Emissions	Not Signif.
Operation (Full Scale Phase 5)									
Blasting: dust and combustion emissions	A	See Mitigation Section	1	1	1/4	R	1	Dust and Combustion Emissions	Not Signif.
Access Road/Haul Roads: dust emissions	A	See Mitigation Section	1	1	5/6	R	1	Dust Emissions	Not Signif.

Permanent Plant: dust emissions	A	See Mitigation Section	1	1	5/6	R	1	Dust Emissions	Not Signif.
Storage Piles	A	See Mitigation Section	1	1	5/6	R	1	Dust Emissions	Not Signif.
Exhaust Emissions from Equipment and Vehicles: combustion emissions	A	See Mitigation Section	1	1	5/6	R	1	Combustion Emissions	Not Signif.
Marine Engines: combustion emissions	A	See Mitigation Section	1	1	1/4	R	1	Combustion Emissions	Not Signif.
Decommissioning									
Decommissioning activities are expected to be comparable to construction activities. Therefore, the same analyses apply.									Not Signif.

Legend

Magnitude:
U= Unknown - An environmental effect affecting an unknown portion of a population or group or where the changes in a specific parameter are unknown.
0 = Nil - No environmental effect.
1 = Low (e.g., specific group, habitat, or ecosystem localized 1 generation or less, within natural variation)
2 = Medium (e.g., portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside the range of natural availability)
3 = High (e.g., affecting entire stock, population, habitat or ecosystem, outside the range of natural variation)

Geographic Extent:
1 = < 1 km^2
2 = 1 – 10 km^2
3 = 11 – 100 km^2
4 = 101 – 1,000 km^2
5 = 1,001 – 10,000 km^2

Duration:
1 = < 1 month
2 = 1 – 12 months
3 = 13 – 36 months
4 = 37 – 72 months
5 = > 72 months

Frequency:
1 = < 11 events/year
2 = 11 – 50 events/year
3 = 51 – 100 events/year
4 = 101 – 200 events/year
5 = > 200 events/year
6 = continuous

Reversibility:
R = Reversible
I = Irreversible

Ecological / Socio-Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity.
2 = Evidence of adverse environmental effects.

N/A = Not applicable
A = Adverse
P = Positive

7.2 NOISE AND VIBRATION

7.2.1 Overview

Activities such as blasting and aggregate processing will undoubtedly produce noise and have the potential to alter the ambient noise conditions of the local area. Noise concerns have been raised by residents living to the east and west of the property. Changes to ambient noise may also affect a variety of wildlife, migratory birds and SAR through driving them out of the area and/or other effects on their behaviour. Noise associated with quarry activities is regulated by the Province of Nova Scotia.

Construction of the marine terminal will likely result in temporary increases to noise in the marine environment, which may in turn affect nearby marine biota. Noise may alter the behaviour patterns of certain marine species, which may in turn affect these species at different times of their life cycles. Shipping associated with the marine terminal will add to the noise already present in the marine environment.

7.2.2 Boundaries

7.2.2.1 *Temporal Boundaries*

Temporal boundaries reflect the duration of Project-related impacts. With respect to Noise and Vibration, the temporal boundaries are:

- Construction (Phase 1)
  - Establish access and haul roads, site preparation: 3 years (2017-2020)
  - Establish portable processing plant (Phase 1): 1 year (2017-2018)
- Operation (Phases 2-5)
  - Establish portable processing plant (Phase 2): 2 year (2018-2020)
  - Construction of marine terminal: 1 year (2019-2020)
  - Expansion of portable processing plant (Phase 3): 2 years (2020-2022)
  - Construction of fixed processing plant (Phase 4): 1 year (2021-2022)
  - Expansion of fixed processing plant (Phases 5): 4 years (2026-2030)
  - Operation of access and haul roads, marine terminal, quarry: end of construction to end of life (~2065)
- Closure, decommissioning, and final reclamation: estimated at 2 years but may be extended.

Daytime, evening and night time periods, described below, are also considered temporal boundaries for the purposes of the noise and vibration assessment.

7.2.2.2 *Spatial Boundaries*

The spatial boundaries for the noise and vibration assessment consist of the Project Area (within the Project property boundary where workplace health and safety regulations dominate), the Affected Area extending to nearby residential properties where provincial noise limits must be met, and the larger Study Area, including the shipping routes between the marine terminal and established shipping lanes, where more diffuse Project impacts may be expected.

7.2.2.3 *Administrative Boundaries*

Noise within the Project site is regulated by the province through the *Workplace Health and Safety Regulations*, which establishes the noise environment needed to maintain worker health. The *Pit and Quarry Guidelines* (NSE 1999) require that noise levels at the boundaries of the project site are not to exceed the following levels:

- $L_{eq} \leq 65$ dBA between 0700 to 1900 hours (daytime)
- $L_{eq} \leq 60$ dBA between 1900 to 2300 hours (evening)
- $L_{eq} \leq 55$ dBA between 2300 to 0700 hours (night-time, Sunday and statutory holidays)

The *Guidelines for Environmental Noise Measurement and Assessment* (NSE 1990) also require these noise levels to be met at locations where people normally live, work, or take part in recreation.

7.2.2.4 *Technical Boundaries*

No technical boundaries are defined for noise.

7.2.3 Threshold for Determination of Significance

A significant adverse effect is defined as an exceedance of the maximum noise or vibration limits listed in the *Pit and Quarry Guidelines* at or beyond the property boundary, where the exceedance is due to noise from the operation and the event occurs more than twice in the period of time that the standard is based.

7.2.4 Effects of the Project on Noise

Project noise and vibration effects were considered in the following potential areas:

- Construction noise and vibration, both terrestrial and underwater;
- Noise from on-going aggregate production and shiploading operations; and
- Noise and vibration from blasting, including impacts on people and structures and the potential for underwater impacts on wildlife.

This assessment also identifies the potential *perceived* noise and vibration effects from the Project, since impacts on people may exist even if compliance with numerical noise and vibration criteria is achieved.

This section summarizes the noise and vibration impacts of the Project. More detail is contained in the Noise and Vibration Technical Report attached as **Appendix D** to this EIS.

7.2.4.1 *Project Construction Noise and Vibration Impacts*

The site development and initial rock processing during the construction phase of the Black Point operation will involve activities similar to those that will occur during full facility operation. Equipment used for the construction will be similar to that used for site operation. Noise generated during construction is anticipated to be similar to or less than the noise generated from facility operations; however, the duration of noise during construction will be less than the fully operational quarry.

For example, the number of heavy vehicles accessing the quarry site by road may be higher during some periods of construction than during operations. Trucks will be used to transport processing equipment to the site and this activity will cease before full operations begin. Increased heavy vehicle noise on local roads may be noticeable at times during construction, but this is expected to be temporary and will be confined to normal working hours.

The construction of the marine terminal has the potential to affect marine receptors including marine mammals due to underwater noise and vibrations produced during construction. These effects would be temporary and localised to the immediate construction area. It is estimated that the underwater noise criteria applicable to fish habitats (including shellfish and crustaceans) may be exceeded during pile driving in an area around the pile locations extending seaward up to 10 m (**Appendix D**). Behavioural modification may occur at greater distances, for the duration of the construction.

7.2.4.2 *Project Operational Noise Impacts*

The Black Point operation will generate noise from the operation of mobile equipment, the operation of the processing plant, blasting and product loadout at the marine terminal. As noted above, the *Pit and Quarry Guidelines* (NSE 1999) require that noise levels at the boundaries of the project site are not to exceed the following levels:

- $L_{eq} \leq 65$ dBA between 0700 to 1900 hours (daytime)
- $L_{eq} \leq 60$ dBA between 1900 to 2300 hours (evening)
- $L_{eq} \leq 55$ dBA between 2300 to 0700 hours (night-time, Sunday and statutory holidays)

The *Guidelines for Environmental Noise Measurement and Assessment* (NSE 1990) also require these noise levels to be met at locations where people normally live, work, or take part in recreation.

In order to calculate the noise emission levels at the site boundary and at residential receiver locations an environmental computer model was developed using SoundPLAN. This software enables compilation of a sophisticated computer model comprising a digitised ground map, the location and acoustic sound power levels of potentially critical noise sources on site and the location of receivers for assessment purposes.

The noise model developed is representative of a "worst-case" scenario for noise impacts. As the detailed design is not yet completed, a number of assumptions have been made in order to predict the maximum potential for operational noise impacts and need to consider noise mitigation:

- Impacts are predicted for a future operational scenario, with all equipment operating at the maximum anticipated capacity.
- The pit has been modelled as expanded to its maximum size, when it will provide a minimum of shielding effect.
- The model assumes all noise sources and equipment are operational continuously throughout a daily production schedule of 16 hours, with a maintenance schedule of 8 hours.
- Shiploading is modelled as occurring continuously at all times of the day or night, when in fact this would be expected to occur on less than a third of all days or nights.

- Downwind sound propagation has been assumed – under calm conditions, noise would propagate less.
- Hard ground (bedrock) was assumed across the Project site and over the ocean, with soft ground (soil and surficial deposits) to the east, west and south.
- Equipment sound power levels have been derived from SLR's experience of the unmitigated noise emissions of equipment in similar applications. The source levels assumed are considered to be conservative. There is potential to mitigate the noise emissions of equipment during the detail design of the Project to minimise noise impacts.

The predicted worst-case, unmitigated noise effects in the future operational scenario are summarised in Table 7.2-1 at the site boundary and in Table 7.2-2 at residential receiver locations.

Table 7.2-1:
Predicted Worst Case Project Noise Levels – Site Boundary

	Leq Sound Level (dBA)	
Location	**Daytime and Evening (7am to 11pm)**	**Night-time (11pm to 7am)**
Western Boundary	66-67	47-57
Southern Boundary	47-64	29-39
Eastern Boundary	56-73	34-58

Maximum permitted at nearest residence: 65 dBA daytime / 60 dBA evening / 55 dBA night-time

Table 7.2-2:
Predicted Worst Case Project Noise Levels – Residential Receivers

	Leq Sound Level (dBA)	
Location	**Daytime and Evening (7am to 11pm)**	**Night-time (11pm to 7am)**
272 Half Island Cove Road	51	40
267 Half Island Cove Road	53	41
257 Half Island Cove Road	52	40
246 Half Island Cove Road	52	40
230 Half Island Cove Road	51	39
215 Half Island Cove Road	52	40
212 Half Island Cove Road	51	39
155 Half Island Cove Road	50	38
3595 Highway 16	47	25
3596 Highway 16	48	25
3581 Highway 16	45	26
3421 Highway 16	55	26
2927 Highway 16	54	30
2823 Upper Fox Island	52	35
2574 Highway 16	48	34
48 Fox Island Main Road	48	33
59 Fox Island Main, Canso	49	34

Location	Leq Sound Level (dBA)	
	Daytime and Evening (7am to 11pm)	Night-time (11pm to 7am)
79 Fox Island Main Road	49	34
75 Fox Island Main Road	49	34
130 Fox Island Main Road	49	34
149 Fox Island Main Road	49	35
169 Fox Island Main Road	50	35
235 Fox Island Main Rd	48	34
RR 1 Canso	50	35

Maximum permitted at nearest residence: 65 dBA daytime / 60 dBA evening / 55 dBA night-time

7.2.4.3 *Daytime and Evening Noise Impacts on Residences*

Under the worst case scenario, the predicted noise levels at the nearest residences during the daytime and evening range from 47 dBA to 55 dBA, complying with the most stringent noise limit of 55 dBA. At the commencement of quarry construction and operation, noise levels would be expected to be considerably less than indicated in this assessment.

While compliance with the numeric noise limits at residences is expected, the noise of the quarry will be noticeable at residences during the daytime and evening, particularly during otherwise quiet periods. Quarry production noise is generally characterised by low-frequency "rumbling" noise that does not vary much with time. At the levels predicted in this assessment, it is anticipated that noise from the quarry would dominate the background noise environment in the local area during the daytime and evening periods, and will be audible at a "moderate to quiet" level in nearby residential areas.

7.2.4.4 *Night-time Noise Impacts on Residences*

The predicted noise levels at the nearest residences during night-time shiploading and site maintenance activities range from 25 dBA to 41 dBA, complying with the night-time limit of 55 dBA. Shiploading is expected to occur on around 100 nights per year once operations reach full capacity.

While compliance with the numeric night-time noise limits at residences is expected, the noise impact of night-time shiploading will be noticeable at nearby residences. At the levels predicted in this assessment, it is anticipated that noise from night-time shiploading would contribute to the background noise environment in the local area, and will be audible at a "quiet" level in nearby residential areas during calm weather. The character of night-time noise would be a steady low-frequency "rumbling" noise. The night-time noise level would not be expected to disturb the sleep of most people in the long term.

7.2.4.5 *Noise Impacts at Project Boundary*

The predicted noise levels around the project boundary indicate there is potential for exceedances of the noise goals at the project boundary both during daytime operations and during night-time shiploading and site maintenance activities. These predicted noise impacts represent a worst-case scenario with no noise mitigation measures included in the detailed

design. The highest noise levels are predicted at the boundary on the coast both to the east and to the west of the site – this is because these project boundaries are closest to the dominant production equipment noise sources, and do not benefit from as much shielding by the terrain as the areas south of the site.

7.2.4.6 *Blasting Noise and Vibration Impacts*

Blasting will occur anywhere from 30 to 120 days per year, depending on aggregate sales demand. The Pit and Quarry Guidelines (NSE 1999) define acceptable limits for blast overpressure (noise) and vibration, and also require a minimum distance from blasting to the nearest off-site structure greater than 800 m. Minimum blasting distances are respected in all directions from the Property boundary.

The assessment indicates that exceedance of the airblast overpressure limit and vibration limit at sensitive receivers is unlikely throughout the life of the quarry.

While underwater blasting is not anticipated to be required by the Project, the location of the quarry adjacent to the ocean means that there is potential for quarry blasting noise and vibration to impact on the underwater environment and marine fauna. Blasting effects in the marine environment are described in Section 7.11.

7.2.5 Mitigation & Monitoring

7.2.5.1 *Mitigation*

As noted, there is potential for exceedances of the noise limits at the project boundary both during daytime operations and during night-time shiploading and site maintenance activities. These predicted noise impacts represent a worst-case scenario with no noise mitigation measures included in the detailed design. As required by the Pit and Quarry Guidelines (NSEL 1999) a Technical Blast Design must be prepared before blasting begins. The blast design must demonstrate the concussion and ground vibration criteria in the Pit and Quarry Guidelines can be met within the site.

There is considerable opportunity to reduce the effects from noise below the levels described in the tables above by design and implementation of noise mitigation measures. Reasonable and feasible mitigation options include the procurement of equipment that meets best practices in terms of noise emissions, and the placement of equipment within the quarry and/or behind stockpiles such that these measures block noise during operations. More generally, the following noise mitigation measures (NSW 2008) will be evaluated during the final design phase and later when construction and operation are beginning.

<u>General</u>

- Procure equipment that meets US EPA Category IV air emission standards for off-road diesel equipment which tend to generate less noise than older equipment;
- Equipment that operates in the quarry pit should stay in the pit to the extent possible so that the pit walls attenuate the noise levels;
- Locate product stockpiles and other structures such as buildings and conveyors to the extent possible to attenuate the noise from the processing equipment;

- Restrict operating hours for the quarry and processing plants to 16-hours per day so that noise levels are reduced during night time;
- Restrict blasting to daytime hours and weekdays;
- Place as much distance as possible between the plant or equipment and residences;;
- Use natural landforms as noise barriers. Place fixed equipment behind earth berms;
- Include clauses in tenders, subcontractor agreements and work method statements that assure the minimization of noise and compliance with directions from management to minimize noise;
- Regularly train workers and contractors (such as at toolbox talks) to use equipment in ways that minimize noise;
- Ensure that site managers periodically check the site, nearby residences and other sensitive receptors for noise problems so that solutions can be quickly applied;
- Keep truck drivers informed of designated vehicle routes, parking locations, acceptable delivery hours and other relevant practices (e.g. minimizing the use of engine brakes and engine idling); and
- Minimize the use of reversing alarms by designing the site layout to avoid reversing, such as by including drive-through for parking and deliveries.
- Ensure the site office is manned 24 hours per day so that complaints can be logged and follow up responses initiated.

Night-time Mitigation Measures

- Minimize the need for reversing alarms; and
- Avoid metal-to-metal contact on equipment.

The Community Liaison Committee will also provide a forum to discuss issues such as quarry and ship loading noise and offer opportunities to find innovative solutions to local concerns. A noise notification procedure will be discussed and, if found to be warranted, implanted at the site. Such a procedure may include for example:

- Provide information/advance notification to neighbors before and during construction through media such as letterbox drops or meetings;
- Defining activities that are expected to be noisy and their expected duration, what noise mitigation measures are being applied, and when noise respite periods will occur; and
- Upon request, residents will be alerted to upcoming production shots (blasts) via automated telephone notifications (“robo-calls”).

7.2.5.2 *Monitoring*

The staged development of the quarry means that there is scope to monitor noise emissions as the quarry expands and to include additional noise mitigation in the later stages if required to comply with the noise limits at the site boundary.

As required by the NSE Pit and Quarry Guidelines, all blasts will be monitored to ensure overpressure and vibration levels remain within maximum acceptable limits. This monitoring would be used to develop site-specific propagation constants to enable refinement of the blast overpressure and vibration predictions as the quarry develops. In this manner, blast designs can be adopted that comply with the overpressure and vibration limits at sensitive receivers throughout the life of the quarry.

As part of the workplace health and safety program, noise monitors will be attached to workers on a regular basis to measure and monitor noise exposure over an eight hour shift.

At the request of NSE, additional noise monitoring may be undertaken during daytime, evening and night-time during the early operational phase to verify compliance with regulatory guidelines. Methodologies will follow those described in the Nova Scotia Department of Environment and Labour Guidelines for Environmental Noise Measurement and Assessment (NSEL 1990).

The Noise and Vibration Technical Report (**Appendix D**) identifies indicative offset distances between a blast and the ocean to meet the underwater noise and vibration limits defined in Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters (Wright and Hopky 1998). These indicative setback distances will be refined following monitoring of initial test blasts at the site. Depending on their proximity to ocean habitats, these initial blasts may need to be designed to limit their intensity. Initial blasts would identify the site-specific vibration transmission characteristics to enable blast design to comply with the underwater noise and vibration limits.

The Project is expected to have a low adverse residual impact on ambient noise. Table 7.2-3 provides a summary of the residual environmental effects and demonstrates the Project is not likely to have significant adverse effects on Noise and Vibration.

Table 7.2-3:
Residual Environmental Effects for Noise

Project Environment Interaction	Potential Residual Environmental Effects A=Adverse P= Positive	Mitigation	Magnitude	Geographic Extent	Duration / Frequency	Reversibility	Ecological / Socio-Economic Context	Residual Effect	Significance of Residual Effect
Construction									
Site Preparation, Trucking	A	See Mitigation Section	1	2	3/3	R	1	Increased ambient noise	Not Signif.
Operation of the Temporary Processing Plant	A	See Mitigation Section	1	2	3/6	R	1	Increased ambient noise	Not Signif.
Initial Blasting	A	See Mitigation Section	2	3	3/3	R	2	Increased ambient noise	Not Signif.
Marine Terminal Construction	A	See Mitigation Section	1	1	3/2	R	2	Increased ambient noise	Not Signif.
Marine Construction Vessel Operation	A	See Mitigation Section	1	2	3/2	R	1	Increased ambient noise	Not Signif.
Operation (Full Scale Phase 5)									
Operation of the Permanent Processing Plant	A	See Mitigation Section	1	1	1/4	R	1	Increased ambient noise	Not Signif.
Operation of the Shiploader	A	See Mitigation Section	2	2	5/3	R	1	Increased ambient noise	Not Signif.

Blasting	A	See Mitigation Section	2	3	5/4	R	1	Increased ambient noise	Not Signif.
Marine Vessel Operation	A	See Mitigation Section	1	1	5/3	R	1	Increased ambient noise	Not Signif.
Decommissioning									
Decommissioning activities are expected to be comparable to construction activities. Therefore, the same analyses apply.								Increased ambient noise	Not Signif.

Legend

Magnitude:
U= Unknown - An environmental effect affecting an unknown portion of a population or group or where the changes in a specific parameter are unknown.
0 = Nil - No environmental effect.
1 = Low (e.g., specific group, habitat, or ecosystem localized 1 generation or less, within natural variation)
2 = Medium (e.g., portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside the range of natural availability)
3 = High (e.g., affecting entire stock, population, habitat or ecosystem, outside the range of natural variation)

Geographic Extent:
1 = < 1 km^2
2 = 1 – 10 km^2
3 = 11 – 100 km^2
4 = 101 – 1,000 km^2
5 = 1,001 – 10,000 km^2

Duration:
1 = < 1 month
2 = 1 – 12 months
3 = 13 – 36 months
4 = 37 – 72 months
5 = > 72 months

Frequency:
1 = < 11 events/year
2 = 11 – 50 events/year
3 = 51 – 100 events/year
4 = 101 – 200 events/year
5 = > 200 events/year
6 = continuous

Reversibility:
R = Reversible
I = Irreversible

Ecological / Socio-Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity.
2 = Evidence of adverse environmental effects.

N/A = Not applicable
A = Adverse
P = Positive

7.3 AMBIENT LIGHT

Ambient light was identified in the EIS Guidelines as a potential VC. The Project site is currently undeveloped and night time ambient light conditions are low. As the site is developed into a quarry, artificial light will be introduced in the form of vehicle headlights, work area illumination lighting, and lights installed on the marine terminal to ensure safe navigation. Changes to ambient light conditions have the potential to negatively affect wildlife, including birds from the immediate area as well as those birds from much further away. Increases in night time light levels may also be perceived as a nuisance by local residents.

The lighting design for the quarry has not yet been completed but it is possible to make assumptions about the location and intensity of the site lighting. Site lighting will consider the following:

- Safety of those working on the site;
- Government regulations and design standards;
- Equipment and layouts that minimise the impact of new lighting on the surrounding environment; and
- Equipment and layouts that maximise the efficiency of the lighting system.

Details of ambient light existing conditions on the Project site are presented in Section 6.3.

7.3.1 Boundaries

7.3.1.1 *Temporal Boundaries*

The temporal boundaries for the assessment of impacts upon ambient light begin at the construction phase and continue through the operational phase, ending with the final decommissioning of the quarry. Construction time is estimated at three years, quarry operations are expected to continue for at least 50 years and closure and decommissioning is expected to require an additional two years but may be extended if needed.

7.3.1.2 *Spatial Boundaries*

The spatial boundaries for the assessment of this VC include the Project footprint, adjacent lands to the east and west (the Affected Area - up to and including residents along Half Island Cove and in Fox Island Main) and Chedabucto Bay south of the established shipping lanes.

7.3.1.3 *Technical Boundaries*

Under the Canada Labour Code, the minimum illumination levels required at various workplace locations are directed by the *Canada Occupational Health and Safety Regulations* (SOR/86-304). To the extent that migrating birds may be affected by the Project, the federal *Migratory Birds Convention Act 1994* and the *Species at Risk Act* are applicable.

7.3.1.4 *Administrative Boundaries*

No administrative boundaries were identified for the Ambient Light VC.

7.3.2 Threshold for Determination of Significance

On human receptors the adverse effects of light trespass are due both to an increase in general illuminance that may cause annoyance and may disrupt sleeping patterns, and from the direct view of the light source that can cause glare issues. The adverse effects of light trespass from exterior lighting are influenced by a number of factors:

- The topology of the area. Light trespass is more likely to be perceived as obtrusive if the lighting installation is located above the observer. Lighting installations are usually directed towards the ground and an observer could hence have a direct view of the luminaire.
- The surrounding topography and existing installations. Hills, trees, buildings, fences and vegetation generally have a positive effect by shielding the observer from the light source.
- Pre-existing lighting in the area. Light from a particular light source is seen as less obtrusive if it is located in, or perceived in, an area where the lighting levels are already high, e.g. along roads and near built up areas. .
- The zoning of the area. A residential area is seen as more sensitive compared to commercial areas where high lighting levels are seen as more acceptable.
- Time of use. Clearly light will be seen as being more obtrusive during night time. This is generally considered to be between 11:00pm and sunrise.

A significant impact is defined as direct light trespass that according to the affected resident regularly interferes with the use and enjoyment of nearby residential properties on a permanent basis and/or evidence of unacceptable levels of bird mortality associated with Project lighting (unacceptable levels are defined in Section 7.3.5.1).

7.3.3 Effects of the Project of Ambient Light

7.3.3.1 *Construction*

With the installation of safety lighting, ambient light levels will increase during the construction of the processing plant, associated infrastructure and the marine terminal. Other lighting introduced to the site will come from vehicle headlights moving around the site as well as entering and exiting the site at the intersection with Route 16.

Temporary lighting systems (including portable lights) may be used during construction to illuminate specific areas and ensure the safety of staff.

As vehicles enter and exit the site, vehicle head lights could be aimed in directions other than on the road. The intersection of Route 16 and the quarry access road is approximately halfway between the nearest residences to the east and west. The vegetation at the sides of the road in this area is quite dense so there should be no light trespass from headlights onto the closest buildings.

7.3.3.2 *Operation*

Potential Effects on Residents

In addition to permanent safety lighting and vehicular headlights, ambient light levels will increase during the operation of stockpiles, load-out facility and marine terminal.

The following areas will require new lighting as part of the operational phase of the Project. Included is the minimum illumination required for those areas (taken from the Canada Occupational Health and Safety Regulations (SOR/86-304), Section 6.11).

1. Marine terminal – an illumination of 150 lux[4] is required.
2. Crusher and processing areas – an illumination of 100 lux is required for the immediate area and 50 lux in the nearby surrounding area.
3. Other work areas – While not specifically referred to in the regulations it is likely that these areas will require at least 200-500 lux depending on how each work area is defined.
4. Site Offices – Offices should have an illumination of 100 lux around the exterior of any entrances and 50 lux around other exterior areas.
5. Roadways – These require 20 lux in high activity areas and 10 lux in low activity areas.
6. Storage areas - These require 30 lux in high activity areas and 10 lux in low activity areas.
7. Parking – Open parking areas should have an illumination of at least 10 lux.

The processing plant and stockpiles will be built on the northern side of the site near the coast at 22 metres above sea level (masl). From here, the quarry will be excavated south towards Route 16. Between the lower coastal platform hosting the processing plant and Route 16, the ground rises to 50 masl and to maximum of about 95 masl. This will provide significant shielding from the east southeast clockwise around to the west southwest and should mean that there will be no significant light trespass on any buildings along Route 16.

There are some buildings along the coast that may have direct line of sight to the marine terminal and, to a lesser degree, main work area. From the west (Yellow Rocks/Half Island Cove Road), the topography prevents direct line of sight view to the quarry, processing plant and marine terminal, except for viewers standing directly on the coast and those who may look toward Black Point from the east side of Gaulman Point. From these vantage points, the marine terminal and stockpiles will be visible, but the quarry will be largely concealed behind a vegetated coastal buffer. Lower Half Island Cove Beach on the east side of Gaulman Point is about 2.9 km from the marine terminal.

There are two topographic ridges between the Property boundary and the houses along Half Island Cove Road. These ridges block direct views from these houses to all work areas. The nearest residence (an abandoned trailer currently for sale) is located approximately 750 m from the property boundary and over 900 m from work areas.

[4] Lux is the SI unit of luminance and luminous emittance as perceived by the human eye.

To the east, direct line of sight viewers are located on the east side of Indian Cove along Fox Island Cove Road. Black Point can also be seen from the beach at Indian Cove, located 3.5 km east of the proposed processing plant. From this direction, much of the processing plant, quarry and marine terminal is expected to be shielded from view by Black Point itself (which is not part of the quarry property and which will remain forested), as well as a 30 m wide vegetated buffer left along the coast. It is likely the tallest components of the processing plant (conveyers, tops of stockpiles, and lighting fixtures) may be visible from these eastern viewpoints.

Potential Effects on Fauna

Reflected light is used by animals to collect a wide range of information within their environment. At night, many nocturnal animals use moonlight and starlight to forage for food and detect predators. Objects in the night sky may be used as aids to navigation for migrating birds. Patterns of light and darkness are also used to regulate circadian cycles; to control the behavior of diurnal, nocturnal and crepuscular animals[5]; to determine day length; and as a directional cue for navigation (Gaston *et al.* 2012).

Lighting needed to illuminate working areas and for navigational purposes at the marine terminal can have an adverse effect on migrating birds. Under conditions of poor visibility, nocturnal migrating birds may be attracted to bright lights. Under cloudy or foggy conditions water droplets in the air refract light creating an illuminated area around the lights. Birds that have lost their celestial navigation aids may enter these illuminated areas and become confused possibly resulting in collisions, exhaustion and mortality (JWEL 2004). Environment Canada has noted that in Atlantic Canada, nocturnal migrants and night-flying seabirds (e.g. storm-petrels) are the birds most at risk of attraction to lights. Attraction to lights may result in collision with lit structures or their support structures, or with other birds. Disoriented birds are prone to circling a light source and may deplete their energy reserves and either die of exhaustion or drop to the ground where they are at risk of depredation.

Strong unidirectional or rotating light sources are most likely to create this problem. Flood lights are associated with bird mortality since the strong lighting attracts birds close to the lighted structure where collisions occur. Navigational beacons may also affect birds since this lighting is typically positioned at heights where night migrating birds are more likely to encounter them. Solid or pulsing red navigation beacons have the strongest ability to attract birds while slow strobe lights have the weakest ability (JWEL 2004).

Decreasing the duration of lighting may alleviate some but not all impacts on nocturnal and crepuscular animals, since peak lighting demand periods often coincide with the peak activities of these species (Gaston *et al.* 2012). Reducing lighting trespass will maintain shadows in otherwise well-lit areas, providing dark refuges that animals can make use of. Decreasing lighting intensity will limit both skyglow (thus reducing the risk to migrating birds) and reduce the surface area impacted by high-intensity direct light. Lowering light intensity also reduces the trespass of reflected light into otherwise unlit areas. Flexible lighting control systems can also be used to mitigate ecological impacts by providing dark periods of sufficient duration for normal ecological function (Gaston *et al.* 2012).

[5] Diurnal animals are most active during the day; nocturnal animals are most active at night; crepuscular animals are most active at dusk and dawn.

7.3.3.3 *Decommissioning*

The effects on ambient light during the decommissioning phase of the Project are anticipated to be similar to construction.

7.3.4 Mitigation and Monitoring

The lighting design will aim to mitigate light trespass from the site and minimise the increase in ambient lighting. At this early development stage mitigation techniques are relatively easy to incorporate into equipment design and work area layouts. In order to achieve the best performance outcome for the quarry while having a minimal impact on the surrounding environment both general and site specific mitigation measures are described.

7.3.4.1 *General Mitigation*

The following general mitigation methods can be incorporated into the detail design to minimise adverse effects of the lighting installations.

- Use luminaires that are aimed to minimise light trespass, e.g. full cut off luminaires where no light is emitted above the horizontal plane (where their use does not compromise worker safety). Less trespass light means that more of the light output can be used to illuminate the area and a lower power output can be used. The energy consumption for the fitting can thus be reduced without decreasing the illuminance of the area (**Figure 7.3-1)**.

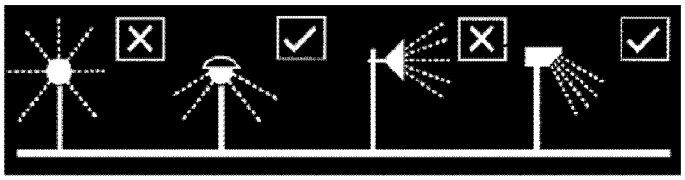

Figure 7.3-1:
Minimise Light Trespass

- Do not waste energy and increase light pollution by over-lighting; use only the lights needed to meet local lighting objectives.
- Keep glare to a minimum by keeping the main beam angle less than 70°, where practical (**Figure 7.3-2**).

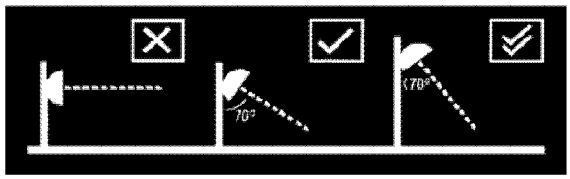

Figure 7.3-2:
Minimise Glare

- Use floodlights with asymmetric beams where possible.
- Direct the site lighting away from sensitive locations such as residential properties.
- Where possible position lights as far away from site boundaries as practical.

7.3.5 Site Specific Mitigation

Bird collisions with Project lighting and subsequent mortality are expected to be rare but if it occurs, it would not likely have significant effects on migrating bird populations. Even so, efforts will be made to reduce the effect of lighting on migrating birds. Lighting requirements at the marine terminal will be more fully defined at later stages in the Project design. Where possible, lighting will be kept at low heights to reduce the chance of illuminating migrating birds as they pass through the area. Pole mounted lighting will be pointed downward and shielded from the top and sides. To the extent possible, low intensity lighting will be used rather than high intensity lighting.

In an effort to minimise the light trespass from the site and the increase in ambient light, the following mitigation measures will be employed where warranted and where their use does not compromise worker safety:

- As noted above, all lighting will be aimed down as much as possible and light sources will be shielded to prevent light escaping above the horizontal plane (known as full cut off luminaires). Lights will also be kept as close to the required area as possible.
- Lights placed on the outside of the quarry work areas will be kept as low as possible and correctly aimed to prevent lighting areas where it is not needed.
- Lights for the marine terminal will be chosen and aimed to prevent where possible light shining directly into the water. Marine terminal lighting will be controlled so that minimal lighting will be used when the terminal is not in operation.
- If lighting is required at the perimeter of the site it will be aimed inward to prevent off site light trespass. Full cut off luminaires will be considered to reduce and prevent off site light trespass.
- Temporary lighting used during construction will be focussed on the intended work area and will be shielded to minimize spillage.
- To reduce night time ambient lighting effects, operations will be routinely monitored so that lighting can be switched off by work area when it is not needed.
- Consideration will be given to using light sources such as directional LEDs to give a better spread of lighting and reduce the overall intensity of the lighting systems.
- The emission spectrums of light sources can vary depending on the bulb type; certain lights can have a greater effect on some species of wildlife. Consideration will be given to selecting lights that have a lesser effect on the wildlife to help reduce lighting effects on nocturnal species.

7.3.5.1 *Monitoring*

Should complaints regarding Project lighting be received at the site office, monitoring of site activity will be undertaken to allow for reduction of light levels in non-active work areas, and/or redirection of lighting installation. In addition to the Complaints / Response Protocol established at the site office, the CLC will provide a forum to register concerns and discuss them with Project representatives.

Routine site monitoring as described in the Environmental Management Plan will include maintaining records of bird mortality so developing issues related to lighting can be identified.

The Environmental Management Plan will include instructions on implementing the protocol "*Best practices for stranded birds encountered offshore Atlantic Canada*" (EC 2014e) for responding to avian strandings related to activities in the marine environment. It is noted that a permit is required to implement this type of protocol; prior to proposed activities, the proponent will contact EC-CWS (email: Permi.atl@ec.gc.ca) to obtain a permit application form.

In the event of the mortality or injury of ten or more migratory birds in a single event, or of any number of species at risk birds, EC-CWS will be notified within 24 hours. Notification will include specific details about the event, including the name and location of the facility, number and species of birds affected, meteorological conditions during the previous night(s), status of lights/flares, and details of any other factor which may have influenced the event. If significant lighting-related bird fatalities are recorded, EC-CWS will be consulted to discuss additional mitigation measures.

7.3.6 Residual Effects and Significance

The ambient lighting on the site will be increased during the construction and operation of the quarry. This may be noticeable at first since the site is currently undeveloped and the only ambient lighting is of natural origin. Increases in ambient light levels and associated effects of light increases on nearby residents and wildlife can be minimized through effective lighting design and lighting layout, combined with ongoing monitoring of site activity to allow for reduction of light levels in non-active work areas when needed.

It is unlikely that surrounding properties and buildings will experience significant adverse effects due to light trespass from the site or vehicle headlights entering and exiting the site. This is largely due to the distance between the properties and the site as well as shielding from the local vegetation and natural topographic and landscape features.

The result of the effects assessment for the ambient light VC is provided in Table 7.3-1: the Project is not likely to have significant adverse effects on Ambient Light.

Table 7.3-1:
Residual Environmental Effects for Ambient Light

Project Environment Interaction	Potential Residual Environmental Effects A=Adverse P= Positive	Mitigation	Magnitude	Geographic Extent	Duration / Frequency	Reversibility	Ecological / Socio-Economic Context	Residual Effect	Significance of Residual Effect
Construction									
Light trespass from the temporary plants	A	See Mitigation Section	1	1	3/3	R	2	Increased ambient light	Not Signif.
Light trespass from the construction of the marine terminal including marine construction vessel operation	A	See Mitigation Section	1	2	3/6	R	2	Increased ambient light	Not Signif.
Operation (Full Scale Phase 5)									
Light trespass from the permanent plant	A	See Mitigation Section	1	2	5/6	R	2	Increased ambient light	Not Signif.
Light trespass from other site lighting including the marine terminal	A	See Mitigation Section	1	2	5/6	R	2	Increased ambient light	Not Signif.
Marine Vessel Operation	A	See Mitigation Section	1	1	5/4	R	2	Increased ambient light	Not Signif.
Decommissioning									
Decommissioning activities are expected to be comparable to construction activities. Therefore, the same analyses apply.								Increased ambient light	Not Signif.

Legend

Magnitude:
U= Unknown - An environmental effect affecting an unknown portion of a population or group or where the changes in a specific parameter are unknown.
0 = Nil - No environmental effect.
1 = Low (e.g., specific group, habitat, or ecosystem localized 1 generation or less, within natural variation)
2 = Medium (e.g., portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside the range of natural availability)
3 = High (e.g., affecting entire stock, population, habitat or ecosystem, outside the range of natural variation)

Geographic Extent:
1 = < 1 km^2
2 = 1 – 10 km^2
3 = 11 – 100 km^2
4 = 101 – 1,000 km^2
5 = 1,001 – 10,000 km^2

Duration:
1 = < 1 month
2 = 1 – 12 months
3 = 13 – 36 months
4 = 37 – 72 months
5 = > 72 months

Frequency:
1 = < 11 events/year
2 = 11 – 50 events/year
3 = 51 – 100 events/year
4 = 101 – 200 events/year
5 = > 200 events/year
6 = continuous

Reversibility:
R = Reversible
I = Irreversible

Ecological / Socio-Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity.
2 = Evidence of adverse environmental effects.

N/A = Not applicable
A = Adverse
P = Positive

7.4 GEOLOGY, SOIL AND SEDIMENT QUALITY

7.4.1 Overview

There is no evidence to suggest that contaminated soils or sediment are present on the site. Geology, Soil and Sediment quality was identified as a VC primarily due to the anticipated disturbance of potentially acid generating rock, as well as concerns expressed by fishermen with respect to the discharge of sediment-laden water from the Project site and the consequent effects on lobster and their habitat. Sediment quality is described here while marine water quality is described in Section 7.6 and effects on marine species in Section 7.11.

7.4.2 Boundaries

7.4.2.1 *Temporal Boundaries*

With respect to the disturbance of potentially acid generating rock, Project-related effects to Geology, Soil and Sediments may occur during the construction phase when this rock is originally exposed, and the during the early operations phase until the rock stabilizes in an oxygenated environment. With respect to potential discharge of sediment-laden water (and by extension, to offshore sediment quality), potential Project-related impacts may occur during construction, operation and decommissioning.

7.4.2.2 *Spatial Boundaries*

Project-related effects are not expected within the Project Area (i.e., within the Property boundary) but may be observed in the marine environment immediately offshore (the Affected Area). The extent of the Affected Area is defined by the zone within the marine environment where elevated concentrations of acidified surface water and/or suspended sediment may be measured above background values, or in the case of suspended sediments, above values that are typically observed during storms and other high wave events.

7.4.2.3 *Administrative Boundaries*

In Nova Scotia, activities that may result in acid rock drainage, as well as the management of excavated acid generating rock itself, are regulated by the *Sulphide Bearing Materials Disposal Regulations*. Additional guidance is provided in Guidelines for Development on Slates in Nova Scotia (NSE and EC 1991).

There are no marine sediment quality criteria as such. Maximum values for total suspended solids in water in the marine environment are provided in the CCME (1999) Water Quality Guidelines for the Protection of Aquatic Life (Marine). The Nova Scotia Pit and Quarry Guidelines also provide liquid effluent discharge criteria for suspended solids (NSEL 1999). Please see Section 7.6 for a full description of these criteria and their applicability to the Black Point Project.

7.4.2.4 *Technical Boundaries*

Although a number of rock samples from the Project site have been analyzed for sulphur content to determine acid generating potential (Appendix B), a sampling program as outlined in

the *Sulphide Bearing Materials Disposal Regulations* has not been completed due to difficulty in accessing the coastal area of this undeveloped property. Additional sampling and geotechnical study is planned once access is available, as described below. For the purposes of this assessment, it is assumed that the Halifax Formation rocks are potentially acid-generating and thus will require appropriate management.

Given anticipated results of the topographic modifications on surface drainage patterns described below, no sediment dispersion modeling in the marine environment was deemed necessary to predict environmental effects on marine sediment quality.

7.4.3 Threshold for Determination of Significance

Rocks that exhibit total sulphide content in excess of 0.4%, and which lack other minerals that can neutralize acidity as measured through chemical analysis, are considered potentially acid generating. A significant effect would be an accidental release of low pH, acid rock drainage (pH <4.5) to the marine environment.

With respect to sediment quality, a significant effect would be an accidental release of total suspended solids in excess of the maximum values listed in the CCME (1999) Water Quality Guidelines for the Protection of Aquatic Life (Marine) and/or the Nova Scotia Pit and Quarry Guidelines (NSEL 1999).

7.4.4 Effects of the Project on Geology, Soil and Sediment Quality

The granite rock that will be quarried for aggregate is not acid generating. In contrast, Halifax Formation sedimentary rocks that underlay a small portion of the site (approximately 11.8 of 28.2 ha, see Figure 3.0-26) near the coast may generate acid and/or leach metals when exposed to oxygen. Excavation of Halifax Formation rocks will be required in preparation for the installation of the processing plant and aggregate stockpiles. Five of the six surface samples of rocks collected in the coastal zone and analyzed in 2011 had a sulphide content below the 0.4% threshold. One sample had a sulphide content above the threshold (i.e., 0.935%); however, the material was found to contain some neutralizing capacity with a pH of 7.4. At this time, it is assumed that disturbance of this rock may leach metals and/or generate acid, which if allowed to drain naturally to the marine environment, may negatively affect water quality in the local area. Despite this, the disturbed surface area will be relatively small (i.e., 11.8 ha). Surface water runoff will collected in stormwater ponds where it will be retained for use as wash water and further diluted by precipitation, runoff from non-acid generating areas, and runoff from non-disturbed areas. Given this, water in the stormwater ponds is not expected to be acidic or contain metals. In the event an accidental release to the marine environment occurs, rapid dilution in the nearshore will result and so no significant effects to marine water quality or biota are expected.

As noted, sedimentation in the marine environment has been identified by fishermen and nearby coastal residents as a potential concern, since the discharge or runoff of sediment-laden water during construction and operation may have harmful effects on nearby lobster habitat or lobster life stages. In addition, residents and fishermen have expressed concern regarding the transport of suspended sediment along the shore and into neighbouring bays.

Only a small portion of ground cover on the coastal platform will be disturbed during initial construction (20.7 ha – **Figure 3.0-26**). This limited disturbance, combined with the

maintenance of a 30 m wide buffer at the coast and the use of standard construction erosion and control measures will help prevent sediment laden runoff from entering the marine environment. More importantly, during the ground preparation for the processing plant and product storage areas the ground surface will be contoured so that storm water runoff and process water used to wash the aggregate will flow back into the property and be collected in sumps or impoundments. Based on this design significant effects to the marine environment are not anticipated.

There is a risk of small amounts of aggregate spillage during the transfer of material from the terminal onto the ships. This is not anticipated to have significant effects on the marine environment since the aggregate is washed to remove fine rock fractions, thus minimizing the sediment that would be released to the environment in the event of a spill. The material that would be released during a spill will consist of granite, a rock type common in the area.

7.4.5 Mitigation & Monitoring

7.4.5.1 *Mitigation*

A geotechnical drilling and sampling program will be required for the detailed design of processing plant foundations. The sampling program will define areas that contain rocks that are potentially acid generating when excavated. Standard mitigation measures used to manage acid generating rock will be applied. This will include controlling and containing drainage, and managing excavated rock to prevent further oxidation. This may include placing the excavated rock underwater to prevent oxidation and acid generation. This option will be explored with NSE and DFO if additional sampling and analysis demonstrates the presence of significant volumes of acid generating rock.

These mitigation and control measures will be described in the site-specific Environmental Management Plan. The Environmental Management Plan will also describe standard construction best management practices and will include Erosion and Sediment Control Plan and a Stormwater Management Plan to describe erosion control measures and surface water collection and control at the site.

Initial site preparation activities require the construction of stormwater management ponds and a protective berm along coast, inside a 30 m undisturbed coastal buffer. This is followed by contouring and sloping of the processing plant/stockpile area (i.e., the entire coastal platform, excluding a 30 m coastal buffer) so that surface water flows south to settling ponds rather than north to Chedabucto Bay. Once quarry expansion begins in a southerly directly, a sump pit will be excavated to collect water within the quarry. The water collected will be used for dust control and aggregate washing. The capacity of the sump pit will be adequate to contain the collected water so that discharges due to normal operations will not be required. There is the possibility that as a result of extreme storm events a portion of the water would need to be discharged following settling and clarification. In these events, the discharge will be fully controlled and will be tested to ensure it meets applicable water quality requirements prior to discharge. Given these topographic modifications and the excessive storage volumes thus created, the possibly of accidental, unmonitored discharges is essentially eliminated.

7.4.5.2 *Monitoring*

To ensure that discharges meet maximum limits listed in the applicable guidelines described above, as well as in the provincial operating permit that will be required for this Project, stormwater pond discharges will be monitored on an as-needed basis, as stipulated in the provincial permit.

7.4.6 Residual Effects & Significance

With the use of standard mitigation measures in the event that acid generating rock is present, no significant adverse residual effects are likely with respect to acid drainage and sedimentation in the marine environment. Residual effects are summarized in Table 7.4-1.

Table 7.4-1:
Residual Environmental Effects for Geology, Soils and Sediment

Project Environment Interaction	Potential Residual Environmental Effects A=Adverse P= Positive	Mitigation	Magnitude	Geographic Extent	Duration / Frequency	Reversibility	Ecological / Socio-Economic Context	Residual Effect	Significance of Residual Effect
Construction									
Preparation of the plant area; impacts to marine water quality from acid rock drainage	A	See Mitigation Section	1	1	1/1	R	1	Surface water discharge to the marine environment	Not Signif.
Preparation of the plant area; impacts to marine water quality from sediment discharge	A	See Mitigation Section	1	1	1/1	R	1	Surface water discharge to the marine environment	Not Signif.
Operation (Full Scale Phase 5)									
Discharge from the sedimentation ponds	A	See Mitigation Section	1	1	1/1	R	1	Surface water discharge to the marine environment	Not Signif.
Decommissioning									
Decommissioning activities are expected to be comparable to construction activities. Therefore, the same analyses apply.								Surface water discharge to the marine environment	Not Signif.

Legend

Magnitude:
U= Unknown - An environmental effect affecting an unknown portion of a population or group or where the changes in a specific parameter are unknown.
0 = Nil - No environmental effect.
1 = Low (e.g., specific group, habitat, or ecosystem localized 1 generation or less, within natural variation)
2 = Medium (e.g., portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside the range of natural availability)
3 = High (e.g., affecting entire stock, population, habitat or ecosystem, outside the range of natural variation)

Geographic Extent:
1 = < 1 km^2
2 = 1 – 10 km^2
3 = 11 – 100 km^2
4 = 101 – 1,000 km^2
5 = 1,001 – 10,000 km^2

Duration:
1 = < 1 month
2 = 1 – 12 months
3 = 13 – 36 months
4 = 37 – 72 months
5 = > 72 months

Frequency:
1 = < 11 events/year
2 = 11 – 50 events/year
3 = 51 – 100 events/year
4 = 101 – 200 events/year
5 = > 200 events/year
6 = continuous

Reversibility:
R = Reversible
I = Irreversible

Ecological / Socio-Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity.
2 = Evidence of adverse environmental effects.

N/A = Not applicable
A = Adverse
P = Positive

7.5 GROUNDWATER RESOURCES

7.5.1 Groundwater Resources

Groundwater extracted from dug and drilled wells is used for drinking water purposes by the nearest residents living to the east, west and south of the Project site. A total of 23 residences are located in the vicinity of the Project (within 2 to 3.5 km); of these, 17 employ dug wells while 6 employ drilled wells. No water wells are installed in the granite rock that will be quarried.

Three distinct hydrostratigraphic units have been identified in the vicinity of the Project: (1) the granite bedrock present within the Property boundary and extending outside the boundary to the limits of the local granite pluton[6] The limits of the granite pluton are shown on **Figure 6.1-6**. A certain degree of connectivity is expected between the water bearing fractured granite and (2) the fractured metasedimentary bedrock that surrounds the local granite pluton, and (3) a relatively shallow, unconfined aquifer situated within the granular glacial till overburden where present overlying the bedrock.

7.5.2 Summary of Conceptual Hydrogeologic Model

The site is characterized by the topographic high created by an erosion resistant granitic pluton, some 95 m above sea level and extending to depth. This feature was intruded up into metasediments of the Meguma Formation and is the target for aggregate extraction. The metasediments surround the site and granite and host six residential wells that extend into the bedrock. Seventeen shallow private wells tap the more permeable glacial till overburden. Wells are found from 1.0 to 3.5 km away, the nearest being 815 m to the southwest.

Groundwater quality in the two bedrock types (granite and metasediments) is similar with the exception of higher levels of dissolved metals (e.g., iron, aluminium and lead) in the granite. As noted there are no water supply wells in the granite. Naturally occurring uranium is present in the granite at concentrations consistent with distribution of this element in granite rock formations throughout Nova Scotia (MacDonald *et al.* 1992; Ford and Ballantyne 1983). Arsenic is present in the groundwater in both the granite and the metasediments. The metals present in the bedrock are entirely from natural mineralization. The overburden groundwater is much more dilute, reflects local recharge of meteoric water, and exhibits a salt signature close to the marine shore (Section 6.1).

The relatively low permeability of the bedrock (even when fractured) at this site restricts surface water movement to depth and is responsible for the high water table, which is generally never deeper than 6 m below ground surface. Groundwater recharge occurs in all the upland areas of the site, with lateral discharge occurring in localized low areas and in some creeks. Horizontal groundwater flow is outward from the granite, primarily along the upper more weathered bedrock. Fracture frequency analysis shows there is a stronger presence of fracturing in the upper granite bedrock, typically above about 40 m. This line is in fact gradational and fracturing occurs throughout the geologic profile. Stream water quality shows little influence of the bedrock. The distinct difference in the metals concentrations between the granite and the metasediments indicates there is little mixing of groundwater between the two rock types.

[6] A pluton is a discrete, well defined body of igneous intrusive rock.

There will however be exchange of the shallow groundwater along the boundary between the two units, based on the higher degree of fracturing at the bedrock surface. All local water wells are very far away from this boundary and there are many intervening wetlands and creeks that act as discharge zones.

From a conceptual model point of view most groundwater recharge joins the shallow unconfined groundwater system and moves laterally to onsite low areas and ultimately offsite via creek systems. An analysis of the water budget (**Appendix A)** compares the average annual recharge to the ability of the ground to convey it. The groundwater flow was calculated based on measured hydraulic conductivity, lateral hydraulic gradients and the depth of fracturing (and thickness of overburden where present). The "water-in to water-out" balanced very well for this conceptual model. The fractured portion of the granite can easily convey recharge falling on the pluton to wetlands and creeks located at lower elevations. The overburden on the flatter lands surrounding the pluton can also convey a large portion of the infiltrating precipitation, and the fractured bedrock below can accommodate the remainder.

As described in **Appendix A**, a conservative approach for the impact assessment assumes an elevated hydraulic conductivity (1.2×10^{-7} m/s) extending to depth throughout the quarry. Under these assumptions the drawdown from the completed quarry will be felt at a distance of 400 m or less from the quarry face. Realistically, the average hydraulic conductivity is likely less than the upper range assumed above, and fracture density (and hence transmissivity) decreases significantly at depth, suggesting drawdown is not likely to be observed at 400 m from the quarry face.

7.5.3 Boundaries

7.5.3.1 *Temporal Boundaries*

Changes to groundwater will occur during the construction phase but are expected to be more pronounced during quarrying, especially during the latter phases when the quarry is approaching maximum lateral extent and depth. The finished (closed) quarry will continue to affect local groundwater flow patterns into the future.

7.5.3.2 *Spatial Boundaries*

Project-related changes to localized groundwater can be expected within the Project Area (i.e., within the Property boundary) since granite will be quarried within this area. Effects of granite removal on the groundwater regime may extend to areas immediately offsite (the Affected Area). The extent of the Affected Area is defined by the maximum limit of the drawdown cone at full quarry build out. A drawdown cone is defined as the area where the water table is lowered due to the quarry, and is typically conical in shape with the degree of drawdown reducing exponentially away from the quarry. The drawdown cone is constrained by the rate of recharge in the Affected Area, may be irregularly shaped depending upon geologic conditions, and does not extend great distances in these types of rocks. In this case, the drawdown cone will not extend to the nearest drilled well (please see below) and so the Affected Area falls between the property and nearest residence.

7.5.3.3 *Administrative Boundaries*

Potable groundwater quality and surface or groundwater water takings greater than 23 m^3/day are regulated by the Province of Nova Scotia. For municipal water supply systems, the province in 2000 adopted the Guidelines for Canadian Drinking Water Quality to ensure that potable water meets national water quality standards (HC 2012). Large scale water takings (much larger than required for residential use) are regulated in the provincial *Activities Designation Regulations*. Water taking is permitted as long as an adverse unmitigable impact does not occur.

7.5.3.4 *Technical Boundaries*

Although preliminary drawdown tests were conducted on boreholes installed in the granite within the limits of the property, these holes were not designed as groundwater monitoring wells but rather to gather samples of the granite resource. Because the boreholes were not screened to restrict groundwater flow into the well, it is not possible to precisely determine the depths in which groundwater was entering the borehole. In addition, the relatively narrow diameter holes did not permit the use of a sufficiently powerful pump to fully stress the water bearing fractures. Despite this, data collected during the summer work programs provide sufficient information to confirm the conceptual model of the local groundwater system, and provided reasonably reliable data regarding the hydrogeological characteristics of the granite aquifer.

With respect to the residential wells, very little information is available regarding the construction of dug and drilled wells. This is not seen as a limitation, given the distance away of the wells and the intervening features that dictate a lack of connection with the site.

Very few drilled water supply wells are present in the vicinity of the Project Area, and with a single exception, all are found east or west of the Property, at a minimum distance of 2.7 km. The lack of groundwater wells within the granite, combined with the paucity of drilled wells in the vicinity and their distance from the Project site, limits the applicability of data collected at these residential wells when investigating the zone near the pit where Project impacts might occur.

The sheer size of the site dictates that investigation points are widely spaced. However the similarity of conditions and uniformity of findings where examples have been investigated allows the analyst to extrapolate conditions with minimal risk.

7.5.4 Threshold for Determination of Significance

As noted, groundwater quality and quantity contributes to local ecological systems as well as to potable groundwater supply. With respect to local ecological systems, a significant effect is defined as a decrease in groundwater supply to Affected Areas by 20% and/or an impairment in water quality such that groundwater discharge to surface waterbodies no longer meets Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (CCME 1999 as updated).

With respect to potable water supply, a significant effect is defined as any decrease in water availability caused by the Project and/or impairment to water quality such that the potable water no longer meets the criteria listed in Guidelines for Canadian Drinking Water Quality.

7.5.5 Effects on Groundwater

Groundwater can play an important role in sustaining streams and wetlands and the habitats and wildlife that depend on them. Project activities also have the potential to affect groundwater supply and quality outside of the Property boundary. Groundwater is also a potential pathway that can transport contaminants offsite, although in this instance, groundwater will be flowing *towards* the site.

The Project will remove granite from within the Property boundaries, ultimately creating a pit approximately 130 m deep. Once pit development begins, surface precipitation that originally landed on the granite, infiltrated surface fractures, and flowed laterally to help recharge wetlands and lakes near the Property boundaries, will be redirected into the pit and collected in the main sump. At the same time, granite will be removed from below the groundwater table and groundwater inflows to the pit will also be collected in the main sump. Initially, the redirection of surface and groundwater will be minimal since the pit will be small and shallow. As the pit develops over time this effect will become more pronounced as more surface and groundwater is diverted away from existing flow patterns and into the pit. Ultimately, the pit itself acts to draw groundwater from the surrounding granite, since the empty pit represents a region of low pressure towards which groundwater will naturally flow.

Despite this, the magnitude and environmental effects of the redirection of surface and groundwater are expected to limited and localised. Currently, precipitation falling on 54.7% of the site's surface area is directed by topography to the north, and is lost to Chedabucto Bay through surface water runoff and groundwater flow. This accounts for all precipitation (minus evapotranspiration) within catchment areas F1-F4, M1 and N1-N6 (**Figure 6.2-1**). Some of these catchments, such as F2 and M1, provide surface water and shallow groundwater recharge to Fogherty and Murphys Lake, and the wetlands associated with these lakes before discharging into Chedabucto Bay. Flow from the remaining 45.4% of the site is directed south to tributaries of Reynolds Brook. The portion of the site that will be developed into the quarry contributes 18% of the flows within catchment of Reynolds Brook above Hendsbee Lake will be developed into the quarry. At full development, this surface water will be captured in the pit and will no longer flow to Reynolds Brook.

Under these circumstances, it can be seen that the precipitation falling on roughly 50% of site's surface supports local, rather than regional, ecological features and functions (i.e., on-site and adjacent wetlands and waterbodies) before discharging into the ocean. Removal of granite will, over time, affect local groundwater flows to the north, and by extension, these local wetlands and waterbodies will be affected by the loss of surface water and shallow groundwater recharge.

Precipitation falling on the remaining 50% of the site flows south and contributes to Reynolds Brook. This includes that portion that infiltrates into the groundwater system. However, this overall contribution is small compared to the size of the catchment area that drains to Reynolds Brook. Even at full pit build out, with the maximum amount of surface water diverted into the pit and away from Reynolds Brook is only about 18% of the total Reynolds Brook catchment area measured at the inflow to Hendsbee Lake. The lands adjacent to the pit will continue to contribute locally to offsite watercourses and wetlands; however base flow in these watercourses will be lower at the Property boundary. Given the size of the catchment area removed (portions of subcatchments S1 and S3 totalling 106 ha) compared to the overall watershed that drains to the Hendsbee Lake to the southwest (578.5 ha) is relatively small

(18%), the overall Project impact on groundwater flow to the south, and by extension to downstream features and functions in a southerly direction is considered to be not significant.

With respect to potential Project effects on the localised surface water aquifers that support dug wells, no Project-related impacts are expected. This is because these aquifers are fed by surface precipitation falling within the subcatchment that hosts the wells and not by precipitation falling on areas that will be developed for the Project. As shown on **Figure 6.2.1**, none of the subcatchments affected by Project activities host dug wells and so no effects are possible.

For those who use drilled bedrock wells to obtain potable groundwater, the conceptual groundwater model, supported by groundwater quality data and initial hydraulic conductivity testing, demonstrates that Project-related impacts to potable groundwater supply and quality will be negligible. This can be seen by considering the following:

1. There is no potable groundwater wells drilled in the granite.

2. Drilled wells within the highly fractured metasedimentary rocks access a chemically different groundwater than the one present within the granite (the bedrock unit that will be affected by the Project). These aquifers are not only chemically different, they are structurally different. While certain connectivity can be expected at the boundaries between the granite and metasedimentary bedrock, the fact that the water chemistry is different indicates that the connectivity is minimal and slow to occur.

3. Drill logs indicate that the granite does not exhibit a great number of fractures at depth and so water movement within is expected to be slow. Even at full pit build out, a thick barrier of granite (over 400 m wide) will remain between the pit wall and nearest metasedimentary bedrock where drilled wells are located (even further away). This thick barrier helps to isolate Project-related effects within the granite from affecting the aquifer tapped by wells in the metasedimentary bedrock.

4. The nearest drilled groundwater well is located 815 m from the 50-year pit boundary, far outside of the maximum potential drawdown cone resulting from the pit (400 m); the next nearest drilled well is more than 2.5 km from the pit boundary. The sheer distance provides a significant measure of security for drilled wells in the vicinity of the Project.

5. As noted, because the groundwater movement within the granite is expected to be limited, no groundwater dewatering will be needed to prevent groundwater inflow into the pit (inflows will be simply collected in the sump). The lack of active dewatering wells means that the cone of influence is limited the zone caused by passive drainage into the pit.

Together, these factors demonstrate that impacts to groundwater feeding nearby dug and drilled wells will be not significant.

7.5.6 Mitigation & Monitoring

7.5.6.1 *Mitigation*

With respect to potential effects on nearby groundwater users, no mitigation measures are proposed at this time since no effects are predicted. In the event that unexpected impacts are detected in the groundwater monitoring program (described below), mitigation measures can be

implemented as required, depending on the nature of the impact. Such measures may include for example, provision of drinking water or artificial recharge near affected ecologic features. In addition, as described in more detail in Section 7.8, wetland and watercourse alteration permits will be required in advance of any damage to these features. The permitting process requires that damaged wetlands are replaced elsewhere through a Wetland Compensation Plan; if this is not feasible or desirable, then other forms of compensation may be considered.

7.5.6.2 *Monitoring*

An adaptive groundwater monitoring program is proposed for the life of the quarry, or until it can be conclusively demonstrated that the quarry will have no measurable effects on potable water quality or quantity. A total of ten pairs of wells may be monitored over the life of the Project; the program would use newly installed wells as well as existing boreholes are present on the site. The wells would be installed over time as the quarry expands, rather than all at once. As the results become known and actual quarry drawdowns compared against predicted values, monitoring well locations can be optimized or eliminated and monitoring frequency reduced if no effects are observed. The groundwater monitoring program is described in more detail in **Appendix A.**

Each groundwater monitoring station would consist of at least a pair of drilled monitoring wells into the bedrock. One of the two wells would be equipped with a water level monitor in the upper 10 m of bedrock (the weathered zone), while the second well would be drilled to the anticipated final quarry depth. Packer testing would be used to select an appropriate permeable horizon within the deeper well to host a water level monitor. If the overburden is found to be substantive and water bearing, a shallow standpipe would be installed in the overburden for monitoring purposes.

The first two sentry well pairs to the south and east of the five year quarry face would be drilled in year zero to establish and monitor the drawdown condition to the south and east of the quarry face, since quarry expansion between years zero and five will occur in the south and easterly directions. If drawdown effects are observed in the eastern well, a third well pair would be installed in year three or four at 400 m east from the quarry face to again test the predicted drawdown condition. Should no effects be measured at 50 m, then no wells would be required at 400 m.

All groundwater monitors would be tested for field permeability for comparison to the original studies. Additional well pairs to the south and west would be installed progressively over the years in keeping with quarry expansion and depending on results of previous well testing, as shown in **Appendix A**.

Groundwater monitoring would consist of seasonal (quarterly) water level measurements plus the use of dataloggers in key sentry wells in line with residential wells. Since no impacts are predicted on private wells over a kilometre away and there is a high level of confidence with this prediction, no private well monitoring program is proposed at this time. However, the groundwater monitoring program is adaptive and if drawdowns at the sentry wells were greater than predicted, additional sentry wells could be added and/or a private well monitoring program could be instituted if deemed necessary following discussions with NSE. Once seasonal baseline conditions (water quality and water level fluctuations) are established the results would be used to determine future seasonal monitoring frequency.

Two baseline water samples per year would be collected, one each in the wet and dry seasons. Samples would be analysed for a basic suite of water quality parameters. Water quality samples would be taken again if/when quarry effects are observed in the sentry wells to determine if the drawdown has had adverse effects on water quality. The need for future water quality sampling would be re-evaluated based on these initial results.

Each well location would be monitored seasonally for a minimum of two years to establish variations over differing meteorological conditions. At the end of two years, the results of program would be discussed with NSE to determine if changes to monitoring frequency and future well locations are warranted.

The monitoring of ground-to-surface water interaction will be achieved using the existing shallow drive point piezometers located in key wetlands plus in Fogherty and Murphys Lakes. The objective of this program is to establish if there is a drying out of wetlands from their baseline conditions. Water level monitoring would be undertaken at the same frequency as in the groundwater monitors but no water samples would be taken. This methodology is non-intrusive to the ecologic features and largely employs drive point piezometers already in place.

In summary, the adaptive groundwater monitoring approach is designed to verify the drawdown predictions described above and in **Appendix A**. It will be progressively implemented as the quarry expands over time and has the additional advantage of being adaptive and flexible, in terms of well locations and monitoring effort, to initial results. This in turn results in a groundwater monitoring program that is reflective of actual quarry expansion and measured Project effects on groundwater.

7.5.7 Residual Effects and Significance

Once the quarry is completed the excavation will be allowed to flood and equilibrate with the existing water table. A residual drawdown cone will result. The depth of the flooded area below the present water table is about 75 m, implying a 300-400 m wide drawdown cone of irregular shape. No residual effects on local wells are predicted (the nearest drilled well is 815 m from the 50-year pit face). Wetlands and watercourses in the 300-400 m area may be affected by some form of depletion by leakage of water out through the groundwater. The significance of this will be in the form of a transition of vegetation types from wetland to upland around the margins of the wetlands closest to the pit, with the effect receding with distance from the pit. Residual effects are summarized in Table 7.5-1.

Table 7.5-1:
Residual Environmental Effects for Groundwater

Project Environment Interaction	Potential Residual Environmental Effects A=Adverse P= Positive	Mitigation	Magnitude	Geographic Extent	Duration / Frequency	Reversibility	Ecological / Socio-Economic Context	Residual Effect	Significance of Residual Effect
Construction and Operation									
Quarry expansion over 50 years; reduction in groundwater recharge to offsite surface water features; changes to water quality	A	See Mitigation Section	1	1	5/6	R	1	Limited reduction in groundwater recharge to offsite surface water features	Not Signif.

Legend

Magnitude:
U= Unknown - An environmental effect affecting an unknown portion of a population or group or where the changes in a specific parameter are unknown.
0 = Nil - No environmental effect.
1 = Low (e.g., specific group, habitat, or ecosystem localized 1 generation or less, within natural variation)
2 = Medium (e.g., portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside the range of natural availability)
3 = High (e.g., affecting entire stock, population, habitat or ecosystem, outside the range of natural variation)

Geographic Extent:
1 = < 1 km^2
2 = 1 – 10 km^2
3 = 11 – 100 km^2
4 = 101 – 1,000 km^2
5 = 1,001 – 10,000 km^2

Duration:
1 = < 1 month
2 = 1 – 12 months
3 = 13 – 36 months
4 = 37 – 72 months
5 = > 72 months

Frequency:
1 = < 11 events/year
2 = 11 – 50 events/year
3 = 51 – 100 events/year
4 = 101 – 200 events/year
5 = > 200 events/year
6 = continuous

Reversibility:
R = Reversible
I = Irreversible

Ecological / Socio-Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity.
2 = Evidence of adverse environmental effects.

N/A = Not applicable
A = Adverse
P = Positive

7.6 MARINE AND SURFACE WATER RESOURCES

7.6.1 Overview

Surface Water Resources including watercourses and lakes on and immediately adjacent to the site are considered to be a VC because they sustain aquatic and support terrestrial ecosystems, convey stormwater, and can either recharge groundwater resources or drain excess groundwater away from an area. Marine water quality may be negatively affected by sediment laden water in the form of discharge or stormwater runoff. Acid rock drainage generated from the disturbance of Halifax Formation rocks may also affect marine water quality. Good quality water is essential to the wellbeing of a large variety of marine organisms, and is also critical to the long term success and sustainability of the commercial fishery.

Potential impacts of the proposed quarry development upon the baseline hydrological regime are twofold. Firstly, the development may impact upon the baseline hydrological regime by increasing or decreasing flows to, or water levels within surface water resources. This in turn may impact upon established aquatic ecosystems, or (during extreme events) additional runoff may increase the risk of flooding within the downstream environment. Secondly, the development may impact upon the quality of surface water which may in turn affect established aquatic ecosystems.

Details of potential impacts to wetlands are presented in Section 7.8 (Wetlands), while anticipated effects to freshwater and marine species and habitats are described in Section 7.10 and 7.11, respectively. Section 7.4 (Geology, Soil and Sediment Quality) addresses discharges to the marine environment from acid generating rock and sediment-laden stormwater.

7.6.2 Boundaries

7.6.2.1 *Temporal Boundaries*

The temporal boundaries for the assessment of impacts upon surface water resources are the construction phase (two to three years) and the operational lifetime of the development (50 years). The impacts of climate change have been considered up to 70 years into the future.

7.6.2.2 *Spatial Boundaries*

The spatial boundaries used for the impact assessment are local (within the site boundary called the Project Area), extending to surface watercourses immediately adjacent that receive drainage from the Project site (the Affected Area). In addition, a more regional boundary is described, which includes potential effects to downstream watercourses within 2 km of the property boundary, provided these watercourses currently receive drainage from the site. In this case, only Reynolds Brook and Hendsbee Lake to the south are located within this regional boundary.

7.6.2.3 *Administrative Boundaries*

The Nova Scotia *Contaminated Sites Regulations* refers to a number of Ministerial Protocols which include numerical Environmental Quality Standards (EQS). These Standards are

applicable for comparison of analytical results of any spills of petroleum hydrocarbons which may occur on the property.

The Canadian Environmental Quality Guidelines published by Canadian Council of Ministers of the Environment (CCME) are also applicable (i.e., CCME Canadian Water Quality Guidelines for the Protection of Aquatic Life, both freshwater and marine – CCME 1999).

The Nova Scotia Pit and Quarry Guidelines also provide liquid effluent discharge criteria that are applicable to this Project, in this case for suspended solids (NSEL 1999).

7.6.2.4 *Technical Boundaries*

No numerical or quantitative modeling was undertaken to assess the impacts of the development on baseline water quality, instead a qualitative assessment is presented. No technical boundaries were identified for the Surface Water Resources VC.

7.6.3 Threshold for Determination of Significance

Water Quantity

The quarry development has the potential to impact upon the baseline hydrology in the following ways:

- Mean Annual Runoff – As noted, alteration of topography / drainage routes, removal of topsoil / vegetation, and use of water for processing may impact the volumes of runoff discharged from the site, thereby affecting downstream flow-dependent receptors such as streams and wetlands. A significant impact is defined as a predicted change in the mean annual runoff within any off-site watercourse, or flow into any water body, which changes by 20%.
- Peak Flow – Project-related alterations to topography and drainage may increase the peak storm flow discharged from the site thereby increasing the risk of downstream flooding. A significant impact is defined as a predicted change in peak flow of water discharged from the site which will measurably increase the risk of flooding to downstream watercourses.

Water Quality

The use of fuels, lubricants and explosives at the site and disturbance of soils and bedrock has the potential to negatively affect water quality discharged from the site thereby impacting downstream receptors. A significant adverse impact on water quality is defined as repeated or sustained surface water discharge from the site exceeds the liquid effluent discharge standards in the Pit and Quarry Guidelines (NSEL 1999) or criteria listed in the CCME Canadian Water Quality Guidelines for the Protection of Aquatic Life, both freshwater and marine (CCME 1999).

The Pit and Quarry Guidelines (NSEL 1999) stipulate that:

> "All storm run-off from the operating site and all liquid effluents resulting from the operation shall be collected and treated to meet the following suspended solids concentrations prior to discharge into a watercourse or beyond the property boundaries:

(a) maximum suspended solids concentration in an grab sample – 50 mg/l;

(b) maximum arithmetic monthly average suspended solids concentration - 25 mg/l"

CCME Guidelines for water quality (1999) recommend the following suspended solids criteria for the protection of aquatic life (both freshwater and marine):

- Clear flow: maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maximum average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
- High flow: maximum increase of 25 mg/L from background levels at any time when background levels are between 25 and 250 mg/L. Should not increase more than 10% of background levels when background is ≥ 250 mg/L.

For contaminated surface water (i.e., such as might exist following a hydrocarbon spill or other incident at the site) environmental quality standards (EQS) have been developed by NSE and a list of potential contaminants of concern is also available (NSE 2014). NSE's Table 3 Tier 1 Environmental Quality Standards for Surface Water (ug/L) is applicable at this site. Table 3 provides criteria for a variety of potential contaminants in both fresh and marine surface waters. All criteria are for the protection of aquatic life.

7.6.4 Effects on Surface Water Resources

Freshwater

Of the total site area, the development will affect approximately 180 ha of quarry and a 28 ha coastal platform for the processing plant and aggregate stockpiles. The vegetation and soils in these areas are likely to be stripped leaving bare rock surfaces and thereby increasing the volume and peak rate of runoff discharged from the site.

Following development, the mean annual runoff is expected to increase by 10% on average across the 354.5 ha site, giving an increase in annual runoff from 1 865 592 m^3 to 2 171 500m^3 when the site is fully developed (**Appendix C**).

Measures are recommended to convey runoff from operational areas to retention ponds reducing the number of discharge points from the site. The mean annual runoff from catchments N4, N5 and S3 (**Figure 6.2-1**) will be increased significantly. The mean annual runoff of catchment F4, M1, N2, N3 and N6 will be reduced as flow is diverted from these to catchments N4, N5 and S3.

The impact upon the hydrological regime of off-site surface water resources is expected to be as follows:

- Murphy's Lake – the mean annual runoff into this water body is expected to be reduced by about 15% at full pit build out.
- Watercourse 3 – the mean annual runoff discharged from the site into this watercourse is expected to be reduced by 70% as development of the pit progressively redirects runoff away from this watercourse and into the pit sump. This watercourse discharges into a wetland that eventually drains to Reynolds Brook. At full build out, the quarry will occupy

106 ha or 18% of the Reynolds Brook catchment above Hendsbee Lake, which has a surface area of 578.5 ha at the inflow to Hendsbee Lake.

- South-West (off-site) Watercourse – the mean annual runoff from the site into this watercourse is expected to decrease by 5%. This watercourse and Reynolds Brook are tributaries to Hendsbee Lake.

Stripping of vegetation and soils across the site is expected to lead to an increase in the peak flows leaving the site by 11% for a 1:25 year event and 8% for a 1:100 year event while the volume of runoff generated post development will be increased by 17% for a 1:25 year event and 13% for a 1:100 year event.

The increase in peak flow and flood volumes attributable to the development are relatively minor and given that there are no downstream watercourses susceptible to flooding, these increases are not considered significant. Therefore, it is not considered necessary to attenuate peak flows on-site to ensure that the pre-development discharge rates are not exceeded.

It is not possible to quantitatively assess the un-mitigated impact of the development upon the baseline water quality conditions. Nonetheless qualitatively the impacts could be as follows:

- Geochemistry – quarrying may expose elements naturally occurring within soils and geology to rainfall and oxidation, potentially mobilizing elements into any discharge from the site. From the water quality monitoring it can be seen that pH is low and aluminum, iron and lead are already found at elevated levels within the surface water environment. On the other hand, whole rock chemistry data collected on site indicates the granite is chemically stable and ideally suited to aggregate production.
- Ammonia and Nitrate - the use of Ammonium Nitrate-Fuel Oil (ANFO) blasting agents leave explosives residues high in ammonia and nitrate within areas where blasting has occurred. These dissolved compounds are easily mobilised by runoff.
- Suspended Solids – quarrying activities will include vegetation removal potentially increasing concentrations of suspended solids within stormwater runoff. Dust will be produced when rock is blasted and later crushed; when this dust comes into contact with stormwater runoff, increased suspended solids concentrations may result.

Since surface water flows will be collected in sedimentation ponds and pit sumps, both of which can overflow harmlessly in the event of a prolonged storm event (Section 3.3.7), the operation will permit water quality monitoring and treatment as needed prior to controlled discharge. The volume of sedimentation ponds and sump pits will be sufficient to contain water on-site for reuse. Given these considerations, no significant adverse effect on surface water quality is predicted.

Marine Water

The potential Project-related effects on marine biota are described in Section 7.11 (Marine Species and Habitats). Section 7.4 (Geology, Soil and Sediment Quality) addresses discharges to the marine environment from acid generating rock and sediment-laden stormwater.

Surface water flows that currently discharge north into Chedabucto Bay will be diverted into retention ponds near the processing plant and additionally (later) into a pit sump located in the quarry floor. Approximately 55% of the Black Point Project site currently flows north into the

Bay. The retention of this water and use for dust suppression and aggregate washing will not affect the water quality or water chemistry in Chedabucto Bay.

Surface water that collects in the ponds and sump is retained until suspended particles settle out of the water column. Water will not be discharged on a continuous basis; when discharge is required to lower the level in the ponds or sump, water will be tested to ensure it meets water quality standards listed in the operating permit, which in turn will be based on the guidelines cited in Section 7.6.3 (Threshold for Determination of Significance) above. Apart from potential effects described elsewhere in the EIS, no Project related effects on Marine Water Resources are anticipated.

7.6.5 Mitigation & Monitoring

In order to reduce the potential impacts of the development on the baseline surface water environment as identified above, the following mitigation measures will be applied:

- Retention or sedimentation ponds will be used near the processing plant while the quarry pit will employ sumps to collect water inflows. Topographic controls (sloping the ground to the south) will ensure that overflow, should it occur, will collect against the south cliff and in the pit, rather than be permitted to discharge directly to the ocean;

- Double walled and or/fully bermed fuel and chemical storage reservoirs will be used;

- The Environmental Management Plan will include a discrete Erosion and Sediment Control Plan to ensure the proper management of stormwater flows during construction and operation. The EMP will also contain a Stormwater Management Plan that describes the construction and operation of drainage swales and stormwater management ponds.

- The EMP will include an Emergency Response and Spill Contingency Plan combined with incident prevention and emergency response training to minimize the risk of accidental spills and to rapidly react to any incident that may occur;

- The Emergency Response and Spill Contingency Plan will include spill dispersion modelling in the marine environment to aid in rapid and effect emergency response.

- The Proponent will contract with a local emergency response consultant to ensure that additional resources and expertise are available in the event of an accidental spill in the marine environment;

- To mitigate reductions in surface flows that supply nearby wetlands, the Proponent in collaboration with NSE implement a Wetland Compensation Plan and associated inspection/monitoring program; and

- All surface water discharges from retention ponds and pits will be sampled as per requirements listed in the industrial operating permit and the Pit and Quarry Guidelines to ensure water quality conforms to applicable guidelines.

7.6.6 Retention Ponds

Runoff from the working areas of the quarry and associated infrastructure will be conveyed to flow retention ponds as shown in the Figures of the Surface Water Assessment Technical Report (**Appendix C**). These retention ponds will be constructed upstream of the final discharge point to improve the quality of any water discharged from the site. Two ponds, each with a volume of approximately 6,000 m^3 are proposed for the processing plant area, while a pit sump will contain water generated within the quarry proper. These features are connected through pumps and piping, allowing water transfer between them to ensure that stormwater can be managed and aggregate wash water is always available.

The retention ponds will be designed in accordance with Nova Scotia Department of the Environment Erosion and Sedimentation Control Handbook guidelines (NSE 1988) to intercept sediment laden runoff and allow sediment to settle out, thereby reducing the amount of sediment leaving the disturbed area and protecting local watercourses and Chedabucto Bay from excessive sedimentation.

The proposed design features are as follows:

- Permanent Pool – a permanent volume of water will be retained within the pond at all times to ensure treatment of stormwater discharged from the site. The permanent pool will be sized to contain at least 190 m^3 per ha of catchment. Based on the mean annual runoff, this equates to at least 11 days of residence time within the pond prior to discharge.
- Flood Conveyance – flood events up to and including a 1:100 year event + 16 % to account for increases in precipitation due to climate change can be conveyed through the pond. Discharge will occur via pumps from the pit once water testing has been conducted.

For the purposes of stormwater management, the quarry development will progress in two phases, and measures will be implemented accordingly:

- Initial Construction: Construction of the lower platform and access road, years 1-3 (2017-2020). During this phase, runoff from the lower coastal platform area (28 ha) will be conveyed to Plant Pond 1 and Plant Pond 2 situated against the south side of the lower platform. Discharge (if needed) will be into the marine environment, likely via the western property limit. Water will be re-used for processing or tested to ensure water quality guidelines are met and discharged when needed.
- Operations: Not including initial quarrying for site preparation, full quarrying will commence in year 3 (2020), progressing from north to south. Runoff and infiltration within the quarry will be collected within sumps (ponds) with excessively large volumes to ensure sufficient water is available for processing. Discharge would only be effected following analysis, and if needed, treatment.

As noted, the settling ponds and pit sump are designed to serve as an integrated water management system, allowing transfer of water between them to ensure ample processing water is available and allowing treatment of stormwater prior to discharge. At this stage of the Project, the above measures and design detail are considered preliminary, based on current designs. The drainage strategy will be revisited during the detailed site design that precedes permitting.

7.6.7 Fuel and Chemical Storage

All fuels and chemicals stored or used on site will be contained within fit-for-purpose containers and stored within designated storage areas. In order to prevent pollution of the surrounding environment due to an accidental spillage, the designated storage areas will be situated on impermeable surfaces with containment provided. The volume of the berm and sump will be sized to contain at least 110% of the largest tank being stored within the designated storage area, as per fuel storage regulations.

7.6.8 Monitoring

The normal operating procedure will be to reuse water within the operation and not have direct discharges to Chedabucto Bay. In the event a discharge is needed, the water will be sampled prior to discharge and the sample submitted for laboratory testing, as described in the Surface Water Monitoring Program included within the Environmental Management Plan. The sampling and testing will be done in accordance with site discharge monitoring requirements applicable to the operation. The analysis will include parameters required by the effluent discharge standards of the Nova Scotia Pit and Quarry Guidelines (NSEL 1999) and any other parameters or conditions listed in the industrial operating permit.

Where monitoring results exceed the guideline values listed in the Pit and Quarry Guidelines, a review of site activities will be undertaken to identify the source of pollution and remedial measures will be implemented.

The success of the Wetland Compensation Plan will be monitored over time as determined in collaboration with NSE; other water features not directly included in the Plan will be inspected to detect hydrological changes potentially caused by the Project – the frequency and timing of these inspections will be outlined in the Plan.

7.6.9 Residual Effects & Significance

Taking into account the mitigation measures outlined above, the residual impacts of the development are:

- Mean Annual Runoff – stripping of vegetation and soils from the operational areas is expected to increase the mean annual runoff discharged from the site by 10%. Much of this will flow north into Chedabucto Bay as is currently the case. Given this, the impacts on nearby surface water resources and associated downstream aquatic ecosystems are not considered to be significant (i.e., less than 20% change). Diversion of flows into sumps and retention ponds will reduce flows to some off site surface water resources (Murphys Lake and Reynolds Brook) and increase flows to others. The impacts of these changes will be felt slowly as the quarry development proceeds. Estimates indicate that there may be 15% decrease to Murphy's Lake by year 20 although the exact timing is difficult to predict. With respect to Reynolds Brook and Hendsbee Lakes, the effects from gradually reduced inflows as surface water is diverted into the quarry will be not significant, given that current flows from the site make up only about 18% and 13% of total flows to these water features, respectively.
- Peak Flow – vegetation and soil removal from operational areas is expected to increase the peak flows leaving the site by 13% for a 1:25 year and 16% for a 1:100 year event. Post development runoff volume will be increased by 18% for both 1:25 and 1:100 year

events. Given that these increases are relatively minor and that there are no downstream receptors susceptible to flooding, the impacts of these effects are not considered to be significant.

- Water Quality – Standard pollution prevention measures will be adopted at site to prevent accidental spills. Runoff from the working areas of the quarry and associated infrastructure will be conveyed to flow retention ponds and sumps. The retention ponds and sumps will allow the water to be reused on-site for dust control; discharges will be restricted to periods of extreme storm events. These discharges will be sampled and tested to ensure the applicable discharge standards are achieved. Given this, the residual adverse impacts on surface water are not expected to be significant.

Table 7.6-1:
Residual Environmental Effects for Surface Water

Project Environment Interaction	Potential Residual Environmental Effects A=Adverse P= Positive	Mitigation	Magnitude	Geographic Extent	Duration / Frequency	Reversibility	Ecological / Socio-Economic Context	Residual Effect	Significance of Residual Effect
Construction									
Preparation of the plant area; impacts to fresh and marine water quality and habitats from erosion, siltation and accidental spills	A	See Mitigation Section	1	1	1/1	R	1	Changes to surface water quality	Not Signif.
Operation									
Impacts to fresh and marine water quality and related environments from erosion, siltation and accidental spills	A	See Mitigation Section	1	1	1/1	R	1	Changes to surface water quality	Not Signif.
Effects to on-site watercourses, Murphys Lake and Reynolds Brook from diversion of surface and groundwater into the pit over time	A	See Mitigation Section	1	2	5/6	I	1	Limited reduction in flow; potential improvement in water quality	Not Signif.
Decommissioning									

Decommissioning activities are expected to be comparable to construction activities. Therefore, the same analyses apply.	Changes to surface water quality; Creation of new freshwater habitat	Not Signif./Positive

Legend

Magnitude:
U= Unknown - An environmental effect affecting an unknown portion of a population or group or where the changes in a specific parameter are unknown.
0 = Nil - No environmental effect.
1 = Low (e.g., specific group, habitat, or ecosystem localized 1 generation or less, within natural variation)
2 = Medium (e.g., portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside the range of natural availability)
3 = High (e.g., affecting entire stock, population, habitat or ecosystem, outside the range of natural variation)

Geographic Extent:
1 = < 1 km^2
2 = 1 – 10 km^2
3 = 11 – 100 km^2
4 = 101 – 1,000 km^2
5 = 1,001 – 10,000 km^2

Duration:
1 = < 1 month
2 = 1 – 12 months
3 = 13 – 36 months
4 = 37 – 72 months
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Frequency:
1 = < 11 events/year
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3 = 51 – 100 events/year
4 = 101 – 200 events/year
5 = > 200 events/year
6 = continuous

Reversibility:
R = Reversible
I = Irreversible

Ecological / Socio-Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity.
2 = Evidence of adverse environmental effects.

N/A = Not applicable
A = Adverse
P = Positive

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7.7 TERRESTRIAL ECOSYSTEMS, HABITAT AND VEGETATION

This section discusses the potential impacts of the Project on terrestrial habitat, as well as vascular plants and non-vascular vegetation. Freshwater aquatic vascular plants are also included here because of expected similarity of effects and mitigation to those for terrestrial vegetation. Marine vegetation is discussed in Section 7.11 and flora SAR is discussed in Section 7.12. Effects on terrestrial flora are a pathway to other VECs including wetlands, SAR, wildlife, hunting or gathering activities, and land-use. These are discussed respectively in Sections 7.8, 7.12, 7.9, 7.13 and 7.14.

7.7.1 Boundaries

The spatial boundaries include all terrestrial habitats within the Black Point Quarry property boundary including the access road.

The temporal boundaries will include all three phases of the Project including construction, operation and decommissioning. No administrative or technical boundaries were employed in the effects assessment of this VC.

7.7.2 Threshold for Determination of Significance

A significant adverse effect on terrestrial habitat and vegetation would be a decline in abundance and/or a change in distribution beyond which natural recruitment (reproduction and immigration from unaffected areas) would not return the population to its pre-project level within several (3-5) generations.

7.7.3 Effects on Terrestrial Habitat and Vegetation

7.7.3.1 *Construction*

Most if not all of the direct interactions between the Project and terrestrial vegetation will occur as a result of the ground disturbance and other activities associated with the construction phase and progressive development of the Quarry. As described in the Project Description (Section 3.0), the construction phase of the Project is planned in a phased approach where portions of the site will be progressively cleared the open pit mine expanded. Despite this temporal component of the construction activities, this assessment examines the effects construction activities will have on terrestrial vegetation regardless of when, relative to the life of the project, these effects will occur.

Construction activities associated with the Project will result in temporary or permanent adverse effects on terrestrial and freshwater aquatic flora. Potential detrimental effects to terrestrial flora will result from site preparation (clearing/grubbing/grading/blasting), road, power line and building construction, and may also be caused by associated dust, erosion/sedimentation, and possible introduction of invasive species. Potential adverse effects on terrestrial and aquatic flora, habitat, communities, and individuals during construction may also occur as a result of accidental events. Effects can be limited to the footprint of the Project, or extend to adjacent lands as indicated below. Specifically, during construction, potential adverse effects on vegetation and habitat include:

- Direct and indirect mortality of plants;
- Temporary or permanent loss or alteration of habitat and habitat availability;
- Impairment from changes to wind exposure and microclimatic conditions; and
- Mortality or impaired growth due to accidental events.

Mortality of Plants and Loss or Alteration of Habitat

Site clearing/grubbing/grading will result in the removal of vegetation. This represents a loss of availability of vegetation habitat, as well as direct mortality of the vascular and non-vascular plants in the area affected. For the purpose of this EA, it is assumed that all the existing vegetation in the entire footprint of the Black Point Quarry, fill areas and plant location will be permanently lost over the lifetime of the Project (over 50 Years), though the development may integrate small amounts of habitat, such as amenity green space (ornamental plantings and turf). Habitat loss within the footprint of the Project area will amount to 212.48 ha (including wetland habitat); however, since the open pit development is progressive over the life of the quarry, the entire 213 ha will not be exposed until the last few years of quarry operations. Site rehabilitation will enable partial recovery of habitat at that time. Lay-down areas will be located within the planned footprint and therefore will not require additional space. As the quarry activities progress, the affected habitats will be replaced with exposed soil / rock surfaces and buildings. In sections where quarrying has been completed, site rehabilitation measures will be implemented to initiate re-vegetation in exposed areas that will not be disturbed further by the operation.

Clearing may also change wind exposure and microclimatic conditions in adjacent forests, resulting in some die-off and reduced growth of forest species until edge vegetation matures. The area surrounding the Project site consists of primarily open habitat including a mix of forest, barren and tall shrub habitat and as such there is little potential for this type of edge effects on forests.

These effects are not considered to be significant for common flora populations, and no mitigation beyond standard environmental protection measures is recommended.

Erosion and Sedimentation

Clearing and grubbing required for all Project components, results in disturbed soil surfaces without cover of vegetation. Exposed soil is vulnerable to erosion, and the resulting sedimentation may smother vegetation or impair plant growth in adjacent terrestrial and aquatic habitats. With the implementation of standard sediment and erosion control measures as outlined in Section 7.4, effects on common terrestrial and aquatic vegetation are not considered significant, and no further specific mitigation is recommended.

Fugitive Dust

Earthwork, movement of construction and transportation machinery, and storage of soil and construction materials may result in development of fugitive dust. The deposition of dust on the leaf surfaces of near-by vegetation may have temporary inhibiting effects on photosynthesis and transpiration in the affected plants, potentially resulting in slower growth rates. Noticeable dust

deposition is expected to not exceed a few metres. Standard dust-abatement measures and measures for the protection of air quality as outlined in Section 7.1 will reduce the effects of dust on vegetation in all habitats. Given the site's climate (relatively frequent and extensive precipitation, these effects are not considered to be significant for common vegetation, and plants will recover. No special mitigation is recommended.

Spills, Malfunctions and Accidents

The potential effects of spills, malfunctions and accidents and recommended mitigation measures are discussed in more detail in Section 7.18. Spills could directly kill vegetation and also create soil conditions unsuitable for vegetation growth.

7.7.3.2 *Operation*

No significant direct effects (mortality, loss of habitat) on vegetation communities are expected during operation beyond those associated with the progressive quarry development as discussed above for the construction phase. Possible adverse effects on terrestrial and aquatic flora of a minor nature may, however, occur due to fugitive dust, road maintenance and traffic. There is also potential for adverse effects on flora during operation from spills and accidental events, which are further discussed in Section 7.18.

During operation, potential adverse effects on flora habitat, communities and individuals include:

- Fugitive dust;
- Impairment from chemicals; and
- Mortality or impaired growth due to accidental events.

Fugitive Dust

Effects on terrestrial and aquatic flora during the operation phase of the project are similar to the construction phase. These effects are not considered to be significant for common vegetation, and plants will recover. No special mitigation is recommended.

Increased Levels of Toxic and Deleterious Substances (Salt)

Road salt used on roads within the Black Point Quarry may adversely affect immediately adjacent terrestrial vegetation and soil quality. Salt will be used sparingly and only when crushed stone cannot be used effectively. With the application of mitigation measures, significant adverse effects on vegetation from road salt are not expected.

Spills, Malfunctions and Accidents

The potential effects would be similar to construction, above.

7.7.3.3 *Decommissioning*

Potential effects of Project activities during the decommissioning phase are somewhat similar to the potential effects during the construction phase. Re-vegetation of reclaimed areas after the decommissioning of the pit, facilities and roads will occur. This activity will have positive effects on the vegetation of the area by initiating re-establishment of vegetation in disturbed areas.

Temporary adverse effects on terrestrial and freshwater aquatic flora, habitat, communities and individuals could occur from infrastructure removal and associated soil disturbance, associated dust, erosion and sedimentation. Potential adverse effects on flora could also arise from spills and accidental events, further discussed in Section 7.18.

7.7.4 Mitigation & Monitoring

A general set of environmental mitigation measures specific to the three project phases (construction, operation, decommissioning/rehabilitation) will be defined in an Environmental Management Plan (EMP). The EMP will also establish monitoring plans to ensure mitigation measures are implemented and effective. Specific monitoring commitments are also specified in the summary table below (Table 7.7-1). The following mitigation measures are recommended specifically to avoid and minimize impacts on terrestrial habitat and vegetation:

During Construction:

- Reduce area of Project footprint and temporary lay-down areas to that which is absolutely necessary;
- Mark Project boundaries to prevent accidental impacts outside the work area;
- Remove/ and salvage topsoil (i.e., approximately upper 30 cm); store separately and reuse for site restoration where possible;
- Control erosion and sedimentation as outlined in Section 7.4;
- Dust-prevention measures and dust abatement measures outlined in Section 7.1, will also protect local flora and habitats;
- Stabilize and rehabilitate areas of disturbance;
- Use local native vegetation in restoration – consideration will be given to the preferential use of vegetation types of interest to the Mi'kmaq; and
- Efficacy of the erosion and sediment control measures, as well the establishment of native flora should be monitored through an EMP (see Section 10.0).

During Operation:

- Vegetation management will be conducted by mechanical cutting (e.g., mower, brush cutter);
- Mitigation measures for the protection of watercourses (see Section 7.6 and 7.10) will help to protect terrestrial and freshwater aquatic vegetation and habitats; and
- Mitigation measures pertaining to air emissions pollution control as outlined in Section 7.1 will also protect common lichen species.

Mitigation measures for potential impacts during decommissioning are similar to those for construction. Decommissioning activities will be conducted in accordance with all applicable regulatory requirements at the time and a decommissioning plan. The decommissioning plan will include a detailed rehabilitation plan. The proponent is committed to implement as part of the rehabilitation specific habitat enhancement measures that maximize terrestrial and freshwater habitat diversity and quality.

7.7.5 Residual Effects & Significance

Table 7.7-1 provides a summary of recommended mitigation measures and residual environmental effects after successful implementation of the mitigation measures described above.

With the implementation of the recommended mitigation measures, Project activities are not likely to result in significant adverse residual effects on terrestrial ecosystems, habitat and vegetation.

Table 7.7-1:
Residual Environmental Effects for Terrestrial Habitat and Vegetation

Project Environment Interaction	Potential Residual Environmental Effects A=Adverse P= Positive	Mitigation	Magnitude	Geographic Extent	Duration / Frequency	Reversibility	Ecological / Socio-Economic Context	Residual Effect	Significance of Residual Effect
Direct plant mortality, habitat removal or alteration due to site preparation, clearing and grubbing.	A	See Mitigation Section	1	2	3/1	R	1	Habitat loss	Not Signif.
Indirect plant mortality as a result of potential erosion, sediment loading, stormwater discharges	A	See Mitigation Section	1	1	3/1	R	1	Habitat loss	Not Signif.
Displacement or loss of natural / native habitat due to the introduction of invasive species.	A	See Mitigation Section	1	2	5/7	R	1	Displacement / Habitat loss	Not Signif.
Indirect plant mortality and impairment as a result of fugitive dust emissions during construction and operation.	A	See Mitigation Section	1	2	5/2	R	1	Plant mortality	Not Signif.

Increase in levels of toxic and deleterious substances due to infrastructure maintenance (salt).	A	See Mitigation Section	1	1	5/1	R	1	Plant mortality	Not Signif.
Decommissioning									
Decommissioning will see habitat recreation and restoration.								Habitat recreation	Positive

Legend

Magnitude:
U= Unknown - An environmental effect affecting an unknown portion of a population or group or where the changes in a specific parameter are unknown.
0 = Nil - No environmental effect.
1 = Low (e.g., specific group, habitat, or ecosystem localized 1 generation or less, within natural variation)
2 = Medium (e.g., portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside the range of natural availability)
3 = High (e.g., affecting entire stock, population, habitat or ecosystem, outside the range of natural variation)

Geographic Extent:
1 = < 1 km^2
2 = 1 – 10 km^2
3 = 11 – 100 km^2
4 = 101 – 1,000 km^2
5 = 1,001 – 10,000 km^2

Duration:
1 = < 1 month
2 = 1 – 12 months
3 = 13 – 36 months
4 = 37 – 72 months
5 = > 72 months

Frequency:
1 = < 11 events/year
2 = 11 – 50 events/year
3 = 51 – 100 events/year
4 = 101 – 200 events/year
5 = > 200 events/year
6 = continuous

Reversibility:
R = Reversible
I = Irreversible

Ecological / Socio-Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity.
2 = Evidence of adverse environmental effects.

N/A = Not applicable
A = Adverse
P = Positive

7.8 WETLANDS

7.8.1 Boundaries

The spatial ecological boundaries for wetlands include all wetlands within the footprint of the proposed quarry, plant, fill areas and access road. Wetlands that are hydrologically connected to areas located in the footprint of Project infrastructure are also included in the ecological boundaries as these are considered to be within the zone of influence of the Project.

Temporal ecological boundaries encompass the entire year, since interactions between wetlands and project components, or effects of short-term project activities, can occur or can extend year round. However, wetlands are less sensitive during the winter, when they are frozen and less susceptible to substrate disturbance. Wetlands are more sensitive during spring, summer and fall when they tend to be utilized by numerous wildlife species including birds. The temporal boundaries extend over all three phases of the Project including construction, operation and decommissioning. No administrative or technical boundaries were identified for the Wetland VC.

7.8.2 Threshold for Determination of Significance

A significant adverse effect from the Project on wetlands is defined as an effect that is likely to cause a permanent net loss of wetland function as established during the wetland evaluation. An adverse effect that does not cause a permanent net loss in wetland function is considered to be not significant.

7.8.3 Effects on Wetlands

Most if not all of the direct interactions between the Project and wetlands will occur as a result of the ground disturbance and other activities associated with the construction phase and progressive development of the Quarry. As described in the Project Description (Section 3.0), the construction phase of the Project is planned in a phased approach where portions of the site will be progressively cleared and prepared for the open pit development. This will extend over most of the Project's lifespan and will be accompanied by expansion of the open pit mine. Despite this temporal component of the construction activities, this assessment examines the effects construction activities will have on wetlands regardless of when, relative to the life of the project, these effects will occur.

As described in Section 6.4.2, field surveys have identified 22 wetlands within the Black Point Study Area (Figure 6.4-2). The majority of wetland habitat identified consists of open bogs and riparian fens which range in size from approximately 16.5 ha to <0.5 ha. Sixteen of the wetlands identified will be partially or completely infilled / removed, totalling approximately 17.5 ha (Figure 7.8-1). These are summarized in Table 7.8-1 below.

Table 7.8-1:
Summary of Predicted Loss of Wetland Habitat

Wetland #	Type	Size ha)	Estimated Area Lost (ha)	Predicted Impact
WL1	Bog/Swamp Complex	16.5	0.2	Partially infilled (0.2 ha) during construction
WL2	Fen/Swamp/Marsh Complex	6	0.7	Partially infilled (0.7 ha) during construction.
WL3	Riparian Fen	0.5	0.5	Infilled during construction
WL4	Bog	0.2	0.2	Infilled during construction
WL5	Riparian Fen	0.5	0.4	Partially infilled (0.4 ha) during construction.
WL6	Bog	0.3	0.3	Infilled during construction
WL7	Riparian Treed Swamp	0.5	0.2	Partially infilled (0.2 ha) during construction.
WL8	Swamp/Bog/Fen Complex	10.3	-	Currently avoided but near the Project boundary.
WL9	Bog	4.6	-	Currently avoided but near the Project boundary.
WL10	Riparian Treed Swamp	0.1	-	Currently avoided but near the Project boundary.
WL11	Bog	9.0	8.1	Partially removed (8.1 ha) during construction.
WL12	Bog/Fen Complex	0.3	0.3	Removed during construction.
WL13	Treed Swamp	0.6	0.6	Removed during construction.
WL14	Fen/Bog Complex	6.2	6.2	Removed during construction.
WL15	Riparian Fen	0.07	0.07	Removed during construction.
WL16	Bog	0.45	-	Crossed by Power line corridor.
WL17	Bog/Swamp Complex	0.74	-	Currently avoided but near the Project boundary.
WL18	Bog	0.07	0.04	Partially infilled (0.04 ha) during construction
WL19	Bog	0.04	0.03	Partially infilled (0.03 ha) during construction
WL20	Bog	0.15	0.02	Partially infilled (0.02ha) during construction
WL21	Fen	0.19	-	Currently avoided but near the Project boundary.

Wetland #	Type	Size ha)	Estimated Area Lost (ha)	Predicted Impact
WL22	Riparian Fen	0.1	0.02	Partially infilled (0.02 ha) during construction.
	Total Area	57.3	17.5	

Wetlands can be adversely affected by direct removal, fragmentation, disturbance, erosion/ sedimentation, and changes to hydrology, introduction of invasive species and release of hazardous materials. These impacts can interfere with wetland function, including species diversity. The effects can result from short term activities during the construction phase and decommissioning phases, as well as long-term activities during the Project operation.

7.8.3.1 *Construction*

The following discussion of potential impacts applies to all wetland areas in close proximity to the Project footprint.

Wetlands depend on a certain level of soil humidity. If the water regime is changed, changes will occur to the vegetation, character and functionality of the wetland. In addition to the direct impacts due to localized infilling or removal, wetlands surrounding the Project footprint could potentially be adversely affected by changes to the hydrology, due to impeded or redirected drainage caused by the construction of the Project infrastructure and pit. Wetlands located up-gradient of the proposed construction may be flooded if drainage is impeded. Wetlands located down-gradient could be adversely affected if surface water flow, including stream flow, decreases. If stormwater from the roads which is collected in roadside ditches is allowed to enter these wetlands in amounts exceeding natural pre-construction flow, similar adverse effects are likely.

All of the above wetlands could also be adversely affected by sediment entrained in surface water runoff during construction activities. Exposed soil associated with site clearing, grubbing, grading, stripping and storing of topsoil or construction materials and reclamation of the Project site during decommissioning may result in erosion and subsequent sedimentation. Sediments carried into wetlands could smother existing vegetation, but may also contribute nutrients to the wetlands. Changes in nutrient levels will change water quality and potentially plant communities in the wetlands. Effects would be greatest in low nutrient systems such as treed bogs and shrub bogs, and would likely result in adverse effects on wetland function.

Dust and minerals from road runoff may have similar effects. Fugitive dust will be formed during the construction phase or decommissioning phase from soil movement, soil and material storage, and the movement of construction equipment and transportation vehicles. The dust may cover native vegetation and smother it, but dust also deposits minerals and nutrients into the wetlands.

Wetlands in close proximity to the Project footprint may be adversely affected if accidental spills of deleterious substances such as fuels, lubricants or engine oil occur during the operation of construction and transportation equipment (see discussion in section 7.18).

Where construction activities occur in wetlands, there is potential for introduction of invasive species. Seeds, roots or "rootable" fragments of invasive species may be stuck to construction equipment, transportation vehicles or shoes of workers. These propagules may be introduced into wetlands directly when equipment or people access the wetlands, or indirectly via runoff or dust from the roads. Invasive species such as Purple Loosestrife (*Lythrum salicaria*), are known to severely degrade wetland habitat and thus one or more of wetland functions. The potential for introduction of invasive species is highest in wetlands in or near the construction zone, including lay-down areas, followed by wetlands downstream or down-gradient of those areas. Since the amount of traffic during construction will be increased over current levels, especially long distance traffic, the likelihood of introduction of invasive species is elevated. However, during the field surveys carried out in 2010 and 2014, no Purple Loosestrife was noted in the Project area.

Wildlife using the wetlands near the construction zone as habitats may be disturbed by noise or lights, or impacted by accidental spill of hazardous materials such as fuel or lubricants from construction and transportation equipment during the construction and decommissioning phases. These effects are discussed in Section 7.9 and Section 7.12.

Runoff from acid generating slates exposed due to construction activities is a potential and may negatively impact wetland habitat should runoff from this material enter this habitat type.

Directly Impacted Wetlands

Wetlands 1, 3, 6, 14 and 17 occur near or form the headwaters of small watercourses throughout the Site and therefore provide critical hydrological functions. It is notable that none of the watercourses present within the Study Area are fish bearing streams. Wetlands 11, 18, 19 and 20 may serve as groundwater recharge sites. As such they were found to provide critical hydrogeological functions. Wetland 2 likely provides critical shoreline protection function during storm events.

Wetlands 1, 2, 3, 6, 11, 14, 18, 19, and 20 represent common wetland types in the region. Wetlands 3 and 6 will be completely infilled / removed. Wetlands 1, 2, 11, 14, 18, 19 and 20 will be partially infilled (15 ha combined) therefore approximately 15.8 ha of wetland habitat providing "critical wetland function" will be lost. These functions represent red rated significant functions based on the NovaWET assessment and are typically unique or rare or associated with a high risk to the watershed if lost (see Section 6.4 for further details).

Wetlands 4, 5, 7, 12, 13, 15 and 22 are not of high value in terms of wetland function, and belong to a wetland class that is common both to the local area and throughout Nova Scotia. One lichen species of conservation concern was found in WL12 although this species is ranked S2S3 by ACCDC and as such is not considered a "Red Rated Significant Function". All of these common relatively "low value" wetlands do not support plant species at risk, and are not considered providing critical wildlife habitat. Wetlands 4, 12, 13 and 15 will be completely infilled / removed while wetlands 5, 7 and 22 will be partially infilled resulting therefore in the loss of approximately 1.7 ha of relatively common "low value" wetland habitat.

A wetland alteration approval will be obtained from NSE prior to construction in any of these wetlands. In conjunction with this approval, compensation will be developed for the loss of these wetlands, as NS aims to prevent net loss of wetland function. The compensation plan will be subject to approval by NSE.

Potentially Indirectly Impacted Wetlands

A number of wetlands have been identified in close proximity to the Project footprint (WL8, WL9, WL10, WL16, WL17 and WL21). These wetlands are considered to be potentially impacted through indirect means such as increased sedimentation, alterations to hydrology, disturbance and impacts resulting from accidental spills or dust / runoff from roads.

Wetland 21 (0.19 ha) is located in the northern end of the Study Area, downstream from the Project footprint and has the potential to be indirectly impacted.

WL 16 (0.45 ha) is located in the southeast corner of the Study Area. The power transmission corridor is proposed to run through this wetland and may result in changes to vegetation structure, soil compaction or alteration to hydrology.

Wetland 17 (0.7 ha) is located at the southeastern end of the Study Area. The access road will be constructed adjacent to the east boundary of this wetland which may alter hydrology. This wetland may also be indirectly impacted by uncontrolled site runoff leading to sedimentation, dust deposition, or accidental spills.

Wetlands 8, 9 and 10 (10.3 ha, 4.6 ha and 0.1 ha respectively) are located along the western end of the Study Area in close proximity to the proposed footprints of the pit and fill areas. These wetlands could be indirectly impacted by uncontrolled site runoff leading to sedimentation, changes in hydrology, dust deposition, or accidental spills.

Wetland alteration approvals will be obtained from NSE for those wetlands where indirect adverse effects are considered likely to occur. Indirect adverse effects will be detected through the implementation of the EMP. Compensation for indirect adverse effects to wetlands will be discussed with NSE during the wetland alteration approval process.

7.8.3.2 *Operation*

During the operation phase, wetlands located in close proximity to the Project footprint can be adversely affected by alteration of hydrology, release of hazardous materials during maintenance activities or accidents and malfunctions, dust/ sedimentation, introduction of invasive species, as well as disturbance.

Activities during the operation phase of the Project such as open pit quarrying, dewatering, water treatment and release and waste rock disposal may result in alteration to wetland hydrology in adjacent wetlands.

Project-related groundwater collection may affect the hydrology in adjacent wetlands in particular wetlands that rely on groundwater discharge to maintain hydrology. This is unlikely to affect wetlands located within the Study Area, however, as these wetlands are largely precipitation driven and/or associated with surface water features such as lakes and streams; as such they do not necessarily rely solely or primarily on groundwater inputs.

The unmanaged use of road salt for winter safety may adversely affect vegetation and water quality in wetlands. Road salt is a toxic substance, controlled under the *Canadian Environmental Protection Act* (CEPA), and can harm wildlife if overused. Road salt runoff can

influence vegetation species composition in wetlands, though the affected area would be very small.

Fugitive dust and sediment runoff generated from road traffic during operation are not likely to adversely affect wetlands, since the amount of material lost is expected to be very small. Dust originating from quarrying and rock crushing may land on native vegetation and interfere with plant respiration, but this effect is expected to be limited in time and space and will be mitigated by natural precipitation events that wash dust onto the soil. Dust may also deposit minerals and nutrients in the wetlands.

The potential for introduction of invasive species carried on vehicles operated on roads is much lower during operation, since disturbed wetland soils will be re-vegetated. During maintenance of the power line right-of-way, the potential for introducing invasive species would be similar to construction.

During the operation phase, wildlife in wetlands may be disturbed by noise and lights from the Quarry operation. Potential impacts on terrestrial fauna are described in Section 7.9, below.

Similarly to the construction phase, wetlands in close proximity to the Project footprint may be adversely affected if accidental spills of deleterious substances such as fuels, lubricants or engine oil occur. Downstream wetlands cannot be affected by a failure in the sediment pond containment system since sedimentation ponds and pit sumps will be located within back-graded work areas; they may flood but they will not overflow.

7.8.3.3 *Decommissioning*

The effects of Project activities during the construction and the decommissioning phase are similar.

7.8.4 Mitigation and Monitoring

Mitigation measures are outlined below for each potential adverse effect. Mitigation measures developed for the protection of surface water quality will also protect wetlands (Sections 7.6). The potential effects of spills, malfunctions and accidents and recommended mitigation measures are discussed in Section 7.18. A wetland specific monitoring program will be implemented immediately post-construction to confirm the predictions of the environmental assessment and to identify any unforeseen wetland impacts.

To reduce disturbance and eliminate loss of wetland function in directly impacted wetlands:

- Wetland areas will be avoided to the extent feasible during Project design and planning.
- Where wetlands cannot be completely avoided, the Project footprint in the wetland area will be minimised to the extent possible.
- A wetland alteration permit will be obtained from NSE prior to construction.
- Wetland functions have been assessed for all potentially disturbed wetlands and the amount and type of functions lost (if any) will be determined.
- Where a permanent loss of wetland function is identified, a Compensation Plan will be developed, subject to approval by NSE.

To prevent impacts on wetland hydrology:

- Maintain a 30 m buffer around all undisturbed wetlands.
- Where the access road cuts across diffuse natural drainage paths, water conveyance structures of sufficient size (culverts or drainage swales) will be installed to maintain water flow to and from wetlands at pre-construction levels.
- To the extent feasible, clean site runoff will be managed so that the amount of water entering adjacent wetlands is similar to pre-construction levels.
- Runoff collected along the roads will not be allowed to enter directly into wetlands, but shall be directed into vegetation buffers around wetlands.
- Integration of existing/remnant wetlands into the quarry's stormwater management system will be considered in the Stormwater Management Plan and in the EMP.
- The monitoring program enacted under the Wetland Compensation Plan will identify vegetation changes or new formation of wet areas within and adjacent to the Project site. This would be a sign of a disrupted hydrologic regime and further investigated to determine the need for management adjustments.

To prevent impacts on wetlands from erosion/sedimentation or dust:

- General erosion and sediment control measures will be established in the Project EMP and implemented on site to prevent or minimize erosion and subsequent site runoff into nearby wetlands and surface waters while soils are exposed and de-stabilized.
- Prior to construction, a site-specific erosion and sediment control plan will be developed, including a description of the proper installation of silt fences and cofferdams.
- Uncontaminated drainage will be directed away from areas under construction.
- Ground disturbance will be kept to a minimum and standard erosion control measures will be implemented for disturbed areas as needed.
- Dust control will be established in the Project EMP.
- Efficacy of the erosion and sediment control measures will be monitored regularly and when high precipitation events are forecast.

To prevent impacts on wetland habitat from contaminated runoff:

- Vegetation management in or near wetlands will be conducted by cutting (i.e., no use of herbicides).
- Potentially contaminated site runoff will be directed to the on-site wastewater treatment system.

7.8.5 Residual Effects & Significance

Project related activities are not likely to result in significant residual adverse impacts on wetland habitats after the successful implementation of the identified mitigation measures, including compensation. Table 7.8-2 provides a summary of the effects assessment.

Table 7.8-2:
Residual Environmental Effects for Wetlands

Project Environment Interaction	Potential Residual Environmental Effects A=Adverse P= Positive	Mitigation	Magnitude	Geographic Extent	Duration / Frequency	Reversibility	Ecological / Socio-Economic Context	Residual Effect	Significance of Residual Effect
Wetland removal or loss of wetland functions as a result of infilling and development activities.	A	See Mitigation Section	1	2	5/6	I	1	Habitat loss / Wetland compensation	Not Signif.
Alteration of wetland hydrology.	A	See Mitigation Section	1	2	5/6	I	1	Habitat loss	Not Signif.
Alteration of water quality from sediments and dust.	A	See Mitigation Section	1	2	5/1	R	1	Habitat loss	Not Signif.
Reduction in wetland functionality due to the introduction of invasive species.	A	See Mitigation Section	1	2	5/1	R	1	Habitat loss	Not Signif.
Impacts from contaminated site runoff and vegetation management.	A	See Mitigation Section	1	1	5/1	R	1	Habitat loss	Not Signif.

Legend

Magnitude:
U= Unknown - An environmental effect affecting an unknown portion of a population or group or where the changes in a specific parameter are unknown.
0 = Nil - No environmental effect.
1 = Low (e.g., specific group, habitat, or ecosystem localized 1 generation or less, within natural variation)
2 = Medium (e.g., portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside the range of natural availability)
3 = High (e.g., affecting entire stock, population, habitat or ecosystem, outside the range of natural variation)

Geographic Extent:
1 = < 1 km^2
2 = 1 – 10 km^2
3 = 11 – 100 km^2
4 = 101 – 1,000 km^2
5 = 1,001 – 10,000 km^2

Duration:
1 = < 1 month
2 = 1 – 12 months
3 = 13 – 36 months
4 = 37 – 72 months
5 = > 72 months

Frequency:
1 = < 11 events/year
2 = 11 – 50 events/year
3 = 51 – 100 events/year
4 = 101 – 200 events/year
5 = > 200 events/year
6 = continuous

Reversibility:
R = Reversible
I = Irreversible

Ecological / Socio-Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity.
2 = Evidence of adverse environmental effects.

N/A = Not applicable
A = Adverse
P = Positive

7.9 TERRESTRIAL WILDLIFE

Terrestrial fauna have ecological, aesthetic and recreational importance to the public and the Mi'kmaq as a food source and as an economic and recreational resource. Project development will diminish or eliminate the productive capacity of some terrestrial habitat within the Project footprint. Other indirect interactions (airborne dust, emissions, noise, vibration, light, water extraction, and consumption) may affect species and habitat within the area of influence of the Project. Most terrestrial species and habitat are regulated by the Province. Migratory bird species are regulated at the Federal level.

A discussion of potential impacts of the construction, operation and decommissioning phases of the Project on common terrestrial fauna is presented below.

7.9.1 Boundaries

Spatial boundaries establish the limits within which the Project interacts with the surrounding environment. The area of influence reflects an area beyond the Project footprint and incorporates aspects such as airborne plumes which can act to expand the physical area over which Project features interact with the receiving environment.

The spatial ecological boundaries for terrestrial wildlife include all undeveloped environments within the footprint of the Project, as well as all undeveloped environments within 500 m of the Project site and the shipping lanes offshore in habitats utilized by marine-associated bird species (including seabirds, waterfowl and shorebirds). This buffer is considered to be the maximum extent to which noticeable effects on birds, wildlife and SAR can be reasonably expected as a result of Project components and activities.

Temporal ecological boundaries encompass the entire year, since interactions between terrestrial fauna and Project components or activities can occur year round. This applies to every year of all phases of the Project. For terrestrial fauna, the breeding season is of particular concern. The breeding season for most migratory bird species in the region is between early April and the end of August (EC 2014f), although some migratory species nest outside of this timeframe. Owls, raptors and woodpeckers generally breed earlier in the season from late winter to early spring (February to May). Most other wildlife breeds in spring and summer.

With respect to the administrative and legislative boundaries, the federal the *Migratory Birds Convention Act* (MBCA) is an important regulatory mechanism to protect birds. At the provincial level, The NSDNR administers the Nova Scotia Wildlife Act (NSWA) which provides mechanisms for the preservation of wildlife species diversity and abundance, including migratory birds. Further protection of habitats that are critical to migratory birds and other wildlife species is provided by the federal *Canada Wildlife Act* and its regulations, which are administered by EC. Legal protection is offered to species that have been proclaimed as endangered, threatened or special concern under the federal *SARA*, and to species proclaimed as endangered, threatened or vulnerable under the *NSESA*.

7.9.2 Threshold for Determination of Significance

A significant adverse effect of Project components or activities on terrestrial fauna is defined as an effect that causes a decline in abundance and/ or a change in distribution beyond which

natural recruitment (reproduction and immigration from unaffected areas) would not return the population to its pre-project level within several (three to five) generations[7]. An adverse effect that does not cause such declines or changes is not considered to be significant in most instances. However, mortality of a single individual of a Species at Risk or a large number of migratory birds or other fauna could also be considered a significant adverse environmental effect.

Effects on critical habitat of a migratory bird SAR which cause breeding failure or abandonment of nesting may also be considered significant, even if the effects are temporary. This would include abandonment or nesting failure of a migratory bird SAR or at a seabird/waterbird colony due to an accidental event or the response to an accidental event associated with the Project.

7.9.3 Effects on Birds and Other Terrestrial Fauna

A discussion of potential impacts of the construction, operation and decommissioning phases of the Project on terrestrial fauna is presented below. Since the potential effects and mitigation for most avian SAR and SOCC is identical to non-SAR birds, they have been included in this discussion. Other SAR is addressed in Section 7.12.

7.9.3.1 *Construction*

Landbirds

The main impact on landbirds will be the loss of nesting and foraging habitat. Vegetation clearing and grubbing activities may also cause destruction of nests and nestlings or eggs if conducted during the breeding season (early April to end of August; EC 2014f).). Breeding evidence has been observed for several avian species within the Project footprint, including seven priority species with a Canadian General Status ranking of "Sensitive": Bay-breasted Warbler, Black-backed Woodpecker, Blackpoll Warbler, Boreal Chickadee, Golden-crowned Kinglet, Ruby-crowned Kinglet, and Yellow-bellied Flycatcher. Up to 213 ha of terrestrial bird habitat may be removed. Habitat within the Project area consists mostly of barren vegetation, tall shrub barren, and some coniferous forest, with patches of mixed forest and wetlands; 22 wetlands totaling approximately 57 hectares were delineated within and adjacent to the Project site.

In addition to habitat loss, construction noise (including blasting) may have deleterious effects on animals in and near the Project area. Flushing of nesting birds may result in decreased productivity due to increased nest predation and stress to adult birds affecting foraging behaviour (Beale 2007); as well, birds may leave the Project area and be forced to move to less favourable nesting sites (Larkin 1996). The data regarding effective distance due to noise disturbance are relatively few and conflicting, with various field studies showing effects from edge of area of disturbance to 200 m. Construction noise can interfere with normal bird behaviour, such as feeding, migrating, and breeding. The distance of effect is of course related to noise volume and quality. Blasting noise is a type of impulse noise, which is defined as a sound with sudden onset and typically a short duration, and which differs from continuous noise in its physiological and behavioural effects on wildlife (Larkin 1996). In terms of behavioural

[7] This definition of significance does not apply to species of conservation concern, which are treated separately in Section 7.12.

effects, flushing of breeding birds from the nest in response to impulse noise and/or vibration is perhaps the most obvious and can have immediate negative consequences including predation of eggs and chicks (e.g., Burger 1981; Brown 1990; Bolduc and Guillemette 2003) and decreased incubation and brooding (Burger *et al.* 2010; Beale 2007). As well, young nestlings that are unable to thermoregulate may be vulnerable to exposure, and adults may inadvertently knock eggs and flightless young from the nest, which is of particular concern for cliff- and tree-nesting species (Burger 1981; Carney and Sydeman 1999). Research has shown that for birds, overt behavioural responses such as flushing typically occur at sound pressure levels above 80 - 85 dB SPL (sound pressure level) (Brown 1990).

Negative effects from noise vary from species to species, because of interspecies differences in both hearing abilities and in behavioural and physiological responses to stimuli. In addition to interspecies differences, there is considerable intraspecies variation in vulnerability to effects of noise, for example in different times of year (i.e., different stages of the breeding cycle) and different life stages (Blumstein *et al.* 2005). The effects of noise on the site due to construction are expected to be temporary and short-term.

Shorebirds

Disturbance due to construction noise (including blasting) is expected to have minor impacts on breeding, migrating and/or wintering shorebirds, depending on when the activities take place. Increased sedimentation from dust generated by construction, as well as changes to hydrology of Fogherty Lake, could potentially result in habitat alteration or habitat loss for shorebird species that could potentially be nesting in the area, such as Greater Yellowlegs and Spotted Sandpiper; however, no evidence of breeding shorebirds was reported during the field surveys.

Seabirds and Waterfowl

Waterfowl along the marine shoreline and inland ponds and lakes may be disturbed by noise from blasting and other construction activities, but these effects are likely to be temporary and minor. Waterfowl and loons are unlikely to nest in Fogherty Lake because of its low pH and low productivity; therefore, they are not anticipated to be negatively affected by habitat loss or alterations in water supply to the lake.

Seabirds nest on a number of offshore islands and other inaccessible coastal areas, notably the Country Island Complex. A large tern colony supporting a significant number of breeding Roseate Terns exists in the Country Island Complex IBA; however, the nearest point of this IBA is 13 km away, and Country Island itself (which supports the largest number of Roseate Terns as well as a significant colony of Leach's Storm-Petrel) is approximately 40 km away, which is sufficiently far from the Project area that no disturbance at the colony is anticipated. Minor disturbance of foraging terns from blasting and other construction noise is possible; however, the distance from the colony is such that it is unlikely that Roseate Terns will forage in the waters near the Project area. Large gulls and Common and Arctic Terns nesting on Fox Island and Half Island, both approximately 3 km from the Project site, could potentially be disturbed by blasting noise. However, this distance is greater than the 1 km buffer recommended by EC for high-disturbance activities including drilling and blasting (EC 2014).

Mammals

Habitat removal and fragmentation will result in displacement of wildlife within the Project footprint. Species that can move easily will likely move to similar habitats elsewhere, if such habitat is available; however, ultimately, there will be a detrimental effect on terrestrial wildlife populations within the Project area. These effects will be non-reversible for the duration of the Project lifetime. During construction activities, temporary and reversible effects from noise (including blasting) and dust generation may also affect terrestrial wildlife in and around the Project area. Potential effects on terrestrial fauna SAR and species of conservation concern are described in Section 7.12.

A number of furbearers have potential to occur in the Project area, and habitat removal and disturbance due to human activities may result in some or all of these species being extirpated from the area. Impacts on other mammals are also expected to be mainly related to loss and fragmentation of habitat.

Clearing and construction activities are expected to slightly reduce the available area used by terrestrial mammals and interrupt local movement to and from adjacent areas of suitable habitat. Project related noise (including blasting) may cause mammals in immediately adjacent areas to flee temporarily. The furbearers and other mammals in the local area may temporarily move elsewhere during the construction period. Local populations are likely to return to normal after construction is complete.

Mammal species with special status such as moose, fisher, and bats may occur in the Project area. Potential for impacts on such species are presented in Section 7.12.

Herpetiles

The loss of ponds, wetlands and riparian areas in the Project area will result in habitat loss for local amphibians and for turtles, and increased sedimentation from dust generated by construction may further impact aquatic habitats. Snakes may utilize much of the Project area, and will be impacted by habitat loss as well as increased fragmentation which may inhibit movement between areas of suitable habitat.

Invertebrates

Some loss of odonate (dragonfly and damselfly) breeding and feeding habitat is expected from the loss of wetlands, ponds and riparian areas within the Project area. Dust from construction activities may contribute to sediment loading in watercourses, potentially altering aquatic habitats. Lepidopterans (moths and butterflies) will be most affected by the loss of larval food plants, which varies from species to species; adults are highly mobile and therefore able to avoid areas impacted by Project activities.

7.9.3.2 *Operation*

Landbirds

Increased human activity associated with the operation phase is expected to result in an increase in populations of species that are adapted to human environments, including European Starlings, American Robins, Common Grackles and Rock Pigeons; these species may compete

with native woodland and forest edge birds, resulting in habitat loss for these species less adapted to human presence. Potential effects of blasting noise are the same as for the Construction phase.

The Project area will of necessity be well-lit with high intensity lighting at night, and although the lighting will be directed as narrowly as possible by shielding, these lights may have disorienting effects upon migrating landbirds, particularly on foggy and overcast nights, causing potentially fatal collisions.

Shorebirds

Potential effects of blasting noise are the same as for the Construction phase. The presence of sedimentation ponds on the site may provide some marginal habitat for shorebirds, although the high level of human activity makes it unlikely that these ponds will be utilized during the operations phase. Increased human activity around the marine terminal and load-out facility will result in increased disturbance to fauna in the surrounding coastal environment, including shorebirds that may feed in the area. Marine traffic associated with the quarry (an estimated 2 ships per week) will travel within existing domestic commercial shipping lanes, which pass to the south of the South Shore (Port Joli sector) IBA. This IBA supports breeding Piping Plovers in the summer and large numbers of migrating shorebirds in the fall months. While day-to-day shipping activities are unlikely to have any impact on shorebirds at the South Shore (Port Joli sector) IBA, accidental spills and releases from marine traffic could result in the direct physical exposure of birds to oil within the affected area; effects of accidents and malfunctions are discussed in Section 7.18.

Waterfowl and Seabirds

Potential effects of blasting noise are the same as for the Construction phase. The presence of sedimentation ponds on the site may provide some marginal habitat for waterfowl, although the high level of human activity makes it unlikely that these ponds will be utilized during the operations phase.

Increased shipping activity associated with the Project (an estimated 2 ships per week) will cause disturbance to seabirds and waterfowl in the waters off the Project site and along shipping routes. The possible effects of marine vessel traffic on birds in the offshore environment include behavioural changes (e.g., avoidance, stress response) that may have energetic consequences (Schummer and Eddleman 2003), and loss of suitable feeding habitat as vessel traffic can reduce bird use of vessel disturbed areas (Bramford *et al.* 1990), although this is mitigated by utilizing existing shipping lanes for most of the shipping route. Increased vessel traffic is not anticipated to cause disturbance at the Country Island Complex and South Shore (Port Joli sector) Important Bird Areas; however, foraging seabirds from these sites may encounter minor disturbance, and accidental spills and releases from marine traffic could result in the direct physical exposure of birds to oil within the affected area, with possible lethal and sublethal effects; effects of accidents and malfunctions are discussed in Section 10.17.

Mammals

Potential effects of the operation phase of the Project are anticipated from increased noise (including blasting) and disturbance from traffic and other human activities at the quarry. Local nocturnal species may be attracted to and/or disoriented by changes in ambient lighting.

Project operation may cause changes in the diversity and relative abundance of local mammal populations, such as potential increase in red fox, raccoon and striped skunk that are well adapted to human presence. This effect could be exacerbated if good housekeeping practices are not maintained on-site.

Herpetiles

No additional impacts on snakes are expected during the operation phase; additional impacts on turtles and amphibians may occur if water levels or surface water drainage patterns were to change, and/or if there is a change in water quality from operational procedures.

Invertebrates

No additional impacts on odonates and butterflies are expected during the operation phase. Moths may be attracted to new artificial lighting on the Project site, increasing the risk of predation.

7.9.3.3 *Decommissioning*

During decommissioning, increased human activity, noise and dust are expected to have temporary negative effects on local terrestrial wildlife populations (including birds). Local populations are expected to return to normal following decommissioning activities.

The lifespan of the quarry is anticipated to be 50 years or more. Impacts during decommissioning are expected to be similar to construction but of much shorter duration. The condition of the site after decommissioning will depend on the future use by the next owner or the municipality. Given that the Project location is relatively isolated, it is likely that the site will be rehabilitated to a natural state upon decommissioning. There is potential for new types of habitats, such as ponds and rocky cliffs, to remain on the site upon decommissioning.

7.9.4 Mitigation & Monitoring

Generic mitigation measures related to terrestrial fauna are listed below. For specifics mitigation measures related to terrestrial SAR and SOCC, please refer to Section 7.12. Mitigation for potential impacts on marine-associated birds from shipping is identical to other marine fauna, as described in Section 7.11.

Mitigation measures for potential impacts during decommissioning are similar to those outlined for the construction phase. Decommissioning activities will be carried out in accordance with all applicable regulatory requirements at the time, and a decommissioning plan will be developed.

During Construction:

- Reduce Project footprint and temporary work areas to the extent possible.
- Clearing of vegetation and overburden should be restricted to areas absolutely necessary to carry out the Project.
- Implement dust-prevention and dust abatement measures.
- Workers should be instructed to maintain good housekeeping practices and not leave any food or garbage at the Project site in order to avoid attracting wildlife, including

omnivorous predators which may disturb or cause direct mortality or injury to other wildlife (including birds).

- Mitigation measures are particularly important during the avian breeding season when nest failure could result if incubating adults are repeatedly flushed from active nests. To minimize impacts on nesting landbirds, clearing activities will take place outside of the breeding season for most bird species (April 1 to September 1) to prevent the disturbance of migratory birds or their nests. If some clearing is necessary during the breeding season the Proponent will assess if the work can be conducted without contravention of the *Migratory Birds Convention Act* and a contingency plan developed in consultation with CWS in order to maintain compliance with the *Act*. With implementation of these mitigation measures, significant adverse residual effects on birds are not likely.
- If an Osprey, Bald Eagle or Northern Goshawk nest is found within the forested areas to be cleared, even outside of the breeding season, a buffer zone appropriate to the species (as determined in consultation with NSDNR) will be placed around the nest and clearing will only occur outside of the buffer zone.
- To discourage ground-nesting or burrow-nesting species from nesting on disturbed soil during construction (e.g. Bank Swallow or Common Nighthawk), ensure that no large piles or patches of bare soil are left uncovered or un-vegetated during the breeding season.

  Should any ground- or burrow-nesting species (e.g. Bank Swallow or Common Nighthawk) initiate breeding activities on stockpiles or exposed areas despite efforts to deter them, the Proponent will establish a 20 m buffer around the nest location once identified and contact EC-CWS for further advice. Potentially disruptive activities such as use of machinery, disposal of additional material, removal of material and stabilization measures (e.g., hydroseeding) will be halted within the buffer area, non-disruptive measures will be taken to reduce potential for erosion of the pile, and the nest(s) will be protected. Periodic monitoring of the nest(s) will be undertaken until the chicks have fledged and left the area and the nest site is found to be inactive.
- Noise suppression equipment such as mufflers on mobile equipment and fixed/portable engines will be maintained in original OEM working condition.
- The duration of noise disturbance should be minimized.
- Lighting should be restricted to areas where it is necessary.
- To minimize interference of nesting activities from noise and human presence, workers will be encouraged to refrain from entering surrounding undisturbed habitat areas where no work is done, as those areas likely hold the largest number of birds.
- In the event that impacts on migratory birds are detected during construction, further mitigation will be developed in consultation with NSDNR and EC.

During Operation:

- Standard mitigation measures for noise (including blasting), as outlined in Section 7.2, will minimize impacts on terrestrial fauna.
- To discourage ground-nesting or burrow-nesting species from nesting on disturbed soil during construction, ensure that no large piles or patches of bare soil are left uncovered or un-vegetated during the breeding season.

Should any ground- or burrow-nesting species (e.g. Bank Swallow or Common Nighthawk) initiate breeding activities on stockpiles or exposed areas on site despite efforts to deter them, the Proponent will establish a 20 m buffer around the nest location once identified, and contact EC-CWS for further advice. Potentially disruptive activities such as hydroseeding will be halted within the buffer area, non-disruptive measures will be taken to reduce potential for erosion of the pile, and the nest(s) will be protected. Periodic monitoring of the nest(s) will be undertaken until the chicks have fledged and left the area and the nest site is found to be inactive.

- As recommended by EC (2014c; 2014e), ships should maintain a minimum distance of at least 300 m from any colony or island occupied by seabirds and waterbirds.
- To minimize the risk to migrant birds, the minimum amount of pilot warning and obstruction avoidance lighting will be used on tall structures. The use of solid-burning or slow pulsing warning lights at night will be avoided.
- A detailed avian management plan (including monitoring program) will be developed in consultation with EC-CWS in order to verify the effectiveness of mitigation measures related to lighting.
- Lighting for the safety of the employees should be shielded to shine down and only to where it is needed, without compromising safety.
- Street and parking lot lighting should also be shielded so that little escapes into the sky and it falls where it is required. LED lighting fixtures are generally less prone to light trespass and should be considered.
- Should seabirds or other species become stranded on vessels or on land, the proponent is expected to adhere to appropriate handling protocols. The protocol "*Best practices for stranded birds encountered offshore Atlantic Canada*" (EC 2014e) will be used for stranded seabirds. The proponent should also consider developing a similar-type protocol for birds other than seabirds (e.g. landbirds, shorebirds) which may become stranded on vessels. A permit is required to implement the Williams and Chardine protocol or other similar protocols, as well as to handle migratory bird carcasses during post-construction monitoring programs. Proponents should be advised that they are required to complete a permit application form prior to proposed activities. Permit application forms can be obtained by contacting Canadian Wildlife Service (email: Permi.atl@ec.gc.ca).
- White lights will be preferred for use on towers or high structures at night, as recommended by the US Fish and Wildlife Service (2003). Solid red or flashing red lights will be avoided as they appear to attract nocturnal migrants more than white flashing lights (US Fish and Wildlife Service 2003).
- Unless safety is a factor, the use of exterior decorative lights such as spotlights and floodlights, whose function is to highlight features of buildings or to illuminate an entire building, will be avoided or restricted because their glow can draw birds from far away, particularly on humid, foggy or rainy nights.
- High intensity lights, including floodlights, will be turned off at night outside of working hours, if possible, especially during the spring and fall migration period.
- Where feasible, tinted or frosted glass windows will be used in buildings to reduce bird mortality from collisions, as recommended by Erickson et al. 2005.

During Decommissioning:

Mitigation measures for potential impacts during decommissioning are similar to those outlined for the construction phase. Decommissioning activities will be carried out in accordance with all applicable regulatory requirements at the time and a decommissioning plan will be developed. The decommissioning plan will include a detailed rehabilitation plan. As part of the rehabilitation, the proponent is committed to implement specific habitat enhancement measures that maximize terrestrial and freshwater habitat diversity and quality.

7.9.5 Residual Effects & Significance

Table 7.9-1 provides a summary of recommended mitigation measures and residual environmental effects after successful implementation of the above mitigation measures.

With the successful implementation of these mitigation measures, Project activities related to construction, operation and decommissioning of Project components are not likely to result in significant adverse residual adverse effects on terrestrial fauna, excluding SAR, which are discussed in Section 7.12.

Table 7.9-1:
Residual Environmental Effects for Terrestrial Fauna

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Residual Environmental Effects: Magnitude	Geographic Extent	Duration/Frequency	Reversibility	Ecological Context	Residual Effect	Significance
Construction									
Loss of habitat for terrestrial wildlife, including landbirds.	A	• Minimize Project footprint; • Implement Wetland Compensation Plan. • See Mitigation above	Low	Limited to Project footprint (about 180 ha).	• Short- term loss: temporary work camp during construction phase. • Long-term alteration: water use (Fogherty Lake). • Permanent loss: quarry footprint (about 180 ha).	R but irreversible during lifetime of Project.	Similar habitat exists in the region. Area is affected by past human activity.	Habitat loss	Not Signif.
Fragmentation of terrestrial habitat in and around the Project area.	A	• Minimize Project footprint • Implement Wetland Compensation Plan • See Mitigation above	Low	Project footprint and adjacent areas of similar habitat.	• Construction and Operation Phase.	NR	Habitats in the Project footprint are not unique; fragmentation already exists from the presence of the	Minimal habitat fragmentation	Not Signif.

			Significance Criteria for Residual Environmental Effects						
Project-Environment Interaction	**Potential Positive (P) or Adverse (A) Effect**	**Mitigation**	**Magnitude**	**Geographic Extent**	**Duration/Frequency**	**Reversibility**	**Ecological Context**	**Residual Effect**	**Significance**
							highway.		
Disturbance of terrestrial fauna due to construction activities (noise, blasting, dust generation).	A	• Implement an EMP • See Mitigation above	Low	Limited to Project footprint and a 200 m buffer (noise).	• Construction phase; Decommissioning phase.	R	Nearby areas are already subject to disturbance by human activities (highway).	Minimal wildlife disturbance	Not Signif.
Destruction of active migratory bird nests during vegetation clearing or other activities.	A	• Avoidance of clearing during the breeding bird season (early April to end of August). • Discouraging of ground- and burrow-nesting species from nesting on denuded soil (e.g. by covering unattended soil piles). • See Mitigation above	Low	Limited to Project footprint.	• Construction phase.	NR	Habitats in the Project footprint are not unique;	None anticipated	Not Signif.
Operation									
Disturbance of terrestrial fauna due to increased human presence and	A	• Implement an EMP • See Mitigation above	Low	Limited to Project footprint and a 200 m buffer (noise).	• Operations phase	R	Nearby areas are already subject to disturbance by human activities	Limited wildlife disturbance	Not Signif.

			Significance Criteria for Residual Environmental Effects						
Project-Environment Interaction	**Potential Positive (P) or Adverse (A) Effect**	**Mitigation**	**Magnitude**	**Geographic Extent**	**Duration/Frequency**	**Reversibility**	**Ecological Context**	**Residual Effect**	**Significance**
noise (incl. blasting).							(highway).		
Destruction of active migratory bird nests during vegetation clearing, other project activities.	A	• Avoidance of clearing during the breeding bird season. • Discouraging of ground- and burrow-nesting species from nesting on unvegetated soil (e.g. by covering unattended soil piles)	Low	Limited to Project footprint.	• Operations phase.	NR	Habitats in the Project footprint are not unique;	None anticipated	Not Signif.
Loss or degradation of habitat for aquatic herpetiles and aquatic-nesting bird species (loons, waterfowl).	A	• Ensuring that water draw from Fogherty Lake does not result in a change in hydrology. • Implement an EMP Treatment of water to government standards prior to discharge. • Monitoring of discharge quality. • See Mitigation above	Low	Fogherty Lake and on-site watercourses.	• Operations phase	R	Not considered ideal habitat for birds and aquatic herpetiles of special status.	None anticipated	Not Signif.
Increased lighting attracting and/or	A	• Minimizing use of lighting to the greatest extent	Low	Project footprint	• Operations phase	R	Project site is not considered part of a major	None anticipated	Not Signif.

			Significance Criteria for Residual Environmental Effects						
Project-Environment Interaction	**Potential Positive (P) or Adverse (A) Effect**	**Mitigation**	**Magnitude**	**Geographic Extent**	**Duration/Frequency**	**Reversibility**	**Ecological Context**	**Residual Effect**	**Significance**
disorienting nocturnal wildlife, including migrating birds.		possible. • See Mitigation above					avian migration corridor. No protected moth species expected in Project area.		
Increased shipping activity causing disturbance to seabirds and waterfowl.	A	• Implement an EMP • Refer to marine fauna VC. • See Mitigation above	Low	Shipping routes offshore near the Project area.	• Operations phase • 2 ships/week	R	Considerable shipping activity is already present	None anticipated	Not Signif.
Increased numbers of human-adapted terrestrial species preying on/competing with native species.	A	• Implement an EMP; proper housekeeping practices and avoiding activities that may entice wildlife. • See Mitigation above	Low	Project footprint and adjacent habitat.	• Operations phase.	R	Relatively pristine area	None antic-pated	Not Signif.

7.10 FRESHWATER SPECIES AND HABITATS

Fish and fish habitat are valued for their ecological services as a renewable resource base, and for their economic, cultural, spiritual and ceremonial benefits. The watercourses and lakes on the Property do not contain fish due to acidic conditions. Nevertheless, other freshwater species and habitat are important biological components of larger ecological systems and are valued by the public and the Mi'kmaw. Project activities will remove some freshwater environment and may indirectly affect other areas. After quarrying ceases and the pit fills with water, the Project will ultimately create more freshwater habitat than currently exists on the site.

As described in Section 6.5, the freshwater environment within the Property boundary includes one waterbody, Fogherty Lake, and three watercourses. No fish were captured in Fogherty Lake or any of the watercourses during fish collection events. The field measured pH level in Fogherty Lake was 2.9 and in the watercourses pH levels ranged from 2.9 to 3.4. Based on the highly acidic conditions in freshwater environments, these water bodies do not support fish species (Robertson and Bryan 2004).

The majority of the effects to the freshwater environment are associated with the construction and operation of the quarry. The construction of quarry infrastructure is not anticipated to result in the removal of freshwater environments; one watercourse (Watercourse 2, which is ephemeral) will be lost during the operation of the quarry.

7.10.1 Effects Mechanics

Table 7.10.1 lists the probable interactions between the Project and Freshwater Species and Habitats.

Table 7.10-1:
Project Interactions with Freshwater Species and Habitats

Project Phase	Duration	Relevant Project Works and Activities
Construction Phase	2-3 Years	• Site Clearing, Grubbing grading in preparation of construction • Watercourse and wetland alteration • Surface water discharge
Operations Phase	50 years	• Domestic wash water supply: potential groundwater – surface water interaction • Rock removal (quarrying) that results in alterations in surface and groundwater flow patterns and water supply to down-gradient watercourses. • Storm water and wash water management and surface water discharge
Closure and Rehabilitation Phase	2+ Years	• Rehabilitation of the quarry

7.10.2 Boundaries

7.10.2.1 *Temporal Boundaries*

As noted, effects to Freshwater Species and Habitats are primarily associated with the Operations Phase, but may also occur during construction and during Closure and Rehabilitation.

7.10.2.2 *Spatial Boundaries*

Assessment boundaries have been characterized as the Project Area (PA), Affected Area (AA), and Study Area (SA).

The Project Area is defined as the freshwater environmental within the Project Property boundary. This includes three watercourses (Watercourse 1, ephemeral Watercourse 2 and Watercourse 3) and Fogherty Lake, but excludes wetlands since wetlands are described in a dedicated chapter of the EIS (Section7.8).

The Affected Area is the zone around the Property which could be affected by Project components or activities. With respect to Freshwater Species and Habitats, this will include all down-gradient freshwater ecological receptors that currently receive surface and groundwater flow from portions of the Property that will be developed for the quarry, since changes to water flow may negatively affect these receptors. It also includes areas immediately adjacent to the Property boundary where dust from quarrying activities may be expected to fall. Within this Area is Murphy's Lake. Given the acidic conditions measured at the lake outlet, Murphy's Lake likely does not directly support fish and fish habitat.

Outside of these zones, no additional Project-environment interactions are expected with respect to the Freshwater Species and Habitat VC.

7.10.2.3 *Relevant Legislation*

The federal Fisheries Act (Section 35) is the primary piece of legislation in Canada governing the protection, conservation and management of fish and fish habitat. This act is enforced by Fisheries and Oceans Canada. The Act prohibits serious harm to fish that are part of or support a commercial, recreational, or Aboriginal (CRA) fishery. Harm can be caused by proposed works, undertakings or activities that affect fish habitat, passage of fish or modify flow in watercourses. If serious harm to fish that is part of or support commercial, recreational or Aboriginal fisheries will occur as the result of a proposed undertaking, the proponent is required to prepare a habitat off-set plan and obtain an authorization under the Fisheries Act 35(2)(b) prior to commencing works.

7.10.2.4 *Technical Boundaries*

No technical boundaries were identified for this VC.

7.10.3 Threshold for Determination of Significance

Methods describing the spatial and temporal effects of the project activities and works on Freshwater Species and Habitat are described below. Presence and absence of fish and fish

habitat was determined through a sampling program described in Section 6.5. To the extent possible potential effects of the project on Freshwater Species and Habitat were quantified. These effects include:

- Direct removal of water bodies: assessed by querying the data layers with the anticipated disturbance areas within the Project boundaries. The amount (ha) of water body and length (m) of watercourses anticipated to be removed was tallied within the Project property boundaries.
- Indirect effects from changes in surface water quantity and quality: assessed based on results from available hydrologic modeling and the surface water quality assessment.

Relevant results from the terrestrial habitat assessment were integrated with the results from the fish and fish habitat assessment (i.e., effects on Freshwater Species and Habitat were cross-referenced with the effects on wildlife and wetlands and riparian habitat).

With respect to this VC, a significant effect is defined as a permanent, irreplaceable loss of Freshwater Species and Habitat that are part of or support a commercial, recreational or Aboriginal fishery.

7.10.4 Effects on Freshwater Environment

No freshwater fish or fish habitat occurs within the Project Area due to unsuitable acidic conditions observed in waterbodies and watercourses. Given this, Project activities will not result in negative effects to fish and fish habitat in these water bodies and watercourses. This is consistent with the highest objective in the planning hierarchy through the principle of avoidance.

The southern portion of the Property is situated within part of the surface water catchment of Reynolds Brook, located in the Affected Area approximately 1.0 km south of the site, immediately south of Route 16. For the purposes of the EIS, Reynolds Brook is assumed to support fish at some point between the headwaters wetland to the east and downstream Hendsbee Lake located approximately 3.0 km to the west. At full quarry build out after approximately 50 years of operation, approximately 106 ha of the Property which formerly drained south to Reynolds Brook will be diverted into the quarry pit for ultimate discharge north into Chedabucto Bay. This represents approximately 18% of the Reynolds Brook catchment above Hendsbee Lake, which totals 578.5 ha at the lake inflow. This eventual permanent reduction in flow may have negative effects on fish and fish habitat in Reynolds Brook during dry periods. Alternatively, the reduction of low pH inflows to Reynolds Brook from the Property may in fact improve water quality and promote higher quality fish habitat than is currently present.

In the absence of fish and fish habitat on the site, the following discussion relates to Project impacts on the freshwater environment including necessary watercourse removals, and crossings to Watercourse 2 and 3.

The next step in the environmental assessment process involves evaluating potential residual adverse environmental effects by Project phase. The evaluation of environmental effects, including cumulative environmental effects, included:

- The potential interaction between Project activities, for each Project phase, and their environmental effects in combination with those of other likely future projects;

- The mitigation strategies applicable to each of the interactions; and
- Evaluation criteria for characterizing the nature and extent of the environmental effects.

Environmental effects assessment matrices have been used to summarize the analysis of environmental effects, including cumulative environmental effects, by Project phase and include accidents, malfunctions and unplanned events. This allows for a comprehensive analysis of all Project-VC interactions. Supporting discussion in the accompanying text highlights particularly important relationships, data or assessment analyses results.

Projects effects are summarized in Table 7.10-2.

Table 7.10-2:
Project Interactions by Project Phase

Project Works and Activities	Interaction with VC (Yes / No)	Rationale
Site Preparation Phase		
Site Clearing, Grubbing and Pre-stripping	Yes	Site clearing, grubbing and pre-stripping will alter riparian habitat and may increase erosion and runoff to surface water bodies. These factors will increase the risk of sedimentation and may affect water quality in turn affecting this VC.
Topsoil and Overburden Stripping and Stockpiling	Yes	Surface water quality may be altered through erosion and runoff, which in turn may affect Freshwater Species and Habitats.
Construction of Enabling Infrastructure (i.e., offices, roads, electrical transmission lines and substation, process water supply system, sewage treatment system)	Yes	Construction of roads may require watercourse crossings and culvert installations (loss of habitat).
Construction of the Processing Plant (e.g. crusher, conveyor, plant facilities)	Yes	Construction of plant area components will alter drainage patterns, and may affect surface water quality.
Operations Phase		
Operations and Maintenance of Enabling Infrastructure (i.e., domestic water supply, sewage treatment and disposal, project roads)	Yes	Discharge of surface water may alter surface water quality which in turn may negatively affect Freshwater Species and Habitats. Operation and maintenance of roads may reduce water quality along roadways and affect this VC downstream of roadways.

Project Works and Activities	Interaction with VC (Yes / No)	Rationale
Pit development	Yes	Blasting residue may impair water quality and cause harm to Freshwater Species and Habitats. Removal of rock will alter surface and groundwater flow patterns and may reduce surface flows to downstream water bodies thereby negatively impacting Freshwater Species and Habitats. Full quarry development will reduce Reynolds Brook inflows by approximately 18%. This may impair fish survival during dry periods and/or improve habitat quality by reducing inflows of low pH surface water.
Closure and Rehabilitation Phase		
Final Rehabilitation of Quarry	Yes	Final rehabilitation and creation of the "Pit Lake" will create more freshwater habitat than will be lost during Project Operation. This will present opportunities for the creation of fish habitat and wetlands.

Construction and Operation

The construction of the open pit quarry will result in the loosening of vegetation, drilling and blasting to establish benches, roads, and stormwater management facilities. Stockpiling of overburden will also occur within the property area. Potable water will be supplied by drilled groundwater wells or bottled water.

The effects to freshwater environments as a result of the construction of access roads have largely been mitigated by design. The access roads will be a minimum of 30 m from waterbodies, including wetlands. A single watercourse crossing (Watercourse 3) will be required as a result of road construction. Best practices will be implemented into the design of the crossing to minimize effects to Freshwater Species and Habitat.

The primary effect of the quarry on Freshwater Habitats and Species will be indirect and due to changes in drainage patterns. As rock is removed through quarrying, surface and groundwater flow will be directed away from current freshwater habitats and into the pit. This altered flow will occur slowly over time as the quarry develops. For example, Watercourse 2 will not be affected until sometime after year 5 of pit development. By the end of year 10, drainage to Fogherty Lake and Murphy's Lake, as well as Reynolds Brook, will be affected by pit development. Complete removal of water bodies due to draw down effects is not anticipated.

Effects from stockpile runoff have been avoided with proper mitigation. Material will be stockpiled a minimum of 30 m from existing waterbodies and enclosed with perimeter silt fencing if warranted.

7.10.5 Mitigation and Monitoring

7.10.5.1 *Mitigation*

Although the waterbodies within and immediately adjacent to the property boundary (i.e., Fogherty and Murphys Lake) do not support fish, standard mitigation measures will be applied to prevent eroded sediment from reaching these water bodies, as well as Reynolds Brook, which is assumed to support fish.

- As described in the Erosion and Sediment Control Plan, erosion and sediment control measures will be implemented to ensure that discharge water quality meets all relevant regulatory standards prior to discharge to receiving environment.
- As described in the Stormwater Management Plan, stormwater will be collected in the pit and in ponds near the processing plant to ensure that uncontrolled runoff will not occur.
- Overburden stockpiles, fuel and chemical storage facilities, and construction equipment will be located a minimum of 30 m from any water body.
- Flagging tape will be used to delineate temporary work areas and control construction access near retained wetlands and water bodies to protect natural substrates and vegetation contributing to habitat and bank stability;
- An Emergency Response Spill Contingency Plan will be prepared to prevent and manage the effects of any malfunctions and accidents.

The primary mitigation measure for the loss of, or impact to, Freshwater Species and Habitat is the creation of a 30 ha lake when quarrying activities cease. This lake will be fed by surface precipitation and groundwater seepage, instead of receiving its primary water supply from the discharge of acidic wetlands. It is anticipated that water quality will be higher than that currently present in Fogherty and Murphy's Lake, and thus freshwater habitat may support fish and fish habitat.

7.10.5.2 *Monitoring*

Fish habitat assessment and a determination of fish presence/absence are proposed for Reynolds Brook above Hendsbee Lake. If fish are present in this reach, then a modest environmental effects monitoring program is proposed for such time as quarry development begins to divert water away from its natural drainage to the south. This is not expected to occur before year 10 of quarry development.

Within the site, monitoring will focus on verification of predicted effects and the effectiveness of mitigation. During construction and operation monitoring will focus on:

- Condition and location of erosion and sediment control intended to protect water features during soil stripping and grading and construction of site facilities;
- Water quality testing of stormwater discharges as outlined in the Surface Water Monitoring Program;
- Location and condition of fencing intended to protect sensitive retained features such as wetlands and water bodies to protect natural substrates and vegetation contributing to habitat and bank stability; and
- Ensuring overburden stockpiles, fuel and chemical storage facilities, and construction equipment are a minimum of 30 m from any water body.

7.10.6 Methodology for Determination of Significance

Potential effects of the project on the freshwater environment include changes in habitat suitability associated with physical habitat loss or alteration, and potential exposure to substances entering the water resulting from project activities. Effects are considered during construction, operation and decommissioning phases of the project. Effects are evaluated based on the definitions provided in Table 7.10-2 and presented in Table 7.10-3.

Given the existing freshwater environment, no significant adverse effects are likely to result due to project activities.

7.10.7 Residual Effects and Significance

Residual effects are evaluated after application of mitigation measures. These effects are assessed in the context of:

- Magnitude
- Geographic extent
- Duration
- Frequency

- Reversibility
- Ecological Context

Given the replacement of Freshwater Habitat and Species that will be undertaken at Project closure with the creation of the Pit Lake, no long term significant adverse residual effects to Freshwater Species and Habitat are anticipated as a result of Project activities.

Table 7.10-3:
Residual Effects on the Freshwater Species and Habitat

Project Environment Interaction	Potential Residual Environmental Effects A=Adverse P= Positive	Mitigation	Magnitude	Geographic Extent	Duration / Frequency	Reversibility	Ecological / Socio-Economic Context	Residual Effect	Significance of Residual Effect
Loss of catchment area and altered flow in Murphy's Lake	A	See Mitigation Section	1	1	5/6	I	1	Minimal; likely not observable	Not Signif.
Increased freshwater fish habitat resulting from filling of pit post closure	P	See Mitigation Section	2	1	5/6	I	1	Positive – creation of new habitat	Not Signif.
Reduced flow to Reynolds Brook	**Positive** (Reduced flow of low pH water may increase pH of downstream water) **or Adverse** (during low flow periods)	See Mitigation Section	1	2	5/6	I	1	Reduced flow (18%) and/or improved water quality	Not Signif.

Legend

Magnitude:
U= Unknown - An environmental effect affecting an unknown portion of a population or group or where the changes in a specific parameter are unknown.
0 = Nil - No environmental effect.
1 = Low (e.g., specific group, habitat, or ecosystem localized 1 generation or less, within natural variation)
2 = Medium (e.g., portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside the range of natural availability)
3 = High (e.g., affecting entire stock, population, habitat or ecosystem, outside the range of natural variation)

Geographic Extent:
1 = < 1 km^2
2 = 1 – 10 km^2
3 = 11 – 100 km^2
4 = 101 – 1,000 km^2
5 = 1,001 – 10,000 km^2

Duration:
1 = < 1 month
2 = 1 – 12 months
3 = 13 – 36 months
4 = 37 – 72 months
5 = > 72 months

Frequency:
1 = < 11 events/year
2 = 11 – 50 events/year
3 = 51 – 100 events/year
4 = 101 – 200 events/year
5 = > 200 events/year
6 = continuous

Reversibility:
R = Reversible
I = Irreversible

Ecological / Socio-Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity.
2 = Evidence of adverse environmental effects.

N/A = Not applicable
A = Adverse
P = Positive

7.11 MARINE SPECIES AND HABITATS

7.11.1 Overview

Marine species and habitats are valued for their aesthetic, cultural, ecological and economic attributes by First Nations and the public at large. Marine SAR are of interest to scientists, regulators and public due to their inherent biological and cultural value and are protected under federal provincial legislation.

The majority of the effects to marine species and habitat are associated with the construction and operation of the marine terminal since the construction of this feature will remove marine habitat. Potential environmental effects on marine sediment quality are described in Section 7.4 while potential effects on marine water quality are described in Section 7.6.

The marine habitat in Chedabucto Bay supports productive and diverse fisheries. A number of fish species reside within the Bay, and additional species migrate from nearby water bodies such as the Strait of Canso and St. Georges Bay to feed or may potentially spawn (Gromack *et al* 2010). Marine mammals associated with Chedabucto Bay typically include seals, whales and porpoise. Potential environmental effects to commercial fisheries are described in Section 7.15. Potential environmental impacts to marine SAR are described in Section 7.12.

Table 7.11-1 lists the potential interactions between the Project and this VC.

Table 7.11-1:
Project Interactions with Marine Species and Habitats

Project Phase	Duration	Relevant Project Works and Activities
Construction Phase	2-3 Years	• Site clearing and grading prior to construction • Pile driving in the marine environment • Blasting in the terrestrial environment • Construction of marine terminal (caisson & rubble mound)
Operations Phase	50 years	• Stormwater and wash water management and use • Blasting in the terrestrial environment • Ship loading and marine vessel operations • Waste water treatment system discharge • Groundwater and surface water runoff, collection, treatment and discharge
Closure and Rehabilitation Phase	2 Years, may be extended	• Closure of marine terminal • Rehabilitation of the processing plant and quarry

7.11.2 Boundaries

7.11.2.1 *Temporal Boundaries*

Potential effects to the Marine Species and Habitats are expected to occur primarily during construction of the marine terminal, as well as during the Operations Phase when loading and shipping are ongoing. Additional effects may be felt in the marine environment during Closure and Rehabilitation, as the terminal is partially or completely dismantled.

7.11.2.2 *Spatial Boundaries*

Assessment boundaries have been delineated as the Project Area (PA), Affected Area (AA), and Study Area (SA).

With respect to the marine environment, the Project Area is defined as the limits of the proposed seabed Crown Lands Lease that will be needed for the marine terminal (Section 1.0 and **Figure 4.0-1**). The Crown lease extends approximately 300 m seaward and will entirely contain the marine terminal.

The Affected Area encloses the zone which could potentially be affected by Project components or activities and routes to the main shipping lanes in Chedabucto Bay (Figure 6.11-3). For this VC, the Affected Area includes the footprint of the marine terminal occupying approximately 0.4 ha in water up to 26 m deep and extending up to 120 m from shore. Cobbles dominate the substrate with boulder patches in the vicinity of the marine terminal footprint. The amount of marine flora decreases at depths greater than 25 m. The Affected Area extends 6.8 km from the marine terminal to the established shipping routes.

The Study Area is defined as the area considering all Project-environment interaction, including effects that may occur as a result of shipping between the marine terminal and established shipping routes. For the purpose of the Marine Species and Habitat, assessment of the Study Area is defined as the Canso Ledges EBSA to the mouth of Chedabucto Bay, considered a functioning marine ecosystem in *Ecological and Human Use Information for Twenty Areas on the Atlantic Coast of Nova Scotia in Support of Conservation Planning* (Gromack et al. 2010).

7.11.2.3 *Administrative Boundaries*

Fish and fish habitat in general are regulated by DFO at the federal level. The federal Fisheries Act (Section 35) is the primary legislation in Canada governing the protection, conservation and management of fish and fish habitat. This Act is enforced by Fisheries and Oceans Canada and prohibits serious harm to fish that are part of or support a commercial, recreational, or Aboriginal (CRA) fishery. Harm can be caused by proposed works, undertakings or activities that affect fish habitat, passage of fish or modify flow in watercourses. If serious harm to fish that is part of or support commercial, recreational or Aboriginal fisheries will occur as the result of a proposed undertaking, the proponent is required to prepare a habitat off-set plan and obtain an authorization under the Fisheries Act 35(2)(b) prior to commencing works.

Marine flora is a component of fish habitat and therefore is subject to regulations under the federal *Fisheries Act*. Sections of the *Fisheries Act* prohibiting the introduction of deleterious substances into marine waters are governed by EC. Protection of marine fauna is subject to the same regulations.

7.11.2.4 *Technical Boundaries*

No technical boundaries were identified for this VC.

7.11.3 Threshold for Determination of Significance

Methods describing the spatial and temporal effects of the Project activities and works on Marine Species and Habitat, including marine fish and fish habitat are described below.

Presence and absence of fish and fish habitat was determined through a sampling program described in Section 6.6. Quantity and quality of fish habitat was estimated using GIS tools. To the extent possible, potential effects of the Project on fish and fish habitat were quantified.

- Direct removal of marine habitat was assessed by querying the data layers with the anticipated disturbance areas within the Project Area and tallied.
- Indirect effects from changes in surface water quantity were assessed based on results from available surface water quality assessment.
- Effects to fish and fish habitat from the use of explosives near water, i.e. blasting.
- Effects to fish and fish habitat from in water vibrations associated with pile driving.

A significant adverse effect on the marine environment and biota is defined as one that is likely to cause:

- Adverse and irreversible changes to critical habitats;
- serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish species that support such a fishery;
- permanent impairment of the ecological functioning of the biotic community; and/or
- increased ecological risk to a level that long term effects to the health of aquatic biota is predicted.

7.11.4 Effects on Marine Environment

As described in Section 3 (Project Description) the construction of the marine terminal will be based on a rubble mound approach with caissons installed to support the slewing or loading arm. Major components of the terminal will consist of:

- Rubble fill mound with an access road for maintenance
- Three breasting caissons.
- Two mooring dolphins.
- Eleven slewing rail piers, with piles installed in the seabed.
- One slewing rail caisson.
- Ship loader mounted on the slewing rail.

No refuelling facilities will be present.

There is limited information on coastal currents along the south shore of Chedabucto Bay in the Project area. Lawrence (1979) reports the results of five current meter moorings placed in Chedabucto Bay for 18 days in April 1970 following the *ARROW* oil spill. Mooring Station 3 was within several tens of meters from Black Point. The mean current amplitude in Chedabucto Bay was reported at 2.9 cm/sec with a large standard deviation (+- 3.0). The extreme current minimum is 0.9 cm/sec while the extreme maximum was 11.5 cm/sec. Lawrence (1979) notes a tendency for anticlockwise flow at all three depth levels with a "strong topographic influence evident from directions at Station 3 near the southern coast" (i.e., near Black Point). He goes on to note "strong mean currents were recorded at Station 3".

Owens and Rashid (1976) described the south shore zone of Chedabucto Bay ranging from "sheltered, low-energy beaches composed of poorly sorted till-derived sediments, cobble and boulder beaches, to resistant rock cliffs directly exposed to the Atlantic Ocean." In their discussion regarding the beach at Indian Cove (within Fox Bay immediately east of Black Point), they note "relatively little sediment is supplied to the littoral zone along this coast, due to the absence of till deposits along the shore zone, the resistant nature of the bedrock outcrops, and the steep offshore gradient." They go on to note "The shoreline at the entrance of (Indian) Cove is rock and is devoid of sediment. The only source for the littoral zone is material transported into the Cove on the sea-floor as bed-load or in suspension during periods of storm waves." Although the beach is prograding…the rate of accumulation is slow because of the low volume of sediment input. This is consistent with Project team subsea video observations (Appendix J) and sediment samples taken for granulometric analysis. The marine substrate at Fogerty Head is dominated by coarse materials including cobble, rock, and large boulders; granulometric analysis reported the samples were approximately 75-80% gravel (Section 6.6.2).

In summary, although currents may be significant off Black Point, observations and limited literature reports together suggest that the transport of sediments along shore is minimal in this area, largely due to the paucity of eroding sediments and the generally coarse grain size.

Project interactions with the VC are summarized in Table 7.11-2.

Table 7.11-2:
Potential Project Interactions with Marine Species and Habitat

Project Works and Activities	Interaction with VC (Yes / No)	Rationale
Site Preparation/Construction		
Construction of processing plant and associated infrastructure (offices, roads, electrical transmission lines and substation, etc.)	Yes	If uncontrolled, erosion may lead to sediment transport to the marine environment, negatively affecting water quality and near shore habitat.
Construction of the marine terminal	Yes	Marine terminal infrastructure will occupy habitat within the marine environment, killing or displacing the flora and fauna present. Marine construction activities may create or re-suspend bottom sediments, smothering nearby habitats
Operations Phase Works and Activities		
Operations and maintenance of terrestrial infrastructure	Yes	Discharge of sediment-laden surface water to the marine environment may negatively affect water quality; sediment may cover marine flora and harm benthic habitat and affect the quality of fish habitat function.
Pit development (including top soil and overburden stockpiling, explosives use, on-site materials transport)	Yes	Excessive use of explosives near water may cause serious harm to fish.
Ship loading	Yes	Aggregate spills during ship loading may cover marine flora, benthic habitat and affect the quality of fish and habitat function.
Aggregate transport by vessel	Yes	Ship noise and movement may affect the behaviour of marine species negatively affecting their survival; illegal bilge water discharge may introduce invasive species. Propeller wash can affect marine flora and fauna negatively by re-suspending sediments and causing siltation.

Project Works and Activities	Interaction with VC (Yes / No)	Rationale
Closure and Rehabilitation Phase Works and Activities		
Partial removal of the marine terminal infrastructure to ensure safety and security	Yes	Limited interactions with marine biota are anticipated during marine terminal decommissioning

Potential effects associated with the Project are:

1. Reduced habitat quality and habitat function due to altered water and sediment quality from sediments introduced to the marine environment during construction and operation. The potential effect of runoff from the terrestrial environment and mitigation measures designed to limit its occurrence are described in Sections 7.4 and 7.6.
2. Reduced habitat for fish that are part of or support commercial, recreational or Aboriginal fisheries resulting from construction of marine terminal.
3. Fish mortality due to the use of explosives within the pit; behavioural changes to fish, crustaceans and other marine species due to noise and vibrations associated with explosives use.
4. Mortality and/or the loss of benthic habitat due to aggregate spills when the ships are loaded.
5. Increased disturbance to marine flora and fauna and reduced habitat quality and function for marine species due to noise and vessel movement from increased ship traffic.
6. Invasive species that may be introduced through the illegal discharge of ballast water.

Effects of Construction

Construction of the marine terminal will remove sea bed habitat even as new habitat is created by the terminal rubble mound foundations. The total seafloor habitat lost will be approximately 11,100 m^2. The area includes the footprint and impact from rubble fill, caissons, and mooring dolphins. While this habitat is important to the marine biota (flora and fauna) it supports, it is not particularly rare within Chedabucto Bay and does not support any unique characteristics. Table 7.11-3 compares the surface area of the Project footprint within the study boundaries to the size of each of the study areas.

Table 7.11-3:
Percentage Occupied by the Terminal Within Each Boundary

Measure	Project Area	Affected Area	Study Area
Area of marine habitat (ha)	1.11	3.87	61, 200
Area of marine habitat affected (ha)	1.11	1.11	1.11
% area of marine habitat removed	100	28	0.002

The Study Area includes 61,200 ha of marine habitat. The habitat lost as a result of the terminal will be approximately 1.1 ha. The loss of marine habitat represents less than 0.002% of the total Study Area. The removal of this habitat for the project is not anticipated to limit the amount of suitable available habitat for American lobster or prey species.

Fisheries and Oceans Canada policy requires that Proponents replace or recreate fisheries productivity lost as a result of their projects. Following discussions with local fishermen under the auspices of the GCIFA, it appears likely that rocky substrate suitable for lobster habitat can be created immediately east or west of the Black Point Project site. In these areas, bathymetry restricts suitable lobster habitat to a narrow band in the nearshore. Local fishermen suggest that opportunities exist to widen this band in the immediate Project vicinity.

As noted above, construction of the terminal will disturb the substrate and re-suspend sediments into the water column. Although this may affect marine plants and cause reduced habitat quality leading to mortality of less mobile invertebrates, fish will likely re-locate to adjacent areas to avoid the disturbance. Within the Project Area, the marine substrate is dominated by coarse materials including cobble, rock, and large boulders with smaller areas of fine substrates (sand and silt). The density of marine flora reduces at depths greater than 25 m within and greater than 100 m from shore. The coarse grained nature of the substrate suggests that sediment resuspension during construction will be minimal and is so is not likely to produce a significant effect.

Vibrations associated with pile driving to install the slewing area foundations will result in a zone potentially lethal to fish extending 10 m from the piles (**Appendix D**). Pile driving is expected to occur over several months but will temporary in duration. Additional noise in the marine environment will be created by the placement of rocks making up the rubble mound, installation of the mooring dolphins (pile driving not required) and associated vessel traffic.

Effects of Operation

The detonation of explosives has the potential to cause injury or death to marine fish and mammals in the immediate nearshore area. Concerns regarding the use of explosives have also been raised by some local fishermen; specifically whether the noise and vibrations will affect lobster and mackerel behaviour. Blasting produces compressive shock waves in water followed by a rapid decay to below ambient hydrostatic pressure (Wright and Hopky 1998). Overpressure can damage fish swimbladders, rupture or haemorrhage internal organs, and kill or damage fish eggs and larvae, including crab and lobster eggs and larvae.

To avoid these effects, blasting charge size must be reduced if the location of blast is near the water's edge. For large blasts – on the order of 100 kg per hole – DFO guidelines stipulate a setback of about 150 m is required (Wright and Hopky 1998).

The Standard Shot Design prepared by the Proponent's blasting specialists demonstrates how different blasting configurations will be used closer and farther from water's edge (Table 3.3 in Section 3 - Project Description). These configurations will be used to ensure that maximum acceptable particle velocities for protection of fish will not be exceeded[8]. This is illustrated on **Figure 7.11-1**, which demonstrates that blasting needed to level the lower coastal platform ("cut and fill" on Figure 3.0-26) as well as blasting at the quarry face can be undertaken without exceeding the DFO guidelines.

[8] Table 2 in Wright and Hopky 1998: *Setback distance (m) from centre of detonation of a confined explosive to spawning habitat to achieve 13mm•sec-1 guideline criteria for all types of substrate.*

Ship loading may result in aggregate spills to the marine environment. Transport of aggregate via seagoing vessels will impact upon the marine environment through noise associated with vessel passage and potentially through accidental spills or other incidents at sea.

During operation, noise produced by ships may adversely affect the behaviour of marine species near the ship loading area and in the travel lanes from the marine terminal to the main shipping lanes. Fish or marine mammals may avoid the area, change migratory routes, and alter feeding habits (Lawson *et al.* 2000). Propeller wash may re-suspend sediment affecting marine plants and relatively immobile marine fauna in relatively shallow areas, although as noted, substrates in the vicinity of the marine terminal are relatively coarse and not likely susceptible to resuspension.

Accidental spills or the release of bilge, ballast or wastewater from ships can affect water quality and negatively affect species in the area. The release of ballast water can also facilitate the introduction of invasive species and potentially alter the aquatic food web structure.

Effects of Decommissioning

The effects are expected to be similar to the construction phase.

7.11.5 Mitigation and Monitoring

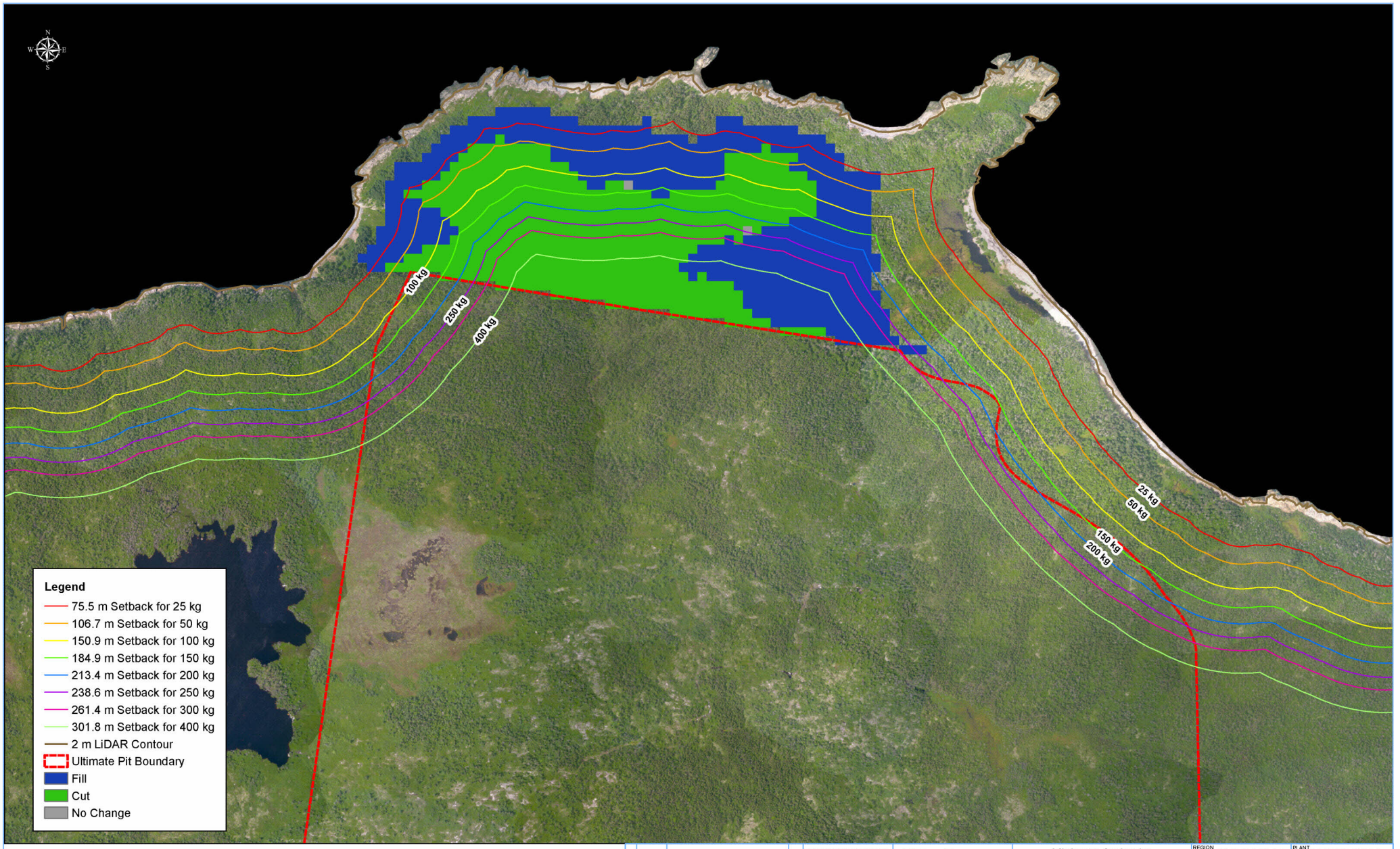
The following additional technically and economically feasible mitigation measures are identified to reduce the severity of adverse effects on Marine Species and Habitat.

Construction

An Environmental Management Plan will describe the following preventative and mitigation measures:

- Application of appropriate timing windows for all in-water work.
- Implementation of terrestrial erosion and sediment control measures.
- Use of surface water monitoring to ensure that quality meets all relevant regulatory standards prior to discharge to receiving environment.
- Installing overburden stockpiles, fuel and chemical storage facilities a minimum of 30 m from Chedabucto Bay.
- Implementation of an Emergency Response and Spill Contingency Plan for Accidents and Malfunctions.

Prior to commencing full blasting operations, field observations will be made to characterize the effects of vibrations on fish habitat. Observations will include measurements of peak particle velocity of substrates and over pressure in fish bearing waters. If peak particle velocities and overpressures meet DFO threshold values, then the Project will proceed with normal blasting operations as assumed for the base case in the vibration assessment. If effects from vibrations exceed the DFO thresholds, then a site specific standard to protect fish and an appropriately scaled fish and fish habitat offset plan will be implemented. This site specific standard may include modified blasting protocols (based on field testing and as currently described) and/or timing of blasts near the marine environment to avoid sensitive periods.



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Minimum Setbacks per kg of Explosives

REGION NOVA SCOTIA

PLANT BLACK POINT

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JOB NO. SCALE 1 in = 150 m

PATH

DWG. NO. Figure 7.11-1

Operation

- Ensure that discharges of water from the operation comply with surface water quality standards
- Locate overburden stockpiles, fuel or chemical storage facilities, and construction equipment a minimum of 30 m from Chedabucto Bay.
- Preparing an Emergency Response and Spill Contingency Plan for Malfunctions and Accidents.
- Control ballast water release via the *Ballast Water Control and Management Regulations* and the requirements as per the International Convention for the control and Management of Ship's Ballast Water and Sediments.

7.11.6 Offset Strategies

Due to the nature of the project, unavoidable serious harm to marine fish and fish habitat will result from the construction of the marine terminal. To counter-balance unavoidable serious harm to fish and loss of fisheries productivity for species that are part of or support a commercial, recreational or Aboriginal fishery, the Proponent will prepare an Offset Plan pursuant to the Fisheries Act Section 35(2)(b). The Offset Plan will be prepared in consultation with Fisheries and Oceans Canada, Environment Canada, local commercial fisherman, and Mi'kmaq groups. Consideration will be given to DFO's four guiding principles, and the fisheries management values and objectives of local commercial fisherman and Mi'kmaq groups.

Offsets will be required for the destruction of approximately 1 ha of marine habitat. The habitat that will be displaced as a result of the marine terminal currently supports invertebrates' species including commercially harvested American Lobster. At present (following discussions with local fishermen), consideration is being given to the following offset measures:

- Artificial reefs
- Eel grass plantings
- Release juvenile lobster
- Improve juvenile lobster habitat

The Project team will evaluate potential offset opportunities that are consistent with local management plans, in proximity to lobster capture locations and have suitable depth, substrate, and vegetation near the Project site.

Artificial reefs can serve as habitat for lobsters and other invertebrates in the study area such as crabs and mussels. Reefs can be designed to incorporate the preferred substrate types such as rock over top of softer substrates. AMEC (2008) indicated that the placement of piles of 15 to 20 cm rock in patches 3 m in diameter and 0.5 m in height would attract adult lobsters. Similarly the placements of rock from 2 to 20 cm plus boulders of 45 to 100 cm would provide habitat within interstitial space for crabs and lobster of different life stages.

Monitoring of the effectiveness of the marine Fisheries Offset Program would be undertaken for at least three years until it can be demonstrated that the program objectives have been met.

7.11.7 Methodology for Determination of Significance

Potential effects of the project on the marine environment include changes in habitat suitability associated with physical habitat alteration, potential exposure to substances entering the water resulting from project activities and changes such as dissolved oxygen, water flow and water temperature regimes. Effects are considered during construction, operation and decommissioning phases of the project. Effects are summarized in a regional context in Table 7.11-4.

7.11.8 Residual Effects and Significance

Residual effects are evaluated after application of mitigation measures. These effects are assessed in the context of:

- Magnitude
- Geographic extent
- Duration
- Frequency
- Reversibility
- Ecological Context

Mitigation by design has been achieved through the evaluation of alternatives as it relates to the layout, construction, and operation of the various project components. Of particular importance was avoiding overprinting of any highly sensitive ecological components.

Provided that the current design plan is used, mitigation measures are followed, and appropriate offset strategies are developed and effective, no significant adverse residual environmental effects on the marine environment are likely to result.

Table 7.11-4:
Residual Effects on Marine Species and Habitat

Project Environment Interaction	Potential Residual Environmental Effects A=Adverse P= Positive	Mitigation	Magnitude	Geographic Extent	Duration / Frequency	Reversibility	Ecological / Socio-Economic Context	Residual Effect	Significance of Residual Effect
Noise and vibration effects to marine biota from blasting and pile driving	A	See Mitigation Section	1	2	1/6	R	1	Temporary disturbance	Not Signif.
Permanent loss of habitat (flora, substrates) resulting from the construction and operation of the marine terminal	A	See Mitigation Section	1	1	3/1	R	1	None anticipated following implementation of Offset	Not Signif.
Effects on marine water quality due to construction of the marine terminal and/or spills or discharges from the terrestrial environment	A	See Mitigation Section	1	1	1/1	R	1	None anticipated	Not Signif.
Re-suspension of sediments from propeller wash affecting marine flora and fauna and their habitat in relatively shallow water	A	See Mitigation Section	1	1	1/5	R	1	None anticipated	Not Signif.

Disturbance of seabirds and waterfowl marine terminal activity and vessel movement between the terminal and the main shipping lanes approximately 7 km from the terminal	A	See Mitigation Section	1	2	1/4	R	2	None anticipated	Not Signif.
Illegal discharge of ballast water	A	See Mitigation Section	1	2	1/1	I	1	None anticipated	Not Signif.

Legend

Magnitude:
U= Unknown - An environmental effect affecting an unknown portion of a population or group or where the changes in a specific parameter are unknown.
0 = Nil - No environmental effect.
1 = Low (e.g., specific group, habitat, or ecosystem localized 1 generation or less, within natural variation)
2 = Medium (e.g., portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside the range of natural availability)
3 = High (e.g., affecting entire stock, population, habitat or ecosystem, outside the range of natural variation)

Geographic Extent:
1 = < 1 km^2
2 = 1 – 10 km^2
3 = 11 – 100 km^2
4 = 101 – 1,000 km^2
5 = 1,001 – 10,000 km^2

Duration:
1 = < 1 month
2 = 1 – 12 months
3 = 13 – 36 months
4 = 37 – 72 months
5 = > 72 months

Frequency:
1 = < 11 events/year
2 = 11 – 50 events/year
3 = 51 – 100 events/year
4 = 101 – 200 events/year
5 = > 200 events/year
6 = continuous

Reversibility:
R = Reversible
I = Irreversible

Ecological / Socio-Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity.
2 = Evidence of adverse environmental effects.

N/A = Not applicable
A = Adverse
P = Positive

7.12 SAR and SOCC

This section discusses the potential impacts of the Project on SAR and SOCC on the Project site. Existing flora and fauna SAR and SOCC are described in Section 6.7.

7.12.1 Boundaries

The Project Area and Affected Area spatial ecological boundaries for terrestrial wildlife include all environments within the footprint of the Project (including the access road), as well as all environments within 500 m of the Project site and the shipping routes offshore in habitats utilized by marine species (including mammals, fish, and reptiles). This buffer is considered to be the maximum extent to which noticeable effects on SAR can be reasonably expected as a result of Project components and activities.

The temporal ecological boundaries encompass every year of all phases of the Project, including construction, operation and decommission. Within each year, interactions between terrestrial fauna and Project components or activities can occur year round.

With respect to the administrative and legislative boundaries, the *Nova Scotia Endangered Species Act* (*NSESA*) and the federal *Species at Risk Act* (*SARA*) offer legal protection to species that have been proclaimed as endangered, threatened or vulnerable under these *Acts*.

7.12.2 Threshold for Determination of Significance

A significant adverse effect of Project components or activities on a SAR or SOCC is defined as an effect that causes a decline in abundance and/ or a change in distribution beyond which natural recruitment (reproduction and immigration from unaffected areas) would not return the population to its pre-project level within several generations. Mortality of a single individual of a Species at Risk could also be considered a significant adverse environmental effect.

Effects on critical habitat of a migratory bird SAR which cause breeding failure or abandonment of nesting may also be considered significant, even if the effects are temporary. This would include abandonment or nesting failure of a migratory bird SAR due to an accidental event or the response to an accidental event associated with the Project.

A significant adverse effect on sensitive/ critical habitat is defined as an adverse effect that causes a net loss of habitat function.

An adverse effect that does not cause such declines or changes is not considered to be significant.

A positive effect occurs when Project activities help increase abundance or diversity of species or enhances habitat.

7.12.3 Effects on Terrestrial Flora SAR/SOCC

Terrestrial SOCC on the project site include both vascular plants and lichens. Potential effects to each of these taxa are discussed separately in the following subsections.

Vascular Plants

Two vascular plant SOCC are known to occur in the Project footprint. These are Northern Commandra (*Geocaulon lividum*) (GSWSC 3 (Sensitive)) and Southern Twayblade (*Listera australis,* GSWSC 3 (Sensitive)). Northern Commandra occurs to the south of the main Project boundary, but lies along the proposed access road. Southern Twayblade was found in two areas, both within the planned Project footprint. Potential effects on Northern Commandra and Southern Twayblade are expected to be similar to effects on vascular plant species as a whole, which are discussed in detail in Section 7.7. Potential effects of the Project phases on flora SAR are summarized in Table 7.12-1.

Table 7.12-1:
Summary of Potential Impacts of the Black Point Quarry Project on Species at Risk (SAR) and Species of Conservation Concern (SOCC) by Project Phase

Priority Species in Project Area Potentially Affected by Project	Critical Habitat Present in Project Footprint	Potential Effects																	Specific Comments
		Direct Mortality	Loss of Habitat	Habitat Alteration	Disturbance/ Displacement	Increased Noise	Increased Dust	Blasting Effects	Increased Human Presence	Sedimentation / Erosion	Decreased Air Quality	Decreased water Quality/Quantity	Alterations to Hydrology	Establishment of invasive Species	Increased Site Lighting		Exposure to Contaminant	Accidents and Malfunctions	Creation of Suitable Habitat	
Construction / Decommissioning Phase	**(Effects of Decommissioning and Reclamation Phase expected to be similar, but of lesser magnitude)**																		
FLORA SAR/SOCC																			
Vascular Plants • Northern Commandra, • Southern Twayblade	No	X	X	X						X				X				X		Effects and Mitigation similar to that for common Vascular Plants (Section 7.7)
Lichens • Angel Hair Ramalina, • Black-footed Reindeer Lichen, • Coastal Bushy Beard Lichen, and • Naked Kidney Lichen	No	X	X	X						X	X			X				X		Effects and Mitigation similar to that for common Lichens (Section 7.7)
Terrestrial Mammal SAR/SOCC																			
• Eastern Moose-Mainland NS population	No	X	X	X	X	X											X	X		Effects and Mitigation also similar to that for common Terrestrial Mammals (Section 7.9) and Accidental Events (Section 7.19).
Bird SAR/SOCC																			
Landbirds (including Passerines, Raptors & Owls): • Rusty Blackbird • Bay-breasted Warbler, • Black-backed Woodpecker, • Blackpoll Warbler, • Boreal Chickadee, • Golden-crowned Kinglet, • Gray Jay, • Ruby-crowned Kinglet; and • Yellow-bellied Flycatcher	No		X	X	X	X			X						X			X		Effects and Mitigation similar to that for common Birds (Section 7.9).

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Priority Species in Project Area Potentially Affected by Project	Critical Habitat Present in Project Footprint	Potential Effects																		Specific Comments
		Direct Mortality	Loss of Habitat	Habitat Alteration	Disturbance/ Displacement	Increased Noise	Increased Dust	Blasting Effects	Increased Human Presence	Sedimentation / Erosion	Decreased Air Quality	Decreased water Quality/Quantity	Alterations to Hydrology	Establishment of invasive Species	Increased Site Lighting	Exposure to Contaminant	Accidents and Malfunctions	Creation of Suitable Habitat	
• **Seabirds and Waterfowl**: • Common Loon, • Great Cormorant, • Harlequin Duck, • Common Tern, • Arctic Tern, and • Roseate Tern.	No		X		x	X			x							x	x		Effects and Mitigation similar to that for common Birds (Section 7.9), Marine Species (7.11) and Accidental Events (Section 7.19).
• **Shorebirds:** • Semipalmated Sandpiper, • Spotted Sandpiper, and • Greater Yellowlegs	No		x		x	x			x							x	x		Effects and Mitigation similar to that for common Birds (Section 7.9) and Accidental Events (Section 7.19).
Herpetile SAR/SOCC		NONE KNOWN OR SUSPECTED TO OCCUR ON BLACK POINT SITE																	
Invertebrate SAR/SOCC																			
Odonates • Spot-tailed Glider	No	x	x	x	x					x		x	x				x	x	Effects and Mitigation similar to that for Freshwater Aquatic Species and Habitat (Section 7.10), Wetlands (Section 7.8), Accidental Events (Section 7.19). Decommissioning / reclamation may create habitat.
Freshwater Fauna SAR/SOCC		NONE KNOWN OR SUSPECTED TO OCCUR ON BLACK POINT SITE																	
Marine Fish SAR/SOCC																			
• Atlantic Sturgeon, • American Eel, • Atlantic Cod-Southern population, • American Plaice- Maritimes population, • Atlantic Halibut, • Porbeagle, • Winter Skate, • Pollock, • Atlantic Salmon, • Spiny Dogfish, • Albacore, • Yellowfin Tuna, • Bigeye Tuna, • Atlantic Bluefin Tuna, and • White Hake-Atlantic and Northern Gulf of St. Lawrence population	No				x	x			x	x		x				x	x		Effects and Mitigation similar to that for, common Marine Species (7.11) and Accidental Events (Section 7.19).
Marine Mammal SAR/SOCC																			
• Harbour Porpoise	No	X-ship collisions				X			X-boat traffic							X-ship discharges	X		Effects and Mitigation similar to that for common Marine Species (7.11) and Accidental Events (Section 7.19).

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Priority Species in Project Area Potentially Affected by Project	Critical Habitat Present in Project Footprint	Potential Effects																	Specific Comments
		Direct Mortality	Loss of Habitat	Habitat Alteration	Disturbance/ Displacement	Increased Noise	Increased Dust	Blasting Effects	Increased Human Presence	Sedimentation / Erosion	Decreased Air Quality	Decreased water Quality/Quantity	Alterations to Hydrology	Establishment of invasive Species	Increased Site Lighting	Exposure to Contaminant	Accidents and Malfunctions	Creation of Suitable Habitat	
Marine Reptile SAR/SOCC																			
• Atlantic Leatherback	No				X-boat traffic	X			X-boat traffic							x-ship discharges	X		Effects and Mitigation similar to that for), common Marine Species (7.11) and Accidental Events (Section 7.19).
Operations Phase																			
Terrestrial Flora SAR/SOCC																			
Vascular Plants • Northern Commandra, • Southern Twayblade	No									X		X	X	X		X- road salt	X		Effects and Mitigation similar to that for common Vascular Plants (Section 7.7)
Lichens • Angel Hair Ramalina, • Black-footed Reindeer Lichen, • Coastal Bushy Beard Lichen, and • Naked Kidney Lichen																			Effects and Mitigation similar to that for common Vascular Plants (Section 7.7) and Lichens (Section 7.7).
Terrestrial Mammals SAR/SOCC																			
• Eastern Moose- Mainland NS population	No	X	X	X	X	X			X										Effects and Mitigation also similar to that for common Terrestrial Mammals (Section 7.9) and Accidental Events (Section 7.19).
Bird SAR/SOCC																			
Landbirds (including Passerines, Raptors & Owls): • Rusty Blackbird • Bay-breasted Warbler, • Black-backed Woodpecker, • Blackpoll Warbler, • Boreal Chickadee, • Golden-crowned Kinglet, • Gray Jay, • Ruby-crowned Kinglet, ; and • Yellow-bellied Flycatcher	No								X						X				Effects and Mitigation similar to that for common Birds (Section 7.9) and Accidental Events (Section 7.19

C 1340-581

Priority Species in Project Area Potentially Affected by Project	Critical Habitat Present in Project Footprint	Potential Effects																	Specific Comments
		Direct Mortality	Loss of Habitat	Habitat Alteration	Disturbance/ Displacement	Increased Noise	Increased Dust	Blasting Effects	Increased Human Presence	Sedimentation / Erosion	Decreased Air Quality	Decreased water Quality/Quantity	Alterations to Hydrology	Establishment of invasive Species	Increased Site Lighting	Exposure to Contaminant	Accidents and Malfunctions	Creation of Suitable Habitat	
• **Seabirds and Waterfowl**: • Common Loon, • Great Cormorant, • Harlequin Duck, • Common Tern, • Arctic Tern; and • Roseate Tern.	No		X						X							X	X		Effects and Mitigation similar to that for common Birds (Section 7.9) and Accidental Events (Section 7.19
• **Shorebirds:** • Semipalmated Sandpiper, • Spotted Sandpiper, and • Greater Yellowlegs	No		X						X							X	X		Effects and Mitigation similar to that for common Birds (Section 7.9) and Accidental Events (Section 7.19
Herpetile SAR/SOCC		**NONE KNOWN OR SUSPECTED TO OCCUR ON BLACK POINT SITE**																	
INVERTEBRATE SAR/SOCC																			
Odonates • Spot-tailed Glider	No	X								X		X				X-pesticides	X		Effects and Mitigation similar to that for common Birds (Section 7.9) , wetlands, (Section 7.8), Terrestrial ecosystems (Section 7.7) , and Accidental Events (Section 7.19
Freshwater Fauna SAR/SOCC		**NONE KNOWN OR SUSPECTED TO OCCUR ON BLACK POINT SITE**																	
Marine Fish SAR/SOCC																			
• Atlantic Sturgeon, • American Eel, • Atlantic Cod-Southern population, • American Plaice- Maritimes population, • Atlantic Halibut, • Porbeagle, • Winter Skate, • Pollock, • Atlantic Salmon, • Spiny Dogfish, • Albacore, • Yellowfin Tuna, • Bigeye Tuna, • Atlantic Bluefin Tuna, and • White Hake-Atlantic and Northern Gulf of St. Lawrence population	No				X-propeller wash				X-ship traffic					X-ballast water		X-ship discharges			Effects and Mitigation similar to that for Marine species and habitats (7.11) and Accidental Events (Section 7.19)

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Priority Species in Project Area Potentially Affected by Project	Critical Habitat Present in Project Footprint	Potential Effects																	Specific Comments
		Direct Mortality	Loss of Habitat	Habitat Alteration	Disturbance/ Displacement	Increased Noise	Increased Dust	Blasting Effects	Increased Human Presence	Sedimentation / Erosion	Decreased Air Quality	Decreased water Quality/Quantity	Alterations to Hydrology	Establishment of invasive Species	Increased Site Lighting	Exposure to Contaminant	Accidents and Malfunctions	Creation of Suitable Habitat	
Marine Mammal SAR/SOCC																			
• Harbour Porpoise	No	X-ship collisions				X			X-ship traffic							X-ship discharges	X		Effects and Mitigation similar to that for Marine species and habitats (7.11) and Accidental Events (Section 7.19)
Marine Reptile SAR/SOCC																			
• Atlantic Leatherback						X			X -boat traffic							X-ship discharges	X		Effects and Mitigation similar to that for Marine species and habitats (7.11) and Accidental Events (Section 7.19)

Note:
No terrestrial Amphibian or Reptile (collectively herpetile) SAR are known or suspected to occur on the site or nearby and therefore are not discussed in this table.

Lichens

Four lichen SOCC are known to occur on the Project site. These are Black-footed Reindeer Lichen (*Cladonia stygia*), Naked Kidney Lichen (*Nephroma bellum*), Coastal Bushy Beard Lichen (*Usnea flammea*), and Angel Hair Ramalina (*Ramalina thrausta*). All of these are listed as 3 (Sensitive) on the GSWSC list for NS.

Black-footed Reindeer Lichen occurs in several locations on the Project site, with 19 occurrences detected. Naked Kidney Lichen and Coastal Bushy Beard Lichen both occur in two locations, with one report of each from the northern and southern portions of the property, respectively. Angel Hair Ramalina is known to occur at one location near the centre of the site. The endangered Boreal Felt Lichen is not known to occur in the general area and was not found on site. Polygons of potential Boreal Felt Lichen habitat, as mapped by NSE (2009), are considered to be too far away from the Project site to be affected by Project activities, such as dust emissions.

It is likely that most of these four species occurring on the Project site will experience some direct mortality from Project activities. Overall, potential effects on lichen SAR and SOCC are expected to be similar to those outlined for lichen species as a whole, in Section 7.1. Potential effects of the Project phases on lichen SAR/SOCC are summarized in Table 7.12-1.

7.12.4 Effects on Terrestrial Fauna SAR/SOCC

For most terrestrial fauna SAR/SOCC (including the one mammal, fourteen bird, and one odonate), potential effects are predicted to be similar to those for terrestrial fauna as a whole (Section 7.7). Potential effects of the Project phases on all terrestrial fauna SAR/SOCC are summarized in Table 7.12-1.

The following subsections focus on terrestrial fauna SAR/ species which are known to occur on the Project site.

7.12.4.1 *Mammals*

Moose

The mainland Nova Scotia population of Eastern moose, which is listed as Endangered under the *NSESA*, could potentially be affected by the proposed Project in a variety of ways. Potential impacts to Mainland Moose are summarized in Table 7.12-1. They include:

- Loss of habitat (foraging, wintering, calving);
- Habitat fragmentation;
- Disruption of migratory routes;
- Mortality due to vehicle collisions;
- Increased poaching levels in area due to increased traffic;
- Noise disturbance; and
- Exposure to runoff from hazardous materials/contaminated soils.

Habitat loss will occur on the site due to site development and clearing activities for the main Project site and the access road. Important habitats for Moose tend to be wintering and calving areas. Preferred wintering habitat for Moose in Nova Scotia typically consists of mature conifer or mixed conifer stands, where snow accumulation is decreased and browse is available, reducing winter energy demands (Parker 2003). Approximately 213 ha of coniferous forest and wetland occurring on the Project site will be removed during site development. This parcel of habitat is not part of a core Moose habitat polygon which encompasses much of Guysborough and Antigonish counties (Parker 2003), and so should not be considered significant. The development of the Project is not expected to significantly affect Moose wintering based on current knowledge. However Moose winter track and spring pellet surveys are planned in the area during the winter of 2015 and will provide site specific data related to site utilization of Moose during the winter.

Moose tend to utilize areas associated with aquatic/wetland areas for calving, but will also use islands in beaver ponds and wetland areas with standing water (Parker 2003). There is little of this habitat on site, and standing water areas occur mostly along the shore, where the exposure likely limits the utility of these locations as calving areas. The low density of Moose in the area, combined with the abundance of similar and much larger wetlands throughout the region results in the proposed Project having very little potential to adversely affect calving.

Land clearing on the Project site (213 ha) and the creation of the access road (800 m in length) will contribute to habitat fragmentation in the region. Land clearing for siviculture has also occurred to the east in the vicinity of Fox Island Main. The region is crisscrossed by many small logging and ATV roads and the effects of the Project are predicted to be insignificant within the region.

The increased visitation of and/or residency in the region during the construction and operations phases could also lead to impacts on Moose due to increased poaching activity. Mainland Moose are endangered and hunting them is not permitted; however, poaching continues to be a concern. The presence of the Project on the site, combined with strict reporting policies for any suspected Moose hunting activities in the area, will help to mitigate this potential effect.

It is possible that Moose could be affected by an accident within the Project site resulting in an off-site forest fire, although this is not considered likely. For a discussion of accidental events, possible consequences and preventative measures refer to Section 7.19.

Increased road traffic in the area due to the Project could potentially lead to increased risk of collisions with Moose, potentially leading to mortality. Vehicle use on-site could also result in accidental mortality of Moose. As very few Moose are present in the area, it is unlikely that encounters will occur; however, it is important to recognize the importance of each individual Moose within the small Guysborough population.

The development of the Project site could potentially hinder some small-scale seasonal movements of Moose. Fencing around the site will prevent Moose from accessing the site, forcing them to travel around the site boundaries if they desire. However, the low density of Moose in the area, combined with the relatively small distance such a detour would require, in relation to a Moose's home typical territory, results in this effect being insignificant.

Noise associated with construction and/or decommissioning and reclamation activities may disrupt Moose within several hundred metres of the active area; however, similar habitat is available throughout the adjacent area and impacts at the population level are not expected.

Effects of the decommissioning phase on Moose are considered to be similar to the construction phase, with the addition of the possible recreation of suitable habitats. Decommissioning activities and site reclamation could possibly have slight temporary negative effects on Moose; however, the effect of the resulting reclamation on Moose is expected to be positive, with rehabilitation of suitable terrestrial habitats and possibly wetlands.

Mitigation measures for these potential effects are outlined in Section 7.9. Potential effects and mitigation for malfunctions and accidents, such as spills, are discussed in Section 7.19.

7.12.4.2 *Birds*

To date, a total of fourteen bird SOCC have been reported from the Project site. Of these, a single species, the Rusty Blackbird, is actually a SAR, as it was listed as Endangered under the *NSESA* in 2013. Mitigation for potential impacts to this species is outlined in the following subsection.

Rusty Blackbird

Rusty Blackbird, which is listed as Endangered under the *NSESA*, could potentially be affected by the proposed Project in a variety of ways. Potential impacts to Rusty Blackbird are summarized in Table 7.12-1. They include:

- Loss of habitat (foraging, nesting);
- Habitat fragmentation;
- Disturbance from construction noise (including blasting); and
- Exposure to runoff from hazardous materials/contaminated soils.

Habitat loss will occur as a result of the Project due to site development and clearing activities for the main Project site and access road. Rusty Blackbirds tend to prefer cool habitats in forest openings, including spruce bogs, swamps, and damp alder swales. They construct their nests from 0.5 to 6 metres above the ground or water. They do not overwinter in Nova Scotia.

Approximately 213 hectares of coniferous forest, shrub barrens, coastal barrens, mixed forest, and wetland occur on the site and will be removed by the Project over time. Not all of this is suitable habitat for Rusty Blackbirds. This will not occur at once, but over several decades. Progressive reclamation of the pit will ensure that new terrestrial and possibly wetland habitat is created prior to the closure of the quarry.

Land clearing on the Project site (213 ha) and the creation of the access road (800 m in length) will contribute to habitat fragmentation in the region. The region is crisscrossed by many small logging and ATV roads and the effects of the Project are predicted to be insignificant within the region.

The increased visitation of and/or residency in the region during the construction and operations phases could also lead to impacts on Rusty Blackbird breeding due to increased disturbance. Flushing of birds from their nests can have significant impacts on both adult birds and nestlings

due to stress and increased predation (see Section 7.9 for a more detailed discussion). Noise associated with construction and/or decommissioning and reclamation activities may disrupt Rusty Blackbirds within a few hundred metres of the active area; however, similar habitat is available throughout the adjacent area and impacts at the population level are not expected.

It is possible that Rusty Blackbirds could be affected by an accident within the Project site resulting in an off-site forest fire, although this is not considered likely. For a discussion of accidental events, possible consequences and preventative measures refer to Section 7.19.

Effects of the decommissioning phase on Rusty Blackbird are considered to be similar to the construction phase, with the addition of the possible recreation of suitable habitats as revegetation progresses. Decommissioning activities and site reclamation could possibly have slight temporary negative effects on Rusty Blackbird; however, the effect of the resulting reclamation on RBB is expected to be positive, with rehabilitation of suitable terrestrial habitats and possibly wetlands.

Mitigation measures for these potential effects are outlined in Sections 7.9 and Section 7.19.

7.12.4.3 *Herpetiles*

No terrestrial herpetile SAR or SOCC are known or suspected to occur on the Black Point site. Therefore, potential impacts to terrestrial herpetile SAR and SOCC are not discussed in this section.

7.12.4.4 *Invertebrates*

A single invertebrate SOCC species, a dragonfly known as the Spot-winged Glider was detected on the site in 2010. Mitigation for potential impacts to invertebrate SAR and SOCC is covered by the mitigation for terrestrial fauna, freshwater fauna, and wetlands, which are discussed in detail in Section 7.8, Section 7.9, and Section 7.10.

7.12.5 Effects on Freshwater Flora and Fauna SAR/SOCC

No freshwater flora or fauna SAR or SOCC are known or suspected to occur on the Black Point site. Therefore, potential impacts to freshwater SAR and SOCC are not discussed in this section.

7.12.6 Effects on Marine Fauna SAR/SOCC

Several marine fish, mammal, and reptile SAR and/or SOCC have the potential to occur within the marine footprint and immediate vicinity of the Black Point Project site. Potential effects on marine fauna SAR and SOCC are predicted to be similar to those for marine fauna as a whole, which are discussed in detail in Section 7.11. The potential effects of each of the Project phases on marine fish, mammal, and reptile SAR and SOCC are summarized in Table 7.12-1.

7.12.7 Mitigation & Monitoring

Mitigation for potential effects on SAR and SOCC are similar to recommendations for terrestrial or marine fauna as a whole (Section 7.11).

7.12.7.1 *Terrestrial SAR/ SOCC*

Vascular Plant SAR/SOCC

Standard mitigation measures such as minimization of Project footprint, dust control, emissions control, and monitoring of air quality targets as detailed in Sections 7.7 and 7.1 will be sufficient to protect vascular plant SOCC. No vascular plant SAR are known to occur on the Project site.

As part of the EMP compliance monitoring, a program of identification and removal of noxious or exotic invasive weeds can be established. This program would include consideration for seasonality and risk associated with species known to occur in NS.

Lichen SAR

Standard mitigation measures such as dust control, emissions control, monitoring of air quality targets and minimization of Project footprint as detailed in Sections 7.7 and 7.1 will protect lichen SOCC.

No lichen SAR is known to occur on the Project site.

7.12.7.2 *Terrestrial Fauna SAR/SOCC*

Mitigation for potential effects to terrestrial habitats, wetlands, and terrestrial fauna is discussed in detail in Section 7.7, Section 7.8, and 7.9. These mitigation measures should be sufficient to minimize potential impacts to bird, mammal, reptile, odonate and lepidopteran SAR/SOCC potentially occurring in the Project area. Specific mitigation for SAR species known to occur on Project site are discussed for the various terrestrial fauna groups in the following subsections.

Mammals

Standard mitigation measures for wildlife, as detailed in Sections 7.9 will protect mammal SAR and SOCC. A single mammal SAR is known to occur on the Project site, and specific mitigation for this species is outlined in the following subsection.

Moose

Mitigation for potential effects to terrestrial habitats, wetlands and terrestrial fauna, is discussed in detail in Section 7.7, Section 7.8, and Section 7.9. Mitigation measures for mammals should be adequate to mitigate potential effects on mainland Moose in the area.

Standard handling and storage procedures for hazardous material, as well as procedures for handling and disposal of contaminated soils (outlined in Section 7.18), will adequately mitigate the potential for exposure of Moose to any hazardous materials or contaminated soils.

Strict reporting policies for any suspected hunting activities in the area will help to minimize any potential Moose poaching in the Project area.

Imposing a 50 km/hr speed limit will reduce the potential for vehicle-moose collisions on-site year-round. It will also decrease encounters between humans and Moose.

As the Project will be causing some loss of Mainland Moose habitat, the Proponent will consider contributing to efforts on conservation of mainland Moose, via support for the Mainland Moose Recovery Team and/or the Assembly of Nova Scotia Chiefs program for Moose recovery being administered by the Unama'ki Institute of Natural Resources. Details of the Proponent's participation in, or contribution to, these programs can be negotiated and finalized upon environmental assessment approval and in consultation with DNR. A Moose Management Plan may also be implemented to provide information and assist in the recovery of Moose in the Project area.

Birds

Standard mitigation measures for terrestrial habitats, wetlands, and terrestrial fauna, as discussed in detail in Section 7.7, Section 7.8, and Section 7.9 will protect bird SAR and SOCC. A single bird SAR is known to occur on the Project site, and a second has been identified as having potential to occur and has been included as a precaution; specific mitigation for these species is outlined in the following subsection.

Rusty Blackbird

Mitigation for potential effects to terrestrial habitats, wetlands, and terrestrial fauna, is discussed in detail in Section 7.7, Section 78, and Section 7.9. Mitigation measures for birds should be adequate to mitigate potential effects on Rusty Blackbird in the area.

Standard handling and storage procedures for hazardous material, as well as procedures for handling and disposal of contaminated soils (outlined in Section 7.18), will adequately mitigate the potential for exposure of Rusty Blackbird to any hazardous materials or contaminated soils.

Common Nighthawk

Common Nighthawk (*Chordeiles minor*) is a migratory SAR which has the potential to occur on the Property, and which EC-CWS has requested is addressed in this assessment. Nighthawks are often not detected during standard breeding bird point count surveys due to their nocturnal nature. Evening surveys to determine the presence of this crepuscular/nocturnal species were not conducted on the Project site. A precautionary measure, the Proponent is preparing this EIS report under the assumption that this species may be seasonally present.

Mitigation for potential effects to terrestrial habitats, wetlands, and terrestrial fauna is discussed in detail in Sections 7.7 - 7.9. Standard mitigation measures for birds should be adequate to mitigate potential effects on Common Nighthawk in the area, with the additional measure of ensuring that any exposed soils and soil stockpiles are adequately covered or vegetated to deter Common Nighthawks from nesting on them.

Should Common Nighthawks initiate breeding activities on stockpiles or exposed areas on site despite efforts to deter them, the Proponent will establish a 20 m buffer around the location once identified, and contact CWS for further advice. Periodic monitoring of the nest(s) will be undertaken until the chicks have fledged and left the area.

Herpetiles

No mitigation for herpetile SAR and/or SOCC is necessary, as none are known or suspected to occur on the Project site.

Invertebrates

Mitigation for potential effects to terrestrial habitats, wetlands, and terrestrial fauna, is discussed in detail in Section 7.7, Section 7.8, and Section 7. 9. These measures should be sufficient to any mitigate potential effects on Spot-winged Glider, the single SOCC reported from the Project site.

7.12.7.3 *Freshwater SAR/SOCC*

As no freshwater SAR or SOCC are known or suspected to occur on the Black Point Project site, mitigation for such is not necessary. Mitigation for potential effects to freshwater fauna and habitats is discussed in detail in Section 7.10.

7.12.7.4 *Marine SAR/SOCC*

Mitigation of potential effects on marine fauna (fish, mammals, and reptiles) is discussed in detail in Section 7.11. This is applicable to marine fish, mammal, and reptile SAR and SOCC which are considered to have potential to occur within the Project spatial boundaries. While no marine fauna SAR or SOCC have been reported from the marine portion of the Project site, their potential presence cannot be discounted, as marine surveys were beyond the scope of this report. A Marine Habitat Offset Plan is also being developed to mitigate the loss of a small amount of marine habitat within the Project footprint.

7.12.8 Summary and Residual Effects

Table 7.12-2 provides the results of the effects assessment for all flora and fauna SAR/SOCC for the construction and operation phases of the Project. Effects associated with the decommissioning phase are expected to involve similar issues as those discussed for the construction phase.

Table 7.12-2 also provides a summary of recommended mitigation measures and residual environmental effects after successful implementation of the mitigation measures described above. With respect to both the Flora and Fauna SAR/SOCC, Project activities are not likely to result in significant adverse residual effects on SAR or SOCC with proper implementation of recommended mitigation measures.

Table 7.12-2:
Residual Environmental Effects for Species at Risk (SAR)

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Residual Environmental Effects						
			Magnitude	Geographic Extent	Duration/Frequency	Reversibility (R=reversible NR=Non reversible)	Ecological/Social-cultural and Economic Context	Residual Effect	Significance
Construction/ Decommissioning and Operations									
Terrestrial Flora SAR/SOCC (Vascular Plants, Lichens)									
Direct and indirect plant mortality due to displacement or loss of biota.	A	• Survey for SOCC plants prior to construction to maximize avoidance. • Complete works during periods of least biological activity/sensitivity.	Low	Locations of SOCC species	Permanent during lifetime of the Project.	NR during lifetime of the Project.	• Area affected by human activity; pristine areas not known. No critical habitat on-site.	Plant mortality	Not Signif.
Indirect plant mortality due to potential runoff and erosion, siltation and turbidity.	A	• Use of suitable backfill materials. • Restrictions on the removal of riparian vegetation. • Establish a buffer zone of 20 m around freshwater habitat. • Management of stormwater quantity and quality to relevant provincial standards. • Establish and implement EPP/EMP including erosion and sediment control plan.	Low	Project site	Construction Phase; Decommissioning phase.	R	• Area affected by human activity; pristine areas not known. No critical habitat on-site.	None anticipated	Not Signif.

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Residual Environmental Effects: Magnitude	Geographic Extent	Duration/Frequency	Reversibility (R=reversible NR=Non reversible)	Ecological/Social-cultural and Economic Context	Residual Effect	Significance
Indirect plant mortality due to alteration of drainage patterns and infiltration/runoff volumes.	A	• Management of stormwater quantity and quality to relevant provincial standards. • Stormwater will be collected and treated in a stormwater facility prior to discharge as per a site-specific Stormwater Management Plan.	Low	Project site	Permanent during lifetime of the Project.	NR during lifetime of the Project.	• Area affected by human activity; pristine areas not known. No critical habitat on-site.	None anticipated	Not Signif.
Indirect plant mortality as a result of fugitive dust emissions from activities such as site preparation, grading and vehicle traffic. Wind erosion of displaced soil may also generate fugitive dust emissions prior to revegetation.	A	• Application of water or dust suppressants. • Covering of haul trucks. • Use of paved roads to the extent possible. • Limiting vehicle speed. • Stabilizing disturbed areas.	Low	Vicinity of footprint.	Construction Phase	R	• Area affected by human activity; pristine areas not known. No critical habitat on-site.	None anticipated	Not Signif.
Indirect plant mortality due to increase in levels of toxic and deleterious substances due to infrastructure maintenance (salt).	A	• Vegetation growth should generally be regulated by physical cutting. • Implement measures outlined in an EPP/ EMP.	Low	Local; depends on size of affected area.	Operation Phase; Short term/ infrequent.	R	• Area affected by human activity; pristine areas not known. No critical habitat on-site.	None anticipated	Not Signif.
Terrestrial Fauna SAR/SOCC (Mammals, Birds, Herpetiles, and Invertebrates)									
Clearing and grubbing will lead to habitat loss or degradation for fauna.	A	• Support Mainland Moose Recovery efforts. • Minimize disturbed area. • Rehabilitate all	Medium	Project site and access road (213 ha).	Permanent during the lifetime of the Project.	NR during lifetime of the Project.	• Area affected by human activity; pristine areas not known. No critical habitat	Habitat loss	Not Signif.

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Residual Environmental Effects: Magnitude	Geographic Extent	Duration/Frequency	Reversibility (R=reversible NR=Non reversible)	Ecological/Social-cultural and Economic Context	Residual Effect	Significance
		temporarily used sites.					on-site.		
Clearing of land and road will increase habitat fragmentation for fauna.	A	• Minimize Project footprint. • Minimize lay-down areas. • Modify EMP/EPP in response to new species information (if applicable). • Conduct EEM, if required.	Low	Project site and access road (213 ha).	Permanent during lifetime of the Project.	NR during lifetime of the Project.	• Area affected by human activity; pristine areas not known. No critical habitat on-site.	Minimal habitat fragmentation	Not Signif.
Project will lead to increased vehicle traffic in area and may result in direct fauna mortality.	A	• Speed limit of 50 km/hr on site. • Fencing on-site.	Low	General area	All phases	R	• Area affected by human activity; pristine areas not known. No critical habitat on-site.	None anticipated	Not Signif.
Indirect fauna mortality as a result of exposure to contaminants via disturbed contaminated soils or spills.	A	• Proper handling and storage of hazardous materials. • Proper handling of contaminated soils • Adherence to site-specific EPP.	Low	Project site and access road (213 ha).	All phases	NR	• Area affected by human activity; pristine areas not known. No critical habitat on-site.	None anticipated	Not Signif.
Change in fauna behaviour as a result of noise and light disturbances (including blasting).	A	• Minimize duration of noise disturbance. • Conduct blasting outside of sensitive periods. • Implement mitigation measures regarding noise and light effects on fauna in Section 7.9. -- and Table 1.-.	Low	Project site and adjacent lands.	All phases	R	• Area affected by human activity; pristine areas not known. No critical habitat on-site.	Displacement	Not Signif.

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Residual Environmental Effects: Magnitude	Geographic Extent	Duration/Frequency	Reversibility (R=reversible NR=Non reversible)	Ecological/Social-cultural and Economic Context	Residual Effect	Significance
Freshwater Aquatic SAR/SOCC (Fish and Freshwater Molluscs)			***NONE KNOWN OR SUSPECTED TO OCCUR ON BLACK POINT SITE***						
Marine SAR/SOCC (Fish, Mammals, and Reptiles									
Loss of fish habitat due to construction of marine terminal	A	• Development and implementation of marine fisheries offset plan.	Low	Marine terminal footprint and immediately adjacent.	Construction phase through to decommissioning.	NR during lifetime of the Project.	• Affected area represents approximately 0.38% of lobster habitat within Stormont Bay.	None anticipated following Offset Program	Not Signif.
Habitat degradation due to sedimentation and turbidity from vessels.	A	• Use of tugs for large vessels.	Low	Marine terminal footprint and immediately adjacent.	Construction phase through to decommissioning.	R	• Marine SAR/SOCC.	None anticipated	Not Signif.
Disturbance and potential change in behaviour due to noise from ship traffic.	A	• Ships will be well maintained and best available technologies for exhaust and pollution control will be used.	Low	Marine terminal approaches.	Construction phase through to decommissioning.	R	• Marine fish and mammal SAR/SOCC.	Temporary displacement	Not Signif.
Disturbance and potential change in behaviour due to noise from pile driving, shore blasting, and other construction activities.	A	• Work during low tide. • Work outside of sensitive periods. • Use of ramped warning signals. • Use of bubble curtains.	Low	Depending on noise level could extend throughout Chedabucto	Construction phase.	R	• Marine fish and mammal SAR/SOCC.	Temporary displacement	Not Signif.
Degradation in fish habitat due to the release of bilge and ballast water to Chedabucto Bay.	A	• Adherence to federal legislation.	Low	Chedabucto Bay	Operation phase.	R	• Potential fish habitat.	None anticipated	Not Signif.

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Residual Environmental Effects						
			Magnitude	Geographic Extent	Duration/Frequency	Reversibility (R=reversible NR=Non reversible)	Ecological/Social-cultural and Economic Context	Residual Effect	Significance
Mortality as a result of collisions with ships.	A	• Tugs will be used to bring in ships. They will be going slowly and observers will monitor for marine mammals and turtles.	Low	Marine terminal and Approaches.	All phases.	NR	• Potential marine mammal and turtle SAR/SOCC.	None anticipated	Not Signif.

7.13 LOCAL ECONOMY, LAND AND RESOURCE USE

7.13.1 Overview

Positive economic effects of the Project will benefit local residents, local businesses in the service sector and government at the municipal and provincial levels. Direct financial benefits to government include corporate taxes and taxes on goods and services. Indirect benefits include increased personal income taxes from local residents that are either involved as employees or contractors with the Project. Improvements in the regional economy can positively affect the population size and demographics as workers move to the area, purchase real estate, goods and services, and raise families. Real estate values can also be positively affected by a vibrant regional economy.

The Project will require a temporary labour force during construction and a smaller but significant labour force over the long term operation of the Project. In addition to direct hires, the Project will generate employment and economic activity through contracting for goods and services.

A major development such as the proposed Project can affect existing as well as planned land uses. Current on-site land uses (trapping, local tourism) will be replaced by quarrying and associated activities. Existing and planned land uses on adjacent properties or within the Affected Area may be impacted through changes to the visual or acoustic environments. In additional, a vessel collision or fuel spill in the marine environment may affect the local economy and alter existing land and resource use patterns.

7.13.2 Boundaries

7.13.2.1 *Temporal Boundaries*

The temporal boundaries for the assessment of impacts upon Local Economy, Land and Resource Use begin with the construction phase of the Project and continue through the operational phase and decommissioning phases. Construction time is estimated at two to three years and closure and decommissioning is expected to require two years. Quarry operations are expected to continue for at least 50 years.

7.13.2.2 *Spatial Boundaries*

The spatial boundaries for the assessment of the Local Economy do not include the Project Area (i.e., within the Project property boundaries) since no opportunities for the purchase of goods and services, beyond those purchases associated with the Project, will be available on site. The spatial boundaries extend to the Affected Area, which includes adjacent lands up to and including Gaulman Point, Fox Island Main and the portion of Highway 16 between these areas. Economic impacts within the Study Area include the limits of the MODG but are generally confined to the area between Guysborough and Canso where communities are expected to be most affected by employment and service opportunities.

With respect to Land and Resource Use, spatial boundaries include all three zones: the Project Area, the Affected Area, and to a lesser extent, the Study Area defined as the MODG.

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7.13.2.3 *Administrative Boundaries*

Land use is regulated by the Province and through municipal zoning and land use bylaws. The Municipality of the District of Guysborough Municipal Planning Strategy (MPS 2013) describes the municipality's intentions for future development. The MPS outlines criteria for Council and planning staff to consider when evaluating development proposals and issuing development permits. Together with the Land Use Bylaw and Subdivision Bylaw, the MPS controls future land use and development in the Municipality.

The sea bed Crown lease needed to build the marine terminal is administered by the Province of Nova Scotia, Department of Natural Resources. An application for this lease has been submitted to NSDNR.

7.13.2.4 *Technical Boundaries*

Although a variety of economic models may be employed to predict the economic effects of a project, the analysis below uses a simpler approach to assessing economic benefit. The assessment is based on comparing the relative scale of predicted Project-related employment levels (both in terms of person-hours and in terms of wages paid) with existing employment opportunities within the MODG, especially the area between Guysborough and Canso. This is a qualitative assessment and does not include a description of the multiplier effects that may be expressed using Input-Output modelling. Nevertheless, the analysis is sufficiently robust to demonstrate whether the Project is likely to produce positive or negative economic effects in the region.

7.13.3 Threshold for Determination of Significance

A significant adverse Project effect on the Local Economy is defined as one that results in a long term decrease in economic activity or employment opportunities within the Study Area. A significant positive effect is one that results in a long term employment gains and/or sustained economic activity within the Study Area.

A significant adverse effect on Land and Resource Use is defined as a pervasive change in land use patterns within the Study Area that adversely affects a community's use of that land and/or is inconsistent with a designated land use established through a municipal planning process. A positive effect is one that enhances the land's cultural or economic value to the community in a manner that is consistent with the regulatory planning process.

7.13.4 Effects on Local Economy, Land and Resource Use

Local Economy

The positive economic impacts are principally related to long term employment opportunities which typically result in amplified demand for goods and services, as well as improved tax revenues for municipal, provincial and federal governments. As existing employers expand or new employment is created, new employees spend their earnings and the local economy expands to meet these increased demands. An expanding economy can create a feedback loop where businesses that must expand to meet rising demand in turn increase their purchases at other local business which must expand in turn.

Fundamentally, regional economic impacts associated with individual projects are dependent on the size and duration of expenditures, and upon the ability of the local economy to accommodate these expenditures. It is important that housing, groceries, gasoline, hardware, recreational opportunities and a host of other goods and services are readily available in the local area, in order to prevent consumers from seeking these goods and services elsewhere.

Project construction and operation will create direct employment of those engaged to construct and operate the quarry (50-60 people), as well as indirect employment through the demand for goods and services including contractors to support the Project. Ultimately, this local economic activity will be reflected in regional and provincial economies. These economic effects are considered as positive Project-related impacts that do not required mitigation or monitoring.

It is difficult to determine the effect the quarry may have, if any, on property values. The Proponent notes that in their experience, property values may increase as quarry workers seek homes near to their work location. Alternatively, property values may decrease due to perceived quarry impacts (e.g., noise) and/or other, non-quarry related reasons (i.e., continued out-migration).

At this time, there is a local labour pool to support this Project. Conversations with local residents suggest that many young skilled and unskilled workers are currently seeking employment outside of Nova Scotia and would be happy to return to well paying jobs in Guysborough Co. There is a total work force of approximately 13,600 in the Strait Region (Statistics Canada 1996). Of these, 1,500 are experienced in primary industries, 1,800 in manufacturing, 1,000 in construction and 900 in transportation. Additional experienced labour is present in Cape Breton and northern mainland Nova Scotia. Given the current labour availability relative to the demand, no negative effects on the labour supply are anticipated.

The Proponent estimates that up to 120 to 150 people will be directly and indirectly employed over the 36 month construction period beginning in 2017. The primary job types required for the construction work include truck drivers, concrete trades, equipment operators, piping trade, industrial welders, and general labourers. The Proponent has expressed a public commitment to source labour from with the Province of Nova Scotia to the extent that these people are available and interested in the work.

Total construction expenditures are estimated at $80 to $110 million over 36 months, or $27 to $37 million on an annualized basis. This will have an estimated direct and indirect GDP impact to the Province of Nova Scotia of $39 to $53 million per year, and $6.5 to $8.8 million per year total GDP for the MODG (based on 1999 Nova Scotia input-output multipliers for oil and gas engineering construction). Provincial taxes for the 3-year construction period will be in the range of $2.0 to $2.6 million, with federal taxes at $2.4 to $3.2 million. The Proponent has engaged in preliminary discussions regarding labour and training requirements with local labour unions and educational institutions. The Proponent intends to continue this dialogue to ensure that the local force is informed with respect to skills needed.

The following estimates of operational economic impacts were calculated using both low and high production scenarios of 2 and 5 million tonnes, respectively. During the operation of the facility, employment is estimated to be between 50 to 60 full time positions, with 95% of these jobs sourced from the MODG and nearby areas. The employment income to these workers will be from $2.9 to $3.4 million per year. Annual GDP is expected to range from $9.7 to $24 million for the Province, with the MODG collecting 40% of this revenue; $3.9 to $9.8 million. Total GDP

contribution over the 50-year period is expected to range from $485 million to $1.2 billion for the Province and from $195 to $490 million for the MODG. Annual provincial taxes will be in the range of $0.9 to $2.2 million, with federal taxes marginally higher at $1.0 to $2.6 million.

A vessel collision or other accident resulting in a fuel spill in the marine environment would have negative effects on Land and Resource Use (see below) as well as on Tourism and Recreation (Section 7.14) and Commercial Fisheries (Section 7.15). These effects would have direct and indirect negative economic consequences as described in the sections cited. In contrast, monies disbursed for cleanup and restoration of a marine fuel spill may partially offset these negative consequences through direct employment of vessels, workers, equipment and related services.

Project related economic effects to commercial fishing are described in Section 7.15.

Land and Resource Use

A diverse assortment of land uses are commonly used to accommodate the various municipal planning objectives in a given area. These objectives include different types of residential and commercial development, parks and recreational spaces, and industrial development. In order to foster long term land use planning and integrate these land use changes into the existing municipal fabric over time, municipalities rely on municipal planning strategies (MPS). The MODG MPS outlines the municipality's vision for land use within its jurisdiction over the coming 20 years or so.

The land designated for the Black Point Quarry Project was assembled by the municipality through a land exchange with the province, combined with the expropriation of two privately owned parcels within the current Property boundaries. Within the long term MPS, this land has been zoned Industrial Heavy I-2. Permitted uses for this zoning includes, among other activities, "rock quarry operation or open-pit mines from which rocks or minerals are extracted" (MODG 2013). One of the primary effects of the Project on the Land and Resource Use VC is to change the use of the Property from an undeveloped piece of land used occasionally for trapping and recreational activities (ATV passage and fishing in the nearshore), to a quarry that will be operated on a continuous basis for roughly 50 years, and where these current activities will eventually be limited or no longer practical. Despite these land use changes, the current zoning reflects a long term municipal vision to promote economic development and so is compatible with the goals and objectives of the community.

With respect to accidental events, a vessel fuel spill in the marine environment would likely result in changes to land and resource use in the vicinity of spill over the short and medium term (estimated at 5-15 years). Depending on where the spill occurred and the volume of fuel released, people may refrain from boating in the area and visiting favourite beaches and headlands.

7.13.5 Mitigation and Monitoring

7.13.5.1 *Mitigation*

For safety reasons, occasional recreational activities that are currently practiced within the Project's terrestrial boundaries (ATV passage and trapping) will be restricted during construction and operation. Recreational users will be notified of restricted access by signage at the entrance

to the construction site. Restriction of the informal recreational use of the Property may be an inconvenience, but is not likely to be significant. Similarly, marine recreational fishing that currently occurs on an occasional basis in the vicinity of the Project may no longer be practiced. Since many other recreational fishing opportunities nearby, this effect is not considered significant.

All of the mitigation measures presented elsewhere in the EIS are applied to reduce actual and perceived project impacts, which in turn may directly or indirectly affect property values.

Vessels will not be refuelled at the marine terminal and fuel used at the quarry will be kept in double hulled reservoirs or will be placed within secondary confinement and protected against collision. This helps to minimize the risk of accidents at the terminal. In the event of a spill on land, site drainage is directed south to the settling ponds rather than north to Chedabucto Bay. This in turn helps to contain any spills and allow them to be cleaned up. Navigational safety mitigation measures and emergency response planning measures are presented in Section 7.18.3.

7.13.5.2 *Monitoring*

No follow-up monitoring will be implemented with respect to the effects of the Project on Land and Resource Use. Similarly, no follow-up monitoring will be undertaken with respect to the effect of the Project on the Local Economy.

7.13.6 Residual Effects and Significance

There are no significant adverse environmental effects on the Local Economy. In contrast, positive impacts can be anticipated in the form of direct and indirect employment resulting in regional economic development. Land use changes are consistent with the community desire for this property, as expressed in the Municipal Planning Strategy. No significant residual effects are anticipated with respect to the predicted change in Land and Resource Use.

Table 7.13-1:
Residual Environmental Effects for Local Economy, Land and Resource Use

Project Environment Interaction	Potential Residual Environmental Effects (A = Adverse; P = Positive)	Mitigation	Magnitude	Geographic Extent	Duration / Frequency	Reversibility	Ecological / Socio-Economic Context	Residual Effect	Significance
Construction									
Preparation of the processing plant and quarry; construction of the processing plant: Exclusion of current trapping and ATV passage	A	• Compliance with zoning requirements • Use of signage and fencing to warn/restrict access • Use local workers and procure local goods services locally to the extent possible • Explain training requirements to local residents, high schools and community colleges	1	2	3/6	I	Pristine	Limitations to public access	Not Signif.
Impacts on labour, income and economic activity	P	• Ongoing communication with labour unions and labour suppliers	1	3	3/6	R	Pristine	None anticipated	Not Signif.
Operation and Maintenance									
Ongoing terrestrial and marine operations: Exclusion of current trapping and ATV passage Marine Spill	 A A	• Compliance with zoning requirements • Use of signage and fencing to warn/restrict access • Implementation of navigational safety measures; Use of an Emergency Spill Response Plan	1	3	5/6	I	Pristine	Limitations to public access None anticipated	Not Signif

Impacts on labour, income and economic activity	P	•	none	Low (1)	3	5/6	R	Pristine	Not Signif

Legend

Magnitude:
U= Unknown - An environmental effect affecting an unknown portion of a population or group or where the changes in a specific parameter are unknown.
0 = Nil - No environmental effect.
1 = Low (e.g., specific group, habitat, or ecosystem localized 1 generation or less, within natural variation)
2 = Medium (e.g., portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside the range of natural availability)
3 = High (e.g., affecting entire stock, population, habitat or ecosystem, outside the range of natural variation)

Geographic Extent:
1 = < 1 km^2
2 = 1 – 10 km^2
3 = 11 – 100 km^2
4 = 101 – 1,000 km^2
5 = 1,001 – 10,000 km^2

Duration:
1 = < 1 month
2 = 1 – 12 months
3 = 13 – 36 months
4 = 37 – 72 months
5 = > 72 months

Frequency:
1 = < 11 events/year
2 = 11 – 50 events/year
3 = 51 – 100 events/year
4 = 101 – 200 events/year
5 = > 200 events/year
6 = continuous

Reversibility:
R = Reversible
I = Irreversible

Ecological / Socio-Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity.
2 = Evidence of adverse environmental effects.

7.14 TOURISM AND RECREATION

7.14.1 Overview

Residents and tourists alike utilize the local terrestrial and marine landscapes for outdoor activities such as camping, hiking, fishing, boating, off-road motoring, and hunting. These activities are popular and to a certain degree, available, due to the largely undeveloped nature of Guysborough County. Tourism and recreational activities, as well as the infrastructure associated with these activities, such as accommodation, marinas, recreation centres and parks, make up the Tourism and Recreation VC. The presence of a quarry may influence perceptions regarding noise and changes in the visual character of the coastal landscape, resulting in changes to resource use patterns. The Project may result in restrictions to currently accessible beaches and headlands. A fuel spill in the marine environment that attains local beaches and headlands would likely reduce the appeal of the affected area and other parts of the county to tourists and recreational users.

Details of existing tourism and recreational activities are presented in Section 6.8.

7.14.2 Boundaries

7.14.2.1 *Temporal Boundaries*

The temporal boundaries for the assessment of impacts upon tourism and recreation begin with the construction phase of the Project and continue through the operational phase and decommissioning phases. Construction time is estimated at two to three years and closure and decommissioning is expected to require two years. Quarry and shipping operations are expected to continue for at least 50 years.

7.14.2.2 *Spatial Boundaries*

The spatial boundaries for the assessment of impact on Tourism and Recreation are within the Project Area (i.e., within the Project property boundaries) and extending to the Affected Area, which includes adjacent lands up to and including Gaulman Point, Fox Island Main and the portion of Highway 16 between these areas. In the event of a marine spill to the environment, the Affected Area would include coastal regions affected by the fuel.

7.14.2.3 *Administrative Boundaries*

For safety, it is expected that recreational and commercial boating traffic will be excluded from areas immediately surrounding the marine terminal. Navigability of water courses and coastal waters is regulated by federal legislation under the *Navigation Protection Act*.

7.14.2.4 *Technical Boundaries*

While a certain amount of data regarding tourism in Nova Scotia is available for review, no statistical data was found to describe expenditures on tourism and recreational activities within the MODG.

7.14.3 Threshold for Determination of Significance

A significant adverse effect on Tourism and Recreation is defined as a permanent and widespread change in tourism or recreational activities such that people are no longer able to undertake these activities within the municipality and/or that result in a significant loss of tourism related revenue to local businesses. A significant positive effect is one that

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enhances tourism or recreational activities or brings additional revenue through these activities to local businesses.

7.14.4 Project Effects on Tourism and Recreation

The quarry development has the potential to affect the tourism and recreation in the following ways:

1. A decrease in wilderness/nature oriented recreation and tourism within the Project Area and vicinity (i.e., Affected Areas) due to marine vessel traffic and actual or perceived noise, dust and light from the quarry construction and operations. Visually, the quarry may deter boaters and kayaks from visiting this portion of the coastline. This in turn may negatively affect revenue at local campgrounds, rental accommodations and other service providers. A fuel spill in the marine environment would likely deter tourists and recreational users from visiting affected areas, possibly including nearby coastal areas.

2. An increase in expenditures on tourism services. Large development projects may hire staff from outside the immediate region and present employment opportunities to local residents who are currently seeking work. These people may choose to live relatively close to the quarry to minimize commuting distances. Increased populations in nearby communities including Fox Island Main, Upper Fox Island, Half Island Cove, Phillips Harbour and Canso would likely result in secondary economic benefits to these communities as new residents increasing frequent local tourism and recreational infrastructure and services. The magnitude of increased expenditures is difficult to estimate, but is generally related to:

    - The number of staff hired for the Project;
    - Recreational opportunities and services available in the immediate area; and
    - The duration of the Project.

In relation to other districts in Nova Scotia, the Eastern Shore of Nova Scotia accounted for only 7% of the visitors to Nova Scotia (2010 Nova Scotia Visitor Exit Survey). Of the 7% of tourists who visited the Eastern Shore, only 9% visited Guysborough and 18% visited Canso. This demonstrates that tourism is not a major source of revenue for these communities, although it no doubt plays a critical economic role to some local businesses. Similarly, demand on existing tourism and recreational services are relatively low. The main tourist locations are beaches, trails and parks. Recreational fishing in the Bay, especially for Bluefin Tuna, is also a popular tourist and recreational activity. Unfortunately, no similar data exist that describe the level of economic activity generated by local tourists; that is, by people visiting this area from Halifax, Cape Breton and other parts of Nova Scotia.

Currently, the coastal regions of the Project Area are occasionally visited by local residents who enjoy the beaches and undeveloped vistas (H. Krause, pers. comm. 2014). These areas are also used occasionally for recreational fishing. Because access to the terrestrial portions of the Project Area has historically been difficult, the Property is not consistently used for recreational purposes. An overgrown access trail connects Fox Island Main to Black Point, and ATV trails reportedly connect Upper Fox Island with residents on Half Island Cove Road (O. Rhynold, pers comm. 2014). Beaches, recreational fishing opportunities and hiking/ATV opportunities are relatively common within the municipality and so the loss of these opportunities within the Project Area itself is not considered a significant adverse effect.

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The closest tourism and recreational facilities in the Affected Area are Lower Half Island Cove Beach, 1.70 km west, Eagle Valley and Hayden Lake Cottages, 880 m 980 m south, respectively, and Seabreeze Campground 3.3 km east. The potential environmental effects of dust, noise, and light trespass on these receptors are presented in Sections 7.1, 7.2, 7.3 respectively. In all cases, no significant adverse effects are predicted although noise and light may be perceptible from viewpoints to the east and west. With respect to Seabreeze Campground located over 3 km from the Project site, it is likely that Project related noise will be perceived as a component of ambient of background noise. This is not expected to affect attendance rates at the campground.

At peak operations there will be approximately 90 ships a year transporting material from the quarry; adding to the almost 600 large vessels (and an unrecorded number of fishing and recreational vessels) that are already present on an annual basis. Given that ships are a common sight in Chedabucto Bay, the presence of these additional vessels is not expected to cause a noticeable change to tourism and recreational use patterns in the Affected Area.

As noted in Section 7.13 (Local Economy, Land and Resource Use), a vessel fuel spill in the marine environment would likely result in changes to land use in the vicinity of spill over the short and medium term (estimated at 5-15 years). Depending on where the spill occurred and the volume of fuel released, people may refrain from boating in the area and visiting favourite beaches and headlands. This is in turn would have negative economic consequences within Guysborough County.

As noted, the Project will employ 50-60 people full time at peak production. The majority of people employed will likely come from local communities and therefore no significant increase in population is expected. Nevertheless, these 50-60 new employees will likely spent a portion of their disposable income on recreational or tourism-type activities, equipment and services. While this expenditure may be noticeable to local businesses and so would be considered a positive Project effect, the increased expenditure is not considered to be a *significant* positive effect.

7.14.5 Mitigation & Monitoring

Since the effects from the Project under normal operating conditions on tourism and recreational activities are expected to be minimal, no specific mitigation or monitoring is proposed. The site entrance from Marine Drive will be equipped with a sign announcing the company and operations, while precautionary signs will be posted at appropriate locations along the property boundary and coastline warning recreational users of potential site and operational dangers.

With respect to a spill in the marine environment, navigational safety mitigation measures aimed at preventing vessel collisions and emergency response planning measures are presented in Section 7.18.3. Vessels will not be refuelled at the marine terminal; this helps to minimize the risk of fuel spills at the terminal. Vehicle fuel used at the quarry will be kept in double hulled reservoirs protected against collision. In the event of a spill on land, site drainage is directed south to the settling ponds rather than north to Chedabucto Bay. This in turn helps to contain any spills and allow them to be cleaned up.

7.14.6 Residual Effects & Significance

The significant residual impacts of the development are considered in the Table 7.14-1. No significant adverse effects to this VC.

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Table 7.14-1:
Residual Environmental Effects for Tourism and Recreation

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Residual Environmental Effects: Magnitude	Geographic Extent	Duration/Frequency	Reversibility (R=reversible NR=Non reversible)	Ecological/Social-cultural and Economic Context	Residual Effect	Significance
Construction									
Decrease in tourism on within the property boundary and Affected Areas	A	None	Low (1)	2 (1-10 km^2)	3/6 (2 years/continuous)	R	Area is affected by past human activity.	Minimal within County	Not Significant
Increase in tourism related expenditure	P	None	Low (1)	3 (11-100 km^2)	3/6 (2 years/continuous)	R	Area is affected by past human activity.	Positive	Not Significant
Operation / Decommissioning									
Decrease in tourism on within the property boundary and Affected Areas	A	None	Low (1)	2 (1-10 km^2)	5/6 (>6 years/continuous)	R	Area is affected by past human activity.	Minimal within County	Not Significant
Marine Fuel Spill	A	Implementation of navigational safety measures; Use of an Emergency Response and Spill Contingency Plan	Medium (2)	2 (1-10 km^2)	5/1 (>6 years/one time)	R	Area is affected by past human activity.	None anticipated	Not Significant

Increase in tourism related expenditure	P	None	Low (1)	3 (11-100 km^2)	56 (>6 years/continuous)	R	Area is affected by past human activity.	Postive	Not Significant

Legend

Magnitude:
U= Unknown - An environmental effect affecting an unknown portion of a population or group or where the changes in a specific parameter are unknown.
0 = Nil - No environmental effect.
1 = Low (e.g., specific group, habitat, or ecosystem localized 1 generation or less, within natural variation)
2 = Medium (e.g., portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside the range of natural availability)
3 = High (e.g., affecting entire stock, population, habitat or ecosystem, outside the range of natural variation)

Geographic Extent:
1 = < 1 km^2
2 = 1 – 10 km^2
3 = 11 – 100 km^2
4 = 101 – 1,000 km^2
5 = 1,001 – 10,000 km^2

Duration:
1 = < 1 month
2 = 1 – 12 months
3 = 13 – 36 months
4 = 37 – 72 months
5 = > 72 months

Frequency:
1 = < 11 events/year
2 = 11 – 50 events/year
3 = 51 – 100 events/year
4 = 101 – 200 events/year
5 = > 200 events/year
6 = continuous

Reversibility:
R = Reversible
I = Irreversible

Ecological / Socio-Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity.
2 = Evidence of adverse environmental effects.

7.15 COMMERCIAL FISHERIES

7.15.1 Overview

Marine commercial fisheries represent an important, sustainable resource of historical, cultural, social and economic value to local communities and Mi'kmaq As noted, there are no *freshwater* commercial or recreational fisheries on the Property. At the same time, aquaculture is not currently practiced along the south shore of Chedabucto Bay. Freshwater fisheries and aquaculture are not discussed further in this section.

The primary species harvested on a commercial basis in Chedabucto Bay south of the established shipping lanes are:

- Lobster;
- Shrimp;
- Herring, Mackerel and Squid
- Snow Crab;
- Tuna; and
- Scallop

Sea urchin, rock crab, marine plants and eels are reportedly not fished on a commercial basis at this time, although local fishermen do have licenses that permit the harvest of these species. Mackerel is the primary salt-water recreational species in the area, but catch and release recreational bluefin tuna fishing is also popular.

The fisheries considered for this assessment include the commercially harvested finfish and shellfish listed above. For the purposes of this section, the term "fish" and "fishing" generally refers to all species mentioned above unless the context suggests otherwise.

7.15.2 Boundaries

7.15.2.1 *Temporal Boundaries*

Impacts to commercial fishing are expected while the marine terminal is being constructed (24 months) and operated (45 years). Decommissioning activities will be short-lived (12 months although this may be extended if needed) but may also interfere with commercial fishing.

The temporal boundaries also consider the different fishing seasons since these are the times when commercial fishing occurs within the spatial boundaries defined for the EIS.

7.15.2.2 *Spatial Boundaries*

The spatial boundaries for Commercial Fisheries are similar to those identified for Marine Species and Habitat. Assessment boundaries divided into the Project Area, the Affected Area and the Study Area.

For the Commercial Fisheries VC, the Project Area is defined as the limits of the proposed seabed Crown lease that will be needed to construct the marine terminal (Section 1.0 and Figure 4.0-1). The Crown lease boundaries will entirely contain the marine terminal.

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The Affected Area is the nearby zone that could potentially be affected by Project activities. For this VC, the Affected Area is a zone around the marine terminal where lobster fishing will be restricted for safety considerations as ships access and berth at the terminal.

The Study Area is the larger zone in Chedabucto Bay where other types of Project-environment interactions may occur. In this case, the Study Area is defined to include the proposed ship travel routes between the marine terminal and the established shipping lanes in Chedabucto Bay, as shown on Figure 3.29. This zone is chosen since it defines an area within which Project-related shipping may interfere with commercial fishing activities.

7.15.2.3 *Administrative Boundaries*

Commercial fish harvesting is managed and regulated by Fisheries and Oceans Canada, a federal agency, under the *Fisheries Act* and its enabling regulations. From the provincial perspective, the *Fisheries and Coastal Resources Act* regulates recreational fishing, sea plant harvesting, licensing of fish buyers and processors, and aquaculture.

Administrative boundaries applicable to commercial fisheries include the fishing area boundaries and districts, as well as fishing seasons imposed by regulation on commercial fishermen. These boundaries are described in Section 6.10.

7.15.2.4 *Technical Boundaries*

To protect the confidentiality and economic livelihood of fishermen, species landing data reported by individual fishermen is "aggregated" into larger datasets that tend to conceal exactly where fish and other species are caught, and how much of each species is landed. According to DFO, each unit of data released consists of a minimum of five license holders, vessels and buyers. This means that only generalized fishing trends are available as a basis for descriptions of Project impacts.

7.15.3 Threshold for Determination of Significance

A Project-related significant adverse effect on commercial fisheries is one that causes:

1. an uncompensated loss of habitat of those fish species that are used for, or support commercial, recreational and/or Aboriginal fisheries; or

2. a sustained decrease in earnings from a fishery due to lower catch quantity and/or quality, or increased fishing costs (i.e., due to longer travel times, loss of gear, additional license fees, etc.).

7.15.4 Effects of the Project on Commercial Fisheries

The presence and use of the marine terminal will result in limitations to lobster harvesting in the immediate area and, as a result, displacement into other areas of those who currently fish in the nearshore at the Black Point site. This limitation will occur for two reasons: (1) the construction of the marine terminal will remove approximately 1.0 ha of lobster habitat that is currently available for commercial exploitation, and (2) fishermen will likely steer clear of the active marine terminal for safety and out of concern for gear losses. The marine terminal itself is not expected to significantly interfere with marine navigation.

Potential sediment-laden water runoff from terrestrial construction activities and consequent negative effects to water quality may displace fish from the immediate near shore but is unlikely to result in their death.

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The transit of empty and loaded aggregate transport vessels has the potential to interfere with other commercial fishing activities that occur in deeper water between the established shipping lanes and the south shore of Chedabucto Bay. Once construction is complete, Project-related ship traffic will begin at a relatively modest rate of about 30 ships per year (less than 3 ships per month), increasing to about 90 ships per year once full capacity is reached after approximately 10 years (provided market conditions support this rate). This is equivalent to about one ship every four days or so. In addition to interference with on-going fishing, noise associated with this increased traffic may displace fish from the immediate area.

The added ship traffic (consisting of aggregate transports, tugs and pilot vessels) may require fishermen who frequent deeper water to avoid preferred fishing grounds to accommodate Project-related ship traffic. The deep water shrimp fishery concentrated along the edge of the established shipping lane is reportedly vulnerable to displacement since fishermen are currently exploiting all the available shrimp grounds.

Accidental fuel spill or other discharges to the aquatic environment can alter water quality and physical habitat, which in turn can negatively affect life-cycle stages of commercially important species and their food supply. Accidental aggregate spills will not likely affect the commercial fishery since this material has already been washed to remove fine-grained sediment. Granite itself is chemically inert and is common in Chedabucto Bay.

Effects of decommissioning the marine terminal will similar to those expected during construction, except that it is likely the marine terminal will be left in place rather than removed. Surface structures such as the access road and slewing arm may be removed for safety and security but work associated with this removal will be of temporary duration.

No impact is expected to the fixed berth mackerel, herring and squid trap fisheries since these berths are considerably removed from the Project site (Section 6.10). A possible exception to this are the two mackerel traps located in Indian Cove approximately 4.0 km east of the marine terminal. Concerns have been raised by local fishermen that the marine terminal will divert mackerel from their normal coastal-hugging route that brings them into Indian Cove where the traps are located. Instead, the terminal may encourage the fish to remain offshore and travel directly from Black Point to Fox Island, rather than entering Indian Cove.

Consideration is also made for the Mi'kmaq First Nations which have recognized rights to the commercial or livelihood fishery. It is understood that any impacts that could result in an uncompensated loss in habitat, or in loss of sustained earnings in the livelihood fishery must be addressed with respect to the impact on Mi'kmaq rights.

Mi'kmaq livelihood fishing is managed in accordance with the regulatory procedures used by DFO for the non-aboriginal commercial fishery: the existing baseline conditions for the commercial fishery are shared with the Mi'kmaq livelihood fishery (seasonality, license conditions, quotas etc.). As a result, the current baseline conditions for the livelihood fishery are the same as those of the commercial fishery.

Although the Mi'kmaq Band Fisheries Departments have reported that there is currently no livelihood lobster fishery activity, or food, social and ceremonial lobster fishing activity in the waters near the Project site at this time, effects on the commercial fishery in the area may have an impact on the right to access the fishery. Therefore it is important to maintain ongoing communication with Mi'kmaq First Nations throughout the Project and during decommissioning. This communication will be through direct dialogue.

It has been noted that the principle livelihood fishery in the area is the commercial shrimp trap fishery. Concerns have been raised by non-aboriginal fishermen that ship movements may interrupt or temporarily displace shrimp trap fishing operations. This spatial conflict has been resolved through dialogue between the Proponent and local area shrimp fishermen, with the result that vessel activity near the marine terminal will avoid preferred shrimping grounds to the extent this is possible, practical and safe.

Mi'kmaq fishing, hunting and gathering activities can be impacted by the cumulative effects of multiple projects (Section 9.0). However, it is likely that the cumulative effects of the identified projects in the area will have little impact on the Mi'kmaq fishery and wildlife harvesting in the Project area. It is possible that there could be a positive cumulative impact on social condition of Mi'kmaq harvesters as multiple projects are undertaken that might provide useful and necessary employment for Mi'kmaq marine and environmental skills at several ongoing project sites.

7.15.5 Mitigation & Monitoring

7.15.5.1 *Mitigation*

The scale of marine terminal construction impacts to commercial fisheries will depend in part on the seasonal timing of in-water work. Impacts will be greater if marine terminal construction occurs during lobster season, which runs from April 29 to June 30. The area occupied by the marine terminal is reportedly fished by only two or possibly three fishermen since appropriate lobster habitat is limited to relatively shallow depths in the immediate nearshore. Off the Black Point property, the water deepens rapidly and the bottom changes from rocky to muddy substrate, which is less preferred by lobster.

The primary mitigation measure is to minimize impacts during construction through the use of standard best management practices for terrestrial and in-water construction. Standard construction best management practices and mitigation measures to control onshore sediment release to the marine environment will be implemented. These measures are described in Section 7.6 and Section 7.11.

The effects of increased ship traffic will be mitigated by ensuring fishermen and the local traffic authority is aware of Project-related vessel traffic with sufficient advance notice to redeploy gear elsewhere as needed. At the same time, regular and on-going communication from fishermen who routinely fish in areas that will likely be transited by Project vessels would be helpful to limit unnecessary changes to fishing habits and accidental interactions between Project vessels and fishing gear. Communication regarding ongoing fishing practices can be used by pilots and ship masters to avoid particular fishing areas at all times, during certain times of the fishing season, or for certain weeks of a specified month. To aid this two way communication, local fishermen will be encourage to call the quarry site office, which will be manned 24 hours per day, in order to receive updates regarding vessel arrivals and departures.

Vessels regularly transit Chedabucto Bay safely and effectively with the help of pilots who understand the navigational hazards of the Bay, using communication with shore based traffic oversight facilities, and through the use of established shipping lanes and navigation protocols. Should Project-related vessel traffic or construction result in fishing gear damage or loss, this loss can be reported to the quarry site office.

Construction and regular use of the marine terminal will likely require a safety exclusion zone around the terminal. The loss of fishing access will no doubt mean that lobster can no longer be harvested from this nearshore area. However, this area is quite small (1.1 ha not

including the estimated safety zone) and preliminary discussions with lobster fishermen have indicated that considerable opportunity to create lobster habitat in the nearshore exists immediately adjacent to (both east and west of) the Project site.

The marine terminal will be equipped with lights and fog horns as required for safety by Transport Canada. These aids will effectively mitigate any navigation concerns.

Mitigation for loss of fish habitat is detailed in Section 7.11. A Fisheries Offset Program will describe the work that will be undertaken to create new lobster habitat along the south shore of Chedabucto Bay. Mitigation measures must also ensure that impacts on Mi'kmaq rights to food, social and ceremonial and livelihood fish harvesting are addressed. As part of the above, the Project will maintain formal and routine communication with Mi'kmaq First Nation representatives to determine the effectiveness of mitigation measures on the specific impacts on Mi'kmaq food, social, ceremonial and livelihood harvesting that may be identified during Project activities. Routine communication protocols will be established under the terms of the Collaborative Benefits Agreements.

Furthermore, potential impacts on livelihood fishing activity will be a focus of discussion in the Community Liaison Committee to which Mi'kmaq representatives have been invited as committee members.

Summary

During the construction phase, efforts to reduce or mitigate effects to commercial fishermen will include (a) on-going communications between the Proponent and representatives of the local fishing community; (b) completing the marine terminal construction outside of lobster fishing season (i.e., for the late summer, fall, winter and early spring) to the extent possible; (c) complying with well-established navigation safety procedures; and (d) addressing claims regarding gear damage and loss and when appropriate, providing compensation. With the implementation of these measures, significant adverse effects on commercial fisheries due to construction of the marine terminal are therefore not anticipated.

Exclusion from fishing grounds due to incoming or outgoing vessels will be mitigated through ongoing communication between fishermen and the vessels. Provided communication is regular, on-going and two-way, impacts associated with commercial fisheries other than lobster are expected to be not significant. The potential effect on overall catch harvest and the cost of fishing is from vessel interference is anticipated to be insignificant, but will be addressed through consultation with the marine fisheries authorities and the local fishing community. The Proponent will inform local fishermen and other vessel captains of the location and scheduling of activities and other potential hazards through issuance of *Notices to Mariners,* as required by applicable regulation. Provided these mitigation measures are implemented on an on-going basis, no significant adverse impacts to commercial fisheries are predicted.

7.15.5.2 *Monitoring*

Monitoring of the effectiveness of the marine Fisheries Offset Program will be undertaken for a minimum of three years during and after marine terminal construction until it can be demonstrated that the program objectives have been met. Terminal operations and fishing access will be monitored in response to concerns expressed by the local fishing community, as needed. In future consultation with the GCIFA, the Proponent will consider participating in the comprehensive and extensive fisheries data collection programs currently undertaken by the GCIFA.

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7.15.6 Residual Effects & Significance

Provided the recommended mitigation measures are implemented and claims for compensation due to gear damage or loss are addressed in a timely and effective manner, no significant adverse residual environmental effects on commercial fisheries are likely to occur. Table 7.15-1 provides a summary of the residual environmental effects and recommended measures for the Commercial Fisheries VC.

Table 7.15-1:
Residual Environmental Effects for Commercial Fisheries

Project Environment Interaction	Potential Residual Environmental Effects A = Adverse P = Positive		Mitigation	Magnitude	Geographic Extent	Duration / Frequency	Reversibility	Ecological / Socio-Economic Context	Residual Effect	Significance of Residual Impacts
Construction										
Marine terminal construction: noise and suspended sediments causing fish avoidance;	A	•	See Mitigation above	1 (low)	2 (1-10km²)	3/1	R	1	Temporary avoidance	Not Significant
Loss of access to fishing grounds; displacement									Temporary pending Offset Program	
Vessel traffic to support construction: loss of access to fishing grounds; displacement	A	•	See Mitigation above	1 (low)	2 (1-10km²)	3/1	R	1	Temporary displacement	Not Significant
Loss or damage to fishing gear									None anticipated	
Operation and Maintenance										
Presence of the marine terminal: loss of access to fishing grounds; displacement	A	•	See Mitigation above.	1 (low)	2 (1-10km²)	5/6	I	1	None anticipated following Offset Program	Not Significant
Accidental fuel spill or other discharges to the aquatic environment can alter water quality and physical habitat, which in turn can negatively affect life-cycle stages of commercially									None anticipated	

important species and their food supply. Interruption of mackerel movements due to the projecting marine terminal resulting in reduced catches in Indian Cove										None anticipated	
Project-related Vessel traffic: loss of access to fishing grounds; displacement Loss or damage to fishing gear	A	•	See above.	Mitigation	1 (low)	2 (1-10km²)	5/6	R	2	None anticipated	Not Significant
Decommissioning											
Project-related vessel traffic:	A	•	See above.	Mitigation	1 (low)	2 (1-10km²)	3/3	R	2	None anticipated	Not Significant

Legend	Geographic Extent:	Frequency:	Ecological / Socio-Economic Context:
Magnitude:	1 = < 1 km²	1 = < 11 events/year	1 = Relatively pristine area or area not adversely affected by human activity.
U= Unknown - An environmental effect affecting an unknown portion of a population or group or where the changes in a specific parameter are unknown.	2 = 1 – 10 km²	2 = 11 – 50 events/year	
	3 = 11 – 100 km²	3 = 51 – 100 events/year	
0 = Nil - No environmental effect.	4 = 101 – 1,000 km²	4 = 101 – 200 events/year	2 = Evidence of adverse environmental effects.
1 = Low (e.g., specific group, habitat, or ecosystem localized 1 generation or less, within natural variation)	5 = 1,001 – 10,000 km²	5 = > 200 events/year	
	Duration:	6 = continuous	
2 = Medium (e.g., portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside the range of natural availability)	1 = < 1 month		N/A = Not applicable
	2 = 1 – 12 months	Reversibility:	A = Adverse
	3 = 13 – 36 months	R = Reversible	P = Positive
3 = High (e.g., affecting entire stock, population, habitat or ecosystem, outside the range of natural variation)	4 = 37 – 72 months	I = Irreversible	
	5 = > 72 months		

7.16 ARCHAEOLOGICAL AND HERITAGE RESOURCES

As defined by the Nova Scotia Department of Communities, Culture and Heritage, an archaeological resource is:

> *"a work of past human activity, or zoological, botanical, geological or other natural materials found in association with such activity that:*
>
> > *(i) is primarily of value for its prehistoric, historic, cultural or scientific significance; and,*
> >
> > *(ii) lay on, or was buried or partially buried in land in the province, including land covered by water."*

Archaeological and Heritage Resources were identified in the EIS Guidelines as a potential VC as concerns have been raised regarding the possible existence of these resources during the public outreach phase of the environmental assessment.

A 2011 Archaeological Resource Assessment survey did not identify any archaeological or heritage resources, but potential post-European contact resources were identified on the Property near the coast during the 2014 Archaeological Resource Assessment (Section 6.12 and **Appendix L**). Although 30 m buffer zones will be left undisturbed along the coastline, (thereby protecting some of these finds), much of the coastal zone inside this buffer will be built upon, thus potentially disturbing, destroying or covering over some of these resources.

Details of archaeological and heritage resources existing conditions on the Project site are presented in Section 6.12.

7.16.1 Boundaries

7.16.1.1 *Temporal Boundaries*

The temporal boundaries for the assessment of impacts upon archeological and heritage resources are limited to the construction phase of the development. Construction is estimated to take two to three years. An adverse effect on an archeological or heritage resource would be permanent.

7.16.1.2 *Spatial Boundaries*

The spatial boundaries for the assessment of impact on archeological and heritage resources are limited to the terrestrial portion of the Project Area, particularly the coastal areas. The inhospitable nature of the barrens suggests that little cultural activity, whether Pre-contact or historic, would have occurred in the central portion of the Project Area.

7.16.1.3 *Technical Boundaries*

No technical boundaries were identified for the Archeological and Heritage Resources VC.

7.16.1.4 *Administrative Boundaries*

Nova Scotia's *Special Places Protection Act* governs archaeological surveys in Nova Scotia. In order to conduct any archaeological work a Heritage Research Permit issued by the Minister of the Department of Communities, Culture and Heritage must be obtained.

7.16.2 Threshold for Determination of Significance

Based on the existing information for the area, the Project may interact with some areas considered to hold a high potential for documented and/or undocumented archaeological resources. If archaeological resources are identified within the Project Area, a significant adverse effect is defined as an uncontrolled disturbance to, or destruction of, any such resource considered by the Mi'kmaq, provincial regulators or local residents to be of major importance.

7.16.3 Effects Archaeological and Heritage Resources

7.16.3.1 *Construction*

There is potential for the loss of archaeological resources in preparation of the site for construction, during the clearing, grubbing and grading phase of the Project. Artefacts may be encountered on the lower coastal platform as described in Section 6.12.

7.16.3.2 *Operation*

There is no potential for the disturbance of archaeological or heritage resources during the operational phase of the Project.

7.16.3.3 *Decommissioning*

There is no potential for the disturbance of archaeological or heritage resources during the decommissioning phase of the Project.

7.16.4 Mitigation and Monitoring

7.16.4.1 *Mitigation*

Exploratory excavation will likely be required in those areas that may be disturbed during Project construction. This excavation work will be undertaken under the direction of experienced archeologists before construction begins. At the same time, potential heritage resources identified during the 2014 study that will not be disturbed by construction will be flagged to ensure they are not accidentally affected by construction activities.

Prior to beginning construction, the Proponent will implement a Cultural Resource Management Plan to guide site personnel in the event that archaeological and heritage resources are identified during construction. An example of this plan is provided in **Appendix L** as an attachment to the 2014 Archaeological Resource Assessment.

The Cultural Resource Management Plan specifies a notification procedure if remains are found, and will describe resource specific preservation measures as needed. This may include archaeological excavation or avoidance of the site. These mitigation measures would be

approved by the Minister of the Department of Communities, Culture and Heritage before site construction could begin. This Plan is considered a standard mitigation measure applied at construction site with cultural heritage or archaeological potential

7.16.4.2 *Monitoring*

The Project archaeologist will be informed with respect to construction starting dates and progress. During initial construction phases, the archaeologist will be on "standby" and may visit the site from time to time as needed.

7.16.5 Residual Effects and Significance

The results of the effects assessment for the archaeological resource VC is provided in Table 7.16-1.

With application of resource specific mitigation measures outlined in the Cultural Resource Management Plan, no significant adverse effects to these resources are likely.

Table 7.16-1:
Residual Environmental Effects for Archaeological and Heritage Resources

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Residual Environmental Effects: Magnitude	Geographic Extent	Duration/Frequency	Reversibility (R=reversible NR=Non reversible)	Ecological/Social-cultural and Economic Context	Residual Effect	Significance
Construction									
Damage to or destruction of cultural resources.	A	• Undertake exploratory excavation to document and conserve resources prior to construction • Flag and buffer heritage resources so that will not be disturbed during construction • Implement a Cultural Resources Management Plan in the event that other heritage resources are revealed during constructions	Low	Limited to the lower coastal platform of the Project footprint (about 30 ha).	Permanent / one time but avoidable with mitigation	NR	Area is affected by past human activity.	None Anticipated	Not Significant
Operation / Decommissioning									
None expected									

7.17 ABORIGINAL LAND AND RESOURCE USE

The MEKS prepared for this environmental assessment (**Appendix K**) highlights the Mi'kmaq Nation's long-standing relationship with, and attachment to, the region in and around the Project site. The region holds historical significance to the Mi'kmaq nation and to the development of relationships between European settlers and the Mi'kmaq. While the Project area is not home to present day Mi'kmaq communities, it was in this region that Mi'kmaq demonstrated local hunting, trapping and gathering practices to newcomers, thus fostering a lasting relationship of peace and friendship with the French, and eventually other European inhabitants of the *Eskikewa'kik* area. This intimate relationship between the Mi'kmaq and the region is demonstrated with the extensive awareness of flora and fauna resources in the Project area despite the interruption in use of the area due to development and national Aboriginal policies. The existence of numerous species of plants, fish, and game in the Project area that are known to be culturally significant to Mi'kmaq is evidence that the site was likely used by the ancestors of today's local Mi'kmaq communities.

Based on the findings of community wellbeing studies conducted by Aboriginal Affairs and Northern Development Canada, the well-being index score for Mi'kmaq communities is well below average index values for local non-aboriginal communities (O'Sullivan 2011). The average Nova Scotia Mi'kmaq income index is 41/100, education is 41, housing is 72, and labour force activity is 66 with an overall community wellbeing index value of 55, which is well below the Atlantic region wellbeing average of 73. Since employment and income levels are below average, many families augment food supplies through hunting and fishing.

This is consistent with traditional and historical practice since Nova Scotian Mi'kmaq communities have always been highly dependent on natural resources. Fisheries and hunting played an important role in in the annual community cycle, with communities migrating between their summer and winter encampments and the associated area harvests being divided between food, ceremonial, and commercial purposes (Stiegman 2006). This dependence was the foundation for the cultural relationship with the environment referred to as Netukulimk, a Mi'kmaq concept that relates to making a livelihood from the land through resource harvesting which does not jeopardize the integrity, diversity, or productivity of the environment (Doyle-Bedwell and Cohen 2001). There was an easy transition into a livelihoods fishery after colonization, as fishing was historically among the essential seasonal activities of the Mi'kmaq (Notzke 1994)

Traditionally, Mi'kmaq rights relating to decision-making over natural resources were not vested in a hierarchical leadership but rather were made through a consensus of all members of the community (Milley and Charles, 2001). This approach to management was eroded over time as a result of government policy and practices. Furthermore, passive exclusion of First Nations from mainstream economic activity resulted from governmental limitations on access to the fishery (as well as forestry and other resources) which resulted in little, if any, economic benefit (Wiber and Milley 2007).

This has resulted in the below average economic condition (as noted above), and while First Nations are provided with various social services and programs (including housing, education and health), program deliver has not kept pace with demand and these communities and many First Nation communities remain well below Canada's accepted national standards.

However, improvements to resource access have come about over the past two decades through the avenue of aboriginal rights, as a result of decisions of the Supreme Court of Canada. In particular, the Marshall decision has led to significantly increased involvement of Mi'kmaq First Nations in commercial fishing activities, through the issuance of communal commercial licenses. Being communal in nature, a community can manage these commercial licenses not only in the interests of those who are fishing, but also to provide benefits across the community.

As noted in section 6.10.4, several Mi'kmaq communities are currently fishing marine species for livelihood purposes along the eastern shore. Of these, only the Waycobah shrimp trap fishery is operating in proximity to the Project where Project-related impacts may be anticipated. The Waycobah band holds the only Mi'kmaq shrimp trap license in the south side of Chedabucto Bay however this license is currently being fished by non-aboriginal license holders on behalf of the Band where the allocated traps are divided among several local non-Mi'kmaq fishermen (G. Boudreau, pers. comm. 2015). In addition, no Mi'kmaq fishermen currently deploy lobster traps in the Project vicinity (G. Boudreau, pers. comm. 2015) although they, like other LFA 31 license holders, have the right to fish anywhere within LFA 31.

Shrimp and other fisheries are managed under the Department of Fisheries and Oceans through communal commercial licenses, some of which are issued for the large fishery management areas along the Nova Scotia eastern shore. Given this, there is no defined "Mi'kmaq fishery" as such.

As noted in section 6.10.4, there is currently no direct Mi'kmaq use of the Project site for subsistence harvesting of food or furbearing in animals. However, as noted in the MEKS (**Appendix K**), based on archival research and interviews with key knowledge holders there is:

1. potential for the disturbance of hitherto unidentified archaeological resources during the construction of the infrastructure (access road, processing facility, shipping terminal) associated with the Project, as well as the quarry operation itself.

2. likely permanent loss of wildlife and plant resources which have been traditionally harvested within the immediate project footprint. This loss is likely the result of the physical removal or displacement of specimens during construction and operation of the quarry, or restriction of access to the location as a potential harvesting area.

3. potential harm or dispersing of local wildlife due to noise disturbance resulting from increased human presence, vehicular traffic, blasting, and general mining activities.

4. potential disturbance or contamination of vegetation, wetlands and water bodies within the corridor along the access road, and within the area of the quarry pit as well as the shipping terminal as a result of settlement of dust and other airborne pollutants created during the mining, crushing and transport of the product. This can depreciate the quality of local food and medicinal plants for human consumption as well as the quality of animal browse and water/wetland habitat.

5. potential degradation of the local marine and shoreline habitats surrounding the shipping terminal due to dust contamination, the potential for accidental aggregate spillage during loading, and possible contamination resulting from accidental spills of petroleum products associated with cargo vessels.

The nature of Mi'kmaq cultural connection with traditional resource harvesting activities suggests that environmental effects on fish, plants and wildlife can create associated socio-cultural and/or socio-economic effects. These can lead to disconnection with traditional food sources thus increased dependence on non-traditional foods and general community frustration and anger due to cultural erosion/assimilation.

7.17.1 Boundaries

The boundaries of the potential environmental effects vary from ecosystem and socio-economic perspectives. The Affected Area includes all lands and waters that are *potentially* used by the Mi'kmaq for traditional harvesting purposes, and which could be affected by the Project via light, noise, dust or other emissions. In this respect, the Project boundaries for the Aboriginal Land and Resource Use VC are identical as those described for each biophysical component in the previous sections. Generally speaking however, the environmental effects (1 to 5 above) are bounded within the Project site, or in close proximity to the project Site since there is currently no active traditional harvesting on the Project site or in the immediate vicinity.

The boundaries for the social, health, cultural, and socio economic effects are wider in geographical scope. These effects include the Mi'kmaq families who have been involved with resource harvesting in the region, and their communities. The boundaries include the Mi'kmaq communities discussed in section 6.9.3.

7.17.2 Threshold for Determination of Significance

The threshold for determination of significance of the social, cultural and economic effects is determined through ongoing discourse with Mi'kmaq representatives. Since Project effects can be considered as a matter of Rights to harvest food, social and ceremonial resources, and Treaty Rights to harvest natural resources, including plants, fish and wildlife for a moderate livelihood the threshold for determination of significance is a matter of consideration by the Crown and Mi'kmaq representatives (Assembly of Nova Scotia Chiefs and the Governments of Canada and Nova Scotia).

Project effects resulting in the loss of employment and income for Mi'kmaq fishers that could not be replaced within a reasonable time, loss of food resources upon which Mi'kmaq families depend that could not be found in reasonable proximity to communities, or permanent loss of cultural relationship caused with the lands, flora and fauna directly by the Project would be significant. Non-permanent or geographically limited (i.e., small scale) changes in harvest areas caused by displacement due to Project activities are not considered to be significant.

7.17.3 Effects on Aboriginal Land and Resource Use

In addition to the environmental considerations discussed below, Mi'kmaq culture is valued greatly in NS. Many Mi'kmaq continue to pursue elements of a traditional lifestyle, spending time in the country harvesting fish, game, berries, and firewood. Mi'kmaq land/resource use and culture could be affected by the Project development through such effects as the loss or alteration of harvesting areas and reduced access to traditionally used lands. Aboriginal land claims can affect the establishment of clear title for land designated for industrial development and exclusive use. Both Federal and Provincial Governments have responsibilities with respect to Aboriginal peoples and the settlement of outstanding land claims. Consideration of Aboriginal interests is legislated by federal and provincial laws.

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While presently there is limited involvement of Mi'kmaq individuals in the Project site, it was clearly evident that the region had been used in the past (within living memory) for food gathering and recreation. The decision to continue to use this area has been affected by a number of historical factors (most significantly centralization policies to move Mi'kmaq families to reserves) and demographic factors. A rapidly growing youth population that is pursuing education and alternative training has resulted in a slight de-emphasis on hunting within the rapidly growing communities (it is possible that firearms regulations and hunter training requirements may be a contributing factor in the decline in hunting amongst Mi'kmaq youth).

It is also clear from the research that, traditionally, decisions related to food, social and ceremonial fishing and hunting has been based on opportunistic access to food resources that are most abundant in close proximity to reserve communities and urban residential areas. As a result, there may be future interest in fishing, hunting and possibly gathering in the Project area as land-use changes, and increased urbanization and other developments impact areas currently used by Mi'kmaq hunters and fishers. In keeping with traditional decision-making practices, an important attribute of the ecological knowledge system, areas such as the Project site would logically be considered for harvesting activities due to its easy access from Nova Scotia's transportation routes.

It has been noted during the engagement activities that several Mi'kmaq communities have access to the waters adjacent to the project site for livelihood fishing. While these licenses fall under the management plans and regulatory control of the Department of Fisheries and Oceans, access to the commercial fishery by Mi'kmaq harvesters is founded in the Treaty Rights held by the Mi'kmaq nation. Mi'kmaq which has been involved in the local groundfish, lobster, snow crab, tuna, swordfish, and mackerel fisheries include: Acadia, Potolotek, Eskasoni, Sipekne'katik, Membertou, Millbrook, Wagmatcook, Waycobah, Pictou Landing and Paqtnkek.

Potential Project-related effects on the natural environment and land resources with potential significance for Mi'kmaq interests are listed in Table 7.17-1 The table includes mitigation measures aimed to minimize the overall ecological effects of the Project on the site and adjacent lands. The Proponent is committed to addressing Mi'kmaq interests, minimizing possible adverse Project effects, and maximizing Project benefits in a collaborative approach to Project planning and development (see Section 11). This is expected to include all phases of the Project.

While there is currently no Mikmaw harvesting on the site or in waters immediately adjacent, it is intended that the Project site and adjacent waters will be accessible to Mi'kmaq for safe harvesting for flora and fauna for food, social and ceremonial purposes, in accordance with provincial and federal regulations. Any future potential Project impacts (environmental, social and economic) on these harvesting activities will be a matter of the formal and regular meetings with the Mi'kmaq community representatives in accordance with the terms set in the Collaborative Benefits Agreements.

Table 7.17-1:
Potential Impacts on Mi'kmaq Interests

Potential Impacts	Assessment of Significance	Mitigation
Construction		
Disturbance of archaeological Resources.	• Archaeological resources are irreplaceable and of extreme importance. Being the only source of information on Mi'kmaq pre-contact history, land use, occupancy and culture, archaeological information from the site should be preserved and protected.	While there has not been a confirmed Mi'kmaq archaeological significance of the Project site, observations will be maintained during all construction activity and should evidence be uncovered all activity will cease in the area until Mi'kmaq archaeological experts have had an opportunity to examine the site and determine appropriate action.
Permanent loss of wildlife and plant resources within the immediate Project footprint.	• The species of significance to Mi'kmaq communities identified within the Project areas, in particular medicinal plants, are also present within the surrounding areas. The permanent loss of some of (or access to) these specimens within the Project area is not expected to significantly limit Mi'kmaq use of these resources.	Efforts will be made to minimize the potential impact by containing all activity to within the Project footprint. Transferring significant flora and fauna to suitable nearby habitat will be implemented if warranted and feasible as determined through ongoing dialogue with Mi'kmaq communities
Construction, Operation and Decommissioning		
Noise disturbance will adversely impacts local wildlife resources.	• Increased sound levels resulting from construction activities can interfere with hunters in areas of significance to Mi'kmaq. Because of the local nature of these impacts, their significance on local Mi'kmaq harvesting activities is limited.	Noise mitigation will include measures noted in Section 7.2.
Contamination of surrounding vegetation, wetlands and water bodies through dust and other airborne pollutants.	• The level of depreciation of local food and medicinal plants for human consumption is determined to be not significant, as are the impacts of a deteriorating quality of animal browse and water/wetland habitats on local fish and wildlife. Even though the radius of these impacts will undoubtedly extend beyond the boundaries of the Project area, their effects on individual Mi'kmaq resource activities is expected to be limited.	Predicted ground level dust concentrations outside the Property will remain well within applicable air quality standards (**Appendix O**). Appropriate mitigation measures have been defined in Section 7.1.

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Potential Impacts	Assessment of Significance	Mitigation
Contamination of marine and shoreline habitats surrounding the shipping terminal through possible fuel, oil or waste discharge associated with Project related vessel traffic or particulate run off from the project site.	• Potential impacts of such may be wider-ranging depending on factors such as the nature of the accident/spill, season and marine currents. The significance of such potential impacts on the Mi'kmaq fishery is undetermined, however, based on the apparent current lack of use of the area for food, social and ceremonial fisheries harvesting, it is assumed that any effects will have negligible effect on current Mi'kmaq FSC fish harvesting. • Impacts of particulate run off have been considered and are expected to be negligible since runoff will be directed to sedimentation ponds for treatment prior to discharge.	Considerations for avoidance and reducing the risk for accidents and malfunctions have been an integral part of the work on design, construction and operation of the Project. This is outlined in Section 7.18, where appropriate mitigation measures are described.

7.17.4 Residual Effects and Significance

The residual effects of the Project on Mi'kmaq land and resource use activities are considered to be of minor significance. However, as noted in Table 7.17-2 below, some residual effects may have greater significance which can be mitigated through monitoring and communication.

Table 7.17-2:
Residual Effects and Significance

Residual Effect	Significance
Permanent loss of wildlife and plant resources which have been reportedly traditionally harvested within the immediate Project footprint; loss of future opportunities to harvest these resources.	Minor significance. The effects are localized only to the Project site and will not likely have widespread impact on regional resource abundance and distribution.
Harm to, or dispersion of local wildlife due to noise disturbance	Minor significance, The effects of noise on fauna can modify local behaviour (often a temporary effect as many species will acclimatize to anthropogenic noise). As above, noise effects will not likely have widespread impact on regional resource abundance and distribution.
Potential depreciation of the quality of local food and medicinal plants for human consumption due to disturbance, or contamination of vegetation, wetlands and water bodies within the Project site	Medium significance. The effects of contamination may result in permanent loss of harvest areas which will not likely have widespread impact on abundance, but could potentially create health risk for people using, or consuming food resources that occupy the Project site. Ongoing monitoring and communication with Mi'kmaq harvesters through representative organization can mitigate this risk.
Potential degradation of the local marine and shoreline habitats surrounding the shipping terminal related to dust contamination, the potential for accidental aggregate spillage during loading, and possible contamination resulting from petroleum products associated with cargo vessels	Medium significance. As above, environmental contamination of local fish and shellfish harvesting areas traditionally used by Mi'kmaq can pose a health risk. Ongoing monitoring and communication with Mi'kmaq representative organizations can mitigate this risk. Since Mi'kmaq exercise their rights to livelihood fisheries in accordance with the DFO Regulatory procedures for commercial fisheries, widespread effects on the Mi'kmaq coastal commercial fisheries will be the same as non-aboriginal commercial fisheries. This is determined as being of minor significance as the area is not considered to be critical habitat for commercially important species.

7.18 CHANGES TO COMPONENTS WITHIN FEDERAL JURISDICTION

7.18.1 Environmental Effects Within Federal Jurisdiction

As stipulated in the EIS Guidelines, this section summarizes those changes to the environment that may be caused by the Project on environmental components listed in paragraph 5(1)(a) of CEAA, 2012, namely fish and fish habitat as defined in the *Fisheries Act*, aquatic species (marine plants) as defined in the *Species at Risk Act* and migratory birds as defined in the *Migratory Birds Convention Act, 1994*. The material presented here is summarized from the sections above.

Freshwater Species and Habitat

There is no freshwater fish habitat present on the Black Point property. For the purposes of the EIS, Reynolds Brook located 1.0 km south of the Property is assumed to support freshwater fish and fish habitat. Full quarry development will reduce Reynolds Brook inflows by approximately 18%. This change to the environment may impair fish survival during dry periods and/or improve habitat quality by reducing inflows of low pH surface water to the Brook. This in turn may positively or negatively change the risk of fish mortality in Reynolds Brook, and/or result in changes to habitat quality and use. The effects and Accidents and Malfunctions will not be felt in Reynolds Brook since these effects would be contained within the quarry pit, which ultimately discharges north through the sedimentation ponds rather than south to Reynolds Brook.

With the implementation of the mitigation measures described in Section 7.10.5.2, including the creation of a 30 ha lake following cessation of quarrying activities, the residual impacts to freshwater fish and fish habitat are predicted to be not significant.

Marine Species and Habitat

The potential Project-related effects associated with this VC are presented in section 7.11.4 and include:

- Reduced habitat quality and habitat function due to altered water and sediment quality from sediments introduced to the marine environment during construction and operation.
- Reduced habitat for fish that are part of or support commercial, recreational or Aboriginal fisheries resulting from construction of marine terminal.
- Fish mortality due to the use of explosives within the pit; behavioural changes to fish, crustaceans and other marine species due to noise and vibrations associated with explosives use.
- Mortality (marine plants, benthic and pelagic organisms, etc.) and/or the loss of benthic habitat due to aggregate spills when the ships are loaded.
- Increased disturbance to marine flora and fauna and reduced habitat quality and function for marine species due to noise and vessel movement from increased ship traffic.
- Invasive species that may be introduced through the illegal discharge of ballast water.

In summary, these Project effects, as well as those resulting from an accidental fuel spill in the marine environment, may result in changes to the risk of mortality or injury to fish, marine mammals and/or marine plants and changes to habitat quality and use.

To address these potential effects a series of mitigation measures are proposed in Section 7.11.5 for implementation during construction and operations. Following the application of these measures, including the replacement of lobster habitat in the immediate vicinity of the Project and the implementation of spill response plans, the residual adverse effects to Marine Species and Habitats are predicted to be not significant.

Migratory Birds

Changes to ambient noise (Section 7.2) and light (Section 7.3) may affect migratory birds through driving them out of the area and/or other effects on their behaviour. These effects in turn may affect change the risk of bird mortality or injury and result in changes to habitat quality and use.

Mortality of a single individual of a migratory or non-migratory Species at Risk or a large number of migratory birds could be considered a significant adverse environmental effect. Effects on critical habitat of a migratory bird SAR which cause breeding failure or abandonment of nesting may also be considered significant, even if the effects are temporary. This would include abandonment or nesting failure of a migratory bird SAR or at a seabird/waterbird colony due to an accidental event or the response to an accidental event associated with the Project.

A variety of generic and site mitigation and environmental protection measures are described to minimize or eliminate Project-related effects to migratory birds; please see Sections 7.2, 7.3, 7.9.4 and 7.12. Following the implementation of these mitigation measures over the course of the Project, residual adverse effects are predicted to be not significant.

7.18.2 Power and Duty by Federal Authority

Should the Black Point Quarry Project require a federal authority to exercise a power or perform a duty (e.g., grant a permit) CEAA, 2012 requires that the Proponent take into account:

(*a*) a change that may be caused to the environment (other than those described in the previous section) and that is directly linked or necessarily incidental to a federal authority's exercise of a power or performance of a duty or function; and

(*b*) an effect, other than those already described regarding aboriginal peoples, of any change referred to in paragraph (*a*) on

(i) health and socio-economic conditions,

(ii) physical and cultural heritage, or

(iii) any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

The marine terminal component of the Project is expected to result in "serious harm to fish" (i.e., the death of fish or permanent alteration to, or destruction of, fish habitat) for species that are

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part of or support a commercial, recreational or Aboriginal fishery. Under these circumstances, the *Fisheries Act* authorisation will be required to undertake the Project. Changes to fish and fish habitat and proposed mitigation measures are described in the preceding Section. As noted, with the implementation of these mitigation measures no significant residual environmental effects are expected.

The potential effects on Aboriginal peoples as required by section 5(2)(b) of CEAA, 2012 are summarized in Section 7.18.4 below.

7.18.3 Changes Expected on Federal or Transboundary Lands

The marine components of the Project, especially aggregate shipping, have the potential to result in changes to the environment on federal submerged lands and federal waters. Shipping routes will enter Canada's territorial sea and internal waters (Chedabucto Bay), both of which constitute federal lands as defined under section 2(1) of CEAA, 2012. Changes to Marine Species and Habitat VC will occur on federal submerged lands and in federal waters; these changes are described in Section 7.11 above. Apart from these changes, the Project may also result in changes to Commercial Fisheries and Aboriginal Land and Resource Use (Mi'kmaq fisheries). These changes are presented in more detail in Sections 7.15 (Commercial Fisheries) and 7.17 (Aboriginal Land and Resource Use).

The primary potential effect to the Commercial Fishery on submerged federal lands/federal waters is a potential change in availability of fisheries resources. This change would occur primarily at the marine terminal but may on occasion extend into Chedabucto Bay if Project-related shipping affects shrimp fishing activities in deeper waters. Although the shipping route has been selected to avoid preferred shrimping grounds, it is conceivable that shrimp fishers may occasionally be displaced from portions of these grounds should weather conditions or pilot advices necessitate an alternative shipping route. Given the small extent of the potentially affected area and the temporary nature of such events, the potential for significant adverse residual environmental effects is low.

In the case of an accidental event leading to a fuel spill in the marine environment, a potential significant adverse effect may experience by the Commercial Fisheries VC. However, the application of spill response efforts, an Emergency Response Plan (which includes spill dispersion modelling), and emergency preparedness training on ship and at the Project site, significant residual effects on Commercial Fisheries are not likely to occur.

As noted in Section 7.17 (Mi'kmaq Land and Resource Use) limited Mi'kmaq communal commercial fisheries are present at and near the Black Point Project site. A single shrimp license is fished in the southern portion of Chedabucto Bay; the Mi'kmaq-allocated traps are distributed among several non-Mi'kmaq fishermen. Given the presence of communal commercial fisheries in the area, there is a potential for a change to Aboriginal Land and Resource Use. The same mitigation measures described for Commercial Fisheries are applicable to this VC. Given the implementation of the mitigation measures described above for Commercial Fisheries, the residual effects on this VC, including in the event of an accidental fuel spill in the marine environment, are expected to be not significant.

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7.18.4 Effects of Changes to the Environment

This section summarizes the effects of changes to the environment that may be caused to those components listed in section 5(1)(c) and 5(2)(b) of CEAA, 2012. The information presented in this section is summarized from the environment effects assessment presented throughout Section 7.0 of the EIS and include:

1. Effects of changes to the environment on Aboriginal people (CEAA section 5(1)(c); and
2. Effects of changes to the environment that are directly linked or necessarily incidental to federal decisions (CEAA section 5(2)(b).

Effects on Aboriginal People

As stipulated in section 5(1)(c) of CEAA, 2012, this section summarizes the effects of changes to the environment on Aboriginal people caused by the Project, namely:

- health and socio-economic conditions,
- physical and cultural heritage,
- the current use of lands and resources for traditional purposes, or
- any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

Given the distance from the Project site to the nearest Mi'kmaq community (Paqtnkek First Nation located 66 km away from the site), potential Project-related effects such as changes to air quality and ambient noise are not likely to affect the health of Aboriginal people. An accidental fuel spill in the marine environment may negatively affect communal commercial or CRA fisheries however such impacted species would not be consumed and thus no health effects would be expected.

An MEKS was undertaken to characterise past and current traditional use of the Project site including the nearshore areas of Chedabucto Bay where the marine terminal will be constructed (Appendix K). To supplement this work, Mi'kmaw representatives from the neighboring Mi'Kmaq communities were contacted to discuss ongoing fishing activity in the Project area. As noted in the MEKS (**Appendix K**), the site is not currently visited for resource harvesting and there are currently no FSC fisheries at the Project site. This is not to conclude that the Project site will not be visited in the future for FSC purposes. Under these circumstances, however, changes to the environment caused by the Project are not likely to affect physical and cultural heritage or the current use of lands and resources for traditional purposes.

Archeological investigations conducted during the course of this EIS concluded there is low potential for presence of Mi'kmaq artifacts or remains on the site. Given this, Project activities are not anticipated to result in any changes to the environment that would have an effect on Aboriginal physical and cultural heritage areas, sites, structures or other resources.

Effects Linked or Incidental to Federal Decisions

As stipulated in section 5(2) (b) of CEAA, 2012, this section summarizes the effects of changes to the environment "directly linked or necessarily incidental to a federal authority's exercise of a power or performance of a duty or function" required to allow the Project to proceed, if any of the following are affected:

- health and socio-economic conditions,
- physical and cultural heritage, or
- any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

An Authorisation for serious harm to fish under section 35(2)(b) of the Fisheries Act will likely be required to permit the construction and operation of the marine terminal. A Navigation Act Approval will be required for marine terminal construction and may be required for watercourse crossings. The anticipated "change" or environmental effect is a potential change in habitat quality and use of the Marine Species and Habitat VC. The marine terminal is not expected to result in adverse effects to heath, physical and cultural heritage, or any structure, site or thing that is of historical, archaeological, paleontological or architectural significance. In contrast, effects on socio-economic conditions may result from the terminal's effect on the commercial fisheries through:

- Change in risk of fish injury or death; and
- Change in fish or other habitat quality and use;

Given that these potential changes to the environment are expected to be temporary and confined to the area around the marine terminal and to the designated shipping routes between the terminal and the main shipping lanes in Chedabucto Bay, the effects of these potential changes are not expected to alter the socio-economic conditions for commercial fishermen. Following implementation of the mitigation measures described in Sections 7.15 and 7.17 (including fisheries offset projects), residual environmental effects on Marine Species and Habitats and related residual environmental effects on socio-economic conditions related to Commercial Fisheries, are predicted to be not significant.

Table 7.18-1:
Summary of Environmental Mitigation

Subject Category	Change or Effect	Mitigation	Follow Up Programs and Commitments
Changes to components within federal jurisdiction	<u>Freshwater Fish Habitat</u> Change to flow and water quality in Reynolds Brook, assumed to support fish	• Creation of a 30 ha lake following Project cessation • Erosion and Sediment Control Plan • Stormwater Management Plan • Emergency Response and Spill Contingency Plan	• Habitat assessment and determination of fish presence/absence in Reynolds Brook. • Flow and water quality monitoring in Reynolds Brook prior to and once the pit begins to affect flow to Reynolds Brook.
	<u>Marine Fish, Fish Habitat and Aquatic Species</u> Reduced habitat quality and habitat function due to altered water and sediment quality. Reduced habitat for fish that are part of or support commercial, recreational or Aboriginal fisheries resulting from construction of marine terminal. Fish mortality due to the use of explosives within the pit; behavioural changes to fish, crustaceans and other marine species due to noise and vibrations associated with explosives use. Mortality (marine plants, benthic and pelagic organisms, etc.) and/or the loss of benthic habitat due to the presence of the terminal and aggregate spills when the ships are loaded. Increased disturbance to marine flora and fauna and reduced habitat quality and function for marine species due to noise and vessel movement from increased ship traffic. Invasive species that may be introduced through the illegal discharge of ballast water.	• Environmental Management Plan • Application of appropriate timing windows for all in-water work. • Implementation of terrestrial erosion and sediment control measures. • Surface water monitoring to ensure that quality meets all regulatory standards prior to discharge • Install stockpiles, fuel and chemicals > 30 m from the coast. • Emergency Response and Spill Contingency Plan. • Control ballast water release via "*Ballast Water Control and Management Regulations*" and the requirements as per the International Convention for the control and Management of Ship's Ballast Water and Sediments.	• Fisheries Offset Program and associated effectiveness monitoring. • Surface water monitoring program
	<u>Migratory Birds</u> Changes to ambient noise and ambient light conditions may affect migratory birds through driving them out of the area and/or other effects	• Noise: please see mitigation measures described in Section 7.2 (Noise and Vibration) and Table 10-1 (Proposed Mitigation and	• Routine site monitoring as described in the Environmental Management Plan will include maintaining records of bird mortality so developing issues

	on their behaviour. These effects in turn may affect change the risk of bird mortality or injury and result in changes to habitat quality and use.	Monitoring by VC). • Light: please see mitigation measures described in Section 7.3 (Ambient Light) and Table 10-1 (Proposed Mitigation and Monitoring by VC). • Please see additional mitigation measures in Section 7.9 (Terrestrial Wildlife) and Section 7.12 (SAR and SOCC), which are also summarized in Table 10-1 (Proposed Mitigation and Monitoring by VC). .	related to lighting can be identified. • The Environmental Management Plan will include instructions on implementing the protocol "*Best practices for stranded birds encountered offshore Atlantic Canada*" (EC 2014e) for responding to avian strandings related to activities in the marine environment. • Nightly site inspections will reveal opportunities for light reduction
Changes to the environment on federal or transboundary lands	Changes to federal submerged lands and in federal waters in the form of changes to Commercial Fisheries including Mi'kmaq Fisheries), Marine Species and Habitat and Marine Surface Waters. These changes may occur through construction and operation of the marine terminal, aggregate shipping, and/or accidental spills in the marine environment.	• Environmental Management Plan • Application of appropriate timing windows for in-water work. • Erosion and Sediment Control Plan • Surface water monitoring to ensure that quality meets all regulatory standards prior to discharge. • Install stockpiles, fuel and chemical storage facilities > 30 m from the coast • Emergency Response and Spill Contingency Plan. • Control ballast water release via "*Ballast Water Control and Management Regulations*" and the requirements as per the International Convention for the control and Management of Ship's Ballast Water and Sediments. • The quarry site office will be manned 24 hrs/day so that fishermen can telephone to receive information regarding vessel arrival and departures. • The phone number can also be used to report loss or damage to gear caused by Project-related vessel traffic.	• Fisheries Offset Program and associated monitoring for effectiveness. • Concussion and ground vibration monitoring during each blast to ensure limits established by DFO for the marine environment are respected. • Mi'kmaq resource harvesting activities will be reviewed with Mi'kmaq representatives at the Community Liaison Committee meetings.

		• Routine communication with potentially affected Mi'kmaq will occur through the CLC. • Any future potential Project impacts (environmental, social and economic) on these harvesting activities will be a matter of the formal and regular meetings with the Mi'kmaq community representatives.	
Changes that are linked or incidental to federal decisions	An Authorisation for serious harm to fish under section 35(2)(b) of the Fisheries Act will likely be required to permit the construction and operation of the marine terminal. A Navigation Act Approval will be required for marine terminal construction and may be required for watercourse crossings. The Project is not expected to result in adverse effects to heath, physical and cultural heritage, or any structure, site or thing that is of historical, archaeological, paleontological or architectural significance. In contrast, potential effects on socio-economic conditions may result from temporary and localized: • Change in risk of fish injury or death; • Change in fish or other habitat quality and use; and • Change in commercial and Aboriginal fisheries.	• Environmental Management Plan • Application of appropriate timing windows for all in-water work. • Implementation of terrestrial erosion and sediment control measures. • Surface water monitoring to ensure that quality meets all regulatory standards prior to discharge • Install stockpiles, fuel and chemicals > 30 m from the coast. • Emergency Response and Spill Contingency Plan. • Control ballast water release via "*Ballast Water Control and Management Regulations*" and the requirements as per the International Convention for the control and Management of Ship's Ballast Water and Sediments. Routine communication with potentially affected Mi'kmaq will occur through the CLC. • Any future potential Project impacts (environmental, social and economic) on these harvesting activities will be a matter of the formal and regular meetings with the Mi'kmaq community representatives.	• Fisheries Offset Program and associated effectiveness monitoring. • Surface water monitoring program • Concussion and ground vibration monitoring during each blast to ensure limits established by DFO for the marine environment are respected. • Mi'kmaq resource harvesting activities will be reviewed with Mi'kmaq representatives at the Community Liaison Committee meetings.

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Effects of changes on Aboriginal peoples	The site is not currently visited for resource harvesting and there are currently no FSC fisheries at the Project site. Changes to the environment caused by the Project and their effects are not likely to affect physical and cultural heritage or the current use of lands and resources for traditional purposes.	• Any future potential Project impacts (environmental, social and economic) on these harvesting activities will be a matter of the formal and regular meetings with the Mi'kmaq community representatives. • Routine communication with potentially affected Mi'kmaq will occur through the CLC.	• Mi'kmaq resource harvesting activities will be reviewed with Mi'kmaq representatives at the Community Liaison Committee meetings. • The Proponent commits to allowing future access to non-active portions of the site to the extent this does not compromise the safety of the Mi'kmaq visitors or quarry workers. • The Proponent will continue to make Project status presentations and offer site visits to interested Mi'kmaq representatives
Effects of changes that are linked or incidental to federal decisions	An Authorisation for serious harm to fish under section 35(2)(b) of the Fisheries Act will likely be required to permit the construction and operation of the marine terminal. A Navigation Act Approval will be required for marine terminal construction and may be required for watercourse crossings. The anticipated effect of changes caused by these decisions (i.e., marine terminal construction) is not expected to result in adverse effects to heath, physical and cultural heritage, or any structure, site or thing that is of historical, archaeological, paleontological or architectural significance. In contrast, effects on socio-economic conditions may result from: • Change in risk of fish injury or death; • Change in fish or other habitat quality and use; and • Change in commercial and Aboriginal fisheries. Given that these potential changes to the environment will temporary and confined to the area around the marine terminal and to the designated shipping routes between the terminal and the main shipping lanes in Chedabucto Bay, the effects of these changes are not expected to alter the socio-economic conditions for commercial or Aboriginal fishermen.	• The non-hazardous portions of the Project site and adjacent waters will be accessible to Mi'kmaq for harvesting purposes, to the extent this is not precluded by safety considerations • Any future potential Project impacts (environmental, social and economic) on harvesting will be a matter of the formal and regular meetings with the Mi'kmaq community representatives. • The impact of construction in the marine environment during and after lobster fishing season will be minimized to the extent possible. • The quarry site office will be manned 24 hrs/day so that fishermen can telephone to receive information regarding vessel arrival and departures. • The phone number can also be used to report loss or damage to gear caused by Project-related vessel traffic. • Routine communication with potentially affected Mi'kmaq will occur through the CLC.	• Monitoring of progress and implementation of MOU and any other agreements reached with other First Nation communities. • Mi'kmaq resource harvesting activities will be reviewed with Mi'kmaq representatives at the Community Liaison Committee meetings. • Monitoring terminal operations and fishing access in response to concerns expressed by local fishing community, as needed; • Fisheries Offset Program; monitoring of the effectiveness of the marine Fisheries Offset Program for a minimum of three years during and after marine terminal construction until it can be demonstrated that the program objectives have been met.

7.19 ACCIDENT AND MALFUNCTION SCENARIOS

The assessment of potential environmental effects resulting from accidents and malfunctions differs from the assessments completed for individual VCs. This assessment employs risk based approach that involves two steps:

1. Identification of hazards associated with the Project infrastructure and activities to be undertaken on-site or off-site. These potential hazards are identified based on past experience with quarries similar to the Black Point Project and with similar types of works and activities in general.
2. Identification of potential environmental effects or the anticipated consequences of the identified hazards by completing a qualitative risk assessment aimed and providing some perspective on the hazards and their consequences by rating the likelihood of the adverse environmental effects. This rating represents the overall assessment of significance for the potential adverse environmental effects of accidents and malfunctions.

Only those accidents and malfunctions that are considered to have both a measureable environmental effect and a high probability of occurring during the life of the Project are considered in this assessment. For these "credible" accidents and malfunctions, the environmental effects identified represent a reasonable worst case outcome. Highly unlikely or hypothetical events (i.e., failure of multiple design features, contingencies and back-up systems) are not assessed.

The key accidents and malfunctions that could potentially occur during site preparation, construction, operation and closure phase of the Project are described in the following sections. Mitigation measures and planning to prevent the occurrence of such events, and response procedures to be implemented in the event they do occur, will be developed as part of the Industrial Approval application process and operational protocols.

It is anticipated that additional potential hazards, design and operational safeguards, and the need for further contingencies and emergency response measures may be identified during the review of the draft EIS report as well as through the ongoing public and Mi'kmaq engagement activities.

Malfunctions and accidental events will be prevented and mitigated through a systematic approach to worker health and safety and environmental protection. Health and safety polices and plans will be required from contractors while onsite workers will receive appropriate training to prevent and mitigate workplace accidents and environmental incidents.

7.19.1 Hazard Identification

Virtually all of the Project works and activities described in Section 3.0 have some potential for accidents and malfunctions. Those hazards with the greatest potential to result in environmental effects are:

- **Structural Failures:** These include quarry pit slope failure, aggregate stockpile slope failure, processing plant/marine terminal infrastructure failure and sediment pond failure;
- **Accidents:** These include an explosives accident, marine spills, transportation accidents (including vehicle and marine collisions), hydrocarbon spills on land or in the water; and,

- **Other Malfunctions:** These include unspecified health and safety incidents, wildlife encounters and forest fires.

Table 7.19-1 summarizes these hazards in terms of the Project phases during which they are most likely to occur. A solid dot indicates that there is higher potential for environmental effects to occur, while a hollow dot indicates a lesser potential.

Table 7.19-1:
Summary of Accidents and Malfunctions by Project Phase

Risk Category	Project Works or Activities	Project Phases During which Accidents and Malfunctions Could Occur				
		Site Preparation	Construction	Operations	Closure	Post-Closure
Structural Failure	Quarry Pit Slope Failure	–	–	●	○	○
	Stockpile Slope Failure	–	○	●	○	–
	Processing Plant/Marine Terminal Failure	○	○	●	○	–
	Sediment Pond Failure	○	○	●	○	○
Accident	Terrestrial Spill	○	○	●	○	–
	Explosives	–	○	●	–	–
	Marine Spill	–	–	●	–	–
	Transportation Accidents	○	○	●	○	–
Other	Forest/Site Fires	●	●	○	○	–

Legend : ● Greatest potential for adverse environmental effects.
○ Lesser potential for adverse environmental effects.

7.19.2 Structural Failures

Quarry Pit Slope Failure

Two primary open pit slope failures are possible:

1. Failure of the bedrock faces caused by improper mine design and operational procedures (including groundwater controls); and
2. Failure of overburden slopes.

The open pit will be excavated through into bedrock to an ultimate depth of approximately 130 m below ground surface (30 m below sea level). The side slopes follow well understood and accepted engineering practices of benched surfaces to provide for slope stability and space for quarry truck access ramps and roads. The final as-built design of the open pit will be engineered and approved at the regulatory stage prior to construction.

As noted in Section 3.0 the quarry benches will generally be 15 meters in height. Safety benches will be established every two benches and will have a width of approximately 7.5 meters. The final slopes for the quarry will have face angles of 85 degrees with a maximum pit slope of 65 degrees. Working benches will have face angles of 70 to 75 degrees.

As described in Section 6.1.9, the granite rock to be quarried has a "high" excavation difficulty, a "high" resistance to weathering and provides a "good" foundation support. The rock is dense (150-200 pcf) and has a very high compressive strength (up to 19,000 psi) (Koloski *et al.* 1989). Therefore, any potential pit instabilities are likely to be structurally controlled (along major joints/discontinuities).

With respect to the overburden, overburden thickness in the vicinity of the pit is typically less than 3 m thick and does not pose a significant risk of failure.

Significance Assessment

A significance environment effect of rock face failure is one that results in worker injury or death.

Potential Environmental Effects

Improperly designed and operated open pits can pose a safety hazard to workers during construction and operation. Apart from the safety hazard, no apparent environmental effects, outside of or in addition to those that would eventually occur through pit development, are evident.

The maximum effects due to pit slope failure are likely to occur during the pit closure period (i.e., just after quarrying is completed and the pit is allowed to start filling). This is because groundwater inflow will continue to occur while day to day observation of the pit slope will be less frequent, since the quarry crew will no longer be operating in the pit.

Mitigation and Emergency Response

During the quarrying process, the open pit slopes will be continually inspected by company staff and monitored by qualified mining engineers who will observe conditions on a daily basis and can adjust the design of the pit wall to avoid unstable conditions.

Bedrock pit slope angles were established using standard of practice approaches and methodologies combined with the Proponents past experience quarrying granite for aggregate.

Specific emergency response procedures describing how to respond to a pit slope failure will be incorporated into the Emergency Response Plan.

Stockpile Slope Failure

Overburden and topsoil stockpiles will be formed into a screening berm along the southern property boundary as discussed in Section 3.0. The screening berm will have a maximum height of about 3 m and will be designed with slope angles that promote stability through the establishment of a vegetation cover.

Aggregate stockpile failure will be contained entirely within the coastal platform near the processing plant, since this entire area will be sloped to south during initial site preparation to help accumulate stormwater runoff needed for the aggregate washing.

Significance Assessment

A significance environment effect of overburden or aggregate slope failure is one that results in worker injury or death.

Potential Environmental Effects

Given the low maximum height and the rapid stabilization expected once the screening berm is colonized by vegetation, the risk of berm failure is minimal. The berm will be placed within the 30 m undeveloped buffer along the southern property boundary. In the event that slumping occurs, soil will be confined within the property boundary and no significant environmental effects will occur.

Given the confining effect that will result by sloping the coastal platform to south, aggregate stockpile failure will not result in any environmental impacts. However, aggregate stockpile failure may result in worker injury or death, as well as damage to conveyors and processing equipment.

Mitigation and Emergency Response

Aggregate stockpiles will be located greater than 30 m from the coast on sloped platform designed to contain stormwater drainage. Overburden stockpiles will be placed at the southern property boundary no nearer than 20 m from the nearest watercourse and will be compacted using loaders and dump trucks. If needed, the screening berm can be artificially vegetated to prevent erosion but this is not considered necessary at this time. As needed, perimeter ditches will be installed to manage water from the screening berm.

If stockpile failure were to occur, the first response will be to cease all work in the area and ensure worker safety. When the failure area is secured, and depending on the scale of the failure, stockpile slope would be re-contoured in place. Slumped material would be excavated and returned to the stockpile, and if required drainage ditches would be repaired. An investigation into the causes of the failure would be undertaken so that the conditions leading to failure could be avoided or mitigation in the future.

Sedimentation Pond Failure

Sedimentation Pond Failure is defined as the failure of the retention pond embankment resulting in the release of stored water used for aggregate washing. As noted, the laydown area containing stockpiled materials will be designed to contain and direct runoff to the settling ponds. Failure of the engineered ponds to contain runoff is highly unlikely since these low, large volume ponds will be excavated into the rock and bermed with crushed stone several tens of meters thick.

Significance Assessment

A significance environment effect of a sedimentation pond failure is one that results in an uncontrolled discharge on sediment laden water to the environment.

Potential Environmental Effects

Due to the sloping and configuration of the coastal platform, sedimentation pond failure would not result in the release of sediment laden runoff to the environment. The ponds and nearby platform and stockpile areas would simply flood, which would halt quarrying activities until the water could be pumped into the pit sump. This also applies to "failure" of the pit sumps: the sumps may overflow but all water would remain fully contained within the pit. The settling ponds and pit sump are designed to allow water transfer between them; each can act as emergency storage for the other. In the case of excessive water, both the ponds and the pit sump can overflow without discharge to the ocean.

Mitigation and Emergency Response

The sedimentation ponds have been engineered to accommodate the anticipated stormwater runoff expected at the Project. These ponds and erosion and sediment control measures installed elsewhere in the Project area will be regularly inspected and monitored, particularly during and after extreme precipitation events. Erosion and sediment control structures found to be damaged will be repaired immediately and any other remedial action will be taken as necessary. Fines storage will be confined to areas within the quarry pit so any control failures would not result in an off-site release of material.

In a pit flooding event, pit water would pumped to the sedimentation ponds for clarification prior to discharge. If the sedimentation ponds were already full, the site manager would wait until the water clarified within the sump, sample the clarified water and if found to meet discharge requirements, pump the water to Chedabucto Bay. This would not interfere with quarrying activities, which could continue elsewhere in the quarry.

Retention pond-specific emergency response procedure will likely not be developed specifically for this component; however, inspection and emergency response procedures in reaction to erosion and sediment control failure will be described in the EMP.

Processing Plant/Marine Terminal Infrastructure Failure

Structural failure of processing plant components (crushers, screening, conveyors, supporting structures, etc.) or the shiploader at the marine terminal may occur over time as joints loosen or metal becomes worn, weakened or corroded.

Significance Assessment

A significance environment effect of a structural failure is one that results in worker injury or death. There is no risk of negative environmental effects associated with such failure. Even if failure of the shiploader arm were to lead to an aggregate spill in the marine environment, the crushed granite is already washed of its fine materials, chemically inert, and would be easily colonized by marine biota.

Potential Environmental Effects

There are no potential environmental effects, apart from worker health and safety considerations, associated with structural failure.

Mitigation and Emergency Response

Equipment wear and tear is expected over the life of the quarry, particularly in a coastal environment subject to salt spray and consequent corrosion. Given this, a regular inspection and maintenance program will be initiated as a matter of course so that worn or inefficient equipment can be replaced on a regularly scheduled maintenance rotation.

Emergency response procedures will primarily be those responses applicable to accidents and worker injury. These procedures will be contained within the Workplace Health and Safety Emergency Response Plan.

7.19.3 Accidents

Terrestrial Spills

Spills onto the land may occur during any phase of the Project. During site preparation and construction spills will be limited to those materials available onsite, which will include:

- Petroleum products consisting of gasoline and diesel fuel; and
- Oils and lubricants

The operations phase will include those materials listed above as well as limited volumes of waste oil, used glycol, spent parts washer fluids and other materials generated during equipment maintenance.

During decommissioning, the reservoirs used to store these materials will be dismantled so that only limited amounts of raw and waste liquids will be stored on site.

Releases may occur during fuelling or through breaks or leaks in hydraulic lines, and/or storage container failure. The amount of any potential spill is limited to the size of fuel tanks, storage tanks and equipment tanks.

Significance Assessment

A significance environment effect of a terrestrial spill is one that results in loss of any quantity fuel, oil or lubricant, or any other Project-related raw materials to the environment such that a measureable impairment of the terrestrial, freshwater or marine environment results. Such impairment may be defined by:

Groundwater: when groundwater discharge to surface water bodies no longer meets Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (CCME 1999 as updated).

Surface Freshwater and Marine Waters: if water quality no longer meets criteria listed in the CCME Canadian Water Quality Guidelines for the Protection of Aquatic Life, freshwater and marine (CCME 1999 as updated) and/or NSE's Table 3 Tier 1 Environmental Quality Standards for Surface Water. Table 3 provides criteria for a variety of potential contaminants in both fresh and marine surface waters. All criteria are for the protection of aquatic life.

Potential Environmental Effects

Small spills will have negligible environmental effects. In the event of a large spill or leak, soil, groundwater and surface water contamination may occur, although it is unlikely that a spill will adversely affect the quality of wildlife habitats since the working areas of this industrial site where a spill might occur will be largely devoid of vegetation. Fuel storage and equipment maintenance will occur in a dedicated area near the access road entrance to the coastal platform. This area located more than 60 m from the nearest surface watercourse and more than 100 m from the ocean.

A fire is also possible if precautions are not taken to prevent exposure to an ignition source near the spilled flammable material. A transient negative effect on air quality would also be possible due to the volatilization of the spilled material.

Mitigation and Emergency Response

Fuelling of land based equipment will need to be conducted onsite on a regular basis. Fuel will be stored in above ground storage containers as indicated in Section 3. All storage tanks will be either double walled self-contained tanks or single walled tanks with secondary containment. All petroleum storage containers 55 gallons (208 L) or larger will be stored within a contained area capable of holding 110% of the volume of the largest reservoir placed within it. The fuelling area will be erected on a reinforced concrete slab or lined containment area enclosed within side curbs and with a sloping floor to contain any spills and/or leaks that may occur during fuelling. These materials will be stored and handled in accordance with all relevant regulations. All staff will have a minimum level of awareness training related to the handling and storage of fuels, chemicals and wastes. In addition there will be strict re-fuelling protocols for heavy equipment that will minimize the risk of accidental spillage.

All Project equipment and vehicles will be maintained to ensure they meet safety standards and are in good operating condition. Regular pre-shift inspections and maintenance programs will ensure the continued reliability and integrity of such equipment.

All fuel, chemicals and wastes will be handled in a manner that minimizes or eliminates spillage and accidents. In the event of a spill or leak during fuelling activities, maintenance, or general equipment operation, immediate action will be taken to stop and contain the spilled material. In addition, a complete Spill Contingency Plan will be developed and approved by regulatory agencies prior to construction. Staff will receive extensive training in responding to spill events and Spill Contingency Plans will be posted for viewing by all staff. There will also be spill training drills to ensure that operations personnel are trained and able to handle unforeseen events.

Hazardous materials will be handled and stored in accordance with provincial hazardous materials regulations and regulations enacted under the Canadian Environmental Protection Act, as applicable. Hazardous materials will be transported for off-site disposal using a licensed hazardous waste transport company. Employees will be trained on proper handling and management practices for these materials.

Terrestrial spills would be localized and easily cleaned up using standard equipment such as absorbent pads and spill responses procedures. All contaminated material will be collected and stored in an appropriate manner so as to not result in a re-release to the environment until such a time as it will be transported to an approved treatment / disposal facility.

All spills will be reported to the 24-hour environmental emergencies reporting system (1-800-565-1633) in accordance with the Emergency Spill Regulations under the Nova Scotia Environment Act.

Vessel Accidents / Collisions

During construction and operation of the marine terminal, considerable vessel activity by multiple ships and boats may occur for limited periods of time around the site. Given this, there is potential for Project related vessel collisions, primarily between aggregate transport ships and either tugs, pilot vessels or nearby recreational or fishing vessels. Other accident types may include collisions with the terminal during bad weather or due to pilot error and grounding of the vessel on submerged rocks. Navigational error, malfunctioning of navigation equipment, engine malfunction and poor weather conditions may all contribute to these accidents.

Significance Assessment

A significance environment effect of a vessel accident or collision is one that results in worker injury or death or loss of any quantity fuel, oil or lubricant to the marine environment such that water quality no longer meets criteria listed in the CCME Canadian Water Quality Guidelines for the Protection of Aquatic Life, marine (CCME 1999 as updated) and/or NSE's Table 3 Tier 1 Environmental Quality Standards for Surface Water (marine).

Potential Environmental Effects

In the event of a vessel tank rupture following an accident at sea, up to 2500 to 3000 metric tonnes of marine diesel oil fuel could be discharged to the marine environment. Fuel containment would be achieved using booms, absorbents and dispersants deployed from stock

on board and/or maintained at the quarry site near the marine terminal. In warm weather, the fuel can be expected to degrade and evaporate over a relatively short time, but this process would be slowed in the winter until the following summer.

Mitigation and Emergency Response

The management of marine traffic in Chedabucto Bay is under the responsibility of the Canadian Coast Guard. It is mandatory that all large vessel traffic report to the Canadian Coast Guard at specified points and that vessels approaching or leaving the marine terminal allow the boarding of a trained and experienced pilot.

Aggregate transport vessels will employ double hulled fuel reservoirs to reduce the risk that a collision will pierce the tank and release fuel. The potential for collisions will be minimized through controlling vessel speed; scheduling and coordinating activities with other marine users, Transport Canada and the Canadian Coast Guard; and posting Notices to mariners as needed. The marine terminal will contain navigational aids and anti-collision radar will provide early warning of a potential collision hazard. In addition, a Mooring Plan that identifies and establishes operating limits for all marine terminal activities (berthing, mooring, and aggregate loading, etc.) under severe atmospheric and/or oceanographic conditions will be employed to minimize collision risks. Emergency response in the event of a vessel collision is coordinated by the Canadian Coast Guard with support from local land based emergency responders as needed. The Coast Guard will be naturally aware of the timing and type of activity associated with the marine terminal operation and will be informed of the construction schedule before work begins. The Proponent's Emergency Response Plan will contain a section regarding response to incidents at sea, however the ship's Master is ultimately responsible for the safe operation and emergency response in case of accident.

Explosives Accident

An explosives accident would be limited to the construction and operational phases of the Project. No explosives will be stored or manufactured on site. The Proponent will contract the explosives component of this project to a licensed blasting contractor. Accidents may include premature blasts or accidental detonation of blasting components. A review of accident data indicates that "flyrock" and lack of blast area security were the primary causes of blasting related injuries in surface mining. Fatal injuries due to lack of blast area security were attributed to: failure to clear blast area; failure to follow instructions; inadequate guarding; inadequate blasting shelter; and unsafe location (Bajpayee et al, 1999).

Significance Assessment

A significance environment effect of an explosives accident is one that results in worker injury or death or environmental impairment. Such impairment is defined as

Groundwater: when groundwater discharge to surface waterbodies no longer meets Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (CCME 1999 as updated).

Surface Freshwater and Marine Waters: if water quality no longer meets criteria listed in the CCME Canadian Water Quality Guidelines for the Protection of Aquatic Life, freshwater and marine (CCME 1999 as updated) and/or NSE's Table 3 Tier 1 Environmental Quality Standards

for Surface Water. Table 3 provides criteria for a variety of potential contaminants in both fresh and marine surface waters. All criteria are for the protection of aquatic life.

Potential Environmental Effects

A spill of fuel oil and/or ammonium nitrate (the ANFO explosives mixture), or the emulsion itself has the potential to contaminate local ground and surface water. Given the use of explosives exclusively within the pit area, any release would likely be to water collected in the pit sump. This provides the opportunity to treat and test the water prior to discharge, minimizing the risk of environmental effects. A spill from a truck in transit to the pit (i.e., on the access road) has a greater possibility of reaching soil and surface watercourses.

Mitigation and Emergency Response Procedures

Preventive measures aimed at reducing the effects of blast accidents include: ensuring that all personnel have evacuated the blast area during shot firing; using adequate blasting shelters for employees whose presence is required in the blast area; controlling and monitoring all entrances to the blast area; ensuring that the blast is properly designed, drilled, and loaded; and emphasizing education and training to enhance skill levels for implementation of engineering control techniques.

Other measures that will be taken to minimize the risk of an incident involving explosives include:

- No explosive material will be stored onsite;
- All blasting activities will be conducted an experienced and trained, licensed contractor;
- The blasting operator will be responsible for blast designs and methods in accordance with the Blasting Safety Regulations made pursuant to the Nova Scotia Occupational Health and Safety Act, the Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters (Wright and Hopky 1998), and in accordance with the Nova Scotia Pit and Quarry Guidelines (NSEL 1999).
- The blast area will be properly secured and notifications issued to workers.
- The Proponent's staff will receive spill response training and will be familiar with the provisions of the site-specific Emergency Response Plan. This plan will address spill response on the quarry property.
- The licensed blasting contractor will maintain his own emergency response plan and staff training records. The Proponent will have the opportunity to review this plan and integrate any explosives-specific measures into the Black Point Emergency Response Plan.

Should an explosive component spill occur, the spill will be managed as per instructions within the Emergency Response Plan and under the direction of the blasting contractor. A spill from a truck on the access road or elsewhere within the property would be managed by the Proponent's staff as any other fuel spill.

Marine Spills

A spill of hydrocarbons in the marine environment could occur during the construction, operation and decommissioning phases of the marine terminal. The potential sources of a fuel spill at or near the marine terminal include vessel collisions with the terminal or with other vessels. No fuel

will be stored at the terminal and no vessel refuelling will occur at the Black Point Quarry. No vessel maintenance will occur at the terminal.

Significance Assessment

A significance environment effect of a marine spill is one that results in contamination such that marine water quality no longer meets criteria listed in the CCME Canadian Water Quality Guidelines for the Protection of Aquatic Life, marine (CCME 1999 as updated) and/or NSE's Table 3 Tier 1 Environmental Quality Standards for Surface Water (marine).

Potential Environmental Effects

As noted above under vessel collisions, release of hydrocarbons to the marine environment has the potential to impact aquatic life (fish, marine mammals and birds), and their respective habitats. A significant spill would also affect commercial fishing interests.

The impacts of such an event may include diesel fuel deposited onto the shoreline and an oil slick expanding to cover an area beyond the immediate spill location. Over the short term (i.e., from the spill to approximately 10 days) impact of such a spill might include fish kills, coating of the fur and feathers of marine mammals and birds, and loss of lobster and other marine species in the immediate area of the spill as well as in areas where the slick migrates before being contained. Over the longer term (i.e., one month and beyond) residual impacts following cleanup of the spill might include impairment of fisheries productivity. Certain mobile species could relocate to other areas; impacts to breeding areas could create lead to decreases in fisheries productivity over time.

Mitigation and Emergency Response Procedures

As noted, vessels will not be refuelled at the marine terminal. All shipping and associated activities (refuelling, waste management, etc.) will be contracted by the Proponent to a third party. This allows the Proponent to select reputable shipping firms with a demonstrated history of safety and operational integrity. The use of experienced, well trained and trustworthy shipping crews, tubs and pilots helps to minimize the potential for collisions leading to spills, and illegal ballast water discharge.

The Project will mitigate marine spill risk by ensuring that ship docking at the terminal is tug and pilot assisted as needed and required by law, the terminal and mooring structures are properly constructed and well lit, and also by having a written agreement with a certified spill response contractor to provide response services in the event of a spill. Other mitigating factors include continual redesign of vessels to make them less susceptible to collision damage. This will reduce this risk over the life of the Project. Finally, an Emergency Spill Response Plan that contains predictive oil spill modelling will be prepared and emergency response training will be employed at the site. Advance planning including mock simulations of spill events and maintenance of spill response equipment at the site to ensure rapid deployment will reduce the response time required to contain the spill which is a key part of reducing the damage to the environment.

Transportation Accident

Vehicular collisions may occur during any phase of the Project. Mobile equipment at the quarry will include excavators, loaders, off-road trucks, bulldozers, water trucks, cranes, drill rigs and service vehicles. Most vehicle traffic is confined to the pit where rock is loaded and transported to the primary crusher. Once the quarried rock has been deposited in the primary crusher, subsequent aggregate transport occurs largely via conveyor.

Significance Assessment

A significance environment effect of a terrestrial vehicular accident is one that results in worker injury or death.

Potential Environmental Effects

A vehicle collision or accident has very little potential to lead to significant environmental damage. Fuel spills from vehicle accidents within the pit will be confined to the pit. Spills from accidents on the access road may attain roadside ditches but the volume of fuel spilled is expected to be minimal. The most significant risk is that posed to worker health and safety.

Mitigation and Emergency Response Procedures

The Proponent has considerable experience in managing the many vehicles that operate within an active quarry. Accident mitigation begins with adequate worker training, and by employing experienced workers to the extent possible. Other controls include ensure access and haul roads are sufficiently wide to allow safe passage of two vehicles side by side, clearing vegetation to ensure adequate line-of-sight around corners and at road junctions, posting and enforcing speed limits within the quarry, the use of in-vehicle radios linked to a central dispatch, and regular maintenance of brakes, tires and other vehicle components.

Emergency response in the event of a vehicle collision or accident would follow procedures outlined in the site-specific Emergency Response Plan.

Ballast Discharge

Under the *Ballast Water Control and Management Regulations*, all ships entering Canadian waters must exchange ballast water outside of the Exclusive Economic Zone (200 nautical miles from shore), treat their ballast water, discharge their ballast water to a reception facility, or retain their ballast water on board ship. This reduces the risk of introducing invasive species to Canadian waters and prevents unauthorised discharge of bilge water and non-compliant ballast water. Ships that fail to do this and discharge untreated ballast water within the Exclusive Economic Zone are committing a criminal act.

Significance Assessment

A significance environment effect of an illegal ballast water discharge is one that results in the release and establishment of a non-native species to Canadian waters.

Potential Environmental Effects

As described in Section 6.11, ballast water taken aboard ships in foreign ports may contain organisms that are not native to Nova Scotia, and which could cause harm to local ecosystems. In Nova Scotia these organisms include green crab, several species of sea squirts (tunicates), Dead Man's Fingers (*Codium fragile*) and *Membranipora menbranacea*.

Mitigation and Emergency Response Procedures

In addition the provisions of the *Ballast Water Control and Management Regulations* described above, an international convention regarding ballast water has been adopted by the International Maritime Organization (IMO); ratification is expected in 2015. Under IMO's International Convention for the Control and Management of Ships' Ballast Water and Sediments, all vessels will be required to report and treat ballast water using an IMO approved method. This convention will further limit the opportunities for illegal ballast dumping.

7.19.4 Other

Forest Fire

A lightning strike or human carelessness may cause a forest fire at or near the site, requiring emergency response from site staff. An accidental fire at the Project site may also occur but this is considered unlikely due to the lack of flammable materials within the quarry and processing plant. Vehicle fires, while uncommon, may also occur. Due to the lack of vegetation, it is unlikely that a vehicle or other on-site fire could cause a forest fire that might spread elsewhere.

Significance Assessment

A significance environment effect of a forest fire at the Project site is one that results in worker injury or death or a fuel spill, which in turn results in the effects listed above.

Potential Environmental Effects

The immediate concern with respect to a forest or vehicular fire is for human health and safety; additional concerns include habitat loss, direct mortality to wildlife, and loss or damage of property. The emissions from a fire would likely consist mainly of smoke (particulate matter) and CO2, but could also include CO, NOx, SO2, and other products of incomplete combustion. A large fire could create air contaminant levels greater than the ambient air quality standard over distances of several kilometres; however, the likelihood of such cases is considered low and the event would be of short duration.

Mitigation by Design and Operational Safeguards

Fire detection systems will be provided at appropriate locations such as the administrative office and fuel dispensing/maintenance shop. All buildings will meet National Building Code of Canada construction standards and will be equipped with appropriate fire suppression systems such fire extinguishers or sprinklers as needed.

The fuel storage facilities will be designed to meet the National Fire Code of Canada requirements and will meet the provincial storage regulations for these facilities.

All Worker Health and Safety requirements regarding fire preparedness will be met, including ensuring that a suitable number of workers are trained in firefighting and tested for proficiency at least once per year. All plant personnel will be trained on:

- Fire hazards;
- Fire prevention; and
- Firefighting roles, responsibilities and requirements for their respective positions.

In addition, all personnel will be provided with orientation and training, including conducting regular fire drills and evacuation.

The site-specific Emergency Response Plan or portions thereof will be distributed to the Queensport and Canso Fire Departments. Representatives of these Departments will be invited to meet with the Black Point Safety Supervisor or equivalent in order to view the site layout and infrastructure, review access and evacuation routes and understand the activities undertaken at the site.

Contingency and Emergency Response Procedures

Emergency response procedures will be developed as part of the Emergency Response Plan. This plan will address how to respond to a fire on the property. Evacuation of personnel from the area will be the highest priority. Meeting places for site workers will be established and headcounts taken to account for all personnel. In the unlikely event of a large fire, local emergency response and firefighting capability will be called to respond to reduce the severity and extent of damage and to protect the safety of workers. The fire department will be notified of the hazardous materials on the site and health concerns related to the chemicals including required personal protective equipment.

7.19.5 Risk Assessment

Each potential accident and malfunction discussed above was assessed according to likelihood of the event and given a risk rating from “negligible” to “high”. Environmental effects are assigned a magnitude rating from “low” to “extreme”. The combination of the likelihood of an event and the magnitude of its environmental effects is determined by plotting these ratings on the matrix shown on **Figure 7.19-1**. As shown in this matrix, increased risk is associated with accidents and malfunctions having a greater *likelihood* of occurrence and greater *magnitude* of effects.

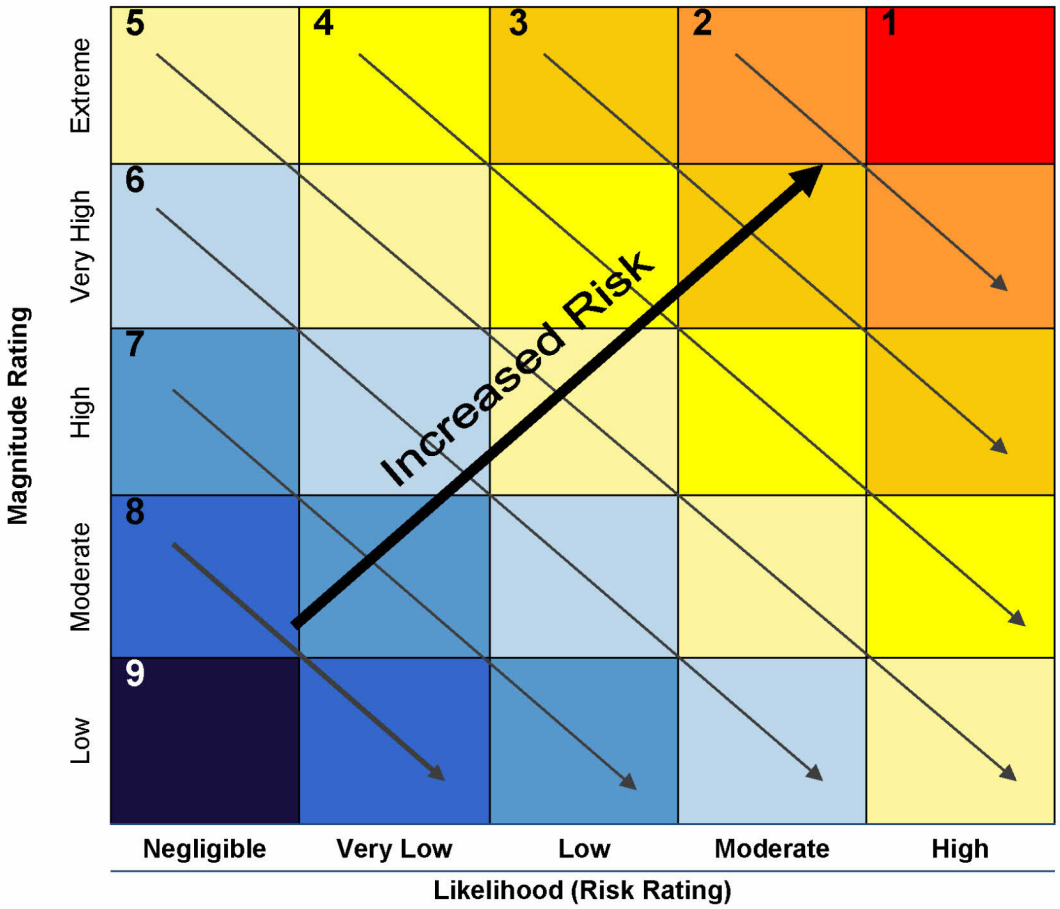

Figure 7.19-1:
Risk Rating Matrix

The magnitude rating not only considers the mitigation, operational safeguards and emergency response available to minimize environmental effects, but also the cost of remediation (as a measure of severity). The magnitude ratings are defined as follows:

- **Low:** No long term effects, readily remediated with a cost in the $10,000's;
- **Moderate:** Limited or no long term effects, remediated for costs in the $100,000's;
- **High:** Moderate long term effects expected, remediated for costs in the $ millions;
- **Very high:** Significant long term effects expected, costly remediation in the $10s millions; and
- **Extreme:** Highly significant long term effects likely, remediation cost in the $100s millions.

The risk ratings (likelihood) are defined as follows:

- **Negligible:** Not likely to occur (less than a 1 in 10,000 probability per year - 1/10,000 events per year);
- **Very Low:** Unlikely to occur (less than a 1 in 1,000 probability per year);

- **Low:** Possibly could happen (less than a 1 in 100 probability per year);
- **Moderate:** May happen (less than a 10% probability per year); and
- **High:** Can happen over the life of the mine (greater than a 10% probability per year).

Accidents and malfunctions with an overall combined rating of greater than or equal to 4 not are considered to be significant events or consequences. An overall combined rating of 3 requires that the accident or malfunction be considered further in during the project's detailed design phase. An overall combined rating of less than or equal to 2 would be considered significant.

Results of this qualitative analysis are provided in 7.18-2. The results indicate that all accidents and malfunctions described above have ratings ranging from 5 to 8. These events and their environmental effects are therefore considered not significant.

Table 7.19-2:
Accidents and Malfunctions affected VECs

Malfunction/Accident	Key VCs Potentially Effected	Risk Rating	Magnitude Rating	Overall Rating 1 = Maximum 9 = Minimum
Quarry Pit Slope Failure	Human Health and Safety	Negligible	High	7
Stockpile Slope Failure	Human Health and Safely Surface Water Resources Terrestrial Habitat and Vegetation	Negligible	Moderate	8
Sedimentation Pond Failure	Marine and Surface Water Resources Terrestrial Habitat and Vegetation Marine Species and Habitat Species at Risk	Very Low	Low	8
Marine Terminal Infrastructure Failure	Marine and Surface Water Resources Marine Species and Habitat Species at Risk	Very Low	Moderate	7
Processing Plant Infrastructure Failure	Marine and Surface Water Resources Marine Species and Habitat Species at Risk	Very Low	Moderate	7
Terrestrial Spill	Human Health and Safely Geology, Soil & Sediment Groundwater Resources Wetlands	Low	Moderate	7
Vessel Accident/Collisions	Human Health and Safely Marine Species and Habitat Species at Risk Local Economy Commercial Fisheries	Very Low	Very High	5
Explosives Accident	Human Health and Safely	Negligible	Moderate	8

Malfunction/Accident	Key VCs Potentially Effected	Risk Rating	Magnitude Rating	Overall Rating 1 = Maximum 9 = Minimum
	Marine and Surface Water Resources Terrestrial Habitat and Vegetation Terrestrial Wildlife Marine Species and Habitat Species at Risk			
Marine Spill	Human Health and Safely Marine and Surface Water Resources Marine Species and Habitat Species at Risk Local Economy Commercial Fisheries	Very Low	Very High	6
Illegal Ballast Discharge	Marine and Surface Water Resources Marine Species and Habitat Species at Risk Local Economy Commercial Fisheries	Low	High	5
Transportation Accident	Human Health and Safely Terrestrial Habitat and Vegetation Terrestrial Wildlife	Low	Moderate	8
Forest / Site Fire	Human Health and Safely Air Quality Terrestrial Habitat and Vegetation Terrestrial Wildlife Tourism and Recreation Aboriginal Land and Resources Use	Negligible	High	7

7.19.6 Conclusion

In the table above, the incidents having greatest likelihood of occurring, combined with the potential of doing the greatest harm, are given the lowest number. Accidents or malfunctions causing spills in the marine environment are ranked as the most risky compared to other incidents that may occur on site. Even so, the risk of a marine spill is not ranked as significant.

Black Point Quarry Project
Municipality of the District of Guysborough, NS

Environmental Impact Statement

PART 4 Sections 8-15

Vulcan Materials Company

February 2015

C 1340-653

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8.0 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

Although environmental assessments typically focus on project-related impacts to the surrounding environment, assessment must also consider the effects of the environment on the project. This is particularly important given that climate change scenarios predict larger magnitude and more frequent extreme weather events, which in turn may negatively impact the Black Point Quarry Project operations.

The natural environment has the potential to adversely interact with the Project through meteorological, climatological and seismological events. These events may include:

- Drought or extreme precipitation events leading to flooding;
- Extreme (high/low) temperatures;
- Rapid or increasing number of freeze/thaw events;
- Lightning strikes;
- Severe wind storms including hurricanes;
- Extreme marine conditions (high waves plus extreme winds);
- Ice storms and hail events;
- Late season sea ice; and
- Earthquakes.

Project infrastructure will be designed to accommodate the conditions imposed by the natural environment and to accommodate, to the extent possible, expected effects of the climate on the Project. Project activities will include emergency preparedness to ensure rapid, organized response in the event of a severe climate episode.

The sections below describe how these events may impact Project infrastructure and activities and how these effects will be mitigated or managed to ensure worker safety, minimize disruptions to production and limit any environmental repercussions.

8.1 Potential Effects of Drought or Flooding

Flood and drought conditions may occur from time to time during the 50-year life of the Project. These events can be accommodated in the Project design as described in Section 6.2 and in the tables below.

The historical mean annual total precipitation for Guysborough is 1425 mm (NS 2014). Although extreme precipitation events may occur in any month of the year, rainfall in the Project area is generally highest during fall, both on a monthly basis and on a storm-by-storm basis. Snow and freezing precipitation can occur between October and May, with the largest amounts falling between December and March (Table 6.3-2).

The potential effects from drought and flooding on the Project and corresponding mitigation measures are summarized in Table 8-1.

Table 8-1: Potential Effects from Flooding or Drought on the Project

Hazard	Potential Effects on the Project	Mitigation through Project Plans	Proposed Adaptive Management Measures	
			Inspection/ Surveillance	Contingency Actions
Drought Conditions	• Increased dust on site; increased potential for off-site dust transport. • Reduced availability of wash water for quarry operations. • Reduced availability of on-site potable groundwater	• Develop a Water Management Plan that describes pre-determined measures to accumulate, conserve, and manage available water. • With the prior approval of NSE, substitute chemical dust suppressants for water and apply to the access roads. • Supplement on-site water with bottled water.	• Monitor water levels of the retention ponds.	• Neutralize and utilize water from onsite freshwater bodies • If necessary obtain water supply from off-site
Flooding	• Flooding of the pit • Overflow of the onsite ponds. • Flooding of culverts and roads resulting in road washout.	• Design facilities to handle excess water in extreme weather events. • Schedule construction of surface water management infrastructure before the start of large excavation and earth works • Reduce quarry activities and secure vulnerable mining equipment if pit becomes flooded • Onsite ponds and sump systems have been sized to accommodate large storm events (i.e., 100-year 24-hour flood event).	• Routinely monitor weather forecasts and water levels in the ponds to assure they continually meet prescribed operating guidelines. • Inspect damage from flooding on infrastructure such as roads, spillways and culverts, and repair as necessary.	• Add or heighten berms around ponds as needed. • Enlarge & deepen culverts; raise roads and other infrastructure above flood levels. • Add a contingency factor when designing infrastructure to account for climate change

8.2 Potential Effects of Extreme Temperatures

Air temperatures vary seasonally, and are highest in July when daily extremes can vary from 21.5° C to 13.1° C (Section 6.3). Short term summer extremes can vary from 30.8° C (May) to 33.3° C (June). The minimum average daily temperature occurs in February (-5.1°C) with extremes ranging from -8.6° C to -1.5° C. Short term extremes in the winter months can vary from -18.4° C (March) to -25.6° C (February). The Project's design and operational procedures can easily accommodate these temperature ranges, which are not considered unusually excessive by the Project team.

In Guysborough County, freeze-thaw cycles predominately occur in the winter months (40.6), with slightly less in the spring (33.2) and a few in the fall (8.7) (NS 2014). These cycles have the potential to damage roads and affect the stability and alignment of Project infrastructure.

The potential effects from extreme heat and cold temperatures on the Project and corresponding mitigation measures are summarized in Table 8-2.

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Table 8-2: Potential Effects of Extreme Temperatures

Hazard	Potential Effects on the Project	Mitigation through Project Plans	Proposed Adaptive Management Measures	
			Inspection/ Surveillance	Contingency Actions
High Temperatures	• Hazard to worker health and safety. • Heat damage to mechanical equipment.	• Implement an Occupational Health and Safety Management Plan to ensure worker safety. • Staff will be trained in accordance with operating procedures and Management Plans.	• Inspect mechanical equipment for damage after extreme temperatures	• Upgrade mechanical equipment and worker safety equipment to allow for work in high temperatures.
Low Temperatures	• Hazard to worker health and safety. • Mechanical equipment problems	• Implement an Occupational Health and Safety Management Plan to ensure worker safety.	• Monitor weather conditions. • Inspect equipment for stress and cold cracks; • Inspect work areas for ice buildup, especially near the wash plant	• Maintain stockpile of vulnerable parts • Replace damaged parts as soon as possible; refrain from using the equipment • Maintain stockpiles of salt • Upgrade mechanical equipment and worker safety equipment to allow for low temperatures work.
Freeze/thaw conditions	• Development of pot holes and/or roads breaking apart making it a hazard to driving. • Ice blockage of flow conveyance in ditches. • Land access to marine terminal may temporarily be difficult due to thawing ground. • Freezing of exposed piping and equipment that carry water (wash plant, dust suppression system, water conveyance and pumping equipment)	• Monitor roads for damage and repair before they get too hazardous • Routinely inspect and maintain haul and access roads; repair as necessary. • Incorporate awareness of the risks of thaws and sudden freezes in Occupational Health and Safety Management Plan to ensure worker safety and effective Project operations. • Maintain access roads with quarry equipment to all critical operating and monitoring locations throughout the Project area. • Implement freeze protection measures on equipment and pipes containing water	• Inspect damage to roadways and other infrastructure after major freeze/thaw events. • Inspect work areas for ice buildup, especially near the wash plant. • Inspect equipment for positional shifts due to frost heave • Inspect equipment to ensure freeze protection measures are employed	• If necessary, reconstruct access road to provide improved performance during thaws. • If necessary, heat trace or otherwise protect from freezing and above-ground water conveyance piping, equipment and systems. • Refrain from using misaligned equipment

8.3 Potential Effects from Storms

The Atlantic coast of Nova Scotia and the south coast of Newfoundland experience more storms over the course of one year than any other region in Canada (EC 2006). These storms bring high winds along the coast, heavy precipitation, storm surges exceeding 1.0 m, freezing rain, and peak waves nearing 14 meters in height (EC 2006). The winds that affect the coast and mainland Nova Scotia can exceed 150 km/h, and may result in extreme wind chills during the winter (Section 6.3.)

The potential effects from storm events on the Project and corresponding mitigation measures are summarized in Table 8-3.

Thunderstorms are not common in the Project area. Burrows and Kochtubajda (2010) note that lightning activity is highly influenced by length of season, proximity to cold water bodies and elevation. In Nova Scotia winter lightning is common as Arctic air masses pass over warmer water. Based on data from 1999 to 2009, Burrows and Kochtubajda (2010) report that cloud to ground lightning occurs on average between five and ten times per year over much of Nova Scotia.

Table 8-3: Potential Effects from Storms

Hazard	Potential Effects on the Project	Mitigation through Project Plans	Proposed Adaptive Management Measures	
			Inspection/ Surveillance	Contingency Actions
• Rain Storms	• Hazard to worker safety from potential flooding. • Dangerous driving conditions due to reduced visibility and washed out roads. • Project area flooding.	• Incorporate flooding awareness and responses/procedures in the Occupational Health and Safety Management Plan to ensure worker safety. • Include stormwater management in the Environmental Management Plan. • If necessary, curtail quarry activities and secure vulnerable quarry facilities during flooding • Design pit slopes to provide for maximize slope stability during extreme storm events.	• Monitor weather forecasts • Inspect damage from flooding on infrastructure such as roads, foundations, supports spillways and culverts and repair as necessary. • Monitor conditions during storms for the potential for forest fires due to damaged power lines. • Inspect pit walls for potential rock fall hazards.	• Add or increase the height of berms around ponds. • Enlarge & deepen culverts and raise roads and other infrastructure above flood levels. • Remove loose rock from pit walls if deemed a hazard or secure area to control access.
• Ice Storm	• Hazard to workers safety due to slippery conditions. • Dangerous driving conditions due to reduced visibility and icy roads. • Chance of power outages due to ice on hydro lines or ice laden trees falling on the hydro lines. • Dangerous quarry conditions due to ice covered operational areas in the pit.	• Provide a description of ice storm hazards and required responses/procedures in management plans to ensure worker safety including hazardous weather driving. • Incorporate emergency response procedures in the Project's Emergency Response plan.	• Monitor weather forecasts • Inspect damage to power lines and trees surrounding power lines after an ice storm to prevent the possibility of power loss. • Inspect conditions of roads and infrastructure to ensure it is safe to continue work.	• Keep trees trimmed along power lines • Have de-icing equipment on site for de-icing roads on site but also for de-icing quarry equipment. • Provide backup power sources in case of loss of power. • Reduce quarry operations in severe weather conditions.
• High Winds and Waves	• Delay in construction schedules • Impact to vessel berthing/loading procedures and schedules • High waves crashing into marina causing damage	• Design marine terminal to withstand waves higher than normal and for extreme events • Schedule loading/unloading to accommodate anticipated storms	• Inspect damage to power lines and trees surrounding power lines after an ice storm to prevent the possibility of power loss. • Monitor marine conditions to predict	• Consider building a jetty to reduce the effects of the waves at the marine terminal • Contingency planning to include emergency evacuation and securing the quarry site

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Hazard	Potential Effects on the Project	Mitigation through Project Plans	Proposed Adaptive Management Measures	
			Inspection/ Surveillance	Contingency Actions
	• Chance of power outages due to trees falling on the hydro lines.	• Install backup power sources in case of loss of power.	when conditions may be favorable for higher waves	• Reduce or curtail quarry operations in severe weather conditions.
• Lightning Strikes	• Damage to processing plant components • Worker injury or death • Power surges / power outages	• Design plant equipment with grounding circuits (standard practice) • Comply with provisions in the National Electric Code.	• Conduct annual continuity checks at the plant; • Monitor weather patterns. • Inspect equipment following severe storms and lightning strikes	• Use warning siren to warn workers of severe weather events; • Cease operations in severe thunderstorm conditions; shut down processing plant; direct employees to a designated location

8.4 Potential Effects of Extreme Marine Conditions

Extreme weather events can develop more quickly on water than on land and are hazardous to the Project due to their sudden onset and intensity, potentially catching workers off guard. Storms can affect vessel berthing and loading, and increases the hazards to people working near water.

Freezing spray occurs when ocean spray generated from winds and heavy seas spreads over the ship and freezes on point of contact. The typical seasonal range for freezing spray occurs between November and April; however, it is highest in February (JWEL 2004). Land fast ice in Chedabucto Bay can persist into April, but the central Bay remains ice-free all year round.

A reduction of visibility due to fog can affect both land and sea operations of the Project. In Canso, 115 days of fog persisting for at least 1 hour were recorded in 2013 (EC 2006). Visibility of one-half nautical mile or less is common for the Chedabucto Bay area in all seasons.

The potential effects of extreme marine conditions on the Project and corresponding mitigation measures are summarized in Table 8-4.

Table 8-4: Potential Effects of Extreme Marine Conditions

Hazard	Potential Effects on the Project	Mitigation through Project Plans	Proposed Adaptive Management Measures	
			Inspection/ Surveillance	Contingency Actions
Ice	• Delay in construction schedule • Change in shipping routes; shipping delays • Vessel and terminal icing due to freezing sea spray • Icing of the processing plant causing delays	• De-icing procedures • Design heated plant or conveyor components if warranted, or add them later if justified	• Inspection procedures for vessels and quarry machinery • Inspect work areas and equipment for ice buildup	• Stockpile sand and salt abrasives before winter
Fog	• Delay in construction schedule • Change in shipping	• Installation of appropriate navigational devices on the marine terminal	• Monitor weather and marine conditions • Communicate routinely	• Use fog-adapted lights where needed

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	routes resulting in delay • Delay in quarry operations			between approaching vessels and land operations with briefing on site-specific weather / marine conditions.

8.5 Seismic Activity

Seismic activity in eastern Canada is associated with regional stress fields and sediment slumping at the edge of the continental shelf, rather than with plate boundaries as in western North America (Section 6.1). Although earthquakes of magnitude 4-5 have occasionally been reported in Nova Scotia, only two have been recorded in the western half of Nova Scotia; most occur offshore. Because of the low frequency of earthquakes and low magnitude of those that do occur, Guysborough County and by extension the Project site is considered to have very low level of seismic activity (NRCan 2014). Considering this, no adverse effects from earthquakes or tsunamis are expected on the Project. Moreover, the simply designed and robust Project infrastructure (conveyors, crushers, screening equipment, etc.) are not particularly vulnerable to earthquakes. Similarly, the durable rock faces of the quarry itself and the low buildings used as administrative offices are not vulnerable to seismic activity.

The potential effects from seismic on the Project and corresponding mitigation measures are summarized in Table 8-5.

Table 8-5: Potential Effects from Seismic Activity

Hazard	Potential Effects on the Project	Mitigation through Project Plans	Proposed Adaptive Management Measures	
			Inspection/ Surveillance	Contingency Actions
Earthquakes and Tsunamis	• Damage to processing plant and marine terminal infrastructure. • Rock slides in the pit • Potential worker safety impacts from above events.	• All infrastructures will be built to the National Building Code of Canada. • Pit walls have been designed to perform stably under the design earthquake.	• Inspect damage to roads, equipment, buildings, and other quarry infrastructure and repair as necessary. • Regularly monitor stability of pit walls and rock stockpiles	• Upgrade building and road structures to withstand larger earthquakes. • Provide for backup power for critical infrastructure

8.6 Implications of Climate Change Trends

The interaction of the Project with weather events caused by climate change over time is assessed because the Project duration is long enough to experience climate change-induced extreme weather events. The increased annual precipitation predicted by climate change scenarios (10-20 % over the next 100 years [Richards and Daigle 2011]) can be accommodated in the design of the Project, but preparing for and adapting to regular, extreme weather events is more challenging.

Extreme weather, such as high winds and precipitation events, is predicted to increase in both frequency and intensity due to climate change (NS 2014). This could increase the risk from potential winter and spring flooding as well as flash flooding resulting from intense, single event rainfalls. As the frequency and intensity of storms increase, sea-level rise increases the baseline for flooding. Given this, storm surges for any given storm will reach further inland in the future than they would today (Wrightman 2012). With the predicted warmer springs and milder winters,

the frequency of ice storms such as the one experienced in Guysborough County in early 2014 will likely increase.

Air temperatures are expected to increase but extreme warming events are not anticipated to increase significantly (NS 2014). Most of the warming is expected to take place in the winter; however, the number of days with snow is expected to increase in the 2020s but then decline for the 2050s (NS 2014).

Over the duration of this Project, it is projected that the number of freeze-thaw events will remain relatively stable during the winter months, but these events are expected to decline in frequency during the spring and autumn (NS 2014).

Despite an increase in summer temperatures, the potential for forest fires is low because the Project site will be mostly cleared of trees. Forest fires are described in more detail in Section 7.18.

Both peak wind speeds and mean significant waves are predicted to increase in the future (NSE 2011).

Combining global sea-level rise projected for Canso Harbour to the year 2100 with crustal subsidence to the year 2100, Richards and Daigle (2011) calculate total sea level change at 0.45 m +/- 0.15 m to the year 2055 and 0.83 m +/- 0.36 m to the year 2085. They go on to estimate the storm surge for the 100-year return period is on the order of 0.8 m in the Canso-Chedabucto Bay area.

These total sea levels do not include the possibility of a rare historical event such as the Saxby Gale (1869), the Groundhog Day Storm (1976) or of a direct hit by a hurricane. From a design perspective it is prudent to consider the impacts of a plausible upper water level that would result from maximum estimated sea-level rise combined with crustal subsidence and the highest storm-surge factor previously recorded by a tide gauge. Taking these factors into account Richards and Daigle (2011) estimate that by 2085, the Extreme Total Sea Level will range from 3.42 m +/- 0.56 m (10 year return period) to 3.66 m +/- 0.56 m (100 year return period) at the Deming climate station in Guysborough County. These scenarios will be considered during the final design of the marine terminal and processing plant.

The Proponent has considered the risk of sea level rise and storm surge in the preliminary design of the operation. The surface elevation of the processing plant area will be increased to over 20 masl. This elevates the foundations of processing plant and loadout equipment above the level where future storm surges are expected to occur.

To prepare for extreme weather events, including sea level rise and anticipated storm surges over the lifetime of the Project, the Proponent will implement an Emergency Action Plan (EAP) prior to the start of construction. The EAP will describe the steps to be taken to prepare for the impacts of anticipated significant weather events such as hurricanes, wind storms, ice storms and blizzards. The measures that will be implemented will depend largely on the anticipated impacts. These measures may include for example:

- moving mobile equipment to a safe location and elevation;
- reinforcing the anchoring of stationary equipment;
- bringing down conveyors or securing them and filling belts that cannot be dropped by loading with stone;

- transferring fuel and other products stored in bulk to a secure location and/or anchoring tanks and closing and securing all connection valves and drain/fill lines;
- modifying or suspending marine operations to ensure that vessels are safely out of the area prior to storm impacts;
- de-energizing electrical equipment and disconnecting plant power; and
- draining water management systems including ponds, piping and ditches to ensure there is adequate free board to accept anticipated precipitation.

The Proponent will engage operations, environmental and safety, and risk management staff as well as local, Provincial and Canadian government agencies as appropriate in determining criteria used to activate the Emergency Action Plan and the specific measures taken in preparation for a storm.

Taking into account the mitigation included in the Project design and the adaptive management measures proposed above, Table 8-6 summaries the key climate change trends and assesses their effects on the Project infrastructure and operations.

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Table 8-6: Overall Implications of Climate Change Trends

Climate Factor Description		Climate Trend	Implication of Climate Change Trends		
			For Project Design	For Project Operations	For the Environmental Assessment
Rain	Drought	Decreasing	• The water needs of the Project are driven by aggregate washing requirements and will not increase due to drought conditions.	• This is not expected result in any changes to the Project operations.	• This trend does not change the conclusions of the environmental assessment: water can be conserved and proactively managed during drought times
	Amount of Rain	Increasing	• The potential increases in rainfall are readily accommodated by the design floods used to size ditches, culverts, ponds, spillways, etc. • These facilities are designed for extremely intense rainfalls that may only occur once every 100 years.	• This is not expected to result in any changes to the Project operations • Increases in rainfall amounts may increase requirements for maintenance and erosion control measures.	• This trend does not change the conclusions of the environmental assessment that the Project design will accommodate these water volumes.
	Frequency	Increasing	• This will not affect the Project since plant designs accommodate for rain events irrespective of their frequency.	• This is not expected to result in any changes to the Project operations	• This trend does not change the conclusions of the environmental assessment
	Rainfall Per Event	Increasing	• As described under "amounts of rain" the Project will be designed to accommodate extreme high rainfall events.	• Increases in rainfall per event may increase requirements for maintenance and erosion control measures.	• This trend does not change the conclusions of the environmental assessment • Project facilities will be designed for extreme rainfall in any events, i.e., of the order of the one in 100 year events.
Snow	Snowfall Amount	Decreasing	• Decreasing snowfall amounts will not impact design	• This may reduce the requirement for snow removal at the Project facilities.	• This trend does not change the conclusions of the environmental assessment
Temperature	Freeze-Thaw Events	Decreasing	• This trend will not likely affect the design, since the facilities will be design to accommodate any number of freeze thaw events.	• Less frequent freeze-thaw cycles may reduce repairs and equipment strain.	• This trend does not change the conclusions of the environmental assessment
	High Temperatures	Increasing	• Project facilities will be designed to accommodate a temperature range that includes the projected effects of climate change.	• There may be an increased need to provide measures such a shading, fluids, work breaks, etc. for outdoor workers.	• This trend does not change the conclusions of the environmental assessment

Climate Factor Description		Climate Trend	Implication of Climate Change Trends		
			For Project Design	For Project Operations	For the Environmental Assessment
	Warmer Winters	Increasing	• No special considerations are required.	• Winter operations may become slightly easier, resulting in production efficiencies and cost savings.	• This trend does not change the conclusions of the environmental assessment.
	Heat Waves	No change	• No special considerations are required.	• There may be an increased need to provide measures such a shading, fluids, work breaks, etc. for outdoor workers.	• This trend does not change the conclusions of the environmental assessment
Other Events	Waves Intensity	Increasing	• The marine terminal has been designed to accommodate these changes	• For safety, operations may be temporarily restricted during high wave periods	• This trend does not change the conclusions of the environmental assessment
	Ice Storm Frequency	Decrease in Fall and Increasing in Winter	• Project facilities will be designed for ice conditions, especially at the marine terminal	• Project will incorporate operational procedures to address with icing conditions	• This trend does not change the conclusions of the environmental assessment
	Sea Level Rise/Storm Surges	Increasing	• The marine terminal and processing plant will be designed to accommodate the predicted rise in sea level	• An Emergency Action Plan will be developed to prepare for and react to severe weather events.	• This trend does not change the conclusions of the environmental assessment
Wind	Speeds	Increasing	• Project facilities will be designed for high wind velocities, especially at the marine terminal	• For safety, operations at the marine terminal may be temporarily restricted during high wind periods	• This trend does not change the conclusions of the environmental assessment

8.7 Conclusion

The Project is located on a relatively exposed southern coastline exposed to northerly winds and considerable wave action. Initial designs have considered prevailing historical conditions, including extreme events, as well the anticipated effects of climate change on key weather variables. As the Project moves into the detailed design stage, additional consideration will be given to the effects of the environment on the Project.

In addition to design factors, potential adverse effects on the Project due to the environment will be mitigated through the monitoring and/or contingency planning described above. Therefore, the effects of the environment on the Project are anticipated to be not significant.

9.0 CUMULATIVE ENVIRONMENTAL EFFECTS

Cumulative environmental effects are residual Project effects combined with the environmental effects of past, present, and future projects. For the Black Point Quarry environmental assessment, the descriptions of the existing environment and of the current condition of each VC already include the effects of current projects occurring within or outside of the Project Area. This assessment also assumes that these existing projects will continue in the future and will have similar effects as are currently observed. The assessment has, therefore, integrated the cumulative effects of these ongoing projects and activities. The cumulative effects assessment presented in Section 9.0 thus focuses on the effects of other future projects and activities.

This is consistent with guidance documentation developed by the CEA Agency: "temporal boundaries...should take into account future physical activities that are certain and reasonably foreseeable, and the degree to which the environmental effects of these physical activities will overlap those predicted from the designated project" (CEAA 2013).

With respect to identifying potential cumulative effects, guidance provided during the review of previous environmental assessments in other jurisdictions has indicated that

1. there must be a measurable environmental effect of the project being proposed;
2. the environmental effect must be demonstrated to interact cumulatively with the environmental effects from other projects or activities; and
3. it must be known that the other projects or activities have been, or will be, carried out and are not hypothetical. That is, there must be some *probability* the cumulative environmental effect will occur rather than simply a *possibility*.

9.1 Project Identification

Information regarding upcoming projects was obtained from a review of new projects listed on the NSE Environmental Assessment Division website and well as the CEA Agency's online registry. In addition, a generalized internet search was used to identify other anticipated projects. From these information sources, the following projects were identified.

9.1.1 Planned and Reasonably Certain

Chedabucto Aggregates Quarry Expansion (Halfway Cove, Guysborough Co.)

Chedabucto Aggregates Limited in September 2014 registered the Chedabucto Aggregates Quarry Expansion for environmental assessment. Approval was granted in November 2014. The project is located approximately 13 km southeast of Guysborough. The proposed expansion is scheduled for 2015; production levels and operations are not expected to increase as a result of the proposed expansion.

Goldboro Liquefied Natural Gas Project (Goldboro, Guysborough Co.)

Pieridae Energy proposes to construct a natural gas liquefaction plant and marine terminal in Goldboro, Guysborough County. On March 21, 2014 the project was approved with conditions and the project is currently in the Front End Engineering and Design phase. On-going land and marine based studies are currently underway at the project site.

Maher Melford Container Terminal (Melford, Guysborough Co)

Melford International Terminal is proposing to develop a 315-acre container terminal and intermodal rail facility in Melford on the Strait of Canso. Construction timelines are uncertain but the terminal may be operating by late 2015 or early 2016 (reported November 2013). In late 2014 the Nova Scotia Minister of the Environment authorized an extension for the commencement of project work: the Proponent must, on or before October 23, 2016, commence work on the project unless granted an extension by the Minister.

Bear Head Liquefied Natural Gas Project (Port Hawkesbury, Cape Breton)

The Bear Head project near Port Hawkesbury received EA approval in 2004. Construction on the LNG facility began in 2005, but ceased when Texas-based Anadarko could not find a natural gas supply to import to the terminal. In July 2014, the company Liquefied Natural Gas Ltd. announced it has purchased the project (reported July 2014). In November 2014, Liquefied Natural Gas Ltd. announced plans to double the capacity of the proposed liquefaction and export terminal from 4 mtpa to 8 mtpa. A final investment decision on the Bear Head project is expected in late 2015 to 2016, and the facility could be in commercial operation in late 2018 to 2019 (reported November 2014).

9.1.2 Announced and Uncertain

H-Energy Liquefied Natural Gas Project (Melford, Guysborough Co)

H-Energy has announced its intention to develop a liquefied natural gas export facility at Melford. The development will be located within the Melford Industrial Land Reserve. A final decision on whether to proceed with the venture will be made by mid-2016 (reported July 2014).

Given the uncertainty associated with Maher Melford Terminal, the Bead Head and the H-Energy LNG proposals, these projects were not considered in the cumulative effects assessment.

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9.2 Cumulative Assessment Methodology

In order to identify potential overlapping projects and systematically assess the likely cumulative effects for each VC, the Project team:

1. Researched the status of future planned or anticipated projects that could overlap in time or space with the Project; and

2. Defined the spatial and temporal boundaries that would be used to assess the degree and significance of the overlap (i.e., the cumulative effect) for each VC.

9.3 Spatial and Temporal Boundaries

Residual effects are predicted for almost all VCs, even following the application of mitigation measures to limit or eliminate these effects. Given this, all VCs were examined for the potential to contribute to cumulative effects. At the same time, the spatial and temporal boundaries applied for each Black Point VC are maintained, since the use of these boundaries for the cumulative effects assessment provides consistency to the analysis.

Once future projects were identified, the infrastructure and activities associated with these projects were reviewed to determine the likelihood that potential effects on VCs at these projects would overlap in space with the VCs assessed for the Black Point Project. If an effect was likely, then these effects were further examined as to their potential to overlap in time (temporal overlap) with Black Point effects. Where an overlap of temporal boundaries was noted, the assessment determined if type of effects would be similar or different in nature or magnitude.

9.4 Cumulative Effects Assessment

9.4.1 Projects Retained

Chedabucto Aggregates Quarry Expansion

Chedabucto Aggregates quarry is located near Halfway Cove approximately 17 km west of Black Point. The quarry produces aggregate for the local building and paving industries, and transports its aggregate to these markets by truck. Given the distance from the Project Area, and the limited scale of quarrying activities associated with the expansion, no overlap in space between the environmental effects produced at Chedabucto Aggregates and the Black Point Project is expected. Therefore, no cumulative effects are anticipated.

Goldboro Liquefied Natural Gas Project

The Goldboro LNG project is located on Nova Scotia's eastern shore, approximately 45 km southwest the Black Point Project. The project is associated with a number of residual environmental effects but most of these effects are not considered to be significant. The project's GHG emissions could be regionally significant when combined with other large, regional GHG emitters, but the Black Point Project is not a significant GHG producer. Vessel traffic to the Goldboro marine terminal will remain many kilometres from Chedabucto Bay. Under these circumstances, there is no overlap in space between the effects produced at Goldboro and those expected at Black Point. Given this, no cumulative effects are anticipated.

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Maher Melford Container Terminal and Bear Head Liquefied Natural Gas Projects

The proposed Melford International Terminal (MIT) will be located 23 km from Black Point within the Strait of Canso and will include a wharf and container storage area. The 950 m long wharf will be large enough to berth three post-Panamax container ships or two super post-Panamax ships at one time (AMEC 2008). As noted, construction is currently expected to begin no later than October 2016. Initially 95-150 ships will visit the terminal each year depending on vessel size, increasing to 260 vessels per year at full capacity, again depending on the size of each vessel time (AMEC 2008).

The Bear Head Liquefied Natural Gas Project is located within the Strait of Canso in the Point Tupper/Bear Head Industrial Park, approximately 30 km northwest of the Black Point Project. Initial phases of the project, which may begin in late 2016 or 2017, involve the construction and operation of a 7.5 mtpa capacity LNG terminal with a natural gas send out capacity of 1,000 million standard cubic feet per day, later expanding to 1,500 million standard cubic feet per day. Pier and berthing facilities would be designed to accommodate LNG carriers up to 250,000 m^3 in capacity with a ship draft of approximately 13.5 m (JWEL 2004).

There will be approximately 75-135 ships per year (JWEL 2004). A vessel will be delivering to the terminal every 5 days if the project employs 70 vessels per year, and every 2 or 3 days if 135 vessels are employed per year.

9.4.2 Interacting or Overlapping VCs

Given their relative proximity and location with respect to the Black Point Project site, certain aspects (i.e., valued components or VCs) of the Bear Head LNG and the Maher Melford Container Terminal projects are expected to overlap in space and time with VCs retained for the Black Point Project. These VCs include:

Shipping and Navigation: Black Point Project vessels will share space within the traffic separation scheme east and north of the Canso Ledges and in addition, may require anchorage sites within Chedabucto Bay during periods of adverse weather. This may result in a potential cumulative adverse effect on navigational safety. At the same time, the Black Point Project will employ the same tug boats and pilots that will be needed to serve vessels calling at Bear Head LNG and the Maher Melford Container Terminal projects, resulting in positive economic benefits to these services.

Local Economy, Land and Resource Use: the Black Point project will draw from the same general labour pool that will serve for construction of the Bear Head LNG and the Maher Melford Container Terminal projects. This will result in increased economic activity within the region but may also result in short term labour shortage in specialized trades. As noted, positive economic benefits may accrue to tug boat operators, their suppliers and the pilots needed during the construction and operation of these three projects.

9.4.3 Mitigation Measures

With respect to **Shipping and Navigation,** the vessels used to transport aggregate will not be operated by Proponent crews and so mitigation of potential vessel collisions is, to a large extent, outside of the control of the Proponent. Nevertheless, the Proponent will review the safety and environmental records of shipping contractors prior to engaging them, with the aim of employing only the most reputable firms. As a cargo transported by sea, aggregate would not cause

significant adverse effects to the marine environment in the event of a vessel collision or sinking.

Marine traffic within Chedabucto Bay managed by the Canadian Coast Guard and the Proponent will communicate with the MCTS to the extent requested or required during adverse weather conditions. To the extent applicable, the Proponent will also

- Comply with the Eastern Canada Vessel Traffic Services Zone Regulations of the *Canada Shipping Act*;
- Comply with navigational and operational requirements of Atlantic Pilotage Authority and Coast Guard; and
- As needed, provide marine vessel volumes and schedules to marine management operators responsible for traffic movement; and

With respect to **Local Economy, Land and Resource Use** the Proponent is committed to meeting with local schools, trade unions and other organizations to describe labour and skill requirements, and to employ a procurement policy that favours local labour markets and suppliers.

9.4.4 Residual Cumulative Effects and Significance

Taking into account the basic mitigation measures described above, the residual adverse cumulative effects expected with respect to Shipping and Navigation are predicted to be insignificant. Cumulative effects to the Local Economy, Land and Resource Use are expected to be positive and potentially significant over the medium to long term.

10.0 PROPOSED COMPLIANCE AND EFFECTS MONITORING PROGRAMS

As the Project moves forward into detailed design, a number of existing monitoring programs will continue so that additional pre-construction baseline data can be gathered. Supplemental monitoring programs will be initiated as needed during construction and operation, primarily to verify the impacts predicted in the EIS. Table 10.0-1 summarizes the mitigation measures presented in Chapter 7 on a VC by VC basis, and lists the monitoring programs designed to verify the predictions made in the assessment. Table 10-2 further elaborates the follow up and monitoring programs for each VC. The precise details of each monitoring program (e.g., monitoring frequency/duration, specific locations, parameters, and reporting) will be determined in consultation with regulatory agencies, but Table 10-2 provides a summary of each program's objectives and methods. All monitoring programs will be described in the Project EMP.

The objectives of the monitoring programs are to:

1. Verify effects predicted in the EIS;
2. Confirm the continuing effectiveness of the proposed mitigation measures;
3. Identify the need for new mitigation measures in response to unanticipated adverse effects; and
4. Ensure compliance with regulatory permits, approvals, and requirements.

Finally, Table 10-3 summarizes the issues raised by the public and the Mi'kmaq over the course of the environmental assessment, describes where the mitigation measures regarding each issue can be found, lists commitments made by the Proponent to address these issues, and summarizes the follow up and monitoring program associated with the concern raised. More

information regarding issues raised during the environmental assessment is presented in Section 11 Consultation and Engagement below.

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Table 10-1:
Proposed Mitigation and Monitoring by VC

VC	Mitigation	Monitoring (please see Table 10-2 for Monitoring Program Details)

Air Quality and Climate Change (7.1)	• Regular maintenance of all equipment and emission control devices.
	• The use of wet suppression on crushers, screens, and conveyor transfer points. Due to high moisture content of the stone, some parts of the process will not need water sprays or additional dust control.
	• The application of water to the access and haul roads and aggregate stockpiles as needed.
	• Use of qualified blasting contractors with blast design plans that incorporate dust controls.
	• Construction of the haul roads using material with low silt content.
	• Use of a binder substance within the dust suppression application (e.g. calcium chloride) during drier periods to aid in keeping the roads moist for longer periods of time, when necessary..
	• Use adaptive management to adjust dust control measures and/or operating conditions to account for changing conditions that affect dust control. Some of the control measures that will be implemented will include:
	  ○ Increase in watering frequency of haul roads and stock piles.
	  ○ Application of dust suppressants to the haul and access roads.
	  ○ Reduction in allowable speed on haul and access roads.
	  ○ Restriction or suspension of operation of part or all of the processing plant until dust can be controlled.
	  ○ Suspension or modification of overburden handling activities.
	  ○ Addition or modification of dust suppression systems to address specific points where dust is being generated, including spray nozzle additions and/or modifications.
	  ○ Modify operation and dust controls during high wind events (>30 km/h) to control dust, if it cannot be controlled suspend operation until it can.
	• Utilize multi-passenger vehicles to transport crew when possible.
	• Use high quality, ultra-low sulphur diesel fuels or standard unleaded gasoline for mobile equipment at the operation. (Note: Ships will not be refuelled at the site; vessel fuel type is not within the Proponent's control).
	• Reduce idling and shut off equipment when parked unless it is required to operate due to safety considerations, inspection requirements or maintenance activity.
	• Turn off equipment that is idling and not in use.
	• Utilize drill rig that has dust suppression incorporated into its design.
	• Apply water to shot rock pile as needed to reduce emissions from loading and conveyance of material to the process.
	• Ships must comply with International Marine Organization limits on NO_X, VOC, and SO_2 but enforcement is the responsibility of Transport Canada.
	• Optimize load times to limit auxiliary engine idling on ships at dock.
		• Daily dust and weather monitoring as described in the Environmental Management Plan.
		• Regular individual worker / workplace health and safety testing.
		• Agency-requested ambient air quality testing or monitoring as required.
		• Implementation of a complaints log / response protocol at the site office.

VC	Mitigation	Monitoring (please see Table 10-2 for Monitoring Program Details)
Noise and Vibration (7.2)	• Include noise specifications in equipment procurement practices • Place as much distance as possible between the plant or equipment and residences. • Maximize shielding from quarry walls, buildings and stockpiles as noise barriers. • Use natural landforms as noise barriers. • Include in tenders, subcontractor agreements and work method statements clauses that assure the minimization of noise and compliance with directions from management to minimize noise. • Regularly train workers and contractors to use equipment in ways that minimize noise. • Ensure that site managers periodically check the site, nearby residences and other sensitive receptors for noise problems. • Procure equipment that meets US EPA Category IV air emission standards for off-road diesel equipment which tend to generate less noise than older equipment. • Equipment that operates in the quarry pit should stay in the pit to the extent possible so that the pit walls attenuate the noise levels. • Locate product stockpiles and other structures to the extent possible to attenuate the noise from the processing equipment. • Restrict operating hours for the quarry and processing plants to 16-hours per day so that noise levels are reduced during night time. Additional 8-hours per day maintenance shift will be part of normal operations. • Restrict blasting to daytime hours and weekdays. • Keep truck drivers informed of designated vehicle routes, parking locations, acceptable delivery hours and other relevant practices (e.g. minimizing the use of engine brakes and engine idling). • Minimize the use of reversing alarms by designing the site layout to avoid reversing. • Provide information/advance notification to neighbors before and during construction through media such as letterbox drops or meetings; • Upon request, residents will be alerted to upcoming production shots (blasts) via automated telephone notifications (“robo-calls”). <u>Night-time Mitigation Measures</u> • Minimize the need for reversing alarms. • Avoid metal-to-metal contact on equipment. • Ensure that periods of respite are provided in the case of unavoidable maximum noise level events.	• As required by the NSE Pit and Quarry Guidelines, all blasts will be monitored to establish concussion and vibration levels. This is consistent with the Proponent’s standard operating practices at all quarries. • As required by NSE, sound level monitoring will be undertaken at the property boundary or elsewhere as directed during daytime, evening and night-time to verify compliance with the Pit and Quarry guidelines. • As part of the workplace health and safety program, noise monitors will be attached to workers on a regular basis to measure and monitor noise exposure over an eight hour shift.
Ambient Light (7.3)	• Use full cut off luminaires where no light is emitted above the horizontal plane, where practical and where they don’t comprise worker safety. • Use only the lights needed to meet local lighting objectives. • Where practical Minimize glare by keeping the main beam angle less than 70 degrees. • Use floodlights with asymmetric beams where possible. • Direct the site lighting away from residential properties. • Where possible position lights as far away from site boundaries as practical.	• Routine site monitoring as described in the Environmental Management Plan will include maintaining records of bird mortality so developing issues related to lighting can be identified. • The Environmental Management Plan will include instructions on implementing the protocol “*Best practices for stranded birds encountered offshore Atlantic Canada*” (EC 2014e) for responding to avian strandings related to activities in the marine environment.

VC	Mitigation	Monitoring (please see Table 10-2 for Monitoring Program Details)
	• Where possible, keep lighting at low heights to reduce the chance of illuminating migrating birds. • Pole mounted lighting will be pointed downward and shielded from the top and sides. • To the extent possible, low intensity lighting will be used rather than high intensity lighting. • Lights placed on the outside of the quarry work areas will be kept as low as possible and correctly aimed to prevent lighting non-essential areas. • Lights for the marine terminal will be chosen and aimed to prevent where possible light shining directly into the water. • Marine terminal lighting will be controlled so that minimal lighting will be used when the terminal is not in operation. • If lighting is required at the perimeter of the site it will be aimed inward to prevent off site light trespass. • Temporary lighting used during construction will be focussed on the intended work area and will be shielded to minimize spillage. • To reduce night time ambient lighting effects, operations will be routinely monitored so that lighting can be switched off by work area when it is not needed. • Consideration will be given to using light sources such as directional LEDs to give a better spread of lighting and reduce the overall intensity of the lighting systems. • Consideration will be given to selecting lights that have a lesser effect on the wildlife to help reduce lighting effects on nocturnal species.	• Nightly site inspections will reveal opportunities for light reduction.
Geology, Soil & Sediment Quality (7.4)	• Standard mitigation measures to manage acid generating rock, including the control and containment of drainage and the management of excavated rock as per NSE regulation. • Sloping of the processing plant area to the south to collect surface water within the sedimentation ponds, prevent discharge to the ocean. • Environmental Management Plan that describes standard ARD control measures. The Environmental Management Plan will incorporate an Erosion and Sediment Control Plan to ensure drainage is properly managed and control structures inspected and a Stormwater Management Plan that describes the construction and operation drainage swales and stormwater management ponds.	• The acid generating potential of bedrock will be assessed at the beginning of construction as per the Nova Scotia *Sulphide Bearing Material Disposal Regulations*. • Discharge will be monitored through a Surface Water Monitoring Program elaborated within the Environmental Management Plan.
Groundwater Resources (7.5)	• Since no impacts to groundwater users are expected, no mitigation is proposed • To mitigate reductions in groundwater flows that supply nearby wetlands, implement a Wetland Compensation Plan for wetlands damaged due to the Project.	• The groundwater wells will be monitored as part of the Groundwater Monitoring Program elaborated within the Environmental Management Plan.
Marine and Surface Water Resources (7.6)	• Sedimentation ponds will be used near the processing plant while the quarry pit will employ sumps to collect water inflows. • Topographic controls (sloping the ground to the south) will ensure that overflow, should it occur, will collect against the south cliff and in the pit, rather than be permitted to discharge directly to the ocean. • Double walled and or/fully contained fuel and chemical storage reservoirs will be used. • The Environmental Management Plan will include a discrete Erosion and Sediment Control Plan to ensure drainage is properly managed and control structures inspected and a Stormwater	• Discharge will be monitored through a Surface Water Monitoring Program elaborated within the Environmental Management Plan. • The success of the Wetland Compensation Plan will be monitored over time as determined in collaboration with NSE; other water features not directly included in the Plan will be inspected to detect hydrological changes potentially caused by the Project – these inspections will be outlined in the Plan.

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VC	Mitigation	Monitoring (please see Table 10-2 for Monitoring Program Details)
	Management Plan that describes the construction and operation drainage swales and stormwater management ponds. • The EMP will also include an Emergency Response and Spill Contingency Plan combined with incident prevention and emergency response training to minimize the risk of accidental spills and to rapidly react to any incident that may occur. The Emergency Response and Spill Contingency Plan will include spill dispersion modelling in the marine environment to aid in rapid and effect emergency response. • The Proponent will contract with a local emergency response consultant to ensure that additional resources and expertise are available in the event of an accidental spill in the marine environment. • To mitigate reductions in surface water flows that supply nearby wetlands, implement a Wetland Compensation Plan for wetlands damaged due to the Project.	
Terrestrial Ecosystems, Habitat and Vegetation (7.7)	• A general set of environmental mitigation measures will be defined in the Environmental Management Plan which will include an Erosion and Sediment Control Plan, a Stormwater Management Plan and an Emergency Response and Spill Contingency Plan. • Minimize the Project footprint. • Mark Project boundaries to prevent accidental impacts outside the work area. • Remove/ and salvage topsoil; store separately and reuse for site restoration. • Dust-prevention and abatement measures outlined above will also protect local flora and habitats. • Stabilize and rehabilitate areas of disturbance. • Use local native vegetation in restoration; consideration will be given to the preferential use of vegetation types of interest to the Mi'kmaq. • Vegetation management will be conducted by mechanical cutting (e.g., mower, brush cutter); • Mitigation measures for the protection of watercourses (see Section 7.6 and 7.10) will help to protect terrestrial and freshwater aquatic vegetation and habitats.	• The Environmental Management Plan will establish monitoring/inspection plans to ensure protective mitigation measures are implemented and effective. • Daily inspection and record keeping will be described in the EMP. • A Rehabilitation Plan will be prepared to guide habitat restoration following closure
Wetlands (7.8)	• Mitigation developed for surface water quality will also protect wetlands (Sections 7.6). • Mitigation against the potential effects of spills, malfunctions and accidents are described in Section 7.18. • Wetlands will be avoided to the extent feasible during Project planning. • Where wetlands cannot be avoided, the Project footprint in the wetland area will be minimized. • A wetland alteration permit will be obtained from NSE prior to construction. • Where a permanent loss of wetland function is identified, a Wetland Compensation Plan will be developed, subject to approval by NSE. • Maintain a 30 m buffer around all undisturbed wetlands. • Where the access road cuts across diffuse natural drainage paths culverts or drainage swales of sufficient size will be installed to maintain water flow at pre-construction levels. • To the extent feasible, clean site runoff will be managed so that the amount of water entering adjacent wetlands is similar to pre-construction levels. • Runoff collected along the roads will not be allowed to enter directly into wetlands, but shall be directed into vegetation buffers around wetlands.	• Efficacy of the erosion and sediment control measures will be monitored as outlined in the Environmental Management Plan. • Monitoring of new or enhanced wetlands will be undertaken as per the Wetland Compensation Plan. • Other water features not directly included in the Plan will be inspected to detect hydrological changes potentially caused by the Project – these inspections will be outlined in the Plan.

VC	Mitigation	Monitoring (please see Table 10-2 for Monitoring Program Details)
	• Integration of existing/remnant wetlands into the quarry's stormwater management system will be considered in the Stormwater Management Plan and in the Environmental Management Plan. • Implement Erosion and Sediment Control Plan. • Uncontaminated drainage will be directed away from areas under construction. • Vegetation management in or near wetlands will be conducted by cutting (i.e., no use of herbicides). • Dust-prevention and abatement measures outlined above will also protect wetlands.	
Terrestrial Wildlife (7.9)	• Minimize the Project footprint. • Implement dust-prevention and dust abatement measures described above. • Implement a Wetland Compensation Plan. • Instruct workers to maintain good housekeeping practices and not leave out any food or garbage to avoid attracting wildlife. • To minimize impacts on nesting landbirds, clearing will take place outside of the breeding season for most bird species (April 1 to September 1). If some clearing is necessary during the breeding season the Proponent will assess if the work can be undertaken without contravention of the *Migratory Birds Convention Act* and a contingency plan developed in consultation with CWS in order to maintain compliance with the *Act*. • If an Osprey, Bald Eagle or Northern Goshawk nest is found, even outside of the breeding season, a buffer zone will be placed around the nest and clearing will only occur outside of the buffer zone. • To discourage ground-nesting or burrow-nesting species, no large piles or patches of bare soil will be left uncovered or un-vegetated during the breeding season. • Should any ground- or burrow-nesting species initiate breeding activities on stockpiles or exposed areas, the Proponent will establish a 20 m buffer around the nest location and contact EC-CWS for further advice. • Noise suppression equipment such as mufflers on mobile equipment and fixed/portable engines will be maintained in original OEM working condition • The duration of noise disturbance will be minimized. • Lighting will be restricted to areas where it is necessary. • To minimize interference of nesting activities, workers will be asked to refrain from entering undisturbed habitat areas where no work is done. • In the event that impacts on migratory birds are detected during construction, further mitigation will be developed in consultation with NSDNR and EC. • Standard mitigation measures for noise (including blasting), as outlined in Section 7.2, will minimize impacts on terrestrial fauna. • As recommended by EC, ships en route will maintain a minimum distance of at least 300 m from any colony or island occupied by seabirds and waterbirds. • To minimize the risk to migrant birds, the minimum amount of pilot warning and obstruction avoidance lighting will be used on tall structures. . The use of solid-burning or slow pulsing warning lights at night will be avoided.	• Routine site monitoring as described in the Environmental Management Plan will include maintaining records of bird mortality so developing issues related to lighting can be identified. • The Environmental Management Plan will include provisions describing specific management actions for at risk species (e.g., Mainland Moose, ground- or burrow-nesting species)

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VC	Mitigation	Monitoring (please see Table 10-2 for Monitoring Program Details)
	• Lighting for the safety of the employees should be shielded to shine down and only to where it is needed, without compromising safety. • Street and parking lot lighting should also be shielded so that little escapes into the sky and it falls where it is required. • The protocol "*Best practices for stranded birds encountered offshore Atlantic Canada*" (EC 2014e) will be used for stranded seabirds. • White lights will be preferred for use on towers or high structures at night, as recommended by the US Fish and Wildlife Service (2003). Solid red or flashing red lights will be avoided as they appear to attract nocturnal migrants more than white flashing lights. • The operation of exterior decorative lights such as spotlights and floodlights, whose function are to highlight features of buildings or to illuminate an entire building, will be avoided unless safety is a factor. • High intensity lights, including floodlights, will be turned off at night outside of working hours, if possible, especially during the spring and fall migration period. • Where feasible, tinted or frosted glass windows will be used in buildings to reduce bird mortality from collisions.	
Freshwater Species and Habitat (7.10)	• As described in the Erosion and Sediment Control Plan, erosion control measures will be implemented to ensure that discharge water quality meets all relevant regulatory standards prior to discharge to receiving environment. • As described in the Stormwater Management Plan, stormwater will be collected in the pit and in ponds near the processing plant to ensure that uncontrolled runoff will not occur. • Overburden stockpiles, fuel and chemical storage facilities, and construction equipment will be located a minimum of 30 m from any pre-development water body. • Flagging tape will be used to delineate temporary work areas and control construction access near retained wetlands and water bodies to protect natural substrates and vegetation contributing to habitat and bank stability; • An Emergency Response Spill Contingency Plan will be prepared to prevent and manage the effects of any malfunctions and accidents. • Creation of a 30 ha freshwater lake within the pit following cessation of quarrying activities.	• Fish habitat assessment and determination of presence/absence is proposed for Reynolds Brook above Hendsbee Lake. If fish are present, then a modest monitoring program is proposed for such time as quarry development begins to divert water away from its natural drainage to the south. This is not expected to occur before year 10 of quarry development. • A Rehabilitation Plan will be prepared to guide habitat restoration following closure During construction and operation monitoring will focus on: • Condition and location of erosion and sediment control structures; • Water quality testing of stormwater discharge as outlined in the Surface Water Monitoring Program; and • Ensuring overburden stockpiles, fuel and chemical storage facilities, and construction equipment are a minimum of 30m from any natural water body.

Marine Species and Habitat (7.11)	• An Environmental Management Plan will describe the following preventative and mitigation measures:
	  ○ Application of appropriate timing windows for all in-water work.
	  ○ Implementation of terrestrial erosion and sediment control measures.
	  ○ Use of surface water monitoring to ensure that quality meets all relevant regulatory standards prior to discharge to receiving environment.
	• Install overburden stockpiles, fuel and chemical storage facilities a minimum of 30 m from Chedabucto Bay.
	• Implement an Emergency Response and Spill Contingency Plan for Accidents and Malfunctions.
		• Fisheries Offset Program and associated monitoring for effectiveness.
		• Concussion and ground vibration monitoring during each blast to ensure limits established by DFO for the marine environment are respected.

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VC	Mitigation	Monitoring (please see Table 10-2 for Monitoring Program Details)
	• If effects from blasting vibrations exceed the DFO thresholds, then a site specific standard to protect fish and an appropriately scaled fish and fish habitat offset plan will be implemented. • Control ballast water release via "*Ballast Water Control and Management Regulations*" and the requirements as per the International Convention for the control and Management of Ship's Ballast Water and Sediments. • Implement a Fisheries Offset Program to recreate fish habitat that has suffered "serious harm".	
Species at Risk (SAR) and of Conservation Concern (SOCC) (7.12)	• Mitigation for potential effects on SAR and SOCC are similar to recommendations for terrestrial or marine fauna as a whole. Standard mitigation measures such as minimization of Project footprint, dust control, emissions control, and monitoring of air quality targets as detailed in Sections 7.7 and 7.1 will be sufficient to protect many SAR and SOCC, if present. • Standard handling and storage procedures for hazardous material, as well as procedures for handling and disposal of contaminated soils (outlined in Section 7.18), will adequately mitigate the potential for exposure of Moose and bird SAR/SOCC to any hazardous materials or contaminated soils. • Strict reporting policies for any suspected hunting activities will help to minimize any potential Moose poaching in the Project area. • Imposing a 50 km/hr speed limit will reduce the potential for vehicle-moose collisions. It will also decrease encounters between humans and Moose. • Exposed soils and soil stockpiles will be adequately covered or vegetated to deter Common Nighthawks from nesting on them. • Should Common Nighthawks initiate breeding, the Proponent will establish a 20 m buffer around the location once identified, and contact CWS for further advice.	• Mainland Moose surveys (presence/absence and use) will be performed annually for up to three years after construction is initiated. • Regular inspections for Common Nighthawk nests.
Local Economy, Land and Resource Use (7.13)	• Recreational users will be notified of restricted access by signage at the entrance to the construction site. • Vessels will not be refuelled at the marine terminal and fuel used at the quarry will be kept in double hulled reservoirs or will be placed within secondary containment and will be protected against collision. This helps to minimize the risk of accidents at the terminal. • Navigational safety mitigation measures and emergency response planning measures are presented in Section 7.18.3. • As part of the Environmental Management Plan, implement an Emergency Response and Spill Contingency Plan in advance of any accident or malfunction causing a spill in the marine environment. • The Proponent will contract with a local emergency response organisation to ensure supplementary emergency resources are available if needed.	• None proposed
Tourism and Recreation (7.14)	• Recreational users will be notified of restricted access by signage at the entrance to the construction site. • Vessels will not be refuelled at the marine terminal and fuel used at the quarry will be kept in double hulled reservoirs protected against collision. This helps to minimize the risk of accidents at the terminal.	• None proposed

VC	Mitigation	Monitoring (please see Table 10-2 for Monitoring Program Details)
	• Navigational safety mitigation measures and emergency response planning measures are presented in Section 7.18.3. • As part of the Environmental Management Plan, implement an Emergency Response and Spill Contingency Plan in advance of any accident or malfunction causing a spill in the marine environment. • The Proponent will contract with a local emergency response organisation to ensure supplementary emergency resources are available if needed.	
Commercial Fisheries (7.15)	• Minimize the impact of construction in the marine environment during and after lobster fishing season to the extent possible. For example: standard construction best management practices and mitigation measures to control onshore sediment release to the marine environment will be implemented (Section 7.6 and Section 7.11). • The quarry site office will be manned 24 hrs/day so that fishermen can telephone to receive information regarding vessel arrival and departures. The phone number can also be used to report loss or damage to gear caused by Project-related vessel traffic. • Construction and regular use of the marine terminal will require a safety exclusion zone around the terminal. Loss of these fishing grounds will be mitigated through the creation of new lobster habitat as described in the Fisheries Offset Program to be established in collaboration with local fishermen and DFO. • Routine communication with potentially affected Mi'kmaq will occur through the CLC or through other means as established by both parties.	• Monitoring terminal operations and fishing access in response to concerns expressed by local fishing community, as needed; • Monitoring of the effectiveness of the marine Fisheries Offset Program for a minimum of three years during and after marine terminal construction until it can be demonstrated that the program objectives have been met.
Archaeological/ Heritage Resources (7.16)	• Prior to construction, implement a Cultural Resource Management Plan to guide site personnel in the event that archaeological and heritage resources are identified during construction. The Plan specifies a notification procedure if remains are found, and will describe specific preservation measures as needed. • These mitigation measures would be approved by the Minister of the Department of Communities, Culture and Heritage before site construction could begin. • Exploratory excavation will likely be required in those areas that may be disturbed during Project construction.	• Follow up pre-construction excavation to investigate heritage resources that will be lost during project construction • Monitor construction activities near known or suspected cultural resources.
Mi'kmaq Land and Resource Use (7.17)	• While there is currently no Mi'Kmaq harvesting on the site or in waters immediately adjacent, it is intended that the non-hazardous portions of the Project site and adjacent waters will be accessible to Mi'kmaq for harvesting for flora and fauna for food, social and ceremonial purposes, to the extent this is not precluded by safety consideration • Any future potential Project impacts (environmental, social and economic) on these harvesting activities will be a matter of the formal and regular meetings with the Mi'kmaq community representatives. • In the event that archaeological remains are excavated, recommended guidelines as directed by the Nova Scotia Communities, Culture, and Heritage Coordinator of Special Places will be employed. Should evidence of aboriginal archeological remains be uncovered all activity will cease until Mi'kmaq archaeological experts have had an opportunity to examine the site and determine appropriate action.	• Monitoring of progress and implementation of MOU and any other agreements reached with other First Nation communities. • Mi'kmaq resource harvesting activities will be reviewed with Mi'kmaq representatives at the Community Liaison Committee meetings.

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Table 10-2:
Monitoring Commitments by VC

Valued Component (EIS Section)	Follow Up and Monitoring Programs	Monitoring Locations	Program Objective	Methods and Frequency
Air Quality and Climate Change (7.1)	1. Dust and weather monitoring as described in the Environmental Management Plan	At the property boundary and elsewhere as needed where dust is produced.	• To ensure that on-site dust abatement is effective. • To identify activities that may require modification to reduce dust emissions. • To document daily conditions that may affect operations and to help respond to reported concerns or complaints.	• Visual observations of dust, wind and weather conditions (i.e., inversions, high winds, dry periods) will be recorded daily by site supervisors. • Observations entered into a log sheet that is part of the Environmental Management Plan documentation.
	2. Regular individual worker / workplace health and safety testing for dust exposure	Monitoring devices are attached to individual site workers.	• To monitor exposure to dust in the work environment and ensure worker exposure is below maximum regulated limits at all times.	• As part of the workplace health and safety program, a dust dosimeter with air pump is attached to an employee over a typical eight hour shift. Dust collected on the dosimeter's filter paper is weighed to assess worker exposure over time.
	3. Agency-requested ambient air quality testing or monitoring as required.	At the property boundary or elsewhere as directed by the regulatory authority.	• To ensure that contaminant concentrations are within provincial and federal Air Quality objectives and/or operating permit conditions.	• Sampling equipment, methods and frequency as directed by the regulatory authority.
	4. Complaints Log / Response Protocol	At the quarry office	• To ensure complaints are registered (logged), forwarded to a knowledgeable, and addressed in a timely fashion.	• The quarry office telephone number will be manned 24-hours per day. Complaints will be logged and return telephone calls will be made by quarry staff to discuss and address any issues raised.
Noise and Vibration (7.2)	1. Concussion (air blast) and Ground Vibration peak particle velocity monitoring during each blast.	• Within the property boundary or • Concussion: within 7.0 m of the nearest structure not on the property or elsewhere as directed by NSE. • Vibration: measured below grade or less than 1.0 m above grade in any part of the nearest structure not located on the property or elsewhere as directed by NSE.	• Compliance with the Pit and Quarry Guidelines	• All blasts will be monitored as required by the Pit and Quarry Guidelines. This is consistent with the Proponent's standard practices at all quarries. • Weather conditions will be observed and recorded on a daily basis to ensure no blasting occurs during a thermal inversion, as required in the Pit and Quarry Guidelines. • Monitoring results will be sent to NSE on a monthly basis unless otherwise directed by NSE.
	2. Preparation of a technical blast design	For quarry operations (blasting)	• Compliance with the Pit and Quarry Guidelines	• The blast design must demonstrate the concussion and ground vibration criteria in the Pit and Quarry Guidelines

Valued Component (EIS Section)	Follow Up and Monitoring Programs	Monitoring Locations	Program Objective	Methods and Frequency
				can be met.
	3. Regular individual worker / workplace health and safety testing for noise exposure	Monitoring devices are attached to individual site workers.	• To monitor exposure to noise in the work environment and ensure worker exposure is below maximum regulated noise limits at all times.	• As part of the workplace health and safety program, noise monitors will be attached to workers on a regular basis to measure and monitor noise exposure over an eight hour shift.
	4. Daily monitoring of Sound Level Limits (night, evening, day) as directed by NSE	At the property boundary or at other locations as directed by NSE	• Compliance with the Pit and Quarry Guidelines	• Methodologies will comply with NSEL's Guidelines for Environmental Noise Measurement and Assessment or other methods as directed by NSE.
	5. Complaints Log / Response Protocol	At the quarry office	• To ensure complaints are registered (logged), forwarded to a knowledgeable employee, and addressed in a timely fashion	• The quarry office telephone number will be manned 24-hours per day. Complaints will be logged and return telephone calls will be made by quarry staff to discuss and address any issues raised.
Ambient Light (7.3)	1. Routine monitoring for dead or injured birds as described in the Environmental Management Plan.	Site wide	• To verify the effectiveness of mitigation measures related to lighting	• Daily inspections and record keeping. • In the event of the mortality or injury of ten or more migratory birds in a single event, or of any number of species at risk birds, EC-CWS will be notified within 24 hours. • Notification will include the name and location of the facility, number and species of birds affected, meteorological conditions during the previous night(s), status of lights, and details of any other factor which may have influenced the event. • If the need arises and dead birds are found on routine inspection and documentation as described in the EMP then EC-CWS will be contacted to help develop additional mitigation measures. • The Environmental Management Plan will include instructions for implementing the protocol "*Best practices for stranded birds encountered offshore Atlantic Canada*" (EC 2014e) for responding to avian strandings related to activities in the marine environment.
	2. Routine site inspections to look for light reduction opportunities	Site wide	• Routine site inspections identify light reduction opportunities, especially reduction of light levels in non-active work areas, and/or redirection of lighting installation.	• Nightly Inspections and record keeping will be described in the Environmental Management Plan.
	3. Complaints Log / Response Protocol	At the quarry office	• To ensure complaints are registered (logged), forwarded to a	• The quarry office telephone number will be manned 24-hours per day. Complaints will be logged and return

Valued Component (EIS Section)	Follow Up and Monitoring Programs	Monitoring Locations	Program Objective	Methods and Frequency
			knowledgeable employee, and addressed in a timely fashion	telephone calls will be made by quarry staff to discuss and address any issues raised.
Geology, Soil & Sediment Quality (7.4)	1. Erosion and Sediment Control Plan, Stormwater Management Plan.	Site wide	• To ensure compliance with discharge water quality objectives and to protect sensitive marine and terrestrial habitats and species.	• Details of the Erosion and Sediment Control Plan and Stormwater Management Plan will be included in the Environmental Management Plan.
	2. Surface Water Quality Monitoring Program	Discharge from the sedimentation ponds	• To prevent discharge of sediment laden, low pH water and ensure compliance with discharge water quality objectives as listed in the operating permit.	• Water sampling will be undertaken as described in the operating permit conditions. Samples will be taken using standard water sampling methods such as found in, for example, Protocols Manual for Water Quality Sampling in Canada (CCME 2011).
	3. Assessment of acid generation potential of bedrock in the processing plant area	All bedrock that will be disturbed during construction of the processing plant	• To ensure potentially acid generating rocks are identified and if present, managed according to provincial regulation.	• The acid generating potential of bedrock will be assessed at the beginning of construction through a sampling and analytical program as per the Nova Scotia *Sulphide Bearing Material Disposal Regulations*.
Groundwater Resources (7.5)	1. Groundwater Monitoring Program	Adaptive monitoring program employing up to ten well pairs located within property boundaries and on adjacent lands up to 400 m from the quarry boundary.	• To verify drawdown and water quality predications made in the assessment.	• The Groundwater Monitoring Program (Appendix A) proposes the progressive installation over time of up to 10 monitoring well pairs (deep and shallow), each to be monitored quarterly for a minimum of two years. Two baseline water quality samples will be taken per year in each well, for a minimum of two years. As an adaptive program, initial results will inform the location and monitoring activities at new wells, and initial results will determine whether continued monitoring is required after two years.
Marine and Surface Water Resources (7.6)	2.Surface Water Quality Monitoring Program	Discharge from the sedimentation ponds.	• To prevent discharge of sediment laden, low pH water and ensure compliance with discharge water quality objectives as listed in the operating permit.	• Water sampling will be undertaken as described in the operating permit conditions. Samples will be taken using standard water sampling methods such as found in, for example, Protocols Manual for Water Quality Sampling in Canada (CCME 2011).
	3. Emergency Response and Spill Contingency Plan, Erosion and Sediment Control Plan, Stormwater Management Plan.	Site wide	• To ensure compliance with discharge water quality objectives and to protect sensitive marine and terrestrial habitats and species.	• Details of the Emergency Response and Spill Contingency Plan, Erosion and Sediment Control Plan and Stormwater Management Plan will be included in the Environmental Management Plan.
	3. Wetland Compensation Plan	Site wide and Affected Area	• To replace wetlands damaged or destroyed during the course of the Project. • To monitor indirect Project effects on nearby watercourses and	• The Wetland Compensation Plan based on a signed Letter of Understanding between the Proponent and NSE will be developed in collaboration with NSE and other stakeholders. The Plan will be based on the NS Wetland Conservation Policy and other guidance

Valued Component (EIS Section)	Follow Up and Monitoring Programs	Monitoring Locations	Program Objective	Methods and Frequency
			wetlands	documents and implemented over the life of the Project as the quarry gradually expands. • The Wetland Compensation Plan will include follow up monitoring of newly created or restored wetlands. • As part of the Wetland Compensation Plan a wetland and surface water feature inspection program will be implemented to confirm hydrological predictions made in the environmental assessment and to identify any unforeseen wetland or watercourse impacts so these impacts can be addressed or compensated.
Terrestrial Ecosystems, Habitat and Vegetation (7.7)	1. Erosion and Sediment Control Plan, Stormwater Management Plan.	Site wide	• To protect sensitive marine and terrestrial habitats and species.	• Details of the Erosion and Sediment Control Plan and Stormwater Management Plan will be included in the Environmental Management Plan.
Wetlands (7.8)	1. Wetland Compensation Plan	Site wide and Affected Area	• To replace wetlands damaged or destroyed during the course of the Project. • To monitor indirect Project effects on nearby watercourses and wetlands	• The Wetland Compensation Plan, based on a signed Letter of Understanding between the Proponent and NSE, will be developed in collaboration with NSE and other stakeholders. The Plan will be based on the NS Wetland Conservation Policy and other guidance documents and implemented over the life of the Project as the quarry gradually expands. • The Wetland Compensation Plan will include follow up monitoring of newly created or restored wetlands. • As part of the Wetland Compensation Plan a wetland and surface water feature inspection program will be implemented to confirm hydrological predictions made in the environmental assessment and to identify any unforeseen wetland or watercourse impacts so these impacts can be addressed or compensated. Any unforeseen wetland or watercourse impacts.
	2. Erosion and Sediment Control Plan, Stormwater Management Plan.	Site wide	• To protect sensitive marine and terrestrial habitats and species.	• Details of the Erosion and Sediment Control Plan and Stormwater Management Plan will be included in the Environmental Management Plan.
Terrestrial Wildlife (7.9)	1. Routine monitoring for dead or injured birds as wells as ground- or burrow-nesting species, as described in the Environmental Management Plan.	Daily	• To verify the effectiveness of mitigation measures related to lighting and at-risk species	• Routine site monitoring as described in the Environmental Management Plan will include maintaining records of bird mortality so developing issues related to lighting can be identified. • The Environmental Management Plan will include for

Valued Component (EIS Section)	Follow Up and Monitoring Programs	Monitoring Locations	Program Objective	Methods and Frequency
				ground- or burrow-nesting species. Should these species initiate breeding on stockpiles or exposed areas, periodic monitoring of the nest(s) will be undertaken until the chicks have fledged and left the area and the nest site is found to be inactive.
	2. Emergency Response and Spill Contingency Plan, Erosion and Sediment Control Plan, Stormwater Management Plan.	Site wide	• To ensure compliance with discharge water quality objectives and to protect sensitive marine and terrestrial habitats and species.	• Details of the Emergency Response and Spill Contingency Plan, Erosion and Sediment Control Plan and Stormwater Management Plan will be included in the Environmental Management Plan.
Freshwater Species and Habitat (7.10)	1. Fish habitat assessment and determination of fish presence/absence	Reynolds Brook above Hendsbee Lake.	• To determine if fish are present and by extension, if follow up monitoring is required.	• Determination of fish presence/absence; characterisation of fish habitat. If present, then: • Obtain seasonal water quality samples (spring, fall, winter) as baseline for future comparisons. • Establish stage/discharge conditions to determine if future quarry operations that will potentially reduce flow can in fact be detected in Reynolds Brook.
	2.Surface Water Quality Monitoring Program	Discharge from the sedimentation ponds.	• To prevent discharge of sediment laden, low pH water and ensure compliance with discharge water quality objectives as listed in the operating permit.	• Water sampling will be undertaken as described in the operating permit conditions. Samples will be taken using standard water sampling methods such as found in, for example, Protocols Manual for Water Quality Sampling in Canada (CCME 2011).
	3. Emergency Response and Spill Contingency Plan, Erosion and Sediment Control Plan, Stormwater Management Plan.	Site wide	• To ensure compliance with discharge water quality objectives and to protect sensitive marine and terrestrial habitats and species.	• Details of the Emergency Response and Spill Contingency Plan, Erosion and Sediment Control Plan and Stormwater Management Plan will be included in the Environmental Management Plan.
Marine Species and Habitat (7.11)	1. Marine Fisheries Offset Program	Following discussions with DFO and local fishermen, offset projects will likely be established immediately east or west of the Project site.	• To recreate fisheries habitat lost or damaged due to construction of the marine terminal	• Monitoring of the success of the marine Fisheries Offset Program for a minimum of three years during and after marine terminal construction until it can be demonstrated that the program objectives have been met.
	2. Concussion and ground vibration monitoring during each blast..	Within the property boundary	• Ensure noise limits established by DFO for the marine environment are respected.	• Continuous-operation seismographs designed to record blast vibrations
	3. Emergency Response and Spill Contingency Plan, Erosion and Sediment Control Plan, Stormwater Management Plan.	Site wide	• To ensure compliance with discharge water quality objectives and to protect sensitive marine and terrestrial habitats and species.	• Details of the Emergency Response and Spill Contingency Plan, Erosion and Sediment Control Plan and Stormwater Management Plan will be included in the Environmental Management Plan.
	4.Surface Water Quality Monitoring	Discharge from the sedimentation	• To prevent discharge of sediment	• Water sampling will be undertaken as described in the

Valued Component (EIS Section)	Follow Up and Monitoring Programs	Monitoring Locations	Program Objective	Methods and Frequency
	Program	ponds.	laden, low pH water and ensure compliance with discharge water quality objectives as listed in the operating permit.	operating permit conditions. Samples will be taken using standard water sampling methods such as found in, for example, Protocols Manual for Water Quality Sampling in Canada (CCME 2011).
Species at Risk (SAR) and of Conservation Concern (SOCC) (7.12)	1. Mainland Moose monitoring program establish as part of the Environmental Management Plan	Within the property boundary extending into adjacent moose habitats	• To supplement current understanding of moose use of the Project area.	• Mainland Moose Surveys will be performed annually for up to three years after construction is initiated. • Moose survey methodologies will be based on established NSDNR protocols and elaborated within the Environmental Management Plan.
	2.Inspection of Common Nighthawk nests, if nesting birds are present	Within the site where nests are found.	• To ensure nesting birds remain undisturbed until chicks have fledged.	• Should Common Nighthawks initiate breeding, daily monitoring of the nest(s) will be undertaken until the chicks have fledged and left the area. • Inspection and other protective measures will be described within the Environmental Management Plan.
Local Economy and Land Use (7.13)	1. Emergency Response and Spill Contingency Plan / emergency response training	Site wide	• To ensure the necessary resources are in place in effectively respond to an emergency event.	• Details of the Emergency Response and Spill Contingency Plan (which will include marine spill dispersion modelling) will be included in the Environmental Management Plan. • The Proponent will contract with a local emergency response organisation to ensure supplementary emergency resources are available if needed.
Tourism and Recreation (7.14)	1. Emergency Response and Spill Contingency Plan / emergency response training	Site wide	• To ensure the necessary resources are in place in effectively respond to an emergency event.	• Details of the Emergency Response and Spill Contingency Plan (which will include marine spill dispersion modelling) will be included in the Environmental Management Plan. • The Proponent will contract with a local emergency response organisation to ensure supplementary emergency resources are available if needed.
Commercial Fisheries (7.15)	1. Marine Fisheries Offset Program	Following discussions with DFO and local fishermen, offset projects will likely be established immediately east or west of the Project site.	• To recreate fisheries habitat lost or damaged due to construction of the marine terminal	• Monitoring of the success of the marine Fisheries Offset Program for a minimum of three years during and after marine terminal construction until it can be demonstrated that the program objectives have been met.
	2. Help Line / Complaints Log / Response Protocol	At the quarry office	• To ensure shipping schedules and marine terminal operations are known to fishermen. • To address concerns or complaints associated with operations and damage or loss of fishing gear.	• The quarry office telephone number will be manned 24-hours per day. Fishermen can contact the quarry supervisor to learn shipping schedules. • Any concerns expressed with respect to terminal or shipping operations, including damage to gear, will be logged and return telephone calls will be made by quarry

Valued Component (EIS Section)	Follow Up and Monitoring Programs	Monitoring Locations	Program Objective	Methods and Frequency
				staff to discuss and address any issues raised.
Archaeological/ Heritage Resources (7.16)	1. Pre-construction archaeological excavation	At those archaeological sites in the processing plant area that will be disturbed/destroyed during construction.	• To investigate and preserve heritage resources that will be lost during Project construction. • To ensure the long term protection and preservation of heritage resources not directly affected by the Project.	• The methods used for the archaeological excavations will require approval by Minister of the Department of Communities, Culture and Heritage prior to initiation.
	2. Cultural Resources Management Plan	Site wide	• To ensure that any additional cultural heritage resources found during construction are managed according to provincial regulation.	• The Cultural Resources Management Plan will be elaborated within the Environmental Management Plan and will following guidance provided by the Minister of the Department of Communities, Culture and Heritage.
Mi'kmaq Land and Resource Use (7.17)	1. Ongoing dialogue with Mi'kmaq representatives	Not applicable	• To ensure that traditional land and resource practices, including those in the marine environment, can continue on the property and marine waters to the extent this can be done safely.	• Discussions to occur through the presence of Mi'kmaq representatives on the Community Liaison Committee or other forums established between the Proponent and Mi'kmaq representatives.

Table 10-3:
Issues Raised During the Assessment and Proponent Commitments

Issue or Concern	Mitigation	Proponent Commitments	Follow Up Program
Raised by the Public			
Biophysical Subjects			
1. Effects of the quarry on groundwater quality, including potable water wells	• Section 7.5 and Table 10-1	• Proponent presented groundwater findings at a Community Liaison Committee meeting. • Groundwater discharge to surface waterbodies will meet Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life for all parameters meeting these standards prior to development. • Potable groundwater will meet the criteria listed in Guidelines for Canadian Drinking Water Quality for all parameters meeting the Guidelines prior to development. • Reductions to groundwater flow in the Affected Area will not exceed 20%.	• Groundwater Monitoring Program (Hydrogeology Technical Report, Appendix A)
2. Changes in ambient noise levels	• Section 3.3.9, Section 7.2 and Table 10-1.	• Maximum noise and vibration limits listed in the *Pit and Quarry Guidelines* will be met at the property boundary. • The Proponent will respect all provisions in the provincial *Workplace Health and Safety Regulations* made under the Occupational Health and Safety Act. • The Proponent will provide the telephone number of the on-site quarry office and document all complaints within a Complaints Log. All callers will receive a return phone call to ensure issues are documented and addressed.	• Concussion (air blast) and Ground Vibration peak particle velocity monitoring during each blast. • Preparation of a technical blast design • Regular individual worker / workplace health and safety testing for noise exposure • Daily monitoring of Sound Level Limits (night, evening, day) as directed by NSE • Complaints Log / Response Protocol
3. Changes in ambient air quality	• Section 7.1 and Table 10-1.	• Air emissions will comply with the Nova Scotia *Air Quality Regulations* and meet the National Ambient Air Quality Objectives under CEPA, 1999. • The Proponent will respect all provisions in the provincial Workplace Health and Safety Regulations made under the Occupational Health and Safety Act. • The Proponent will provide the telephone number of the on-site quarry office and document all complaints within a Complaints Log. All callers will receive a return phone call to ensure issues are documented and addressed.	• Dust and weather monitoring as described in the Environmental Management Plan • Regular individual worker / workplace health and safety testing for dust exposure • Agency-requested ambient air quality testing or monitoring as required. • Complaints Log / Response Protocol
4. Changes in ambient light levels	• Section 3.3.9, Section 7.3 and Table 10-1.	• Lighting will be restricted to that necessary to ensure worker safety. • Light will not interfere with the use and enjoyment of nearby	• Subject to be discussed at Community Liaison Committee meetings.

		residential properties on a permanent basis. • The Proponent will provide the telephone number of the on-site quarry office and document all complaints within a Complaints Log. All callers will receive a return phone call to ensure issues are documented and addressed.	
5. Potential for siltation in the marine environment	• Section 7.4 and Table 10-1.	• Total suspended solids in water released from the site will respect maximum values listed in the CCME Water Quality Guidelines for the Protection of Aquatic Life (Marine) and the Nova Scotia Pit and Quarry Guidelines.	• Surface Water Quality Monitoring Program
6. Introduction of invasive species through ballast water	• Section 6.11.4	• Illegal ballast exchange is a criminal act. The Proponent will investigate and employ a reputable shipping firm for aggregate transport.	• Observations regarding shipping access to the marine terminal, including ballast water discharge will be discussed at the Community Liaison Committee meetings.
7. Radon monitoring	• Radon is not expected to accumulate in the open air quarry	• The Proponent will respect all provisions in the provincial *Workplace Health and Safety Regulations* made under the Occupational Health and Safety Act.	• Radon monitoring will be undertaken if/when requested by NSE or other regulatory agency.
8. Changes to surface water quality and baseflow	• Section 7.6 and Table 10-1.	• Surface water discharged from site will comply with quality criteria in the Pit and Quarry Guidelines, CCME Guidelines for suspended solids, and provisions in the operating permit. • Changes in peak flow of water discharged from the site will not measurably increase the risk of flooding to downstream watercourses. • Reductions to means annual runoff to off-site watercourses will not exceed 20%.	• Surface Water Quality Monitoring Program
9. Effective surface and groundwater management prior to discharge	• Section 3.3.7 and Table 10-1.	• The Proponent will prepare a Stormwater Management Plan prior to construction.	• Surface Water Quality Monitoring Program
10. Management of archaeological resources including human remains	• Section 7.16 and Table 10-1.	• The Proponent will prepare a Cultural Resources Management Plan prior to construction to guide response to any additional finds, including human remains. • Area near Fogerty Head identified as having potential to contain human remains will be marked off to prevent future disturbance.	• Archaeological investigations will be undertaken to address 19th century building foundations identified on site. • Report on the pre-construction archaeological investigation, including recommendations if applicable, will be made to the Nova Scotia Department of Communities, Culture and Heritage
11. Project effects on protected species	• Section 7.12 and Table 10-1.	• Should Common Nighthawks initiate breeding activities on stockpiles or exposed areas on site despite efforts to deter them, the Proponent will establish a 20 m buffer around the location once identified, and contact CWS for further advice. • Please see #12 for measures to address Mainland Moose. • In the event of the mortality or injury of ten or more migratory birds in a single event, or of any number of species at risk birds, EC-CWS will be notified within 24 hours.	• Mainland Moose Surveys will be performed annually for a period of three years after construction is initiated. • Should Common Nighthawks initiate breeding, daily monitoring of the nest(s) will be undertaken until the chicks have fledged and left the area. • Inspection and other protective measures will be described within the Environmental Management Plan

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12. Concern regarding wildlife, vegetation and wetlands loss	• Section 7.7, 7.8 and 7.9 and Table 10-1.	• Mainland Moose studies would be performed annually for a period of three years after construction was initiated. • A Wetland Compensation Plan will be developed in consultation with NSE.	• Mainland Moose survey methods would be based on NSDNR's Protocol for Mainland Moose Snow Tracking Survey and Pellet Group Inventory Data Collection Period. • Survey transects and timing would be discussed with NSDNR prior to undertaking the work.
13. Effects of extreme weather	• Section 8.6; Table 8-6	• At the detailed design phase the Proponent will again consider climate change, crustal subsidence and storm surge projections to inform marine terminal design. • An Emergency Action Plan and Mooring Plan will be used to ensure appropriate measures are taken before and in reaction to severe weather events	• No follow up program is proposed
14. Effects on migratory birds	• Section 7.3, Section 7.9; Table 10-1.	• In the event of the mortality or injury of ten or more migratory birds in a single event, or of any number of species at risk birds, EC-CWS will be notified within 24 hours. • Clearing activities will take place outside of the breeding season for most bird species (April 1 to September 1) to prevent the disturbance of migratory birds or their nests. If some clearing is necessary during the breeding season the feasibility of maintaining compliance with the *Migratory Birds Convention Act* will be assessed and a contingency plan developed in consultation with CWS	• Routine site monitoring as described in the Environmental Management Plan will include maintaining records of bird mortality so developing issues related to lighting can be identified. • The Environmental Management Plan will include for ground- or burrow-nesting species. Should these species initiate breeding on stockpiles or exposed areas, periodic monitoring of the nest(s) will be undertaken until the chicks have fledged and left the area and the nest site is found to be inactive. • EC-CWS will be consulted in order to verify the effectiveness of mitigation measures related to lighting, including implementation of the protocol "*Best practices for stranded birds encountered offshore Atlantic Canada*" (EC 2014e) for responding to avian strandings in the marine environment.
15. Traditional use of the land by Mi'kmaq people	• These lands are not currently used for traditional resource harvesting.	• The site will remain available for traditional harvesting to the extent this is not precluded by safety considerations.	• Subject to be discussed at Community Liaison Meetings and directly with Mi'kmaq representatives
16. Effects on marine and coastal ecosystems	• Sections 7.6, 7.11, 7.12, 7.15 and Table 10-1.	• Total suspended solids in water released from the site will respect maximum values listed in the CCME Water Quality Guidelines for the Protection of Aquatic Life (Marine) and the Nova Scotia Pit and Quarry Guidelines. • A Fisheries Offset Program will be undertaken to restore habitat lost or damaged with the construction of the marine terminal	• Monitoring of the effectiveness of the marine Fisheries Offset Program would be undertaken for at least three years until it can be demonstrated that the program objectives have been met. • Monitoring objectives and methodology will be established in consultation with DFO
17. Effects on marine life, fish; existing and	• Sections 7.6, 7.11, 7.12,	• Avoid construction during lobster fishing season to the extent	• Monitoring of the effectiveness of the marine

emerging fisheries	7.15 and Table 10-1.	possible. • A Fisheries Offset Program will be undertaken to restore habitat lost or damaged with the construction of the marine terminal • A Marine Communication Strategy is proposed to help ensure efficient and timely communication between the Proponent and local fishermen.	Fisheries Offset Program would be undertaken for at least three years until it can be demonstrated that the program objectives have been met. • Monitoring objectives and methodology will be established in consultation with DFO. • Terminal operations and fishing access will be monitored at the Community Liaison Committee meetings in response to concerns expressed by the local fishing community, as needed.
Socio-Economic Subjects			
1. Perceived effects of the quarry on property values	• Section 7.13; all mitigation measures in Table 10-1 are applied to reduce actual and perceived project impacts that may directly or indirectly affect property values.	• The Proponent commits to the mitigation and monitoring measures presented in the EIS.	• Subject to be discussed at Community Liaison Meetings
2. Transparency/due process during expropriation	• Expropriation was undertaken by the MODG and is not part of the environmental assessment.	• Not applicable	• Not applicable
3. Commitment hire locally and employ union members	• Ongoing dialogue at the Community Liaison Committee meetings	• The Proponent is committed to ongoing communication with labour unions and other labour sources with the aim of employing locally sourced, skilled workers, both union and non-union, to the extent they are available when needed at the site. • The Proponent has and will again in the future present skills requirements at local high schools and community colleges. • The Proponent will solicit and interview local workers for employment vacancies.	• Subject to be discussed at Community Liaison Committee Meetings
4. Inflated job estimates / use of temporary foreign workers	• Ongoing dialogue at the Community Liaison Committee meetings	• The Proponent reiterates job estimates presented in the EIS. • No temporary foreign workers will be used unless employment vacancies cannot be filled otherwise.	• Subject to be discussed at Community Liaison Committee Meetings
5. Continued use of the site for trapping	• Safety restrictions may limit but not eliminate trapping on certain areas of the property at least in the near future. • Ongoing dialogue at the Community Liaison Committee meetings	• The Proponent will endeavour to accommodate trapping to the extent that safety considerations are not compromised.	• Subject to be discussed at Community Liaison Committee Meetings
6. Concern regarding changes to tourism	• Section 7.14 and Table 10-1	• Ongoing dialogue at the Community Liaison Committee	• Subject to be discussed at Community

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and recreational land and water use patterns		meetings.	Liaison Meetings.
7. Concern regarding lack of local benefits	• Ongoing dialogue at the Community Liaison Committee meetings	• The Proponent reiterates job estimates and local benefit calculations presented in the EIS.	• Subject to be discussed at Community Liaison Committee Meetings
8. Potential for tax payer funded clean up upon closure	• Section 3.4	• A Site Rehabilitation Plan is required by the Nova Scotia Pit and Quarry Guidelines. As part of the Plan, a security bond to pay for rehabilitation in the case of default is required.	• No follow up is proposed.
9. Concern regarding physical appearance of quarry	• Section 3.1.1, Section 3.3.9	• A 30 m wide wooded buffer will be left along the coastline. The quarry will not be visible from Marine Drive (Route 16).	• Subject to be discussed at Community Liaison Committee Meetings
10. Concern regarding the permanent change in land use	• Section 7.13, Table 10-1	• Recreational users will be notified of restricted access by signage at the entrance to the construction site.	• Subject to be discussed at Community Liaison Committee Meetings
11. Proponent commitment to sustainability and the community	• Not applicable	• Proponent provided information regarding its community outreach programs and sustainability record.	• No additional follow up is proposed.
Raised by the Mi'kmaq			
1. Employment/training opportunities; expectations regarding an impact benefits agreement	• The Proponent has commenced and will continue to engage Mi'kmaq communities in the planning and development process	• Initiated communication with Chiefs and KMK; made commitments in a draft MOU pertaining to development of long-term relationship and provision of Project benefits. • The Proponent will monitor the progress and implementation of MOU and any other agreements to ensure that the Aboriginal community is able to participate and benefit from opportunities by the Project." • The Proponent will continue to make Project status presentations and offer site visits to interested Mi'kmaq representatives	• Subject to be discussed at Community Liaison Committee Meetings. CLC membership includes Mi'kmaq representatives and is open to other interested Mi'kmaq.
2. Potential for petroglyphs or other Mi'kmaq historic cultural resources on the site	• Section 7.16 and Table 10-1.	• Two archaeological studies undertaken; no evidence in Mi'kmaq historic cultural resources was found. • Culture Resource Management Plan to be prepared before construction begins. • The Proponent has committed to a separate site visit undertaken with a qualified Mi'kmaq archaeologist prior to project implementation.	• Archaeological investigations will be undertaken to address 19th century building foundations identified on site. • Report on the pre-construction archaeological investigation, including recommendations if applicable, will be made to the Nova Scotia Department of Communities, Culture and Heritage • Subject to be discussed at Community Liaison Committee Meetings. CLC membership includes Mi'kmaq representatives and is open to other interested Mi'kmaq.
3. Potential Effects on Mi'kmaq commercial, recreational and Food/Social/Ceremonial fisheries	• Section 7.15 and 7.17; Table 10-1. • No current commercial, recreational or FSC resource use was identified.	• The Proponent is committed to continuing discussion and collaboration on these subjects, ideally through Mi'kmaq participate in the Community Liaison Committee. • The Proponent will continue to make Project status presentations and offer site visits to interested Mi'kmaq	• Subject to be discussed at Community Liaison Committee Meetings. CLC membership includes Mi'kmaq representatives and is open to other interested Mi'kmaq.

	• Mi'kmaq representatives have been invited to participate as members in the Community Liaison Committee.	representatives	
4. Status of site-specific Mi'kmaq Ecological Knowledge	• MEKS was provided upon request.	• Mi'kmaq Ecological Knowledge Study undertaken	• No follow up is proposed.
5. Concerns for fish, fish habitat, and Mi'kmaq fisheries	• Section 7.11, 7.15 and 7.17; Table 10-1. • Mi'kmaq representatives have been invited to participate as members in the Community Liaison Committee.	• Mi'kmaq Ecological Knowledge Study undertaken • The Proponent's' dialogue with Mi'kmaq communities has addressed potential project-related effects and establishes commitments for effects management and communication. • The Proponent will continue to make Project status presentations and offer site visits to interested Mi'kmaq representatives	• Subject to be discussed at Community Liaison Committee Meetings. CLC membership includes Mi'kmaq representatives and is open to other interested Mi'kmaq.
6. Consultation and Engagement	• The Proponent has engaged the Mi'kmaq since February, 2014. This engagement is ongoing. • Mi'kmaq representatives have been invited to participate as members in the Community Liaison Committee.	• Direct dialogue with Mi'kmaq organizations and communities without prejudice will be maintained. • The Proponent will continue to make Project status presentations and offer site visits to interested Mi'kmaq representatives	• Subject to be discussed at Community Liaison Committee Meetings. CLC membership includes Mi'kmaq representatives and is open to other interested Mi'kmaq.
7. Project effects on biophysical attributes listed above	• Please see Biophysical sections above	• Please see Biophysical sections above	• Please see Biophysical sections above
8. Changes to current use of land and resources by the Mi'kmaq for traditional purposes	• No current traditional resource use was identified.	• The Proponent commits to allowing future access to non-active portions of the site to the extent this does not compromise the safety of the Mi'kmaq visitors or quarry workers. • The Proponent will continue to make Project status presentations and offer site visits to interested Mi'kmaq representatives	• Subject to be discussed at Community Liaison Committee Meetings. CLC membership includes Mi'kmaq representatives and is open to other interested Mi'kmaq.

11.0 CONSULTATION AND ENGAGEMENT

11.1 Consultation Strategy and Objectives

The Proponent has developed and implemented a public consultation program that engages stakeholders and satisfies the requirements of the Nova Scotia *Environmental Assessment Regulations* and the Proponent's Guide to Environmental Assessment (NSE 2009). The Proponent has been and remains committed to open and transparent engagement using an approach that fosters collaborative working relationships. The Proponent strives to be the best source of information for stakeholders about the Project.

As part of Project development, the Proponent implemented a comprehensive consultation program with the following key objectives:

- to identify issues and concerns of interest to the affected communities, stakeholder groups and residents;
- to assist in judging the nature and intensity of Project benefits or impacts;
- to solicit local information and expert opinions; and
- to fulfil regulatory requirements.

The consultation program is intended to continue throughout the Project development process. It started in the early planning stages of the Project in 2010, expanded during the formal environmental assessment process, and is scheduled to continue through subsequent approvals, permitting and construction phases. The Proponent also intends to continually engage with all stakeholders during the operation of the facility. A full list of consultation and outreach events is provided in **Appendix M,** Attachment 4.

11.2 Public and Agency Consultation

The Proponent, using a variety of public outreach methods, has informed stakeholders of the Project, explained the planning and regulatory processes, advertised consultation and engagement opportunities and solicited input into the Project Description and the EIS report.

Specific engagement tools and techniques that have been applied during the public consultation program include:

1. a Project-specific website – www.blackpointquarry.ca
2. a stakeholder database including email and mailing lists used for email outreach to interested residents and others;
3. an open house event, public information sessions, and public presentations;
4. public notices regarding key milestones and CLC membership;
5. interviews with provincial and local media outlets;
6. a Project newsletter distributed via mail drops, newspaper inserts and email;
7. the Community Liaison Committee (CLC);
8. government agency briefings (federal, provincial and local); and
9. other stakeholder group meetings and door-to-door introductions to residents.

These items are described in greater detail below.

11.3 Website

A Project website was established early in assessment process, when the Project Description was first being elaborated in February, 2014. The website was created to allow the public easy access to up-to-date information about the Project. The website also functions as the authoritative source of information for all stakeholders. The website address is www.blackpointquarry.ca. The website includes:

- Project overview
- Project history
- Project details:
  - Location
  - Aggregate Market
  - Project Benefits
  - Project Decommissioning
  - Maps and Photographs
- Community information
  - Community Liaison Committee
  - Questions and Answers
  - Frequently Asked Questions
  - Newsletters
  - Presentations
  - Reports

The Project website also includes a link to the CEA Agency website. The Project website will continue to be updated as the Project moves through the environmental assessment process.

11.4 Stakeholder Database and Mailing List

A stakeholder database was created at the beginning of the Project. During the first open house held on April 22, 2014, visitors were invited to provide their name and contact information (mailing address, telephone and email address) to receive updates on the Project. Since that time, the team has continued to add names of interested people to the Project stakeholder database.

A designated Project team member is tasked with maintaining the database and mailing list. There are currently 240 names on the list. The stakeholders in the database have been identified and grouped according to their interest as they relate to the Project (Table 11-1).

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Table 11-1: Stakeholder Database and Mailing List Categories

Interest Group Category		
Open House Attendees	Mi'kmaq	Elected Officials
CLC Members	Local Fisherman	Government - Federal
Local Residents	Guysborough Inshore Fisheries Association	Government - Provincial
Non-Government Organizations	Media	Businesses

Updates regarding activities associated with the Project (meetings, field studies, reports) are circulated regularly; to date, eight outreach communications have been provided to people and organizations on the mailing list (Table 11-2).

Table 11-2: Stakeholder Outreach Communications

Date	Item	Distribution Method	Approximate Total Distribution
April-09-14	Open House Announcement	Ad in the Guysborough Journal	1,200 people; newsstands, subscribers, businesses
April-14-14	Morien Press Release re: Vulcan and the Project	Newswire / Press Release	>900 Canadian news outlets
April-17-14	Open House Announcement	Canada Post Mail Drop	3,000 households; does not incl farms, business, apartments
April-22-14	Display Boards, Vulcan Presentation Booklets	Hand-outs at the Open House	200+ attendees
April-30-14	CLC Member Solicitation	Ad in the Guysborough Journal	1,200 people; newsstands, subscribers, businesses
July-07-14	Project Fact Sheet	Canada Post Mail Drop	3,000 households; does not incl farms, business, apartments
July-30-14	Summer 2014 Newsletter	Pamphlet in the Guysborough Journal	1,200 people; newsstands, subscribers, businesses
August-27-14	CLC Member List	Ad in the Guysborough Journal	1,200 people; newsstands, subscribers, businesses
Dec-19-14	Frequently Asked Questions	Canada Post Mail Drop	3,000 households not including farms, business, apartments
Jan-13-15	GCIFA Endorsement	Newswire / Press Release	>900 Canadian news outlets
February 4-15	Winter 2015 Newsletter	Canada Post Mail Drop	3,000 households not including farms, business, apartments

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11.5 Public Information Sessions/Open Houses

The first Open House was held at the Queensport Fire Hall in Guysborough on April 22, 2014. The goal of the Open House was to inform the community about the Black Point Project and the environmental assessment process, and describe anticipated Project timelines. The Open House provided an opportunity for citizens to engage directly with the Proponent's Project team, which included specialists in Health and Safety, Engineering Design, Geology, Environmental Assessment, Quarry Operations and Communication. Two different information sessions (afternoon and evening) were held to accommodate interested visitors. Over 200 people attended the two sessions.

The format was casual, allowing visitors to meet the individual Project team members, ask questions, and voice concerns. With over 21 large format information boards on display, Project team members and subject matter experts were on hand to talk about the Project and answer questions. The topics of the information boards are provided in Table 11-3.

Table 11-3: Open House Information Display Topics

Display Board Topics		
Vulcan Materials Company	Marine Terminal	Federal EA Process
Morien Resources Corp.	Aggregates Explained	Existing Environment
Black Point Quarry	Aggregates Market	Safety
Maps – Project Location	Project Benefits	Land Management
Aggregates Mining Process	Project Schedule	Environmental Stewardship
Production Plan	Information & Engagement	Geology

At the Open House, visitors were asked to sign-in and provided an opportunity to sign-up for future updates on the Project. At one information display board and table, visitors were invited to volunteer to serve of the Project Community Liaison Committee (CLC). During the Open House, comment cards were made available to visitors for future follow-up with the Project team.

In May 2014, a follow-up email was circulated to those who provided their email address requesting confirmation of their interest in receiving updates on the Project as required by the new "anti-spam" legislation, which came into force in early 2014. Project team members continue to meet with stakeholders individually or in groups to provide updates on the Project and answer questions.

An additional Open House has been tentatively scheduled for mid March, 2015, once the EIS report has been submitted and the prescribed comment period is underway.

Additionally, several presentations have been given to various groups interested in the Project. These community presentations are provided in Table 11-4.

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Table 11-4: Community Presentations

Presentation Topic	Group	Date
Black Point Marine Aggregate Quarry Update	Mining Society of Nova Scotia	June 6, 2014
Introduction to Vulcan Materials and the Project	Strait of Canso Superport Days	July 10, 2014
Project Introduction and Jobs in the Mining Industry	Fanning Academy, grades 9-12	October 16, 2014
Geology Presentation	Fanning Academy, 4th grade	October 16, 2014
Project Introduction and Jobs in the Mining Industry	Guysborough Academy, grades 9-12	October 28, 2014
Geology Presentation	Guysborough Academy, Middle School	October 28, 2014
Introduction to Vulcan Materials and the Project	Geology Matters Conference, NS Department of Natural Resources	November 13, 2014
Introduction to Vulcan Materials and the Project	Strait Area Chamber of Commerce	December 2, 2014

11.6 Interviews

The Proponent has been asked by several media outlets to provide comment or updates on the Project. Table 11-5 lists the interviews conducted to date.

Table 11-5: Media Interviews

Interview Topic	Media Outlet	Date
Media call; quote, general Information	AllNovaScotia.com	April 14, 2014
Media call; interview	Chronicle Herald	April 14, 2014
Radio interview	CBC Information Morning	June 18, 2014
Interview, general information	Chronicle Herald	June 19, 2014
Meeting with publisher; General information	Guysborough Journal	July 16, 2014
Meeting with Editorial Board; General information	Chronicle Herald	August 12, 2014
Media call; quote, general Information	Port Hawkesbury Reporter	September 25, 2014
Interview, GCIFA endorsement	Guysborough Journal	January 12, 2015
Interview, GCIFA endorsement	Chronicle Herald	January 13, 2015
Interview, GCIFA endorsement	Port Hawkesbury Reporter	January 15, 2015

11.7 Newsletters

The Proponent has developed the Black Point Quarry Project Newsletter to provide updates on the Project and to keep interested parties informed about the progress and current/upcoming activities. The first issue of the Black Point Quarry Project newsletter was distributed on July 30, 2014. Referred to as the Summer 2014 Newsletter, the information sheet was emailed to the Project stakeholder database and mailing list, and was distributed by Canada Post that

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same week to residents in Guysborough County. A copy of this issue and all future issues will be available on the Project website.

This inaugural issue announced the beginning of the environmental assessment, provided an anticipated timeline for the assessment and project overview, and described the open house, the Superport Days event and the formation of CLC. Future newsletters will continue to provide readers with important information about the project and key milestones.

The newsletter will be distributed to stakeholders on a semi-annual basis, or when specific project developments warrant an additional newsletter. Copies of the Summer 2014 and Winter 2015 newsletters are included in **Appendix M Attachment 1**.

11.8 Community Liaison Committee

In mid-2014, the Proponent established a CLC to help document community questions and concerns and distribute updates regarding the Project. The overarching objectives of the CLC are:

- to facilitate frank and open communication between the local community and the project team; and
- to provide a forum for the two way exchange of accurate and up-to-date information between the community and the Proponent.

The ultimate, long term objective of establishing the CLC is to protect and enhance the quality of life for all residents and to promote a vibrant and sustainable economic climate in the Municipality of the District of Guysborough.

The Proponent solicited CLC membership at the first Open House in April, 2014 and through a public notice published in the Guysborough Journal. Twenty volunteers expressed interest in participating in the CLC. From that list, eight community members were selected to serve with four Project Team members. The CLC members represent the following communities or groups (Table 11-6):

Table 11-6: CLC Communities and Groups Represented

Canso	The Sipekne'katik Band (formerly the Shubenacadie Band)
Cook's Cove	Antigonish/Guysborough Black Development Association
Phillips Harbour	Director of Economic Development, MODG
Fox Island	District 4 Councillor, MODG
Guysborough	Vulcan Materials Company
Queensport	Morien Resources Corp.

The first CLC meeting was held on August 12, 2014 at the Queensport Fire Hall. Two Co-Chairs were nominated to lead the CLC: Mary Jurcina-Taylor (Canso resident) and Chris Ridgway (Vulcan Materials Company). Atisthan Roach (Vulcan Materials Company) is currently serving as secretary for the CLC.

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During the first meeting, the CLC discussed their Terms of Reference (TOR) and frequency of meetings. The TOR was agreed upon, and CLC meetings were determined to take place quarterly, or when specific project developments warrant. The second CLC meeting was held on October 15, 2014 at the Queensport Fire Hall. The next CLC meeting is tentatively scheduled for mid-March, 2015.

A copy of the TOR is included in **Appendix M Attachment 2**.

11.9 Government and Agency Consultation

The Black Point Quarry Project team has been consulting with government officials and regulators (municipal, provincial, and federal), both formally and informally, on an ongoing basis. The objective of these consultations is to provide information and updates on the Project and the environmental assessment, and also to receive input and guidance as appropriate. The CEA Agency and the following federal Regulatory Authorities have been consulted both before and since filing of the Project Description:

- CEA Agency
- Transport Canada (TC)
- Fisheries and Oceans Canada (DFO)
- Environment Canada (EC)
- Natural Resources Canada (NRCan)
- Health Canada (HC)

There have also been on-going meetings with the provincial Department of Environment and the Department of Natural Resources to keep them apprised of Project developments and solicit input into study design.

These consultations have involved one-on-one meetings, telephone conversations, and e-mail correspondence. Issues and concerns identified during these meetings are presented in greater detail within the EIS.

11.10 Other Group Meetings

Please see **Appendix M,** Attachment 4 for a full list of consultation and outreach events.

Guysborough County Inshore Fishermen's Association

The Guysborough County Inshore Fishermen's Association (GCIFA) is considered a key local and regional stakeholder group with direct and ongoing interest in the Project. Given this, a series of meetings and information exchanges were held with GCIFA representatives to learn about fishermen and fishing activity in the area and to provide information regarding the Project to the GCIFA. The GCIFA was extremely helpful in putting Project team members in touch with local fishermen, and in facilitating meetings by offering meeting space and communicating meeting opportunities to fishermen. Although the GCIFA provided useful information to the Project team, their representatives underlined the fact that the fishermen "speak for themselves", rather than exclusively through the Association.

Concerns expressed and issues raised by the GCIFA and local fishermen are summarized in Table 11-7.

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Meetings with Fishermen

Based on information provided at the April Open House and with the help of the GCIFA and local residents, the Project Team compiled a list of fishermen most likely to be interested in the Project and its potential effects on commercial fishing. Sit down meetings with local fishermen were held on several occasions as summarized in Table 11-6. The overall objective of the meetings was to meet the fishermen, introduce the Project and some of its team members, and discuss / document questions and concerns with respect to commercial fishing. The meetings were intended to initiate a dialogue with fishermen that will continue as more information becomes available with respect to Project design, layout and day to day activities at the site. The ultimate objective was to identify fishermen concerns so they could be addressed within the EIS report.

Table 11-7: Issues and Concerns Raised by People in the Commercial Fishing Industry

People in the Commercial Fishing Industry

Event	Date	Comment Source	Made To	Comment, Question or Concern
Letter to CEAA	24-Mar-14	Thomas Grover WT Grover Fisheries Ltd.	CEAA	• Supportive of the Project.
Letter to CEAA	27-Mar-14	Eugene O'Leary, President Guysborough County Inshore Fishermen's Association	CEAA	• Requests additional consultation. • Notes Project Description inaccurately describes local fishing conditions. • Expresses concerns regarding displacement of fishermen, silting and noise. • Supportive of project but not at the cost of the fishing industry.
Meeting	8-Apr-14	Ginny Boudreau, Manager Guysborough County Inshore Fishermen's Association	Proponent	• Concerns expressed regarding potential impacts to lobster, shrimp, and ground fisheries. • Concern raised regarding increased traffic and displacement from fishing grounds around shipping lanes. • Concerns expressed regarding potential shipping impacts to shrimping activities. • Tentatively supportive of the Project. • Questioned the setback distance from the terminal (where no fishing will be permitted). • Concerns expressed regarding the effects of blasting on fish – mainly lobster. • Questioned the effects of siltation runoff on lobster fishing. • Questioned if the Proponent will offer training courses to local workers. • Questioned if "foreign workers" will be used at low wages instead of local workers.
Letter	14-May-14	William Bond, Fisherman	CEAA re Draft Guidelines	• Concerns expressed regarding the guidelines: ○ lack of detail regarding the marine environment ○ fisher compensation ○ monitoring of environmental effects ○ biomass of aquatic species as baseline information ○ impacts to marine waterfowl migration patterns ○ baseline data regarding invasive species (zebra mussels and green crab) ○ monitoring and company mitigation should new invasive species be discovered ○ effects of silt run off ○ effects of severe weather on project infrastructure.
Meeting	29-May-14	Ginny Boudreau, Manager Guysborough County Inshore Fishermen's Association	Proponent	• Concerns expressed regarding: ○ increased traffic and the location of increased traffic ○ new buoy/markers ○ how ships will affect existing fisheries as they leave the shipping lane ○ siltation

People in the Commercial Fishing Industry

Event	Date	Comment Source	Made To	Comment, Question or Concern
Meeting	16-Jul-14	David Murphy, Fisherman	Proponent	• Concern expressed that the Project will not consult with other fishers who are permitted to fish within LFA 31a.
Meeting	16-Jul-14	Jerry Creamer, Fisherman	Proponent	• Concerns expressed regarding: ○ coal dust from ongoing transfer operations ○ invasive species in ballast water ○ potential displacement of shrimp and scallop fishermen
Meetings	17-Jul-14	Fishermen: Kenny Snow, Alan Newel, Bob Anderson, Tom Anderson, Steve Mead, Billy Bond, Basil Dobson, Ben Hensbee, Dave Murphy, Allan Hensbee, Thane Jameson	Proponent	• Questioned if dust from off-loading will cause siltation on nearby lobster beds. • Questioned the amount of silt that will be discharged (in storm water or process water) and how far the tides and currents will disperse the silt. • Questioned the effect of ships leaving the shipping lane to access the marine terminal on shrimp and scallop fishers. • Questioned the amount of lobster fishing grounds to be lost. • Questioned the size of the exclusion zone or "off limits zone". • Questioned the cumulative traffic effects of additional ships combined with new ships when the new container terminal starts up. • Concerns expressed regarding the effects on fishing from additional noise, displacement of fishers and loss of gear. • Questioned how ballast water from ships will be addressed. • Questioned the management of new invasive species from ballast water. • Questioned the cumulative effects of new invasive species from ballast water (two years from now, five years, ten years). • Questioned the effect of blasting and vibration on lobster and if blasting will push them offshore. • Questioned if blasting will cause the female lobster or snow crab (or other egg carriers) to drop their eggs early. • Questioned the assurances or guarantees that can be given that the Project will not destroy the Bay or their livelihood with explosives by scaring away or changing the behaviour of these species. • Concerns expressed regarding mackerel and squid being diverted by noise and vibrations from blasting. • Concerns expressed regarding the displacement of fishers onto other fishers as the area is reportedly fully fished with little room for displacement. • Questioned if the shipping lane can skirt a depression off of Black Point that extends for several kilometres, as it has a muddy bottom and is very good for shrimp fishery, and come parallel to the shoreline to avoid the prolific shrimp grounds.
Meeting	13-Aug-14	Fishermen: Garth Meade, Jim Meade	Proponent	• Appreciative of Proponent's efforts to meet with them. • Questioned if the dates and times of ship arrival and departures could be posted.

People in the Commercial Fishing Industry

Event	Date	Comment Source	Made To	Comment, Question or Concern
Meeting	15-Oct-14	Fishermen: Kevin Horne, Howard Jack, Alan Newel, Bob Anderson, Basil Dobson, Allan Hensbee; Others: Eugene O'Leary, Ginny Boudreau, Sara Delory (GCIFA)	Proponent	• Discussion of proposed shipping routes; one preferred route was selected by the fishermen present • Discussion of the marine terminal and probable exclusion zone; • Discussion of nearby areas suitable for the creation of new lobster habitat • Discussion of mackerel behaviour with respect to A. Newell's traps in Indian Cove – will the terminal interrupt their movement along the shore? • Discussed training requirements for workers at the quarry • Discussion of sedimentation, effects of blasting, bilge water disposal
Meeting	12-Jan-15	Eugene O'Leary, Ginny Boudreau, William Bond, Roger Williams, Patricia Rhynold, Duncan Bellefountaine	Proponent	• Update on the Project • Letter of endorsement from the GCIFA

Door to Door Meetings

Although many residents attended the first Open House in April, 2014, the Proponent was not entirely sure that all of residents nearest to the Project site were able to attend that event. To help ensure the these residents had the opportunity to learn about the Project, pose questions, express concerns, and contact the Project team specialists if needed in the future, two Project team members (Mike MacDonald, Morien Resources and Russell Dmytriw, SLR Consulting) went door-to-door along Half Island Cove Road, Upper Fox Island and Fox Island Main during the week of July 14, 2014. In total, 17 of 25 addresses were visited and face-to-face meetings held. Of the 8 unvisited residences, 4 occupants were not home while 4 addresses were not occupied (i.e., for sale or apparently abandoned).

Residents typically expressed support for the Project, especially with respect to job opportunities for local residents and their children. At the same time, a certain degree of frustration was expressed at the perceived slow pace of development. Other residents were neutral or indifferent, neither positive nor negative towards the proposed Project. In several instances, discussions were more detailed; certain residents posed a number of questions regarding project effects to the local environment, water quality, ambient noise conditions and other subjects. Project team members responded to questions and followed up with additional information by email where needed. In all cases, residents who expressed concerns were open minded and interested in learning more about the Project. Concerns expressed and issues raised by local residents are summarized in Table 11-8.

Other concerns and questions have been raised curing Proponent outreach events by people who are not residents of the immediate vicinity of the Project. These events and the subjects discussed are presented in **Appendix M Attachment 4.**

Table 11-8: Issues and Concerns Raised by Residents in the Project Vicinity

Residents in the Project Vicinity (Names omitted to ensure privacy)				
Event	**Date**	**Comment Source**	**Made To**	**Comment, Question or Concern**
Open House	22-Apr-14	Local residents (2 people)e	Proponent	• Supportive of the Project.
Meeting	16-Jul-14	Residence #1 (2 people)	Proponent	• Supportive of economic development in the area. • Questioned the effect of the quarry on their water well. • Questioned the chemicals that might be left in the groundwater and the harmful effects they can cause in drinking water. • Concern expressed regarding the level of noise they will hear. • Concern expressed regarding dust generated at the quarry.
Meeting	16-Jul-14	Residence #2 (2 people)	Proponent	• Supportive of the Project.
Meeting	16-Jul-14	Residence #3 (1 person)	Proponent	• General discussion, neither positive nor negative.
Meeting	16-Jul-14	Residence #4 (1 person)	Proponent	• Supportive of the Project.
Meeting	16-Jul-14	Residence #5 (1 person)	Proponent	• Supportive of the Project.
Meeting	16-Jul-14	Residence #6 (2 people)	Proponent	• Supportive of the Project.
Meeting	16-Jul-14	Residence #7 (2 people)	Proponent	• Supportive of the Project.
Meeting	16-Jul-14	Residence #8 (2 people)	Proponent	• Supportive of the Project. • Provided information regarding tuna fishing by non-residents.
Meeting	16-Jul-14	Residence #9 (1 person)	Proponent	• Generally supportive of the Project.
Meeting	17-Jull-14	Residence #10 (1 person)	Proponent	• Questioned the potential for siltation in Indian Cove. • Concerns expressed regarding quarry noise. • Concerns expressed regarding the level of ship noise. • Questioned the effect on property values.
Meeting	17-Jul-14	Residence #11 (1 person)	Proponent	• Concerns expressed regarding transparency during expropriation. • Questioned the number of Proponent's employees compared to local hires. • Questioned the Proponent's commitment to sustainability and the local community. • Concerns expressed regarding ballast water and invasive species.
Meeting	17-Jull-14	Local Business (1 person)	Proponent	• Concerns expressed regarding noise generated at the quarry. • Concerns expressed regarding the effect on her well water.
Email	31-Jul-14	Residence #12 (2 people)	Proponent	• Thanked the Proponent for the update.

11.11 Engagement of Aboriginal Communities

11.12 Strategy and Objectives

The Proponent understands that it is the duty and responsibility of the Crown to consult with First Nations regarding matters related to the impact development projects may have on the Treaty and Aboriginal Rights of the Mi'kmaq, and that these responsibilities are met through direct consultations between the Nova Scotia Office of Aboriginal Affairs and the Kwilmu'kw Maw-Klusuaqn (KMK) Negotiations Office. The Proponent is also cognizant that there are several international, national, and provincial protocols and procedures that aim to advance First Nation involvement in environmental management and promote cooperation between project proponents and Aboriginal communities in Nova Scotia. As a result, the Proponent has undertaken several measures to identify the concerns of Mi'kmaq communities, through their designated representatives, about potential adverse effects or the environmental effects of the Project, and to promote Mi'kmaq involvement in the Project. Similar to other development initiatives in Nova Scotia, The Proponent has taken direction from "A Proponent's Guide to Environmental Assessment," and "Proponents' Guide: Engagement with Mi'kmaq of Nova Scotia," in developing its strategies and objectives (NSE 2014; NSOAA 2009).

The Proponent has also taken a more proactive approach by following the principles of Free, Prior and Informed Consent as presented and discussed within the United Nations Permanent Forum on Indigenous Issues. To this end, the Proponent has addressed early engagement with the Mi'kmaq community in Nova Scotia as a priority and has developed an Aboriginal Community Engagement Strategy, which commenced several years prior to the filing of the Project Description with in February 2014. The premise of the engagement strategy is that, through effective engagement, the Proponent can establish an effective relationship with Mi'kmaq communities and organizations. The Proponent's objectives were to:

- inform Mi'kmaq communities about its proposal;
- solicit information on the Mi'kmaq issues and concerns with respect to the proposed Project; and
- identify ways and means for Mi'kmaq engagement in the planning process and approaches to a mutually beneficial Project implementation.

Based upon a preliminary assessment of the Project location and the known activity of Mi'kmaq communities in Nova Scotia, several communities and Mi'kmaq organizations were identified as potentially affected and/or having a direct interest in the Black Point Quarry Project. These communities (shown on **Figure 6.8-1**) and organizations are listed in Table 11-9.

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Table 11-9: Key Mi'kmaq Communities

Category	Communities/Organizations
Mi'kmaq communities	Paqtnkek First Nation Potlotek First Nation Millbrook First Nation Sipekne'katik First Nation
Mi'kmaq organizations	Assembly of NS Mi'kmaq Chiefs Kwilmu'kw Maw-Klusuaqn (KMK) Negotiations Office KMK Benefits Committee Sipekne'katik Negotiations Office
Provincial organizations	Nova Scotia Office of Aboriginal Affairs

11.13 Engagement Strategy and Activities

As noted above, the primary objectives of the Mi'kmaq engagement strategy are to establish a positive collaborative working relationship with the Mi'kmaq of Nova Scotia, and to identify potential issues of concern to the Mi'kmaq communities or their representatives that could potentially cause negative effects on the Mi'kmaq if not addressed. To achieve these objectives, The Mi'kmaq Community Engagement Strategy for the Black Point Quarry Project involves a series of engagement activities that include:

- face to face contacts with Chiefs and Council representatives;
- presentations/meetings with communities;
- presentation at regional Tribal Council/Provincial Tribal Organization meetings;
- frequent telephone and email communication;
- letters of notification of EA;
- MEK Study;
- tours of the Project site on three occasions; and
- telephone interviews with Band Fishery Managers with members holding communal commercial licenses in the area.

The engagement activities that have taken place to date are listed in Table 11-10. In addition invitations to all Public meetings/Open House events (Section 11-3) were sent to representatives of the Mi'kmaq communities identified in Table 11-9 above.

Table 11-10: Engagement Activities

Mi'kmaq Community Engagement Activities	Date
Face to Face Contacts with Chiefs	
Paqtnkek	Oct 12, 2010 (initial meeting with Chief)
Millbrook	Mar 21, 2011 (initial meeting with Band Manager) May 7, 2014
Sipekne'katik	Jun 18, 2014 Aug 12, 2014 (site visit)
Presentations / Meetings with Communities	
Sipekne'katik Band Council	Jun 17, 2014 Aug 11, 2014 Aug 12, 2014 (site visit)
Presentation at regional Tribal Council/Provincial Tribal Organization Meetings	
KMK staff	Oct 13, 2011 (initial meeting with CEAA) Nov 21, 2011 Sept 20, 2013 (with CEAA) Mar 11, 2014 May 27, 2014 Jun 18, 2014 (site Visit)
KMK - Benefits Committee	Sep 10, 2014
Assembly of NS Chiefs	Through KMK
Site Visits	
J. Walsh, M. Nevin	18 June, 2014
J. Copage, I. Knockwood, J. MacDonald	August 12, 2014
Chief W. Marshall, K. Prosper	October 27, 2014

Finally, the Proponent has requested to present the Environmental Impact Statement report to the Assembly of Nova Scotia Chiefs and agreed to set up a web-based portal through which Mi'kmaq Communities can provide direct comment on the documents.

The Guidelines for the EIS were issued on June 9, 2014 (CEA Agency 2014). The Kwilmu'kw Maw-klusuaqn Negotiation Office provided comments which were forwarded to the Proponent for review and response, where applicable. The comments are presented in summarized form in Table 11-11.

Table 11-11: Key Comments and Issues Raised by Mi'kmaq Communities

Subject Area	Comments/Concerns/ Suggestions	Study Team Responses/Actions
Opportunities (Economics, Training, Other)	Seeking engagement in accordance with Proponents Guidelines, issued by the NS Government	Initiated communication with Chiefs and KMK; made commitments in a draft MOU pertaining to development of long-term relationship and provision of Project benefits.
	Potential for collaboration and employment	Negotiation of collaborative benefits agreement.
	Potential for training and skills development	Including training in negotiation of benefits agreement.
	Potential for support for KMK operations	MOU includes negotiation of support to facilitate development of benefits agreement.
Planning Process	MEK Study	MEKS updated and submitted for review.
	Environmental protection	Providing opportunity for direct review of the EA document (made presentation and provide means to facilitate

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Subject Area	Comments/Concerns/ Suggestions	Study Team Responses/Actions
		feedback).
Review of EIS Guidelines/KMK meetings	Request internal review of MEKS	Agree. A copy of the MEKS has been provided for review and comment.
	Concerns for fish, fish habitat, and Mi'kmaq fisheries	A MEKS has been prepared as part of the EA process. This includes a discussion of potential effects on fishing. The Proponent's' engagement program with Mi'kmaq communities has addressed potential project-related effects and establishes commitments for effects management and communication.
	Identified concerns for archaeological assessment	A MEKS and archaeological assessments have been prepared as part of the EA process. This includes a discussion of potential effects on archaeological sites. The Proponent' engagement program with Mi'kmaq communities also addresses potential project-related effects and establishes commitments for archaeological fieldwork and documentation. In addition the Proponent has committed to a separate site visit being undertaken with a qualified Mi'kmaq archaeologist prior to project implementation
	Kwilmu'kw Maw-klusuaqn Negotiation Office may coordinate Mi'kmaq representation in CLC.	The Proponent has established a CLC and invited Mi'kmaq community to be represented (Sipenkne'katik is represented).
	Identified expectations for impact benefits agreement.	The Proponent has commenced and will continue to engage Mi'kmaq communities in the Project's planning and development process. As such The Proponent is in the process of negotiating with the Kwilmu'kw Maw-klusuaqn Negotiation Office a comprehensive Cooperation Agreement.
Consultation and Engagement	Crown responsibilities and activities regarding consultation with Mi'kmaq communities about the Project.	Maintaining direct dialogue with Mi'kmaq organizations and communities without prejudice. Maintaining arm's length discussions with Office of Mi'kmaq Affairs.
	Distinction between Crown Consultation and Proponent Engagement.	Proponent is ensuring Project staff is not directly involved in negotiations between NS Government and Mi'kmaq negotiators.

11.14 Identified Issues and Concerns

As described above, preliminary meetings with the KMK Benefits Committee, and the Sipekne'katik Band Council, have been held. Presentation materials used during these initial contacts are provided in **Appendix M Attachment 3** while issues and concerns identified are summarized above in Table 11-11. Based on discussion during these engagement sessions, there is a general understanding between The Proponent and Mi'kmaq communities that the engagement process will continue to facilitate open dialogue on matters related to First Nations interest regarding environment and economic development.

11.15 Memorandum of Understanding (MOU)

The Proponent is in negotiations to conclude a MOU with the Assembly of Nova Scotia Chiefs through the KMK Benefits office and a separate MOU is being negotiated with the Sipekne'katik First Nation. The purpose and focus of these MOUs is to guide ongoing discussions regarding

collaborative benefits agreements (CBAs) between the Proponent and Mi'kmaq communities. Discussions have been ongoing since spring, 2014 and are proceeding in an open and constructive manner.

11.16 Engagement Following EIS Submission

The Proponent has committed to an ongoing relationship with the Mi'kmaq of Nova Scotia. In accordance with the terms of the MOU, the focus of engagement activities in the short-term will be the conclusion of the CBA. This Agreement will provide the foundation for continued engagement activities that will meet the spirit and intent of the MOU, namely, to cooperate with each other with respect to the Project on the basis of equality, reciprocity and mutual benefit. Future engagement activities will be coordinated through specifically designated contact persons, and through the Mi'kmaq Representatives on the Community Liaison Committee (CLC).

The Proponent will make presentations to update the Assembly of NS Chiefs, or their designated committees, on the Project from time to time. Mi'kmaq communities are also represented on the CLC and as such will be regularly involved in the discussion of Project planning and implementation with The Proponent and other community representatives.

The Proponent has also reserved seats on the Community Liaison Committee for representatives from both the KMK and the Sipekne'katik First Nation. This participation is expected to foster greater participation in the project both through bilateral processes under the CBA, and through community level activities in collaboration with participants from the community of Guysborough.

11.17 Issues Identified by Other Stakeholders

The Proponent has communicated with members of the public and stakeholders to provide updates on the Project and receive feedback regarding key issues or concerns. As described above the Proponent has met with individuals and groups to better understand issues and information to be considered during the environmental assessment. Contacts have been made either as face-to-face meetings, telephone conversations, and email correspondence. Key outreach events (meetings, telephone calls, emails, etc.) are provided in **Appendix M Attachment 4**. A summary of key comments and concerns is provided in Table 11-12.

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Table 11-12: Comments and Issues Raised by Other Interested Parties

Other Interested Parties

Event	Date	Comment Source	Made To	Comment, Question or Concern
Email to CEAA	13-Mar-14	Tanner Welsh	CEAA	• Supportive of project. • Concerns expressed regarding increased land and sea traffic, noise pollution and silt runoff.
Letters to CEAA	22-Mar-14	89 People	CEAA	• Supportive of the Project.
Letter to CEAA	24-Mar-14	Warden Vernon Pitts (MODG)	CEAA	• Supportive of the Project.
Letter to CEAA	24-Mar-14	Harold Roberts, President CADA	CEAA	• Supportive of the Project.
Letter to CEAA	24-Mar-14	Tom Gunn, Principal Strait Area Campus, NSCC	CEAA	• Supportive of the Project.
Letter to CEAA	27-Mar-14	H. Basil Mattie, P. Eng	CEAA	• Supportive of the Project.
Letter to CEAA	27-Mar-14	R. Bruce MacKeen, Campbell & MacKeen	CEAA	• Supportive of the Project.
Letter to CEAA	31-Mar-14	Michele McKenzie	CEAA	• Concerns expressed regarding impacts to sustainable tourism.
Letter to CEAA	undated	Heather Cross, Hydrogeologist	CEAA	• Referenced concerns and made recommendations for EIS Guidelines: • dust emissions • radon monitoring • water quality and management • stream monitoring • impacts to stream and lake baseflow & aquatic life • Referenced sea water intrusion into the pit, sea level change, dewatering, bench slopes & stability, reclamation, storage tanks, organic stockpiles, ARD, storm water management, contingency plans, Pre-Blast Survey and offsite groundwater study. • Recommended hydrogeologic study components, geological assessment, aquifer characterization, modelling and water quality/quantity monitoring.
Letter to CEAA	2-Apr-14	Sean Kirby Mining Association of Nova Scotia	CEAA	• Supportive of the Project.
Email	19-Apr-14	Michael Hendsbee	Proponent	• Concerns expressed regarding traffic noise.
Open House	22-Apr-14	Donald Green	Proponent	• Questioned if union workers will be used at the quarry.

Other Interested Parties

Event	Date	Comment Source	Made To	Comment, Question or Concern
Open House	22-Apr-14	David Hochman	Proponent	• Supportive of the Project.
Open House	22-Apr-14	Unknown	Proponent	• Suggested that Proponent contact local Nova Scotia Community College (Port Hawkesbury) to align workforce.
Open House	22-Apr-14	Joe Murphy	Proponent	• Questioned if he can continue to trap on the property over the short term.
Open House	22-Apr-14	Frank Fogarty	Proponent	• Questioned what would happen to human remains if they are found on the expropriated Fogerty Property.
Open House	22-Apr-14	Bill MacMillan	Proponent	• Supportive of the Project. • Stated he would like to discuss support for a coastal trail with the Proponent.
Open House	22-Apr-14	Jerry Creamer	Proponent	• Supportive of the Project.
Report	6-May-14	Frank Fogarty	CEAA re: Draft Guidelines	• Concerns expressed, in Fogarty Family EIS Response, regarding: • air pollution • noise • light • protected species • fisheries • recreational boating • vegetation loss • wetland loss • beach loss • wildlife loss • permanent change in land use • loss of family heritage resources • disturbance of human remains • lack of local economic benefits • difficulty in rehabilitating the site • lack of communication prior to expropriation
Email	6-May-14	June Jarvis	CEAA re: Draft Guidelines	• Concerns expressed regarding the potential negative effects of on-site and downstream wetlands and water features and the ecology supported therein.
Post Card	22-May to 27 May	Post Cards from 33 citizens	CEAA re: Draft Guidelines	• Expressed concerns through the submission of post cards with a series of items that could be "checked" to indicate concern • Concerns include: Destruction to Flora, Destruction to Fauna, Proximity to Watershed Lands, Potential Destruction to Artifacts, Damage to Fisheries, Encroachment on

Other Interested Parties

Event	Date	Comment Source	Made To	Comment, Question or Concern
				Beach
Email	22 May-14	Cindy Davidson	CEAA re: Draft Guidelines	• Expressed concern regarding physical appearance of quarry ("eyesore")
Email	23-May-14	Heather Cross, Hydrogeologist	CEAA re: Draft Guidelines	• Recommended that the following items be considered: • 200-year flood event • extreme precipitation events • additional geological references • dewatering and seawater intrusion should the quarry extend below sea level • reclamation plan
Email	26-May-14	Garnet Rogers	CEAA re: Draft Guidelines	• Concerns expressed regarding: • negative effects on wildlife and fisheries • toxic runoff • loss of historical artifacts • damage to local roads • loss of tourism • out-sourcing of jobs • potential tax-funded clean up upon closure.
Social Media Post	26-May-14	Garnet Rogers	Proponent	• Concerns expressed regarding: • expropriation • destruction of road • permanent impact on fragile ecology and fishery • massively toxic runoff that will impact inshore fishery and water table • unspecified impacts to Mi'kmaq and their artifacts • jobs being outsourced • impacts on real long terms jobs and tourism • creation of "toxic and filthy mess" • "massive and catastrophic impacts to health and environment, etc."
Email	27-May-14	Diana Wallis	CEAA re: Draft Guidelines	• Concerns expressed regarding: • loss of pristine environment • loss of local tourism business and related employment • noise
Letter	28-May-14	G. Fitzgerald, Director Sierra Club Atlantic	CEAA re: Draft Guidelines	• Concerns expressed regarding significant and irreversible impacts to: • fish and fish habitats

Other Interested Parties

Event	Date	Comment Source	Made To	Comment, Question or Concern
				• aquatic life • migratory birds • traditional use of the land by Mi'kmaq people • Species at Risk • wetlands • cultural heritage • Concerns expressed locally regarding the implications of the project on the environment and community values.
Letter	28-May-14	J. West Geoscience Coordinator and J. Graham Coastal Coordinator, Ecology Action Centre (EAC)	CEAA	• Requested a Review Panel due to potential impacts to: • marine and coastal ecosystems • freshwater • wetlands • wildlife • fish • existing and emerging fisheries • tourism and communities • Stated that the EAC is not necessarily opposed to a quarry in this area, but want to ensure that it brings the most long term benefits to the community, the region, and the environment. • EAC acknowledged the need for job creation.
Letter	28-May-14	Gretchen Fitzgerald, Sierra Club Atlantic	Ministers Aglukkaq and Delorey; CEAA	• Requested a Review Panel and comments to the Draft Guidelines.
Facebook Post	8-Jun-14	Various	Proponent via public posting	• Concerns expressed regarding: • perceived lack of due process during expropriation • dust • air quality • aggregate trucking • exaggerated employment claims • inadequate Nova Scotia air quality regulations • Proponent interaction with community
Email	9-Jun-14	Frank Fogarty for the Fogarty Family	CEAA	• Concerns expressed regarding perceived environmental effects on: • flora

Other Interested Parties

Event	Date	Comment Source	Made To	Comment, Question or Concern
				• fauna • wetlands • Fogherty Lake • beach • noise pollution • light pollution • generation of dust particles
Email	9-Jun-14	F. Fogarty	CEAA re: Draft Guidelines	• Requested a Panel Review. • Concerns expressed regarding effects on: • flora • fauna • wetlands • Fogherty Lake • beach • noise pollution • light pollution • dust • negative visual aesthetics
Email	17-Jun-14	Garnet Rogers	CEAA	• Concerns expressed regarding effects perceived impacts to: • groundwater • fishery • air quality • water storage and treatment • fishing industry • feeding and migration (whales, blackfish, seals) • dust • Concerns expressed regarding: • use of local union workers • OSHA standards • Mi'kmaq consultation • secrecy & transparency • compensation • tourism

Other Interested Parties

Event	Date	Comment Source	Made To	Comment, Question or Concern
CBC Radio Interview	17-Jun-14	James Fogarty	Proponent via public radio	• Concerns expressed regarding: • expropriation • lack of forewarning of expropriation • lack of due process • ongoing work at the site
Newspaper Article	26-Jun-14	Eva Hoare with quotes from the Fogarty Family	Proponent via newspaper article	• Concerns expressed regarding: • a lack of warning regarding expropriation • inflated job expectations • conflict of interest • remediation costs to taxpayers • impacts to tourism (Fogarty family) • petroglyph survey (KMK) • harvesting, fishing and archaeological resources (Sidney Peters, co-chair Assembly of NS Mi'kmaq Chiefs) • impacts to fisheries (GISFA)
Newspaper Article	27-Jun-14	Editorial	Proponent via newspaper article	• Stated unfairness of the Nova Scotia Expropriation Act.
Newspaper Article	28-Jun-14	Garnet Rogers	Proponent via newspaper article	• Concern and suspicion expressed regarding the offer from MODG (G. MacDonald) to meet and explain expropriation process in more detail.
Letter	30-Jun-14	John Pettipas, Pettipas Market, Auld's Cove	Proponent via letter to the newspaper	• Disagreed with G. Rogers' critical letter. • Stated that in his experience, the nearby Auld's Cove quarry is "exceptionally safety conscious" and has an excellent safety record. • Stated the Auld's Cove quarry provides good paying jobs with benefits and is a substantial contributor to the local economy.
Newspaper Article	2-Jul-14	Helen Murphy	Proponent via newspaper article	• Refuted errors contained in the Chronicle Herald article dated June 26, 2014.
Letter	16-Jul-14	Garnet Rogers	Proponent via letter to the newspaper	• Concerns expressed regarding: • unfairness expropriation • lack of public knowledge in Canso about the project • impacts to tourism • remediation costs to taxpayers

Other Interested Parties

Event	Date	Comment Source	Made To	Comment, Question or Concern
				• inflated job estimates • use of temporary foreign workers • erroneous compensation figure • lack of transparency from the municipality
Funding Request	29-Jul-14	Paul Ehler, Curator Out of the Fog Lighthouse Museum Half Island Cove	Proponent	• Stated that he found the Open House to be informative and well presented. • Stated he was pleased with Proponent's support of community organizations.
Email	31-Jul-14	Billy Joe MacLean, Mayor of Port Hawkesbury	Proponent	• Supportive of the Project.
Email	31-Jul-14	Grail Sangster, New Harbour	Proponent	• Thanked Proponent for information. • Questioned if the time and location for the community liaison meeting had been established.
Email	31-Jul-14	June Jarvis	Proponent	• Thanked Proponent for information. • Stated that they will be following the process with great interest.
Email	31-Jul-14	Adam Rodgers, President of Strait Area Chamber of Commerce	Proponent	• Supportive of the Project.
Email	31-Jul-14	Sean Kirby, MANS	Proponent	• Supportive of the Project.
Email	31-Jul-14	Gavin Isenor, Dexter Construction Company	Proponent	• Thanked Proponent for information. • Stated that, as a player in the local aggregate industry and President of the Mining Association of Nova Scotia, he was impressed with the Proponent's efforts to engage the community in the Project from the start.
Email	31-Jul-14	Miles MacDonald, MODG, Councillor District #3	Proponent	• Thanked Proponent for information and stated that it was very informative.
Email	31-Jul-14	Don Dixon, Business Representative for Intl. Union of Operating Engineers, Local 721 & 721B	Proponent	• Thanked Proponent for information and stated that they could provide help to promote the Project.
Telephone Call	5-Aug-14	Mrs. Mayola Dobson	Proponent	• Concerns expressed regarding: • dust fallout on her home • noise from blasting • destruction of pristine wilderness

Other Interested Parties

Event	Date	Comment Source	Made To	Comment, Question or Concern
Meeting	12-Aug-14	John Pettipas, Pettispas Market, Aulds Cove	Proponent	• Supportive of the Project.
CLC Meeting	12-Aug-14	C. Cosgrove, MJ Taylor, Ben Hendsbee, Dorian Harnish, Donna Hochman, G. MacDonald, B. George + Ed Parker (DFO) + Ian Knockwood, Jason MacDonald (Shubenacadie Band)	Proponent	• Discussed terms of reference, nominated secretary, discussed follow up meetings, project overview and history, misinformation regarding expropriation, discussed land valuation & expropriation. • Concerns expressed regarding: • project impacts to beach • weather patterns • property values • runoff effects on fish habitat • loss of fish habitat • workforce training • DFO's role
Letter	19-Aug-14	John Pettipas, Pettipas Market, Auld's Cove	Proponent	• Thanked the Proponent for visiting the Market. • Expressed support for the anticipated economic opportunities. • Requested local sourcing of goods and services. • Provided information regarding the Terry Fox fundraising event.
Telephone Call	22-Oct-14	Joe Murphy, Resident	Proponent	• Explained his use of the site for trapping • Enquired how much longer trapping would be possible

11.18 Consultation Following EIS Submission

The Proponent will continue both public and agency consultations throughout the permitting, construction, and operation phases of the Project. Public consultation activities will include the continuation of the CLC, publication of newsletters, and as appropriate, public meetings. Agency consultation activities will focus on implementation of the conditions of environmental assessment approval, as well as requirements for federal, provincial, and local permits. Interactions and results of discussions with the regulatory agencies will be communicated to the public using the Project newsletter as warranted.

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12.0 ENVIRONMENTAL IMPACT STATEMENT CONCLUSIONS

This section summarizes in Table 12-1 the environmental effects assessment presented in this EIS and presents the Proponent's concluding statements with respect to the Project's impacts on the environment and the environment's impacts on the Project.

12.1 Effects of the Project on the Environment

Project effects on the environment were assessed from the probable Project-environment interactions derived for each VC of interest to the different stakeholder groups identified for the Project. The assessment considered the nature of infrastructure required to support the quarry and marine terminal, as well as the activities that will be undertaken during the construction, operation and decommissioning phases of the Project. To the extent possible unforeseen incidents, malfunctions and accidental events were also considered as part of the assessment.

Three types of mitigation measures were applied to reduce or eliminate potential Project-environment interactions:

1. Design measures specifically applied to Project infrastructure before construction;
2. Standard, proven industry best management practices for industrial construction and operation in the marine and terrestrial environments; and
3. Site specific oversight, training, control, management and operational mitigation measures.

Following the application of these mitigation measures, residual effects were listed and assessed.

The significance of the residual effects (i.e., those that remain following mitigation) was determined by a commonly used environmental assessment methodology. All residual effects are assessed as not significant, that is, while residual effects are expected, no significant residual effects are predicted. As a result, the Project is not likely to have significant adverse effects on the environment over the short or long terms. A series of monitoring programs are proposed to verify these predictions, meet commitments made in the EIS, comply with regulatory requirements, and help identify unexpected effects that may arise in the future.

In contrast, the Project is predicted to have positive local and regional economic effects in the form of direct and indirect employment opportunities, increased discretionary income in the local economy, royalties paid for extraction of the granite resource and increased tax revenues to various levels of government. A corollary positive benefit results from the increased understanding of the evolving environmental conditions, including the use of the local area by Mainland Moose, that will result from Project-related commitments made as part of the assessment process.

Table 12-1 summarizes the expected effects of the Project, lists the criteria used to determine if an effect is "significant" and describes the mitigation measures for each VC. As the table notes, none of these effects is significant according to the criteria established for their assessment.

12.2 Effects of the Environment on the Project

As required by the EIS Guidelines issued by the CEA Agency and NSE for this Project, the potential effects of the environment on the Project were also evaluated.

The Black Point Quarry will utilize simple, robustly built and commonly employed industrial machinery that is currently found in many different coastal environments around the world. Quarry operations in Nova Scotia do not require unusually specialized equipment or operational procedures. Site equipment including the marine terminal will naturally be designed to account for severe weather events including the changing conditions predicted in worst-case climate change scenarios over the life span of the Project. In this regard, design considerations that include climate change-induced severe events are typically applied to new industrial developments. Given these factors, the effects of the environment on the Project are considered to be insignificant.

It is understood that special consideration must be made to consider the effects of even minor environmental impacts on the rights of Canada's aboriginal peoples. Furthermore, every effort will be made to advance positive project impacts of the human environmental condition of First Nations communities. To this end, the Project will conduct ongoing, formal and routine meetings with representatives from the Mi'kmaq First Nations to identify any such impacts and to determine appropriate mitigations measures. These discussions will be conducted in accordance with the terms established under the Collaborative Benefits Agreements undertaken for this Project.

12.3 Cumulative Effects

This assessment inherently includes an evaluation of the cumulative effects of existing and past projects since these effects are already present in the description of the existing environment. In addition, this assessment considers the cumulative effects from other potential projects that are likely to occur in the foreseeable future. These projects include:

1. Chedabucto Aggregates Quarry Expansion (Halfway Cove, MODG)
2. Goldboro Liquefied Natural Gas Project (Goldboro, MODG)
3. Maher Melford Container Terminal (Melford, MODG)
4. Bear Head Liquified Natural Gas Project (Port Hawkesbury, Cape Breton)

As described in Section 9.3, Shipping and Navigation and Local Economy, Land and Resource Use aspects of the Melford Container Terminal and the Bear Head Natural LNG Projects are expected to overlap with the residual effects of the Black Point Quarry Project Taking into account the basic mitigation measures described in Section 9.3, the residual adverse cumulative effects expected with respect to Shipping and Navigation are predicted to be insignificant. Cumulative effects to the Local Economy, Land and Resource Use are expected to be positive and potentially significant over the medium to long term.

Cumulative effects on First Nations are a special consideration. Some cumulative impacts may result in small changes in abundance or distribution of food resources. This can result in changes in areas of primary hunting activity. While it is expected that there will be no significant impact from the Black Point Quarry, cumulative effects on wildlife and fish in the area will be a matter of routine discussion with Mi'kmaq First Nations as part of the formal and routine

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meetings undertaken during the course of negotiations regarding the Collaborative Benefits Agreements. In other instances the cumulative effects of multiple developments in the region can have a positive impact on the social and economic environment for the Mi'kmaw. It is possible that there could be a positive cumulative impact on the social condition of Mi'kmaq harvesters as multiple projects are undertaken that could provide useful and necessary employment employing Mi'kmaq marine and environmental skills for the mutual benefit of several projects. Every effort will be made to advance these effects through discussion with the Mi'kmaq.

12.4 Conclusions of the Proponent

As progressively described within this EIS, a series of Project-environment interactions can be expected during the construction, operation and decommissioning of the Black Point Quarry Project. These interactions and their resulting effects on the environment are entirely consistent with and typical of environmental impacts of natural resource development projects in Nova Scotia and elsewhere in Canada. For many reasons the Project site is well suited for a quarry operation. The large, chemically stable granite resource is not used as a potable water supply, the nearest residential properties are not situated at the property boundary but rather hundreds or thousands of meters away, the quarry face is directed across open water rather than toward residential development, the resource is located near a deep water, ice free shipping route to a major commercial market, prime fishing areas can be avoided or in the case of lobster habitat occupied by the marine terminal, can be recreated through offset compensation measures in the immediate vicinity, etc.

Given these considerations and a number of others, the Proponent concludes that the Project is not likely to result in any significant adverse environmental effects. In contrast, the Black Point Quarry Project is expected to result in long term direct and indirect employment opportunities, in addition to other positive economic benefits for the local, regional and provincial economies.

Table 12-1: Summary of Residual Adverse Effects, Significance Thresholds, Significance of Residual Effects

VC and Residual Adverse Effects	Threshold for Determination of Significance	Significance of Residual Adverse Effect
Air Quality and Climate Change		
Fugitive dust emissions from site preparation, quarrying, crushing, stockpiling, vehicle traffic and off loading	An exceedance of the Nova Scotia or CCME ambient air quality standards at a residential or commercial location outside the property boundary, where the exceedance is due to emissions from the operation and the event occurs more than twice in the period of time that the standard is based	Not Significant
Emissions of fuel combustion products from site vehicles and generators	As above	Not Significant
Noise (Terrestrial)		
Ambient noise perceived by residents living around the site during construction (road building, vehicle traffic, blasting, crushing, marine terminal construction)	An exceedance of the maximum noise or vibration limits listed in the *Pit and Quarry Guidelines* at or beyond the property boundary, where the exceedance is due to noise from the operation and the event occurs more than twice in the period of time that the standard is based.	Not Significant
Ambient noise perceived by residents living around the site during operation (blasting, loading, crushing, screening, offloading)	As above	Not Significant
Ambient Light		
Increased ambient light from the Project construction and operation, including operation of the marine terminal	Direct light trespass that according to the affected resident regularly interferes with the use and enjoyment of nearby residential properties on a permanent basis.	Not Significant
Attraction or disturbance of nocturnal wildlife and/or migrating birds	Evidence of unacceptable levels of bird mortality associated with Project lighting (mortality or injury of ten or more migratory birds in a single event, or of any number of species at risk birds).	Not Significant
Geology, Soil and Sediment Quality		
Surface water discharge to the marine environment	An accidental release of low pH, acid rock drainage to the marine environment.	Not Significant
As above	An accidental release of total suspended solids in	Not Significant

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VC and Residual Adverse Effects	Threshold for Determination of Significance	Significance of Residual Adverse Effect
	excess of the maximum values listed in the CCME (1999) Water Quality Guidelines for the Protection of Aquatic Life (Marine) and/or the Nova Scotia Pit and Quarry Guidelines (NSEL 1999).	
Groundwater Resources		
Reduction in groundwater recharge to offsite surface water features; changes to groundwater quality	A decrease in groundwater supply to Adjacent Areas by 20% and/or an impairment in water quality such that groundwater discharge to surface waterbodies no longer meets Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (CCME 1999 as updated).	Not Significant
Marine and Surface Water Resources		
Changes to surface water quality	Discharge from the site exceeds the liquid effluent discharge standards in the *Pit and Quarry Guidelines* (NSEL 1999) or criteria listed in the CCME *Canadian Water Quality Guidelines for the Protection of Aquatic Life*, both freshwater and marine (CCME 1999).	Not Significant
Effects on Reynolds Brook and Murphys Lake from diversion of surface and groundwater into the pit over time	A predicted change in the mean annual runoff within any off-site watercourse, or flow into any water body which changes by 20%. A predicted change in peak flow of water discharged from the site which will measurably increase the risk of flooding to downstream watercourses	Not Significant
Terrestrial Ecosystems		
Habitat loss / plant mortality	A decline in abundance and/or a change in distribution beyond which natural recruitment would not return the population to its pre-project level within several (3-5) generations.	Not Significant
Wetlands		
Progressive habitat loss due to Project construction and operation over 50 years	An effect that is likely to cause a permanent net loss of wetland function as established during the wetland evaluation.	Not Significant following compensation
Changes to wetland hydrology and water quality resulting in habitat loss	As above.	Not Significant
Terrestrial Wildlife		
Habitat loss / fragmentation	An effect that causes a decline in abundance and/ or	Not Significant

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VC and Residual Adverse Effects	Threshold for Determination of Significance	Significance of Residual Adverse Effect
	a change in distribution beyond which natural recruitment would not return the population to its pre-project level within several (three to five) generations	
Wildlife disturbance	As above	Not Significant
Disturbance of seabirds and waterfowl	As above	Not Significant
Freshwater Species and Habitat		
Effects on Reynolds Brook from diversion of surface and groundwater into the pit over time	A permanent, irreplaceable loss of Freshwater Species and Habitat that are part of or support a commercial, recreational or Aboriginal fishery.	Not Significant
Marine Species and Habitat		
Temporary noise and vibration effects to marine biota	1. Adverse and irreversible changes to critical habitats; 2. Serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish species that support such a fishery; 3. Permanent impairment of the ecological functioning of the biotic community; and/or 4. Increased ecological risk to a level that long term effects to the health of aquatic biota is predicted.	Not Significant
Permanent loss of habitat resulting from the construction and operation of the marine terminal	As above	Not Significant following Offset
Species at Risk (SAR)		
Terrestrial Flora and Fauna SAR/SOCC - Clearing and site preparation will result in habitat loss and fragmentation and SOCC plant mortality	An effect that causes a decline in abundance and/ or a change in distribution beyond which natural recruitment would not return the population to its pre-project level within several generations and/or an adverse effect that causes a net loss of habitat function	Not Significant
Terrestrial Fauna SAR/SOCC - Change in behavior as a result of noise and light (including blasting).	As above	Not Significant
Marine SAR/SOCC - Loss of fish habitat due to construction of	As above	Not Significant

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VC and Residual Adverse Effects	Threshold for Determination of Significance	Significance of Residual Adverse Effect
marine terminal		
Marine SAR/SOCC - Disturbance and potential change in behavior due to noise from ship traffic, pile driving and blasting	As above	Not Significant
Economy, Land and Resource Use		
Change in land use from occasional recreational/trapping to quarry, with resulting limitations on these activities	Pervasive change in land use patterns within the Study Area that adversely affects a community's use of that land and/or is inconsistent with a designated land use established through a municipal planning process.	Not Significant
Tourism and Recreation		
A decrease in wilderness/nature oriented recreation and tourism within the Project Area and vicinity due to vessel traffic and actual or perceived noise, dust and light	A permanent and widespread change in tourism or recreational activities such that people are no longer able to undertake these activities within the municipality and/or that result in a significant loss of tourism related revenue to local businesses.	Not Significant
Commercial Fisheries		
Temporary loss of lobster fishing grounds due to the marine terminal construction and operation and, as a result, displacement of fishermen into other areas	1. An uncompensated loss of habitat of those fish species that are used for, or support commercial, recreational and/or Aboriginal fisheries; or 2. A sustained decrease in earnings from a fishery due to lower catch quantity and/or quality, or increased fishing costs (i.e., due to longer travel times, loss of gear, additional license fees, etc).	Not Significant following Offset
Archaeological and Heritage Resources		
None anticipated	An uncontrolled disturbance to, or destruction of, any historical resource considered by the First Nations, provincial regulators or local residents to be of major importance.	Not Significant
Aboriginal Land and Resource Use		
Loss of future opportunities to harvest traditional terrestrial resources on portions of the property (there is currently no harvesting on the site)	Loss of fishing employment/income that could not be replaced within a reasonable time, loss of food resources not present in reasonable proximity to communities, or permanent loss of cultural relationship with the lands, flora and fauna.	Not Significant

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VC and Residual Adverse Effects	Threshold for Determination of Significance	Significance of Residual Adverse Effect
Harm to or dispersion of local wildlife; Potential depreciation of the quality of local food and medicinal plants; Potential degradation of the local marine and shoreline habitats	As above	Not Significant

13.0 ACRONYM LIST

AAROM - Aboriginal Aquatic Resource and Oceans Management

ACCDC – Atlantic Canada Conservation Data Centre

AICFI - Atlantic Integrated Commercial Fisheries Initiative

APA - Atlantic Pilotage Authority

AQI – Air Quality Index

Amsl - above mean sea level

ARIA – Archaeological Resource Impact Assessment

ARTM – Atlantic Road and Traffic Management

asl – above sea level

bgs – below ground surface

BMP – Best Management Practice

BP – (Years) Before Present

CAC – Criteria Air Contaminants

CBA – Collaborative Benefits Agreement

CCG – Canadian Coast Guard

CCME – Canadian Council of Ministers of the Environment

CD – Chart Datum

CEAA – Canadian Environmental Assessment Act

CEAA 2012 – Canadian Environmental Assessment Act, 2012

CEA Agency – Canadian Environmental Assessment Agency

CEAR – Canadian Environmental Assessment Registry

CEPA – Canadian Environmental Protection Act

CHS – Canadian Hydrographic Services

CIS – Canadian Ice Service

CLC – Community Liaison Committee

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CO – carbon monoxide

CO_2 – carbon dioxide

CO_2e – carbon dioxide equivalent

COSEWIC – Committee on the Status of Endangered Wildlife in Canada

CRA – commercial, recreational, or Aboriginal

CSA – Canadian Standards Association

CSAS - Canadian Science Advisory Secretariat

CWS – Canadian Wildlife Service

DFO – Fisheries and Oceans Canada

DHV – Design Hourly Volume

DWA – Deer Wintering Areas

EA – Environmental Assessment

EC – Environnent Canada

ECAREG - Eastern Canada Vessel Traffic Services Zone

ECM – Environmental Compliance Monitoring

EEM – Environmental Effects Monitoring

EHS – Emergency Health Services

EIS – Environmental Impact Statement

ELC – Ecological Land Classification

EMP – Environmental Management Plan

EPP – Environmental Protection Plan

FN – First Nation

FWAL – Freshwater Aquatic Life

GASHA – Guysborough Antigonish Straight Health Authority

GCHA – Guysborough County Heritage Association

GCIFA - Guysborough County Inshore Fishermen's Association

GHG – Green House Gas

GHGMP – Greenhouse Gas Management Plan

GPS – Global Positioning System

GSC – Geological Survey of Canada

HADD – Harmful Alteration Disruption or Destruction

HASP – Health and Safety Plan

HSE – Health, Safety and Environment

IFMP - Integrated Fishery Management Plan

IMO – International Maritime Organization

ISO – International Standards Organization

JRCC - Joint Rescue Co-ordination Centre

KMK – Kwilmu'kw Maw-klusuaqn

Lat - Latitude

LFA – Lobster Fishing Area

LOA – Length Overall (boat specification)

Lon - Longitude

MBA – Maritimes Butterfly Atlas

MBBA – Maritime Breeding Birds Atlas

MBCA – Migratory Birds Convention Act

MCTS Marine Communications and Traffic Services

MEDS - Marine Environmental Data Service

MEKS – Mi'kmaq Ecological Knowledge Study

MODG – Municipality of the District of Guysborough

MOU – Memorandum of Understanding

MPA – Marine Protected Area

MRI - Marshall Response Initiative

MSDS – Materials Safety Data Sheets

MWL – Mean Low Water

NAFO – Northwest Atlantic Fisheries Organization

NB – New Brunswick

NBCC – National Building Code of Canada

NFPA – National Fire Protection Association

NH_3 – ammonia

NO_2 – nitrogen dioxide

NO_X – nitrogen oxides

NPA – *Navigation Protection Act*

NPRI – National Pollutant Release Inventory

NRCAN – Natural Resources Canada

NS – Nova Scotia

NSDA – Nova Scotia Department of Agriculture

NSDAF – Nova Scotia Department of Aquaculture and Fisheries

NSDE – Nova Scotia Department of Energy

NSDNR – Nova Scotia Department of Natural Resources

NSDTCH – Nova Scotia Department of Tourism, Culture and Heritage

NSE – Nova Scotia Environment

NS*EA* – Nova Scotia *Environment Act*

NSEL – Nova Scotia Department of Environment and Labour

NSESA – Nova Scotia Endangered Species Act

NSF – Nova Scotia Department of Finance

NSFA – Nova Scotia Federation of Agriculture

NSGSAR - Nova Scotia's Ground Search and Rescue

NSMNH – Nova Scotia Museum of Natural History

NSPI – Nova Scotia Power Incorporated

NSTIR – Nova Scotia Department of Transportation and Infrastructure Renewal

NSUARB – Nova Scotia Utilities and Review Board

NSWA – Nova Scotia Wildlife Act

NWPA – Navigable Waters Protection Act

PAIR - Pre-Arrival Information Report

PID – Property Identification Number

PEI – Prince Edward Island

PEL – Probable Effects Level

PET - Potential Evapotransporation

PIRI – Partners in RBCA (Risk-Based Corrective Action) Implementation (various countries; environmental program)

PM - Particulate Matter

PM_{10} – PM with aerodynamic diameter less than a nominal 10 micrometers

$PM_{2.5}$ - PM with aerodynamic diameter less than a nominal 2.5 micrometers

POL – petroleum-oil-lubricant

RBCA – Atlantic Risk-Based Corrective Action

RMP – Risk Management Plan

ROW – Right-of-Way

SAR – Species at Risk

SARA – Species at Risk Act

SO_2 – sulphur dioxide

SO_X – sulphur oxides

SOCC – Species of Conservation Concern

SPA – Scallop Production Area

SQG – Sediment Quality Guidelines

TAC – Total Allowable Catch

TC – Transport Canada

TERMPOL – Technical Review Process of Marine Terminal Systems in Transshipment Sites

the Agency – Canadian Environmental Assessment Agency

the Project – Black Point Quarry Project

the Proponent – Vulcan Materials Company

TOR – Terms of Reference

TRS – Total Reduced Sulphur

TSP – total suspended particulates

TSS – total suspended sediments

UNESCO – United Nations Educational, Scientific and Cultural Organization

US – United States

USACE – United States Army Corps of Engineers

USEPA – United States Environmental Protection Agency

UTM – Universal Transverse Mercator

VC – Valued Component

VOC - Volatile Organic Compound

VTS Vessel Traffic Services

WHMIS – Workplace Hazardous Materials Information System

WHO – World Health Organization

WMP – Waste Management Plan

WNS – White-Nose Syndrome

14.0 LIST OF UNITS

% - percent

µg/kg – micrograms per kilogram

µg/L – micrograms per litre

µg/m3 – micrograms per cubic metre

µS/cm – microseimens per centimetre

µS/m – microseimens per metre

cm – centimetre

dB – decibels

dB (LA_{max}) – decibels (Maximum Sound Level)

dB (L_{eq}) – decibels (Equivalent Sound Levels)

dB re 1 µPa – decibel micropascals

dB (A) – decibels (A-Weighted)

dB (Lin) – decibels (Unweighted)

dbh – diameter breast height

g/s – grams per second

ha – hectare

kg – kilogram

km – kilometre

km/h – kilometres per hour

km^2 – square kilometre

kVA – kiloVolts-amps

kW – kilowatt

kW/m^2 – kilowatt per square metre

L – litre

L/d – litres per day

Ldn – Day-night level

LMP – litres per minute

m – metre

m/s – metres per second

m^2 – square metres

m^3 – cubic metres

m^3/d – cubic metres per day

m^3/h – cubic metres per hour

mbar (g) – millibars (gague)

mg/kg – milligrams per kilogram

mg/L – milligrams per litre

mg/m3 – milligrams per cubic metre

mm – millimetre

Mt – million tonnes

Mtpa – million tonnes per annum

MW – megawatt

NTU – Nephelometric Turbidity Units

ng/L – nanograms per litre

°C – degrees Celsius

ppb – parts per billion

ppm – parts per million

ppmv – parts per million (volumetric)

ppt – parts per thousand

t – tonne (metric tonne)

t/d – tonnes per day

t/y – tonnes per year
V - volt

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15.0 REFERENCES

ACCDC: Atlantic Canada Conservation Data Centre. 2014. Maritime Butterfly Atlas. Retrieved from: http://www.accdc.com/mba/index-mba.html.

ACZISC: Atlantic Coastal Zone Information Steering Committee. 1999. Workshop Report – Natural Disasters in the Coastal Zone and their Mitigation: Rising Sea levels, Hurricanes, storm surges and erosion.

ACOA: Atlantic Canada Opportunities Agency. 2009. Guysborough County Profile.

ACS: Archibald Consulting Services, LLC. 2009. Eastern US Seaboard Market Study. Prepared for Erdene Resources Development Corp. 21 pp.

AECOM. 2014a. Black Point Quarry Project Description. Prepared for Morien Resources Corporation. February 2014. Project 60314716.

AECOM. 2014b. Technical Memorandum: Black Point Hydrogeology June and July, 2014 Field Program.

AECOM. 2014c. Technical Memorandum: Black Point Hydrogeology August, 2014 Field Program.

AFN: Assembly of First Nations. 2011. Marketing/International Trade – Barriers, Opportunities, and Best Practices. Overview of First Nation Fisheries and Policy Considerations. 20 pp.

AMEC. 2006. Environmental Assessment. Keltic Petrochemicals Inc. Goldboro, Nova Scotia. Project No. TV61029.

AMEC. 2008. Environmental Impact Statement (EIS) for the Proposed Melford International Terminal Final Report. Submitted to Nova Scotia Environment and CEAA.

AMEC. 2011. Black Point Baseline Ecological Surveys Summary Report. Erdene Resource Development Corporation.

AMEC. 2013. Environmental Impact Assessment Report (Class II Undertaking) Goldboro LNG Project. Natural Gas Liquefaction Plant and Marine Terminal Pieridae Energy Canada Ltd.

APA: Atlantic Pilotage Authority. 2013. Compulsory Areas. Website accessed August 2014. https://www.atlanticpilotage.com/eng/compulsory-areas/strait-of-canso.html. Copyright 2013.

APCFNC: Atlantic Policy Congress of First Nations Chiefs. 2009. Marshall 10 Years Later: Atlantic and Gaspé First Nations Participation in Fisheries. 49 pp. www.apcfnc.ca/en/fisheries/resources/Marshall10years.pdf.

Beale, C.M. 2007. The behavioural ecology of disturbance responses. International Journal of Comparative Psychology 20:111-120.

Bigelow, H.B. and Schroeder, W.C. 2002. Fishes of the Gulf of Maine. United States Department of the Interior – Fish and Wildlife Service. Fishery Bulletin of the Fish and Wildlife Service, Volume 53.< http://gma.org/fogm/Default.htm > 2014-09-26.

Bird Studies Canada. 2015. Atlantic Canada Shorebird Survey. Data accessed from NatureCounts, a node of the Avian Knowledge Network, Bird Studies Canada. Available: http://www.naturecounts.ca/. Accessed: 12 January 2015.Blumstein, D.E. Fernandez-Juricic, P. Zollner, and S. Garity. 2005. Inter-specific variation in avian responses to human disturbance. Journal of Applied Ecology 42:943-953.

Bolduc, F., and M. Guillemette. 2003. Human disturbance and nesting success of Common Eiders: interaction between visitors and Gulls. Biological Conservation 110:77-83.

Boudreau, V., and Social Research for Sustainable Fisheries (SRSF). 2001. Fishing for a living: a profile of the Guysborough County inshore fisheries. Canso, NS. Internet publication: http://www.gcifa.ns.ca/Docs/fishing.doc.

Bramford, A.R., Davies, S.J.J.F., & Van Delft, R. 1990. The effects of model power on boats on waterbirds at Herman Lake, Perth, Western Australia. Emu, 90, 260-265.

Broders, H.G., G.M. Quinn, and G.J. Forbes. 2003. Species Status, and the Spatial and Temporal Patterns of Activity of Bats in Southwest Nova Scotia, Canada. Northeastern Naturalist 10:383-398.

Brown, A.L. 1990. Measuring the effect of aircraft noise on sea birds. Environment International 16: 587-592.

Burger, J. 1981. Behavioral responses of Herring Gulls (*Larus argentatus*) to aircraft noise. Environmental Pollution Series A, 24: 177-184.

Burger, J., M. Gochfeld, C. Jenkins, and F. Lesser. 2010. Effect of approaching boats on nesting Black Skimmers: using response distances to establish protective buffer zones. Journal of Wildlife Management 74:102-108.

Canadian Biodiversity Information Facility (CBIF). 2014-04-15. Integrated Taxonomic Information System – Search Records. <http://www.cbif.gc.ca/acp/eng/itis/search> 2014-09-26.

Canadian Environmental Assessment Act. Prepared by the Federal Environmental Assessment Review Office. 16 99.

Carney, K. M., and W.J. Sydeman. 1999. A review of human disturbance effects on nesting colonial waterbirds. Waterbirds 22:68-79.

CBCL: CBCL Limited. 2010. Black Point Quarry Marine Facility, Review of Engineering Study February 2010.

CBDC: Community Business Development Corporation. 2013. Guysborough County Community Business Development Corporation Limited Annual Report. http://www.cbdc.ca/ns/uploads/file/Final%20Annual%20Report-june2013.pdf. Webpage Accessed September 28, 2014.

C 1340-738

CCD: Canadian Church Directory. 2014. http://churchdirectory.ca/browse/?p=NS&a=&c=Guysborough. Webpage accessed on September 17, 2014.

CCG: Canadian Coast Guard. 1981. TEMPOL Assessment of Melford Point. Volume 2. Transport Canada Canadian Coast Guard Office of the Commissioner. 400 pp.

CCG: Canadian Coast Guard. 2012. Ice Navigation in Canadian Waters: Chapter 3 Ice Climatology and Environmental Conditions. Icebreaking Program, Maritime Services, Canadian Coast Guard, Fisheries and Oceans Canada. 165 pp.

CCG: Canadian Coast Guard. 2014. Maritime Region – Search and Rescue. Retrieved from: http://www.ccg-gcc.gc.ca/Search-and-Rescue-Maritimes. Webpage accessed September 24, 2014.

CCME: Canadian Council of the Ministers of the Environment. 1999a. Canadian Environmental Quality Guidelines. Retrieved from: http://www.ccme.ca/en/resources/canadian_environmental_quality_guidelines/index.html

CCME: Canadian Council of the Ministers of the Environment. 1999b. Canadian Environmental Soil Quality Guidelines for Protection of the Environment and Human Health: Industrial/Commercial. Retrieved from: http://st-ts.ccme.ca/en/index.html?chems=all&chapters=4&pdf=1

CCME: Canadian Council of Ministers of the Environment. 2000. Canada-Wide Standards for Particulate Matter (PM) and Ozone. Retrieved from: http://www.ccme.ca/assets/pdf/pmozone_standard_e.pdf

CCME: Canadian Council of Ministers of the Environment. 2001. Canadian Sediment Quality Guidelines for the Protection of Aquatic Life. Retrieved from: http://www.ccme.ca/en/resources/canadian_environmental_quality_guidelines/index.html

CCME: Canadian Council of Ministers of the Environment. 2010. Canada-wide Standards for Particulate Matter (PM) and Ozone Endorsed by CCME Council of Ministers, June 5-6, 2000, Quebec City. 11 pp.

CCME: Canadian Council of the Ministers of the Environment. 2012. Canadian Environmental Quality Guidelines - Canadian Water Quality Guidelines. Retrieved from: http://www.ccme.ca/en/resources/canadian_environmental_quality_guidelines/index.html

CEA Agency: Canadian Environmental Assessment Agency. 1994. Determining Whether a Project is Likely to Cause Significant Adverse Environmental Effects.

CEA Agency: Canadian Environmental Assessment Agency. 2013a. Operation Policy Statement Assessing Cumulative Environmental Effects Under The Canadian Environmental Assessment Act, 2012. Retrieved from: https://www.ceaa-acee.gc.ca/Content/1/D/A/1DA9E048-4B72-49FA-B585-B340E81DD6AE/CEA_OPS_May_2013-eng.pdf

C 1340-739

CEA Agency: Canadian Environmental Assessment Agency. 2013b. Addressing "Purpose of" and Alternative Means" under the Canadian Environmental Assessment Act, 2012. website http://www.ceaa-acee.gc.ca/default.asp?lang=En&n=1B095C22-1 December 2013 last updated 2014-06-26.

CEA Agency: Canadian Environmental Assessment Agency / The Province of Nova Scotia. Updated 2014. Guidelines for the Preparation of an Environmental Impact Statement pursuant to the Canadian Environmental Assessment Act, 2012 and Nova Scotia Registration Document pursuant to the Nova Scotia Environment Act, Black Point Quarry Project (June 2014). 40 pp.

Cooper, T., Hickey, T. Sock, L., G. Hare and B. Milliea. 2010. Critical Success Factors in the First Nations Fisheries of Atlantic Canada: Mi'kmaq and Maliseet Perceptions. The Atlantic Aboriginal Economic Development Integrated Research Program, AAEDIRP. 147 pp.

CSAS: Canadian Science Advisory Secretariat. 2013. ASSESSMENT OF NOVA SCOTIA (4VWX) SNOW CRAB Maritimes Region Science Advisory Report 2013/060. Fisheries and Oceans Canada.

Dalton, P. 2011. Field Report – Acid Rock Drainage Potential. Prepared for Erdene Resource Development. 7 pp.

DFO: Fisheries and Oceans Canada. 1998. Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters. Retrieved from:http://www.dfo-mpo.gc.ca/Library/232046.pdf

DFO: Fisheries and Oceans Canada. 2000a. Stock Status Report C3-49 (2000) Maritimes Region – Southwestern New Brunswick (LFA 36-38) Green Sea Urchins. < http://www.dfo-mpo.gc.ca/csas/csas/status/2000/c3-49e.PDF > 2014-09-26.

DFO: Fisheries and Oceans Canada. 2000b. Stock Status Report C3-48 (2000) Maritimes Region – Nova Scotia Green Sea Urchins. 2014-09-26.

DFO: Fisheries and Oceans Canada. 2003. Strengthening Our Relationship: The Aboriginal Fisheries Strategy and Beyond. Retrieved from:http://www.dfo-mpo.gc.ca/fm-gp/aboriginal-autochtones/afs/afsoct03-eng.htm

DFO: Fisheries and Oceans Canada. 2004. Eastern Shore Lobster (LFAs 31A, 31B, 32). Stock Status Report 2004/033. 8 pp.

DFO: Fisheries and Oceans Canada. 2005. The Scotian Shelf: An Atlas of Human Activities. Oceans and Coastal Management Division, Oceans and Habitat Branch.

DFO: Fisheries and Oceans Canada. 2008a. State of the Ocean 2007: Physical Oceanographic Conditions on the Scotian Shelf, Bay of Fundy and Gulf of Maine. Sci. Advis. Sec. Sci. Advis. Rep. 2008/025.

DFO: Fisheries and Oceans Canada. 2008b. Aquatic Species at Risk – Harbour Porpoise (Atlantic). Accessed: September 2014. http://www.dfo-mpo.gc.ca/species-especes/species-especes/harbourporpoiseAtl-marsouinat-eng.htm

DFO: Fisheries and Oceans Canada. 2008c Aboriginal Aquatic Resource and Oceans Management Program http://www.dfo-mpo.gc.ca/fm-gp/aboriginal-autochtones/aarom-pagrao/index-eng.htm Accessed August 2014; last modified 2012-09-13.

DFO: Fisheries and Oceans Canada. 2010a. Aquatic Species – Details for Grey Seal. Accessed: September 2014.http://www.dfo-mpo.gc.ca/species-especes/aquatic-aquatique/grey-seal-phoque-gris-eng.htm

DFO: Fisheries and Oceans Canada. 2010b. Aquatic Species – Details for Green Sea Urchin. <http://www.dfo-mpo.gc.ca/species-especes/aquatic-aquatique/green-sea-urchin-oursin-vert-eng.htm > 2014-09-26.

DFO: Fisheries and Oceans Canada. 2011a. About Harbour Authorities. http://www.dfo-mpo.gc.ca/sch-ppb/aboutha-aproposap-eng.htm Last modified 2011-07-08.

DFO: Fisheries and Oceans Canada. 2011b. Assessment of Lobster Off the Atlantic Coast of Nova Scotia (LFAs 27-33) CSAS Science Advisory Report 2011/064 25 pp.

DFO: Fisheries and Oceans Canada. 2011c. The Scotian Shelf in Context. State of the Scotian Shelf Report. Oceans and Coastal Management Division. 67 pp.

DFO: Fisheries and Oceans Canada. 2012a. Marine Protected Area Network Planning in the Scotian Shelf Bioregion: Objectives, Data, and Methods. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2012/064. 19 pp.

DFO: Fisheries and Oceans Canada. 2012b. The Scotian Shelf in Context. http://coinatlantic.ca/docs/scotian-shelf-in-context.pdf. 67 pp.

DFO: Fisheries and Oceans Canada. 2013a. Aquatic Species at Risk – Fin Whale (Atlantic). Accessed: September 2014. http://www.dfo-mpo.gc.ca/species-especes/species-especes/finwhale-atlantic-rorqual-commun-atlantique-eng.htm.

DFO: Fisheries and Oceans Canada. 2013. Fisheries Protection Policy Statement. Retrieved from: http://www.dfo-mpo.gc.ca/pnw-ppe/pol/PolicyStatement-EnoncePolitique-eng.pdf

DFO: Fisheries and Oceans Canada. 2013. Changes to the Fisheries Act. Retrieved from: http://www.dfo-mpo.gc.ca/pnw-ppe/changes-changements/index-eng.html

DFO: Fisheries and Oceans Canada. 2013. Fisheries Productivity Investment Policy: A Proponents Guide to Offsetting. Retrieved from: http://www.dfo-mpo.gc.ca/pnw-ppe/offsetting-guide-compensation/index-eng.html

DFO: Fisheries and Oceans Canada. 2013. Commercial Data Division, Policy and Economics Branch Data Request: CDD20130066. September 2014.

C 1340-741

DFO: Fisheries and Oceans Canada. 2013. Underwater World – Northern Shrimp. <http://www.dfo-mpo.gc.ca/science/publications/uww-msm/articles/northernshrimp-crevettenorique-eng.html > 2014-09-26.

DFO: Fisheries and Oceans Canada. 2013. Underwater World – Snow Crab. <http://www.dfo-mpo.gc.ca/Science/publications/uww-msm/articles/snowcrab-crabedesneiges-eng.html > 2014-09-26.

DFO: Fisheries and Oceans Canada. 2014a. Integrated Fisheries Management Plans. Website accessed July 2014: http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/ifmp-gmp/index-eng.htm Last modified 2014 08 12.

DFO: Fisheries and Oceans Canada. 2014b. Shrimp (*Pandalus borealis*) - Scotian Shelf - As of 2013 (Integrated Fisheries Management Plan) http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/ifmp-gmp/shrimp-crevette/shrimp-crevette-2013-eng.htmDate modified: 2014-05-08.

DFO: Fisheries and Oceans Canada. 2014c. Canadian Atlantic Herring Southwest Nova Scotia Rebuilding Plan – Atlantic Canada 2013.

DFO: Fisheries and Oceans Canada. 2014d. Bluefin Tuna Management in Atlantic Canada. Webpage http://www.dfo-mpo.gc.ca/international/tuna-thon/bluefin-mgt-gestion-rouge-eng.htm Accessed August 2014. Last modified 2014-01-06.

DFO: Fisheries and Oceans Canada. 2014. Shrimp. <http://www.dfo-mpo.gc.ca/fm-gp/sustainable-durable/fisheries-peches/shrimp-crevette-eng.htm > 2014-09-26.

DFO: Fisheries and Oceans Canada. 2014. Snow Crab. <http://www.dfo-mpo.gc.ca/fm-gp/sustainable-durable/fisheries-peches/snow-crab-eng.htm > 2014-09-26.

Di Cesare F. 2006. Ambient Air Quality in Nova Scotia. Air Quality Branch, Nova Scotia Environment and Labour. 20 pp.

DMA: Davis MacIntyre & Associates Limited. 2011. Fogherty Head Project: Archaeological Resources Impact Assessment (Heritage Research Permit A2011NS67). July 2011.

DMA: Davis MacIntyre & Associates Limited. 2014. Black Point Quarry 2014: Archeological Resource Impact Assessment Heritage Research Permit A2014NS099 Category C. Project No. 14-033.1SLR.

Doherty, P. and T. Horsman. 2007. Ecologically and Biologically Significant Areas of the Scotian Shelf and Environs: A Compilation of Scientific Expert Opinion. Can. Tech. Rep. Fish. Aquat. Sci. 2774: 57 + xii pp.

Doyle-Bedwell, P., Cohen, F.G. 2001. Aboriginal peoples in Canada: their role in shaping environmental trends in the twenty-first century. In: Parson, E.A. (Ed.), Governing the Environment: Persistent Challenges, Uncertain Innovation. University of Toronto, Toronto, Canada.

C 1340-742

Dummer, T.J.B., Yu, Z.M., Nauta, L., Murimboh, J.D. and Parker, L. 2014. Geostatistical modelling of arsenic in drinking water wells and related toenail arsenic concentrations across Nova Scotia, Canada.

EAC: Ecology Action Centre. 2012. Chedabucto Bay Trap Caught Shrimp Recognized for Sustainability and Quality; Fishermen Benefit Financially. Posted by Miles Howe, March 29, 2012. Webpage accessed September 2014. http://halifax.mediacoop.ca/newsrelease/10353

EC: Environment Canada. 1994. Guidance Document on Collection and Preparation of Sediments for Physiochemical Characterization and Biological Testing. Webpage Accessed Oct 3, 2014

EC. Environment Canada. 1996. The Federal Policy on Wetland Conservation – Implementation Guide for Federal Land Managers.

EC: Environment Canada. 1998. National Guidelines for Monitoring Dredged and Excavated Material at Ocean Disposal Sites. Retrieved from http://publications.gc.ca/collections/collection_2014/ec/En40-573-1999-eng.pdf

EC: Environment Canada. 1999. Disposal at Sea Permit No. 4543-2-06754. Retrieved from: http://www.ec.gc.ca/lcpe-cepa/0A968D70-3D0A-4B0A-99D1-1FD38F91FB8B/4543-2-04394_eng.pdf

EC: Environment Canada. 2006a. Atlantic Climate Centre: The Climate of Nova Scotia Retrieved from: http://atlantic-web1.ns.ec.gc.ca/climatecentre/default.asp?lang=En&n=61405176-1

EC: Environment Canada. 2006b. Atlantic Canada Wastewater Guidelines Manual for Collection, Treatment and Disposal. Retrieved from: https://www.novascotia.ca/nse/water/docs/AtlCanStdGuideSewage.pdf

EC: Environment Canada. 2007. Management Plan for the Harlequin Duck (*Histrionicus histrionicus*) Eastern Population, in Atlantic Canada and Québec. Species at Risk Act Management Plan Series. Environment Canada. Ottawa. vii + 32 pp.

EC: Environment Canada. 2009. Canadian Climatic Normals or Averages 1971-2000. Web page. Accessed January 2011 from: http://www.climate.weatheroffice.ec.gc.ca/climate_normals/index_e.html.

EC: Environment Canada. 2013a. 10 Years of Data from the National Air Pollution Surveillance (NAPS) Network: Data Summary from 1999-2008.

EC. Environment Canada. 2013b. About Wetlands. Updated May 16, 2013. Available online at: http://www.ec.gc.ca/tho-wlo/default.asp?lang=En&n=B4669525-1#_definitions. Accessed September, 2014.

EC: Environment Canada. 2013. Guidelines to Avoid Disturbance to Seabird and Waterbird Colonies in Canada. Retrieved from: https://www.ec.gc.ca/paom-itmb/default.asp?lang=En&n=E3167D46-1.

C 1340-743

EC: Environment Canada. 2013. Guide for Reporting to the National Pollutant Release Inventory under the Canadian Environmental Protection Act, 1999. Retrieved from:

http://ec.gc.ca/Publications/40876B47-097F-4986-BADB-3776ED3097AB/2012-2013_NPRI_Guide.pdf

EC: Environment Canada. 2013. National Air Pollution Surveillance (NAPS) Network Monitoring Results. Accessed January 2014. http://maps-cartes.ec.gc.ca/rnspa-naps/data.aspx?lang=en.

EC: Environment Canada 2014a. 'Canadian Climate Normals 1971-2000 Station Data.' Website accessed July 2014. http://climate.weather.gc.ca/climate_normals/index_e.html. Last modified 2014-02-27.

EC: Environment Canada. 2014b. Climate and Historical Weather. Meteorological Service of Canada Website accessed August 2014: http://www.ec.gc.ca/meteo-weather/default.asp?lang=En&n=17A7AAB9-1 Last updated 2014-04-17.

EC: Environment Canada. 2014c. Guidelines to Avoid Disturbance to Seabird and Waterbird Colonies in Canada. https://www.ec.gc.ca/paom-itmb/default.asp?lang=En&n=E3167D46-1#_008. Accessed 24 September 2014.

EC: Environment Canada. 2014d. Nova Scotia Provincial Statistics (Hurricanes) website accessed January 2015 (Link: http://www.ec.gc.ca/Hurricane/default.asp?lang=En&n=2281E83C-1

EC: Environment Canada. 2014e. Best practices for stranded birds encountered offshore Atlantic Canada. Draft - July 2014.EC: Environment Canada. 2014f. General Nesting Periods of Migratory Birds in Canada. https://www.ec.gc.ca/paom-itmb/default.asp?lang=En&n=4F39A78F-1#_01_0_1. Accessed 19 January 2015.

EC-CWS: Environment Canada, Canadian Wildlife Service. Atlantic Region. 2014. Colonial Waterbird Database.

ECSAS: Eastern Canadian Seabirds at Sea. 2014. Eastern Canadian Seabirds at Sea Database maintained by EC-CWS.

EL: Environmental Laboratory. 1987. Corps of Engineers Wetland Delineation Manual. Technical Report Y-87-1. US Army Engineer Waterways Experiment Station. Vicksburg, Mississippi.

ERDC: Erdene Resource Development Corporation. 2011. Black Point Quarry Scoping Study.

Erickson, W.P., Johnson, G.D. and Young, D.P. Jr. 2005. A summary and comparison of bird mortality from anthropogenic causes with an emphasis on collisions. In: Ralph, C.J. and Rich, T.D., editors. 2005. Bird Conservation Implementation and Integration in the Americas: Proceedings of the Third International Partners in Flight Conference. 2002 March 20-24; Asilomar, California, Volume 2 Gen. Tech. Rep. PSW-GTR-191. Albany, CA: U.S. Dept. of Agriculture, Forest Service, Pacific Southwest Research Station: p. 1029-1042.

C 1340-744

Fader, G.B.J. 2005. Glacial, Post Glacial, Present and Projected Seal Levels, Bay of Fundy. Atlantic Marine Geological Consulting Ltd. 20pp. Accessed on October 3, 2014.

Farmzone. 2014. Weather Statistics by Month; Canso Nova Scotia. The Weather Network – Pelmorex Media Inc. Accessed July 2014: http://www.farmzone.com/statistics/precipitation/cl8205193/ma018. Copyright 2014.

Fogarty Family. 2014. Environmental Impact Statement Response. Proposed Black Point Quarry Project, CEAA File # 80064.

Ford, K.L. and S.B Ballantyne. 1983. Uranium and Thorium Distribution Patterns and Lithogeochemistry of Devonian Granites in the Chedabucto Bay area, Nova Scotia; *in* Current Research, Geological Survey of Canada, Paper 83-1A, p. 109-119.

GALA: Guysborough County Adult Learning Association. 2012. Retrieved from: http://www.guysboroughlearning.ca/index.htm.

Gardner M, MacAskill G and DeBow C. 2009. Economic Impact of the Nova Scotia Ocean Sector 2002-2006. Prepared for Fisheries and Oceans Canada and Nova Scotia Government. 27 pp.

GASHA: Guysborough Antigonish Straight Health Authority. 2014. Retrieved from: http://www.gasha.nshealth.ca/programs.

Gaston, K.J., T.W. Davies, J. Bennie and J. Hopkins. 2012. Reducing the ecological consequences of night-time light pollution: options and developments. Journal of Applied Ecology, 49, 1256–1266.

GC: Government of Canada. 1991. The Federal Policy on Wetland Conservation. 15 pp.

GC: Government of Canada. 2010. Fire Protection Standard. Retrieved from: http://www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=17316&section=text

GC: Government of Canada. 2013a. Applications for Authorization under Paragraph 35 (2)(b) of the Fisheries Act Regulations. Retrieved from: http://laws.justice.gc.ca/PDF/SOR-2013-191.pdf.

GC: Government of Canada. 2013b. Updated Guidelines for Federal Officials to Fulfill the Duty to Consult. Retrieved from:http://www.aadnc-aandc.gc.ca/DAM/DAM-INTER-HQ/STAGING/texte-text/intgui_1100100014665_eng.pdf.

GC: Government of Canada. 2015. Climate Website. Historical Climate Data. Date modified 2015-01-12. Hart Island and Eddy Point data accessed February 2015. http://climate.weather.gc.ca/advanceSearch/searchHistoricDataStations_e.html?searchType=stnProv&timeframe=1&lstProvince=NS&optLimit=yearRange&StartYear=1840&EndYear=2015&Year=2015&Month=2&Day=3&selRowPerPage=25&cmdProvSubmit=Search&startRow=76

GCIFA: Guysborough County Inshore Fisherman's Association. 2013. Research Working Document – Trends and Projections Lobster Fishing Areas 31A and 31B.

C 1340-745

GCIFA: Guysborough County Inshore Fisherman Association (GCIFA). 2014a. Fisheries. http://www.gcifa.ns.ca/Fisheries.html. Webpage accessed September 22, 2014.

GCIFA: Guysborough County Inshore Fishermen's Association. 2014b. Letter to CEA Agency March 27, 2014.

GCIFA: Guysborough County Inshore Fishermen's Association. 2014c. Webpage: Research. http://www.gcifa.ns.ca/Research.html Copyright 2014. Accessed August 2014.

GHS: Guysborough Historical Society. N.D. Old Court House Museum. Retrieved from: http://www.guysboroughhistoricalsociety.ca/courthouse-museum.htm.

Gilhen, J. 1984. Amphibians and Reptiles of Nova Scotia. Nova Scotia Museum. Halifax, Nova Scotia.162 pp.

GNL: Government of Newfoundland and Labrador – Department of Fisheries and Aquaculture. 2002. Rock Crab.< http://www.fishaq.gov.nl.ca/research_development/fdp/rock_crab.pdf > 2014-09-26.

GNS: Government of Nova Scotia. 2009. Proponent's Guide: Engagement with the Mi'kmaq of Nova Scotia. Retrieved from: http://www.novascotia.ca/abor/docs/proponants-guide.pdf

GNS: Government of Nova Scotia. 2011. Nova Scotia Community Counts: Community Profile. Retrieved from: http://www.novascotia.ca/finance/communitycounts/profiles/community. Webpage Accessed on September 22, 2014.

GNS: Government of Nova Scotia. 2013. Nova Scotia Department of Economic and Rural Development and Tourism. Retrieved from: http://novascotia.ca/econ/overview/ . Accessed on September 22, 2014.

GNS: Government of Nova Scotia. 2014a. Finance and Treasury Board. Retrived from: http://www.novascotia.ca/finance/statistics/analysis/default.asp?id=1&sid=5).Webpage Accessed on September 26, 2014.

GNS: Government of Nova Scotia. 2014b. Community Counts. Retrieved from: http://www.novascotia.ca/finance/communitycounts/topicview.asp. Webpage Accessed on September 18, 2014.

GNS: Government of Nova Scotia. 2014c. Emergency Management Office. Retrieved from: http://novascotia.ca/dma/EMO/ground_search_rescue/. Webpage Accessed on September 24, 2014.

GNS: Government of Nova Scotia. 2014d. Transportation. Retrieved from: http://novascotia.ca/tran/hottopics/ferries.asp. Webpage Accessed on September 27, 2014.

GNS: Government of Nova Scotia. 2014e. Nova Scotia Outdoor Activities: Queensport Beach. Retrieved from: http://www.novascotia.com/see-do/outdoor-activities/queensport-beach. Webpage accessed September 22, 2014.

GNS: Government of Nova Scotia. 2014f. Nova Scotia Outdoor Activities: Chapel Gully Trail. Retrieved from: http://www.novascotia.com/see-do/outdoor-activities/chapel-gully-trail. Webpage Accessed on September 22, 2014.

GNS: Government of Nova Scotia. 2014g. Nova Scotia Places to Stay: Campgrounds. Retrieved from: http://www.novascotia.com/places-to-stay/campgrounds/boylston-provincial-park. Webpage accessed September 22, 2014.

GNS: Government of Nova Scotia. 2014. Nova Scotia Attractions, Canso Museum: Whitman House. Retrieved from: http://www.novascotia.com/see-do/attractions/canso-museum-whitman-house. Webpage Accessed on September 22, 2014.

GNS: Government of Nova Scotia. 2014. Nova Scotia Outdoor Activities: Black Duck Cove Provincial Park. Retrieved from: http://www.novascotia.com/see-do/outdoor-activities/black-duck-cove-provincial-park. Webpage accessed September 22, 2014.

GNS: Government of Nova Scotia. Not Dated (n.d.). Guysborough County Profile of Agricultural Land Resources. Retrived from: http://novascotia.ca/agri/documents/business-research/AL1014%20Guysborough.pdf. Webpage accessed September 25, 2014.

Goudie, R. I., G. J. Robertson and A. Reed. 2000. Common Eider (*Somateria mollissima*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/546 doi:10.2173/bna.546

GP: Gardner Pinfold Consulting Economists Ltd. 2006. Profile of the Atlantic Shrimp Industry. The Atlantic Council of Fisheries and Aquaculture Ministers (ACFAM) –Task Group on Northern Shrimp. 52 pp.

GP: Gardner Pinfold Consulting Economists Ltd. 2010. Black Point Quarry Economic Impact Analysis. Prepared for Erdene Resource Development Corporation. November 2010.

GP: Gardner Pinfold Consulting Economists Ltd. 2011. Application Order for the Dissolution of the Town of Canso- A Socio-Economic Profile. Prepared for the Municipality of the District of Guysborough, October 24, 2011.

Greenlaw, M.E. 2009. A Classification of Coastal Inlets of Mainland Nova Scotia, Using Geophysical Information to Define Ecological Representation and to Evaluate Existing and Proposed Protected Areas. M.Sc. Thesis Manuscript, Acadia University

Gromack, A.G., K .Allard, D. Fenton, S. Johnston, and J. Ford. 2010. Ecological and Human Use Information for Twenty Areas on the Atlantic Coast of Nova Scotia in Support of Conservatiion Planning. Can. Tech. Report. Fish. Aquatic. Sci. 2880: xiv + 226 p.

Hart, H.C. 1877. History of the County of Guysborough. Belleville Ont.: Mika Publishing. Reprinted 1975.

Hastings, K., M. King, and K. Allard. 2014. Ecologically and Biologically Significant Areas in the Atlantic Coastal Region of Nova Scotia. Can. Tech. Rep. Fish. Aquat. Sci. 3107: xii + 174 p. in preparation.

Hatcher, B.G., MacDougall, J. and G. Pardy. 2013. Spatially Explicit Assessment of the Commercial Fishery Yields, Productivity and Fishing Activities in the Area of the Donkin Export Coking coal Transshipment Project. Bras d'Or Institute for Ecosystem Research, Cape Breton University. 51pp.

HC: Health Canada. 2010. Useful Information for Environmental Assessments. Retrieved from: http://www.hc-sc.gc.ca/ewh-semt/pubs/eval/environ_assess-eval/index-eng.php

HC: Health Canada. 2012. Guidelines for Canadian Drinking Water Quality – Summary Table. Water, Air, and Climate Change Bureau, Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa, Ontario.

Herbert, D., R. Pettipas, D. Brickman, and M. Dever. 2012. Meteorological, Sea Ice and Physical Oceanographic Conditions on the Scotian Shelf and in the Gulf of Maine during 2012. Ocean and Ecosystem Sciences Division Bedford Institute of Oceanography P.O. Box 1006, 1 Challenger Drive Dartmouth, Nova Scotia B2Y 4A2

Hilchey, J.D., Cann, D.B. and J.I. MacDougall. 1964. Soil Survey of Guysborough County, Nova Scotia. Report No. 14, Nova Scotia Soil Survey. Canada Department of Agriculture and Nova Scotia Depart of Agriculture and Marketing. 56 pp

Hill, J.D. 1991. Petrology, Tectonite Setting, and Economic Potential of Devonian Peraluminous Granitoid Plutons in the Canso and Forest Hill Areas, Eastern Meguma Terrane, Nova Scotia. Energy Mines and Resources Canada.

Hooper, W.C., McCabe, L. and Robertson T. 1995. A Standardized Fisheries Stream Survey Approach for Atlantic Canada. Department of Natural Resources and Energy. Fredericton, New Brunswick.

IBA: Important Bird Areas in Canada. 2014. http://www.ibacanada.ca. Accessed 18 September 2014.

ISANS: Invasive Species Alliance of Nova Scotia. 2011. Retrieved from: http://www.invasivespeciesns.ca/. Accessed on October 3, 2014

IRNS: Immigrate to Rural Nova Scotia – Community Profile – Guysborough County. 2008. Webpage Accessed September 29, 2014.

JWEL: Jacques Whitford Environmental Limited. 2004. Environmental Assessment for the Proposed Bear Head LNG Terminal, Bear Head Nova Scotia. Prepared for Access Northeast Energy Ltd.

King, L.H. and Fader, G.B.J. 1988: Late Wisconsinan Ice on the Scotian Shelf; Geological Survey of Canada. Open File No. 1972, 20 pp.

Koeller, P., Covey, M. and M. King. 2007, Biological and Environmental Requisites for a Successful Trap Fishery of the Northern Shrimp *Pandalus borealis.* Proc. N.S. Inst. Sci. (2007) Volume 44, Part 1, pp. 51-71.

C 1340-748

Koloski, J.W., Schwarz, S.D. and D.W. Tubbs. 1989. Geotechnical Properties of Geological Materials. Engineering Geology on Washington, Vol. 1. Washington Division of Geology and Earth Resources Bulletin 78.

Kronfeld, J.; Godfrey-Smith, D.I.; Johannessen, D.; Zentilli, M. 2004. Uranium Series Isotopes in the Avon Valley, Nova Scotia.

Larkin, R.P. 1996. Effects of military noise on wildlife: a literature review. US Army Construction Engineering Research Laboratories Technical Report 96/21. January 1996.LC: Lions Club - District N2-Lions of Nova Scotia. 2014. http://www.e-district.org/sites/n2/page-8.php. Webpage accessed September 26, 2014.

Lawrence, D. J. 1979. Flow Patterns in Chedabucto Bay, Nova Scotia. Atlantic Oceanographic Laboratory, Bedford Institute of Oceanography, Dartmouth, Nova Scotia in Canso Marine Environment Workshop Part 4 of 4 Parts Physical Oceanography and Environmental Effects F.D. McCraken Editor (1979).

Lemontagne, M., Halchuk, S., Cassidy, J.F., and G.C. Rogers. 2007. Significant Canadian Earthquakes 1600-2006.Geological Survey of Canada Open File 5539. 32 pp.

MacAndrew, J. 2014. The Shrimp Fishery of Chedabucto Bay: A Model of Sustainability with Profitability. Atlantic Fisherman. Webpage accessed August, 2014. http://atlanticfisherman.com/stories.asp?id=6503.

MacDonald, M.A, Horne, R.J., Corey, M.C. and L.J. Ham. 1992. An Overview of Recent Bedrock Mapping and Follow-Up Petrological Studies of the South Mountain Batholith, Southwestern Nova Scotia, Canada. Atlantic Geology 28, 7-28 (1992). 22 pp.

Mackenzie, C., and J.R. Moring. 1985. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (North Atlantic) –American Lobster. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.33). U.S. Army Corps of Engineers, TR EL-82-4. 19 pp.

MAPS: Mi'kma'ki All Points Services. 2013. Mi'kmaw Ecological Knowledge Study Black Point Quarry, Guysborough Co., NS Proposed by Erdene Resource Development Corp. 50 pp.

MBBA: Maritimes Breeding Bird Atlas. 2014. Maritimes Breeding Bird Atlas, data summary for square 20PR42. http://www.mba-aom.ca Accessed 5 September 2014.

Milley, C., Charles, A. 2001. Mi'kmaq fisheries in Atlantic Canada: traditions, legal decisions, and community management. In: Paper presented at the People and the Sea: Maritime Research in the Social Sciences: an Agenda for the 21st century, Amsterdam, Netherlands.

Mine Environment Neutral Drainage (MEND) Program. 2009. Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials. Report 1.20.1. 579pp.

MODG: Municipality of the District of Guysborough with Nova Scotia Power Incorporated. Environmental Assessment Registration Document: Sable Wind Project. June 27, 2012

MODG: Municipality of the District of Guysborough. 2013. Municipality of the District of Guysborough Land Use Bylaw. 2013 Official Land Use Bylaw as Amended April 10, 2013. 72 pp.

MODG: Municipality of the District of Guysborough. 2014a. Homepage. Retrieved from: http://www.municipality.guysborough.ns.ca/home.

MODG: Municipality of the District of Guysborough. 2014b. Where to Stay. Retrieved from: http://www.municipality.guysborough.ns.ca/visitors/where-stay

Mosely, M. 2007. Records of Bats (Chiroptera) at Caves and Mines in Nova Scotia. Nova Scotia Museum Curatorial Report No. 99. 27 pp.

MRMS: Maritime Resource Management Service. 1975. Strait of Canso Natural Environment Inventory. Fish and Wildlife Resources. Canada-Nova Scotia Strait of Canso Environment Committee. 28 pp.

MRT: Mulgrave Road Theatre. 2014. History. Retrieved from: http://mulgraveroad.ca/?page_id=57.

MSC: Meteorological Service of Canada. 2002. Canadian Climate Normal's (1951-1980).Internet publication. Last Updated December 2002. Accessed from: http://www.msc-smc.ec.gc.ca/weather/contents_e.html.Mullen, D.M., and J.R. Moring. 1986. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (North Atlantic) – sea scallop. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.67). U.S. Army Corps of Engineers, TR EL 82-4. 13 pp.

NAS: National Audubon Society. 2014. The Christmas Bird Count Historical Results Online. http://www.christmasbirdcount.org. Accessed 22 September 2014.

Neily, P.D., Quigley, E., Benjamin, L., Stewart, B. and T. Duke. 2003. Ecological Land Classification for Nova Scotia. Volume 1 – Mapping Nova Scotia's Terrestrial Ecosystems. Report DNR 2003-2. 83 pp.

NLDEC: Newfoundland and Labrador Department of Environment and Conservation. 2005. Guidelines for the Design, Construction and Operation of Water and Sewerage Systems. Water Resources Management Division. 525 pp.

Notzke, C. 1994. Aboriginal Peoples and Natural Resources in Canada. Captus University, Ontario.

NRCan: Natural Resources Canada. 2013a. Earthquake Zones in Eastern Canada. Website accessed August 2013. http://www.earthquakescanada.nrcan.gc.ca/zones/eastcan-eng.php. Last modified 2013-04-26.

NRCan: Natural Resources Canada. 2013b. The Magnitude 7.2 1929 "Grand Banks" Earthquake and Tsunami Webpage accessed August 2014, http://www.earthquakescanada.nrcan.gc.ca/historic-historique/events/19291118-eng.php Last modified 2013-04-26.

C 1340-750

NRCan: Natural Resources Canada. 2013. Revised Modified Mercalli Intensities for the Magnitude 7.2 Grand Backs Earthquake. Webpage accessed August 2014, http://www.earthquakescanada.nrcan.gc.ca/historic-historique/events/19291118-revmmi-eng.php Last modified 2013-04-26.

NS: Nova Scotia. 2014. Climate Change Adaptation Database Guysborough. http://climatechange.gov.ns.ca/adaptation/54/61#table. Webpage accessed October 2, 2014.

NSAS: Nova Scotia's Authentic Seacoast. 2014. Retrieved from: http://www.authenticseacoast.com. Webpage Accessed on September 15, 2014.

NSBC: Nova Scotia Bat Conservation. 2014. Retrieved from: http://www.batconservation.ca.

NSBI: Nova Scotia Business Inc. 2015. Point Tupper/Bearhead Industrial Park. Website http://www.novascotiabusiness.com/en/home/locate/property/pointtupperbearheadindustrialpark.aspx accessed January 2015.

NSCAP: Nova Scotia Community Access Program. 2014. Retrieved from: http://www.nscap.ca/find-a-cap-site/cap-sites-by-region/guysborough. Accessed on September 18, 2014.

NSDNR: Nova Scotia Department of Natural Resources . 2003. Ecological Land Classification for Nova Scotia, Volume 1 – Mapping Nova Scotia's Terrestrial Ecosystems. Report DNR 2003-2, April 2003.

NSDNR. Nova Scotia Department of Natural Resources. 2006. Ecological Land Classification Map of Nova Scotia – Online Viewer. Version 2, Updated March 22, 2006. Available at: http://gis4.natr.gov.ns.ca/website/nselcmap/viewer.htm. Accessed September, 2014.

NSDNR: Nova Scotia Department of Natural Resources. 2007a. Recovery Plan for Moose (*Alces alces Americana*) in Mainland Nova Scotia.

NSDNR: Nova Scotia Department of Natural Resources. 2007b. Orthoimagery from GeoNOVA, 2007, downloaded June 2014.

NSDNR: Nova Scotia Department of Natural Resources. 2007. Ecodistricts of Nova Scotia. Map DNR 2007-2 Ecological Land Classification Map. Scale 1:500,000.

NSDNR: Nova Scotia Department of Natural Resources. 2011a. From Strategy to Action, An Action Plan for the Path We Share, A Natural Resources Strategy for Nova Scotia. Retrieved from: http://novascotia.ca/natr/strategy/pdf/Strategy_Action%20Plan.pdf

NSDNR: Nova Scotia Department of Natural Resources. 2011b. The Path We Share, A Natural Resources Strategy for Nova Scotia 2011-2020. Retrieved from: http://novascotia.ca/natr/strategy/pdf/Strategy_Strategy.pdf

NSDNR: Nova Scotia Department of Natural Resources. 2012a. Significant Species and Habitats Database. http://novascotia.ca/natr/wildlife/habitats/hab-data/DEFAULT.ASP. Accessed 5 September 2014.

NSDNR. Nova Scotia Department of Natural Resources. 2012. Nova Scotia Wetlands Vegetation and Classification Inventory. Updated June 12, 2012. Online viewer available at: http://gis4.natr.gov.ns.ca/website/nssighabnew/viewer.htm. Accessed September 2014.

NSDNR. Nova Scotia Department of Natural Resources. 2013. Forest Inventory (2007/2012). Updated: May 15, 2013. Available at: http://novascotia.ca/natr/forestry/gis/dl_forestry.asp. Accessed September, 2014.

NSDNR: Nova Scotia Department of Natural Resources. 2014a. Hunter and Trapper Harvest Statistics Index 2014a. http://novascotia.ca/natr/hunt/stats-index.asp. Accessed 11 September 2014.

NSDNR: Nova Scotia Department of Natural Resources. 2014b. Nova Scotia Abandoned Mine Opening (AMO) database. http://www.novascotia.ca/natr/meb/links/amolinks.asp. Accessed August 2014.

NSE: Nova Scotia Environment. 1988. Erosion and Sedimentation Control Handbook. Retrieved from: https://www.novascotia.ca/nse/surface.water/docs/ErosionSedimentControlHandbook.Construction.pdf

NSE: Nova Scotia Environment. April 1991. Guidelines for Development on Slates in Nova Scotia.

NSE: Nova Scotia Environment. 1997. Regulations Respecting On-Site Sewage Disposal Systems.

NSE: Nova Scotia Department of Environment. 1998. The State of the Nova Scotia Environment; 1998. Halifax, Nova Scotia.

NSE: Nova Scotia Environment. 2001. A Proponents Guide to Environmental Assessment. Retrieved from: https://www.novascotia.ca/nse/ea/docs/EA.Guide-Proponents.pdf

NSE: Nova Scotia Environment. 2005. Test Your Water Well for Naturally Occurring Arsenic. Accessed online.

NSE: Nova Scotia Environment. 2006. Guidelines for the Handling, Treatment, and Disposal of Septage, February 2006.

NSE: Nova Scotia Environment. 2007. Solid Waste-Resource Management Regulations. Retrieved from: http://www.novascotia.ca/just/regulations/regs/envsolid.htm. Webpage Accessed on October 7, 2014.

NSE: Nova Scotia Environment. 2007. On-Site Sewage Disposal Systems Regulations, March 2007.

NSE: Nova Scotia Environment. 2009a. Guide to Preparing an EA Registration Document for Pit and Quarry Developments in Nova Scotia, September 2008. Environmental and Natural

Areas Management Division, Environmental Assessment Branch. 355pp. Retrieved from: https://www.novascotia.ca/nse/ea/docs/EA.Guide-RegistrationDocumentation-PitQuarry.pdf

NSE: Nova Scotia Environment. 2009. Guide to Addressing Wildlife Species and Habitat in an EA Registration Document. Retrieved from: http://www.novascotia.ca/nse/ea/docs/EA.Guide-AddressingWildSpecies.pdf

NSE: Nova Scotia Environment. 2009. Nova Scotia's Climate Change Action Plan. Retrieved from: http://climatechange.gov.ns.ca/doc/ccap.pdf

NSE: Nova Scotia Environment. 2009. Guide to Preparing an EA Registration Document for Pit and Quarry Developments in Nova Scotia. September 2008. Environmental and Natural Areas Management Division, Environmental Assessment Branch. 35 pp.

NSE: Nova Scotia Environment. 2010. Water for Life: Nova Scotia's Water Resource Management Strategy. Retrieved from: https://www.novascotia.ca/nse/water.strategy/docs/WaterStrategy_Water.Resources.Management.Strategy.pdf

NSE: Nova Scotia Environment. 2011. Guide to Considering Climate Change in Environmental Assessments in Nova Scotia. Retrieved from: https://www.novascotia.ca/nse/ea/docs/EA.Climate.Change.Guide.pdf

NSE: Nova Scotia Environment. 2011. Guide to Considering Climate Change in Project Development in Nova Scotia. Retrieved from: https://www.novascotia.ca/nse/ea/docs/Development.Climate.Change.Guide.pdf

NSE: Nova Scotia Environment. 2011. Nova Scotia Wetland Conservation Policy. Retrieved from: http://www.novascotia.ca/nse/wetland/docs/Nova.Scotia.Wetland.Conservation.Policy.pdf

NSE: Nova Scotia Environment. 2013. Nova Scotia Watercourse Alteration Activity Standards. Retrieved from: https://service.clearservice.com/constructionns/campaignimages/1/otherpdf/121105-DRAFT-WatercourseAlterationsStandardsversion1.5.pdf

NSE: Nova Scotia Environment. 2013. Watercourse Alteration Protection; Erosion Protection; Wharves; Pipe Culverts; Arch or Open Box Culverts.

NSE: Nova Scotia Environment. 2013. On-Site Sewage Disposal System Technical Guidelines, June 2013.

NSE: Nova Scotia Department of the Environment. 2013. Regulations Respecting Air Quality made by the Governor in Council under section 112 of Chapter 1 of the Acts of 1994-95; the Environment Act.

NSE: Nova Scotia Environment. 2014a. Well Logs Database. Retrieved from: http://www.novascotia.ca/nse/welldatabase/wellsearch.asp. Accessed online on October 3, 2014.

C 1340-753

NSE: Nova Scotia Environment. 2014b. Naturally Occurring Uranium in Groundwater in Nova Scotia. Accessed online.

NSE: Nova Scotia Department of Environment. 2014c. Resources for Wetland Assessors. Available online at http://gov.ns.ca/nse/wetland/wetland.assessment.resources.asp. Updated on Mar 31, 2014. Accessed September 2014.

NSEL: Nova Scotia Environment and Labour. 1990. Guidelines for Environmental Noise Measurement and Assessment.

NSEL: Nova Scotia Environment and Labour. 1996. Guidelines for Management of Contaminated Sites in Nova Scotia. Retrieved from: http://www.novascotia.ca/nse/contaminatedsites/docs/contaminatedsitemanagementguidelines.pdf

NSEL: Nova Scotia Environment and Labour. 1997. Nova Scotia Standards for Construction and Installation for Petroleum Storage Tank Systems. Retrieved from: https://novascotia.ca/nse/dept/docs.policy/petroleum.storage.tank.systems.pdf

NSEL: Nova Scotia Environment and Labour. 1999. Pit and Quarry Guidelines. Environmental Monitoring and Compliance Division. May 4, 1999. 8pp. Retrieved from: https://www.novascotia.ca/nse/dept/docs.policy/Guidelines-Pit-and-Quarry.pdf

NSEL: Nova Scotia Environment and Labour. 2002. Storm Drainage Works Approval Policy. Retrieved from: https://www.novascotia.ca/nse/dept/docs.policy/Policy-Storm.Drainage.Works.Approval.pdf

NSEL: Nova Scotia Environment and Labour. 2004. Nova Scotia Ambient Air Monitoring Stations. November 22, 2006. Accessed from: https://novascotia.ca/nse/air/docs/DiCesare-AmbientNSAir.pdf

NSEL: Nova Scotia Environment and Labour. 2005. Guidelines for Monitoring Public Drinking Water Supplies. Retrieved from: https://www.novascotia.ca/nse/water/docs/Guidelines_for_Monitoring_Public_Drinking_Water_Supplies.pdf

NSEL: Nova Scotia Environment and Labour. 2009. Guide to Addressing Wildlife Species and Habitat in an EA Registration Document. 9pp.

NSFA: Nova Scotia Fisheries and Aquaculture. 2014a. Aquaculture Site Mapping Tool Webpage accessed August 2014. http://novascotia.ca/fish/programs-and-services/industry-support-services/aquaculture/site-mapping-tool/

NSFA: Nova Scotia Fisheries and Aquaculture. 2014b. Nova Scotia Anglers' Handbook and Summary of Regulations 2014. 68 pp.

NSHVS: Nova Scotia Historical Vital Statistics. 1891. Marriage Record: Murdock McNeil to Bridget Eaton, 2nd July. Book 1814, page 162, number 132. https://www.novascotia genealogy.com

NSLRT: Nova Scotia Lynx Recovery Team. 2006. Provincial Recovery Plan for the Canada Lynx (*Lynx canadensis*), Nova Scotia.

NSMNH: Natural History Museum of Natural History. 1984. The Natural History of Nova Scotia, Volume 1. Nova Scotia Department of Lands and Forests and Nova Scotia Department of Education.

NSTPW: Nova Scotia Transportation and Public Works. 1997. Standard Specification: Highway Construction and Maintenance. Retrieved from: https://novascotia.ca/tran/publications/standard.pdf

NSTPW: Nova Scotia Transportation and Public Works. 2007. Generic Environmental Protection Plan (EPP) for the Construction of 100 Series Highways. Retrieved from: https://novascotia.ca/tran/works/enviroservices/EPP100series/Generic%20EPP_July%202007.pdf.

NSW: New South Wales. (2008). New South Wales Construction Noise Guideline. Department of Environment and Climate Change, New South Wales, Australia. August 2008 draft for consultation.

O'Sullivan, E. 2011. The Community Well-Being Index (CWB): Measuring Well-Being in First Nations and Non-Aboriginal Communities, 1981-2006. Unpublished report submitted to Aboriginal Affairs and Northern Development Canada.

Owens, E.H. 1971. The Restoration of Beaches Contaminated by Oil in Chedabucto Bay, Nova Scotia. Marine Science Branch, Department of Energy Mines and Resources, Ottawa. Manuscript Report Series No. 19. 83 pp.

Owens, E.H. and M.A. Rashid 1976 Coastal Environments and Oil Spill Residues in Chedabucto Bay, Nova Scotia Can. J. Earth Sci. 13, 908-928 (1976)

PC: Parks Canada. 2011. Canso Island National Historic Site of Canada. Retrieved from: http://www.pc.gc.ca/eng/lhn-nhs/ns/canso/index.aspx. Webpage accessed September 22, 2014

PHA: Port Hawkesbury Airport. 2014. http://www.porthawkesburyairport.com/airport-facilities/. Webpage accessed September 27, 2014.

RCL: Royal Canadian Legion – Branch Locator. 2014. http://www.legion.ca/who-we-are/branch-locator/. Webpage accessed September 26, 2014.

RCMP: Royal Canadian Mounted Police. 2014. Districts and Detachments. http://www.rcmp-grc.gc.ca/ns/detach/index-eng.htm. Webpage accessed on September 19, 2014.

Richard, W. and R. Daigle. 2011. Scenarios and Guidance for Adaptation to Climate change and Sea-Level Rise – NS and PEI Municipalities. Atlantic Climate Adaptation Solutions Association. 90 pp.

Robertson and Bryan. 2004. Technical Memorandum – pH Requirements of Freshwater Aquatic Life. Robertson-Bryan Inc. Accessed Sept 2014. http://www.swrcb.ca.gov/rwqcb5/water_issues/basin_plans/ph_turbidity/ph_turbidity_04phreq.pdf

Rock, J. and D. Shervill. 2012. Country Island Tern Restoration Project Annual Report, 2012 (Year 15).

Ruffman, A. 1995. Earthquakes and Tsunamis of Eastern Canada: Cause for Concern?; Atlantic Geology, 31 (1), p. 58.

Ruffman, A. and Tuttle, M.P., 2005. Tsunamis of Eastern Canada and New England: the primary historical record; Proceedings of the 12th Canadian Coastal Conference, Dartmouth, Nova Scotia, November 6-9, 2005.

SC: Statistics Canada - 2006 Community Profiles - Guysborough. 2014. http://www12.statcan.gc.ca/census-recensement/2006/dp-pd/prof/92-591/details/page.cfm?Lang=E&Geo1=CSD&Code1=1213004&Geo2=PR&Code2=12&Data=Count&SearchText=guysborough&SearchType=Begins&SearchPR=01&B1=All&Custom=. Webpage accessed on July 10, 2014.

SC: Statistics Canada - 2011 Census Profile. 2014. http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/prof/index.cfm?Lang=E. Webpage accessed on July 10, 2014.

SC: Statistics Canada - Labour Force Characteristics, unadjusted, by economic region (3 month moving average) (Nova Scotia, New Brunswick). 2014. http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/lfss05b-eng.htm. Accessed on July 10, 2014

Schummer, M.L. & Eddleman, W.R. 2003. Effects of disturbance on activity and energy budgets on migrating waterbirds in south-central Oklahoma. Journal of Wildlife Management, 67 (4), 789-795.SD: Science Daily. 2010. Spawning Habitat of Bluefin Tuna in Gulf of Mexico: Critical area intersects Deepwater Horizon oil spill. Retrieved from: http://www.sciencedaily.com/releases/2010/05/100528210726.htm. Accessed on September 26, 2014.

SD: Science Daily. 2012. Tracking Atlantic Bluefin Tuna Shows Migration Secrets. Retrieved from: http://www.sciencedaily.com/releases/2012/05/120522175408.htm. Accessed on September 26, 2014.

Shaw, J., Piper, D.J.W., Fader, G.B.J., King, E.L., Todd, B.J., Bell, T., Batterson, M.J. and Liverman, D.G.E. 2006. A Conceptual Model of the Deglaciation of Atlantic Canada. Quaternary Science Reviews 25, P. 2059 – 2081.

Simon, M. 2014. Bay of Islands Colonial Seabird Surveys and Habitat Assessment. Prepared by Molly Simon for the Nova Scotia Nature Trust. August 25, 2014.

C 1340-756

SLR Consulting Ltd. 2014. Surface Water Assessment: Black Point Quarry, Nova Scotia.

Soulliere, C.E. and Thomas, P.W. 2009. Harlequin Duck Threat Assessment, Eastern Population. Canadian Wildlife Service Technical Report, Series No. 491, St. John's, NL.

SRI: Soil Research Institute. 1963. Soil Map of Guysborough County, Nova Scotia, East Sheet. Research Branch, Canada Department of Agriculture, Ottawa. Scale 1 in. to 1 mile.

SRSF: Social Research for Sustainable Fisheries. 2001. The SRSF Eastern Shore Nova Scotian Coastal Fisheries Ecosystem Project: A Social Profile of LFA's 29 (Southern Richmond County) 31A and 31B (Guysborough County) Fisheries. SRSF Research Report #1. 20 pp.

Stantec. 2009. Roadmap for Aquaculture Investment in Nova Scotia. Prepared for the Nova Scotia Department of Fisheries and Aquaculture File 1048755. 110 pp.

Stea, R.R. and J.H. Fowler. 1979. Pleistocene Geology Eastern Shore Region, Nova Scotia. Sheet 1 Scale 1:100,000.

Stea. R.R., Conley, H. and Brown, Y. 1992. Surficial Geology of the Province of Nova Scotia. Map 92-3, 1:500,000 scale. Nova Scotia Department of Natural Resources.

Stiegman, M., 2006. Fisheries privatization versus community-based management in Nova Scotia: emerging alliances between first nations and non-native fishers. In: Adkin, L.E. (Ed.), Environmental Conflict and Democracy in Canada. University of British Columbia, Vancouver, Canada, pp. 69-83.

Strait Superport. 2014. Strait of Canso Port. Website accessed July 2014. http://www.straitsuperport.com/port/.

TC: Transport Canada. 2011. Ballast Water Management. Website accessed August 2014. http://www.tc.gc.ca/eng/marinesafety/oep-environment-ballastwater-management-1963.htm Last modified 2011-08-04.

TC: Transport Canada. 2014. Tanker Safety and Spill Prevention. http://www.tc.gc.ca/eng/marinesafety/menu-4100.htm#e Website accessed August 2014. Last modified 2014-06-17.

The Three Shores Nova Scotia. 2014. http://threeshoresnovascotia.ca. Webpage accessed September 15, 2014.

Trail Peak. 2014. Guysborough Nature Trail – Trans Canada Trail. http://www.trailpeak.com/trail-Guysborough-Nature-Trail-Trans-Canada-Trail-near-Canso-NS-6676. Webpage accessed September 22, 2014.

UNESCO: United Nations Educational, Scientific and Cultural Organization. 1987. Ramsar Convention on Wetlands. Retrieved from: http://www.ramsar.org/cda/en/ramsar-documents-texts-convention-on/main/ramsar/1-31-38%5E20671_4000_0__.

C 1340-757

USACE: United States Army Corps of Engineers. 2012. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (Version 2.0).

USGS. 1982. Habitat Suitability Index Models: Creek Chub. Biological Services Program. FWS/OBS-82/10.4. U.S. Department of Interior Washington, D.C. 20240.

US Fish and Wildlife Service. 2003. Interim Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines. Memorandum to Region Directors Regions 1-7 from the Deputy Director, May 13, 2003, Washington D.C., 2003.

Watanabe S, Scheibling RE and Metaxas A. 2010. Contrasting Patters of Spread in Interacting Invasive Species: *Strongylocentrotus droehbachiensis,* and the Abundance of American Lobster, *Homarus Americanus,* on the Atlantic Coast of Nova Scotia. Canadian journal of Fisheries and Aquatic Sciences 38: 1339-1349.

Webb, K.T. and Marshall, I.B. 1999. Ecoregions and Ecodistricts of Nova Scotia. Crops and Livestock Research Centre. Research Branch, Agriculture and Agri-Food Canada, Truro, N.S.: Indicators and Assessment Office, Environmental Quality Branch, Environment Canada, Hull, Quebec. 39 pp.

Wiber, M., Milley, C. 2007. After Marshall: implementation of aboriginal fishing rights in Atlantic Canada. Journal of Legal Pluralism and Unofficial Law 55, 163-186.

Wightman, J. 2012. Development Trends and Vulnerability to Severe Storms. A Case Study Analysis in Nova Scotia. Dalhousie University Department of Environmental Planning Website. 17 pp.

Williams, U. and J.W. Chardine. 1998. The Leach's Storm-Petrel: General information and handling instructions. Unpublished information paper for offshore oil companies. 5 pp.

Personal Communication

J. Murphy, comment received at open house, April 22, 2014 Queensport, Nova Scotia. Follow up email received October 23, 2014.

F. Fogarty, Fogarty descendant, email, 6 May 2014.

G. Boudreau, Manager, Guysborough County Inshore Fishermen's Association, May 2014.

G. Herbert, Fisheries and Oceans Canada, September 2014

G. Anderson (Captain), Senior Marine Inspector - Expert Maritime Principal Transport Canada Marine Safety Compliance & Enforcement August 2014.

G. Freer, Port Hawkesbury Port Authority, September 2014.

D. Fewer, Nova Scotia Ground Search and Rescue Association, Central Zone September 26, 2014.

J. Rock, Environment Canada - Canadian Wildlife Service, September 2014.

A. Hicks, Environment Canada - Canadian Wildlife Service, September 2014.

C. Gjerdrum, Environment Canada - Canadian Wildlife Service, September 2014

D. Torrey, Development Officer, MODG, 2014

M. Pulsifer, NSDNR, August 2014

H. Krause, local resident, July 2014

O. Rhynold, local resident, July 2014

EC-CWS Environment Canada – Canadian Wildlife Service 2014.

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Appendix A – Hydrogeological Technical Study

ATTACHMENT A - Sites Borehole Logs

ATTACHMENT B – Fracture Frequency Plots

ATTACHMENT C – 2014 Granite Analytical Chemistry Results

ATTACHMENT D –Metasedimentary Rock and Surface Water Analytical Chemistry Results

ATTACHMENT E - AECOM Technical Memo June/July 2014 Fieldwork

ATTACHMENT F - AECOM Technical Memo – August 2014 Fieldwork

ATTACHMENT G - Hydraulic Conductivity Tests Analysis

ATTACHMENT H - Groundwater Elevation Summary Tables & Hydrographs

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

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Proposed Black Point Quarry Project
Guysborough County, Nova Scotia

Hydrogeological Technical Report

February 2015
SLR Project No.: 210.05913.00000

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HYDROGEOLOGICAL TECHNICAL REPORT

PROPOSED BLACK POINT QUARRY PROJECT

GUYSBOROUGH COUNTY, NS

SLR Project No.: 210.05913.00000

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Attachment H	Groundwater Elevation Summary Tables and Hydrographs

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1.0 INTRODUCTION

SLR Consulting was retained by Vulcan Materials Group and Morien Resources Corporation to conduct a hydrogeological assessment of a proposed aggregate quarry in Guysborough County, Nova Scotia. The assessment and description of hydrogeological conditions within the vicinity of the site was conducted in accordance with and is a requirement outlined in the "Guide to Preparing an EA Registration Document for Pit and Quarry Developments in Nova Scotia" (Nova Scotia Environment [NSE], 2009) and the guidelines provided for the site by the Canadian Environmental Assessment Agency (CEA Agency 2014).

1.1 Site Description

The proposed Black Point Quarry Project is located on a 354.5 ha property along the south shore of Chedabucto Bay, approximately 4.0 km west of the village of Fox Island in Guysborough County, Nova Scotia. The Project site location and study area is presented on Drawing 1.

The proposed quarry land is currently zoned by the Municipality of the District of Guysborough (MODG) as Heavy Industry (M-2).

The site is greenfield (undeveloped) and covered by thin soils, which sustain tall shrub and some coniferous forest. The site features numerous wetlands and a lake (Fogherty Lake). Topography on the site slopes in all directions away from a granite hill, located within the southern central part of the site. This granite is the target resource for the proposed quarry.

1.2 Proposed Development

The proposed quarry will extract the granite beneath the hill which has minimal overburden covering it. The quarry at full build out will be approximately 130 m deep and will occupy a footprint of 180 ha. Processing including secondary crushing, screening, washing will be undertaken on a 28 ha platform situated on lower land between the quarry and the coastline. The aggregate will be exported by ship via a marine terminal and load-out facility, to be constructed north of the processing platform.

1.3 Objectives

The objectives of this hydrogeological assessment are based on Section 6.1.1 and 6.1.3 of NSE (2009) and section 9.1.2 of CEA Agency (2014). These objectives include:

- Provide a general description of the geological features of the proposed pit or quarry site including the surficial geology and bedrock geology;
- If acid slates are present, provide additional information to determine if the material is net acid producing / consuming. Use acid rock drainage (ARD) / metals leaching (ML) prediction information to predict water quality for effects assessment and to determine mitigation requirements for the project;
- Discuss the predicted effects on the identified geological formations and how the effects will be avoided or minimized;
- Provide a description of the hydrogeology at the site and the local and regional study areas, which will include;

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- A review of the physical geography and the geology of the area as it relates to local and regional groundwater flow and aquifer / aquitards;
- A conceptual hydrogeologic model in plan and cross-section;
- An inventory and analysis of existing information on the hydrogeological conditions / groundwater resources in the project area, including published reports, geological maps, well record data;
- A pre-development water well survey to establish baseline well water quality and quantity;
- Measurements of hydraulic conductivity for all hydrogeological units in the project area; and
- Baseline analysis of groundwater quality at the site and within the local and regional study area.

In order to achieve these objectives, this report is divided into two main sections, the first of which relates to the host geophysical environment and the second of which relates to the groundwater resources contained therein.

2.0 GEOPHYSICAL ENVIRONMENT

2.1 Physiography, Topography and Geomorphology

The Project site falls within the Atlantic Coast Ecoregion which is located along the southeastern coast of Nova Scotia (Drawing 2). Ecoregions are characterized by distinctive, large-order landforms or assemblages of regional landforms, small order climates, water, soils, vegetation, and regional human activity uses and patterns, and are usually influenced by groundwater conditions.

The coastline south of Canso is highly embayed, and fault lines have had a strong influence on shaping deep inlets along the eastern shore of Nova Scotia. West of Canso, along the south shore of Chedabucto Bay where the project is situated, the coastline is generally straight with few embayments (Drawing 2).

The surface is composed predominantly of Paleozoic metamorphic and granite bedrock, mantled by a discontinuous veneer of stony glacial till. The presence of a high water table, caused by abundant rainfall and underlying low permeability bedrock support numerous wetlands throughout the region. Common wetlands in this Ecoregion include fens, salt marshes, and raised and flat bogs (Webb and Marshall 1999). These may or may not be groundwater fed.

The Project site is located in the Eastern Shore Ecodistrict, a subdivision of the Atlantic Coast Ecoregion. The influence of the Atlantic Ocean provides a consistent coastal climate which is reflected in the forests of the Ecodistrict.

The Project site is located on a granite hill with a maximum elevation of approximately 97 metres (m) above sea level (asl). This is one of the highest elevations in the region and places the Project site at the top of the local watershed. Topography slopes gently in all directions from the peak of the granite hill; to the north an abrupt change in elevation is observed at 60 m asl. The northwest edge of the property (north of Fogherty Lake) forms a granitic cliff, which descends from 60 m asl to the sea over a distance of about 150 m. This cliff is lower in the north-central and northeast portions of the property between Fogherty Head and Black Point,

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where the topography levels off at approximately 20-30 m asl and gradually grades to the rocky coast (Drawing 3).

2.2 Soils and Sediment

Approximately 94% of the soils in Guysborough County have developed from glacial till, with the remainder being developed on alluvial or glaciofluvial deposits. Textures in the till soils range from sandy loam to loam in the upper layer, and in the parent material the soils range from gravelly sandy loam to clay loam. Textures in the alluvial and glaciofluvial soils range from gravelly sandy loam to silt loam in the surface layer and in the subsoil, the soils range from gravel to silt loam in the subsoil (Hilchey 1964).

Soils are thin to non-existent on the top of the granite hill that dominates the property. Soils thicken to the east and west at lower elevations where wetlands have developed. The soil map (Drawing 4) labels the Project site as "rockland", defined as soil areas with 50% or more of rock outcrops or boulders. Isolated pockets of peat, defined as brown, poorly decomposed organic material 12 in. or more in depth, are shown adjacent to Fogherty Lake. A single occurrence of Wolfville Series soil is shown in the extreme southeast corner of the property. This soil consists of "moderately stony, dark brown friable loam over dark grayish brown sandy clay loam". As noted above, this soil is developed from a parent material made of glacial till, in this case "firm dark reddish brown sandy clay loam glacial till" (SRI 1963).

2.3 Surficial Geology

Surficial geology in the vicinity of the Project site is described by the published geology maps (Stea *et al.* 1992; Stea and Fowler 1979). It is predominantly comprised of Pleistocene-age stony till up to 20 m thick which consists of a sandy matrix and material derived from local bedrock sources (Drawing 5). Three types of glacial till are found on the site. The granite till shown within the property boundary is yellow-brown in colour, loose and sandy. It averages 2 m thick but is up to 5 m thick in some areas. The quartzite till is bluish-greenish-grey in color, loose and coarser grained than the granite till; it averages 3 m thick but may be up to 20 m thick in some places. A thin band of red till developed on Halifax Formation bedrock is present along the coastal portion of the property.

Observations made on site indicate these tills are essentially absent on the top of the granite hill, but thicken on the slopes of the hill at lower elevations. The tills are well exposed along the coastline at Half Island Cove (Figure 1) and Fox Island Main. Dug wells, which are used more often than drilled wells in this area to provide potable water, are installed in these tills. Well records obtained from NSE indicate that surficial deposits are generally comprised of various mixtures of clay, sand, gravel and boulders and vary in thickness between approximately 1 m and 19 m, which is consistent with the geologic mapping.

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Figure 1
Photo - View from the east side of Gaulman Point looking at glacial tills.

Glacial tills in the background of Figure 1 host dug wells along Half Island Cove Road. An outcrop of Halifax Formation bedrock and marine beach deposits are shown in the foreground.

Several drumlin[1] features are indicated along Highway 16 west of Hayden Lake; deposits in these areas are thought to be up to 30 m thick (Stea and Fowler 1979). Drumlin deposits are generally siltier than the rest of the stony till, as they incorporate material formed from the erosion and incorporation of older till units. An esker[2] feature comprising sand and gravel deposits is indicated north of Highway 16 in the vicinity of Hayden and Cavanaugh Lakes.

Core logs from on-site drilling of the granite aggregate resource indicate that surficial deposits over the majority of the Project site proposed for the quarry are thin (<2 m) or absent where granite outcrops at surface.

[1] Drumlin deposits are low, smoothly rounded, elongate mounds of glacial till, carved that way by the horizontal movement of glacial ice.

[2] Eskers are low, sinuous, elongate mounds of sand and gravel deposited in sub-glacial streams.

2.4 Bedrock Geology

2.4.1 Regional Geology Overview

Structurally, the Project site is located within the Meguma Terrane structural province, south of Chedabucto Bay. Chedabucto Bay lies on top of the Cobequid-Chedabucto Fault System, which separates the Meguma Terrane in the south from the Avalon Terrane in the north. The sedimentary rocks of the Meguma Terrane consist of primarily metamorphosed, fine-grained sandstones and shales, with minor amounts of volcanic and carbonate rocks in local areas. The Meguma Terrane was later intruded by younger granitic rocks (NSMNH 2014), including the granite that will be quarried as aggregate in the Black Point Quarry Project.

The regional geology at the Project site consists of Cambro-Ordovician age metamorphosed sedimentary rocks of the Goldenville and Halifax formations that were intruded by Devonian-age granite. Granite represents about 20-25 percent of the bedrock in Nova Scotia and is found throughout mainland Nova Scotia and Cape Breton. South of the Cobequid-Chedabucto Fault System, granite intrusions are found within sedimentary rocks of the Meguma Zone. The granite was generated during the Acadian Orogeny, when the Meguma sedimentary pile was squeezed against, and possibly over, the Avalon Zone (NSMNH 2014). The geology of the site and surrounding area is presented on Drawing 6.

2.4.2 Local Geology

The geology surrounding the Project site consists of Cambro-Ordovician age metamorphosed sedimentary rocks (metasediments) of the Goldenville and Halifax Formations. The Goldenville Formation is the oldest and is generally found to the south and west of the Project site, with some outcrop on the tip of the Fogherty Head / Black Point headland. The Goldenville Formation comprises a thickly bedded metawacke with minor metapelite (<5%). Photographs showing the Goldenville Formation in situ are presented in Figure 2.

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Figure 2
Photo – Outcrop of Goldenville Formation showing vertical bedding and jointing.

Immediately to the south of the faulted boundary with the Goldenville Formation on the Fogherty Head / Black Point headland lies the Halifax formation, comprising a porphyroblastic, sulphide-bearing, graphite schist interbedded with thin layers of metawacke (Hill 1991). Figure 3 illustrates the highly deformed and sheared Halifax Formation in outcrop.

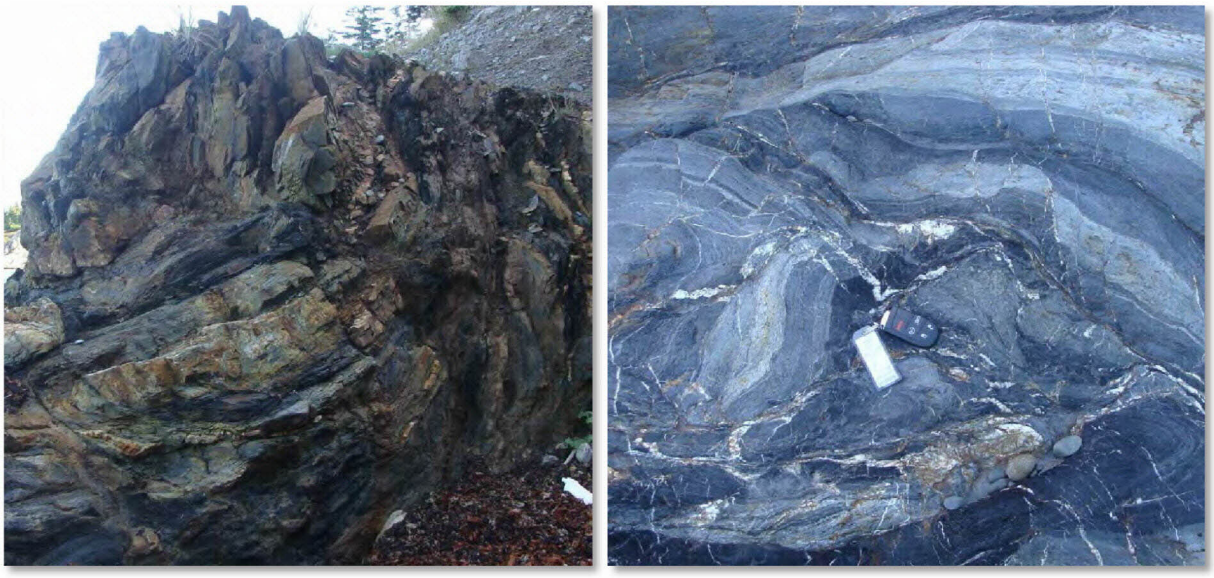

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Figure 3
Photo - Outcrop of Halifax Formation (left) and shearing detail in closeup (right).

Based on provincial geologic mapping, the majority of the Project site, including the area to be quarried, is composed of a medium-grained, equigranular to slightly porphyritic granite with less than 4% biotite (Hill 1991). The granitic pluton has been intruded into the Goldenville Formation and the northern boundary with the Halifax Formation comprises a west-northwest to east-southeast trending, dextral strike-slip fault. This fault is consistent with the major structural fabric direction within the metamorphic rocks in the vicinity of the Cobequid-Chedabucto Fault System and is likely to be the dominant fracture orientation in the Halifax and Goldenville Formations. The boundary between the Halifax and Goldenville Formations between Fogherty Head and Black Point is also faulted.

Eleven core holes have been drilled in the Project site footprint in order to confirm the granite's suitability as a construction aggregate. Their drill logs are provided as Attachment A and locations shown on Drawing 7. The logs demonstrate a pinkish to greyish-white granite comprising 50% to 60% feldspar, 35% to 48% quartz and up to 10% biotite and muscovite mica.

The granite does not exhibit a structural fabric, i.e. it is massive as illustrated in the outcrop and core photographs in Figure 4, and is not sheared or deformed. The core logs indicate that the most frequent fracturing and jointing occurs in the upper 40 m as demonstrated by the fracture frequency plot in Attachment B. Two fault zones were noted in the core logs for BP-8 and BP-9 at 93 to 94 m bgs and 20 m to 25 m bgs respectively, and are shown on the fracture plots by fracture frequencies of >20 fractures per metre. Detailed topographic and LiDAR data of the site indicate a bifurcating lineament running from the northwest corner of Murphy's Lake to the minor watercourse to the northeast of Fogherty Lake. This northwest-southeast trend is consistent with known faulting in the area and may indicate the surface expression of a fault zone within the granite. Core holes BP-8 and BP-9 are located close to this lineament and intersect broken zones of rock which may be related to a fault or faults. This is of interest as these zones may provide preferential pathways for groundwater movement into the quarry in future.

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Figure 4
Photo - Outcrop of granite (left) and core detail in closeup (right).

2.4.3 Acid Rock Drainage Potential

The granite at the Project site will be quarried to produce crushed-stone aggregate. Analytical testing was conducted in 2014 on the granite taken from three boreholes drilled in the granite resource (BP-7, BP-8 and BP-9) to confirm its suitability as construction aggregate. Testing included analysis of weight % sulphur and acid production potential as indicators of acid rock drainage (ARD) potential, since ARD has both structural and environmental implications. Testing indicated that the concentration of sulphur / sulphide in the granite is well below the threshold indicated in the Sulphide Bearing Material Disposal Regulations (N.S. Reg. 57/95) and is therefore considered non-acid producing (Attachment C). This is fully consistent with the chemical composition of aggregate quality granite: even limited ARD potential would render the rock un-useable as aggregate.

Halifax formation slates, which are often sulphide bearing, and Goldenville formation quartzite and greywacke, which is rarely sulphide bearing, are present within the proposed Project area at the northern end of the site. These rocks underlay the area proposed for the processing plant and aggregate stockpiles. Although they will not be quarried for aggregate, these formations may be disturbed for construction of the laydown area and excavated rock may be used to construct the marine terminal.

In October 2011, Black Point Quarry project geologists collected samples from these formations for ARD analysis. Five of the six surface samples collected have sulphide contents below the 0.4% threshold stipulated in the Regulations (Dalton 2011 in Attachment D). One sample had sulphide above the threshold (i.e., 0.935%); however, the material was found to contain some neutralizing capacity with a pH of 7.4. From all indications, the Goldenville Formation rock on site is sulphide free and is proposed to be used in construction of the rubble-fill for the wharf. The Halifax Formation, which likely contains sulphides appears to exist only in a small band across the site (Attachment D) and will be avoided to the extent possible. The Proponent will sample and test these rocks prior to any excavation in accordance with the guidance provided in

the provincial Sulphide Bearing Material Disposal Regulations. Should sulphide bearing materials be disturbed, the Proponent will work with NSE and NSDNR to confirm that all regulatory requirements are met before excavation begins.

3.0 GROUNDWATER RESOURCES

The hydrogeological regime at the application site and the surrounding area is described in the following sub sections:

- groundwater wells and use;
- aquifer characteristics;
- recharge mechanisms;
- groundwater levels and flow; and
- groundwater quality.

The hydrogeological data has been used to develop a conceptual site model that has in turn been used to assess potential impacts associated with the proposed development. The model has also been used to determine appropriate mitigation measures.

3.1 Groundwater Wells and Use

The objectives of the residential well assessment were to establish baseline water quality conditions and to provide an assessment of the hydraulic parameters within the aquifers utilised by local residences adjacent to the Project site. Initially, a water well records search was undertaken by obtaining records from NSE, followed by a door-to-door survey of all residences within a 2 km radius of the Project site. A number of properties outside the 2 km radius were surveyed and sampled and/or yield tested in order to further assess the relevant aquifer units. At each residential well, a questionnaire was completed to determine the type of well (drilled or dug), well completion details, water levels and whether the well user has any issues with water quality or quantity. Details of the work undertaken at the residential wells are provided in Attachments E and F (AECOM 2014a and 2014b).

The majority of local wells (for which there are records) are utilized for domestic or commercial purposes. The NSE records indicated a total of 16 wells within the main settlements adjacent to the Project site; however 31 wells were identified by the door to door survey. These wells are located in the vicinity of the settlements of Half Island Cove (five well records) and Fox Island Main / Indian Cove (six well records) with several spread along Highway 16 (five well records) to the south of the site. Drawing 7 presents the locations of the wells identified from the records search and the door-to-door survey for which Table 1 summarizes the information collected.

The majority of drilled wells are between 30 m and 105 m below ground surface (bgs) and are screened within either the Goldenville or Halifax formations. There are no residential or commercial water wells drilled in the granite. The closest drilled well (BPRWA007) to the Project site is approximately 1 km to the south along Highway 16, however all of the other drilled wells recorded are greater than 2 km from the site.

Dug wells are between 1.8 m and 7.0 m deep according to measurements taken in the field. No lithological logs are available for the dug wells, however, based on their measured depth it is inferred that they are completed in the surficial deposits. Dug wells are by far the most common residential well type in the area, of which there are two (BPRWA008 and BPRWA013) within 1 km and five between 1 km and 2 km from the Project site.

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Table 1
Water Wells Reportedly Within 2 km and Other Wells Tested

Drawing Ref [1]	Address	Easting (UTM)	Northing (UTM)	Well Depth (m)	Drilled / Dug	Distance (m) and Direction from Site
NSE10497	-	639500	5023500	85.26	Drilled	Unknown
NSE62059	79 Fox Island Road	648697	5022586	103.53	Drilled	2,740m E
NSE62061	2238 Highway #16	650111	5022018	85.26	Drilled	>2000m E
NSE71270	169 Fox Island Road	648809	5022942	74.6	Drilled	~3000 m E
NSE810105	-	641188	5022332	90.44	Drilled	Unknown
NSE820027	-	647717	5022481	75.46	Drilled	Unknown
NSE840028	-	641188	5022332	105.66	Drilled	Unknown
NSE840029	-	641188	5022332	46.28	Drilled	Unknown
NSE870892	-	640500	5022500	44.15	Drilled	Unknown
NSE891208	-	640500	5022500	48.72	Drilled	Unknown
NSE921506	-	649500	5022500	38.06	Drilled	Unknown
NSE980451	-	640500	5022500	60.9	Drilled	Unknown
NSE991271	Fox Island	649500	5021500	30.45	Drilled	Unknown
NSE111412	2290 Highway #16	649763	5022026	50.24	Drilled	>2000m E
NSE111413	3155 Highway #16 , Fox Island	644975	5019612	62.42	Drilled	~1500m SE
BPRWA001	257 Half Island Cove Road	642088	5023441	5.89	Dug	1,630m W
BPRWA002	272 Half Island Cove Road	642231	5023406	6.3	Dug	1,490m W
BPRWA003	267 Half Island Cove Road	642232	5023505	4.19	Dug	1,465m W
BPRWA004	230 Half Island Cove Road	642132	5023296	1.89	Dug	1,630m W
BPRWA006	155 Half Island Cove Road	641731	5023150	6.19	Dug	2,050m W
BPRWA007	3421 Highway 16, RR#1	644835	5021376	85.34	Drilled	1,050m S
BPRWA008	3596 Highway 16	643589	5021745	4.55	Dug	815m SW
BPRWA009	59 Fox Island Main, Canso	648615	5022586	n/a	Drilled	2,675m E
BPRWA011	235 Fox Island Main Rd; PO box 501 Canso	649335	5023096	n/a	Drilled	>3,000m E

Drawing Ref (1)	Address	Easting (UTM)	Northing (UTM)	Well Depth (m)	Drilled / Dug	Distance (m) and Direction from Site
BPRWA012	RR #1 Canso	648466	5022724	3.4	Dug	2,535m E
BPRWA013	3595 Upper Fox Island	643569	5021658	7.0	Dug	860m SW
BPRWA014	2823 Upper Fox Island RR#1			3.04	Dug	1,510m SE
BPRWA015	2574 Hwy 16, RR 1 Fox Island	648538	5022253	n/a	Dug	2,630m E
BPRWA016 / NSE62060	79 Fox Island Main Road	648680	5022576	85.26	Drilled	2,740m E
BPRWA017	2927 Highway 16	646643	5021585	n/a	Dug	~1500m SE

(1) NSE = wells recorded in the NSE Well Logs Database; BPR = wells sampled for this study. Well owner's names withheld to protect privacy.

3.2 Aquifer Characteristics

A number of different geological units with different hydraulic properties are present in the study area. The distinct units are discussed here in order of increasing geological age. The testing of several residential wells was undertaken and details of the work are provided in Attachments E and F (AECOM 2014a and 2014b). However, due to difficulty obtaining accurate discharge rates and interruptions in pumping and recovery tests due to household water system interference, any figures quoted for household wells BPWRA001 and BPRWA007 are approximations.

3.2.1 Surficial Deposits

Surficial deposits, where present, consist of stony till and related drumlin and esker deposits. Intergranular flow predominates in the sandy matrix and the hydraulic conductivity is locally highly variable, having low conductivity where clay rich material predominates and higher conductivity where interconnected sand is present. A number of dug wells, described in Section 3.1, are present in the area. These wells are installed into the surficial deposits for potable water supply domestic purposes, indicating that the surficial deposits are locally important aquifers. Such water supplies usually obtain their water from localized recharge of precipitation.

An in-situ variable head permeability test has been undertaken in residential well BPRWA001 by undertaking a short term pumping and recovery test. No other dug residential wells were available for yield testing. Test results were analysed using the Theis Recovery method as hosted by AquiferTest (v3.5) software to obtain hydraulic conductivity values. A copy of the analysis undertaken is presented in Attachment G. The test results show that the surficial deposits have an approximate hydraulic conductivity of 2×10^{-6} m/s with a transmissivity of 2×10^{-5} m^2/s. The hydraulic conductivity value obtained at this residential well is at the upper end of the generally recognized spectrum for glacial tills (10^{-6} to 10^{-12} m/s Freeze and Cherry, 1979). Given the sandy nature of this glacial till, such a result is expected.

3.2.2 Granite

The granite bedrock is a crystalline igneous rock, and as such has negligible primary (intergranular) porosity, so all groundwater storage and flow occurs within the joints and fractures. The fracture frequency plot in Attachment B indicates that the highest frequency of fractures within the granite occurs in the upper 40 m. These fractures are likely to represent various types of joints and discontinuities caused by tectonic stresses, cooling of the granite, the release of pressure upon the rocks due to overburden removal and chemical or physical weathering. Two fracture zones were noted in the core logs for BP-8 and BP-9 that may be evidence of faulting, and depending on their nature may act as preferential pathways or boundaries to groundwater flow. It is considered likely that the majority of groundwater flow in the granite takes place in the upper 40 m based on the fracture frequency.

Given the remote nature of this site and low risk of effects on private wells, packer testing was not undertaken on the core holes.[3] To provide initial hydraulic conductivity information, a number of slug, and pumping and recovery tests were undertaken on granite core holes BP-5, BP-7, BP-8 and BP-9 in 2014. Details of the work undertaken at the granite core holes are

[3] It is anticipated that further hydraulic conductivity testing would be undertaken as the monitoring network is developed as per Section 3.7.4.

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provided in Attachments E and F (AECOM 2014a and 2014b). The slug tests were conducted using a solid slug with instantaneous head changes in the wells and the pumping and recovery tests were undertaken by pumping for between 25 minutes and 140 minutes. To obtain hydraulic conductivity values, the slug tests were analysed using the Bouwer-Rice method and the recovery tests were done using the Theis recovery method, both hosted in the AquiferTest (v3.5) software. A copy of the analysis undertaken is presented in Attachment G. Initial slug tests indicated hydraulic conductivities of approximately 6 x 10^{-7} m/s to 7 x 10^{-7} m/s, however, later pumping and recovery tests indicated hydraulic conductivities of 2 x 10^{-7} m/s to 6 x 10^{-7} m/s. It is considered that the longer pumping and recovery tests give a better idea of the bulk granite properties due to their larger water level changes and radius of influence around the wells. These values are typical of low yield wells.

3.2.3 Cambro-Ordovician (Meguma) Metasediments

The Cambro-Ordovician metasediments of the Goldenville and Halifax Formations are primarily comprised of slate, shale and quartzite and demonstrate low intergranular porosity due to their relatively high degree of metamorphism. Secondary fracture porosity is likely to be responsible for the yields obtained from residential wells in the vicinity of the site. A number of residential wells in the area are drilled into the Goldenville and Halifax Formations indicating that the aquifers are at least locally important for groundwater supplies.

Nova Scotia Environment records indicate two yield tests in wells in the vicinity of the Project site, with one in the Halifax Formation with a calculated hydraulic conductivity of 1 x 10^{-6} m/s and the second in the Goldenville Formation with a calculated hydraulic conductivity of 7 x 10^{-7} m/s. A yield test was completed in the drilled well BPRWA007; however, the pumping rate during the test is not known and was not possible to estimate because of the configuration of the water supply system (AECOM 2014a). The most complete recovery test was therefore analysed as a slug test using the KGS method in Aqtesolv. The analysis gave an estimated hydraulic conductivity of 6 x 10^{-8} m/s. A copy of the analysis undertaken is presented in Attachment G.

3.2.4 Summary

In summary these hydraulic conductivity values are compared here:

- the **surficial till** deposits had an approximate hydraulic conductivity of 2 x 10^{-6} m/s;
- the fractured **granite** hydraulic conductivities were 2 x 10^{-7} m/s to 7 x 10^{-7} m/s;
- the **Halifax Formation** had a measured hydraulic conductivity of 1 x 10^{-6} m/s; and
- the **Goldenville Formation** had a measured hydraulic conductivity of 7 x 10^{-7} m/s

While it is recognized that these measurements do not establish the full range for each unit, they do provide insight into the aquifer characteristics. It is commonly held (Freeze and Cherry, 1979; Fetter 2001) that useable aquifers have a hydraulic conductivity of greater than 1 x 10^{-6} m/s. Only low yield wells are possible below that value. The surficial till has a value higher than this, but not by much, due primarily to the fine grained soils entrained in the glacial till. This is not a regionally connected surficial aquifer, but rather pockets of localized aquifer material, that derives its water from localized recharge on the scale of the host lot.

All three bedrock types have hydraulic conductivities less than 1 x 10^{-6} m/s. The granite appears to have the lowest range. It must be kept in mind that these test results are for wells and boreholes where only the most permeable horizons were screened and tested (the granite boreholes are not screened at all). The host rock in all three formations will have hydraulic

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conductivities two or three orders of magnitude lower (10^{-9} to 10^{-8} m/s) than the calculated values. It is reasonable to conclude that there are no regional aquifers in these bedrock units, but rather fractured zones that locally provide water to isolated wells. Based on the fracture plots presented in Attachment B, the upper 40 m of the bedrock provides the best opportunity for such wells.

3.3 Aquifer Recharge

Precipitation falling onto a catchment either evaporates, is lost to plant transpiration, infiltrates to groundwater, or runs off as storm water to forests and wetlands. An estimate of the average recharge to groundwater in the area was calculated by applying infiltration factors based on topography, soils and vegetation (Main Report, Appendix C). Infiltrating water that is not taken up again by plants from the rooting zone migrates to the shallow water table, and at that point is considered to be aquifer recharge. An average annual infiltration of 351 mm was derived for the entire site. This varies from location to location on site, generally being more in the flatter areas with significant overburden, and less on the steeper rocky areas.

3.3.1 Definitions

There are a variety of terms used by the technical community when describing water balance mechanisms, depending upon the technical background of the user. For the reader's convenience the terms used in this report have been defined in the following manner:

Precipitation: Includes both rainfall and snowfall (as water).

Evapotranspiration: This is the water that is either evaporated from open surfaces, or is taken up by plant transpiration and returned to the atmosphere.

Potential Evapotranspiration: This is the amount of evapotranspiration that would occur if there was unlimited water available.

Actual Evapotranspiration: This is the amount of evapotranspiration that occurs based on the availability of water, and considers temporary storage in the soils above the water table.

Surplus: this is the difference between precipitation and the actual evapotranspiration. This water is available for run off or infiltration into the ground.

Infiltration: this is the water that soaks into the ground and does not runoff. It can be partly removed by plant uptake.

Recharge: This is the remaining infiltration that is not taken up by plants, and reaches the water table.

Surface Water Flow or Runoff: This is the portion of the water surplus that moves laterally on the ground surface and does not infiltrate.

Groundwater Flow: Once water has entered the subsurface it is deemed to be groundwater and moves under gravity and other natural groundwater pressures. It can subsequently re-emerge as groundwater discharge into surface water bodies. At this site groundwater flow occurs locally in the overburden and in the bedrock.

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Subsurface Runoff: This term is not used in this report, but is occasionally used to describe the shallow movement of groundwater that rejoins the surface water system. Sometimes also called "interflow", although that term is not used in this report.

3.3.2 Surficial Deposits

Where present, the glacial deposits influence recharge to the underlying bedrock aquifers. Recharge to groundwater relies on the retention time of surplus water (after evapotranspiration) on the landscape. The glacial deposits accept rainwater infiltration and act as a temporary storage reservoir (on a local scale) allowing it to recharge the less permeable bedrock below. Where the overburden is thin, infiltrating groundwater will deflect along the low permeability bedrock, and unless it intersects fractured rock, it will flow in the shallow groundwater ultimately discharging to the creeks or wetlands, or perhaps simply to thicker deposits of overburden further downhill.

3.3.3 Bedrock

Drawing 12 was prepared by partitioning the average annual water surplus based on soils/bedrock, topography and ground cover, in a GIS platform. It shows that recharge is typically less than 200 mm in the topographic high areas that exhibit exposed bedrock. Values of 200 to 300 mm are found in the areas of moderate overburden and less steep slopes. In the flatter areas, where the overburden is thickest, typically in the low lying areas, the recharge rates exceed 300 mm/yr and can locally approach 700 mm/yr. (The average annual surplus is 877 mm/yr, and this implies that only 177 mm will runoff in those areas.) Notwithstanding this wide variance across the site, the average annual recharge for the entire site is 351 mm/yr, as stated above.

3.4 Groundwater Levels and Flow

A total of eight granite core holes were installed at the Project site in late 2007 / early 2008, and three additional holes were drilled in early 2014. These core holes were left open with shallow surface casings and thus transect the whole quarry and provide a groundwater elevation representative of the most permeable horizon within the granite. The locations of these core holes are shown on Drawing 7.

The information from these wells has been supplemented with groundwater level information from the residential wells presented in Drawing 7 and a series of drive point piezometers installed within the wetland areas surrounding the site, the locations of which are presented on Drawing 8. Nine locations were instrumented with drive point piezometers which were installed in wetlands and streams to assess the vertical gradient of shallow groundwater. In the wetlands, the piezometers were installed as nested pairs with one deep and one shallow piezometer. The vertical gradient can be used to infer whether the wetlands are formed by groundwater discharge or whether they form an area of groundwater recharge. In the streams, a single piezometer was installed in the stream bed so a comparison between the groundwater level beneath and the surface water level can be made, and the stream defined as losing or gaining based on the direction of the vertical hydraulic gradient.

The groundwater monitoring points at the Project site have been subject to periodic groundwater elevation measurements between June and August 2014, with a previous round of water levels being collected in September 2011. Four of the granite core holes (BP-5, BP-7, BP-8 and BP-9) have been recording continuous groundwater levels using data loggers from 5 June

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2014 to 28 August 2014 and two of the drive point piezometers (MP2 and MP6) have been monitoring groundwater and stream levels using data loggers since 24 July 2014. Groundwater hydrographs and summary tables of monitoring data to date are presented in Attachment H, a review of which shows:

- the highest groundwater elevations are recorded in on site borehole BP-4 (97.54 mASL) located at the high point of the Project site. This water level lies within the granite bedrock;
- the lowest groundwater elevations are recorded in residential well BPRWA012 (2.73 m asl) near the ocean in the settlement of Fox Island Main to the east of the Project site;
- groundwater elevations are all less than 6 m below ground surface in wells completed in granite, metasediments or surficial deposits and demonstrate that groundwater levels follow topography. This is probably due to the relatively lower hydraulic conductivity of the underlying bedrock, inhibiting drainage to depth;
- groundwater levels in those wells instrumented with data loggers have been declining since installation in June, which would fit with increasing evapotranspiration rates and lower infiltration during the summer months;
- all instrumented granite boreholes show a response to rainfall events to varying degrees, with groundwater levels in BP-8 and BP-9 increasing approximately 0.1 m during the most intense rainfall events whereas BP-5 and BP-7 increase by over 1 m during the same event. The upper part of the response curve in BP-5 is truncated at approximately ground level, which implies that this borehole is flooding from the surface during intense rainfall; and
- a small tidal influence in the order of 10 to 30 mm is seen in the granite boreholes as illustrated by the comparison of the daily high tide with the daily high groundwater level in Attachment H. The apparent lag between the daily high tide and the corresponding groundwater level high is approximately 8 hours. Given the wide topographical range found on site this small change over several hours on a measurement day does not affect the interpretation of the water table.

Using site groundwater observation data, Drawing 9 shows the regional potentiometric groundwater surface at site as recorded in July / August 2014. This interpretation incorporates site specific measurements in the bedrock boreholes, minipiezometer readings in the wetlands and creeks, and water levels estimated from the private water wells, as well as topographic lake levels and stream elevations. As such it is a general representation of the water table and is intended to give a sense of the horizontal direction of groundwater flow. Where no observation points exist, the level has been estimated from knowledge of the topography and the approximate depth to water table in similar settings across the site.

Drawing 9 demonstrates that the water table generally reflects the topographic pattern, as should be expected. Groundwater flows laterally from topographic highs towards the shallow lakes, creeks and valleys onsite. The dominant feature is the granitic pluton on site which drives lateral ground water flow either north or south. A groundwater divide is shown on Drawing 9. Groundwater in the ground to the north of this divide flows laterally towards Chedabucto Bay, and that south of the divide moves towards the creeks to the south. There are in addition local patterns created by local topographic highs and lows that cause easterly or westerly flow towards the local watercourses.

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3.4.1 Groundwater / Surface Water Interactions and Wetland Function

As noted, drive point piezometers (sometimes called mini-piezometers because of their narrow diameter and shallow depth) were installed in selected creeks and wetlands to assess groundwater contributions to these features. Vertical hydraulic gradients within the drive point piezometer pairs can be used to indicate how the surface water bodies are gaining groundwater from or losing it to the ground.

The vertical gradients measured on 26 August 2014 indicate that five of the locations, including wetlands at MP1, MP2[4] and MP5, along with streams at MP6 and MP8 indicate downward gradients which suggest aquifer recharge is occurring at these locations. Upward vertical gradients measured at wetland areas MP3, MP4 and MP7, along with the stream at MP9 indicate that discharge from the underlying soil is occurring at these locations. There is no pattern to the upward or downward hydraulic gradients with respect to locations in streams or wetlands. It is noted that the upward gradients are weak and likely localized, ranging from just 0.01 to 0.11 m/m (mean of 0.05 m/m upwards). On the other hand, the downward gradients are relatively stronger, ranging from 0.13 to 0.61 m/m, with a mean of 0.35 m/m downwards. A number of these early readings may also reflect un-equilibrated piezometers, similar to MP2. The summer season is generally a season of low water levels and gradients may only seasonally be downward. Therefore these conclusions should be considered preliminary only until further data are collected.

Diurnal fluctuations of the groundwater levels can be seen in the hydrograph data for both MP2 and MP6, in the order of 0.5 to 2 cm. The effect is more pronounced in the stream at MP6. These diurnal fluctuations are due to the increased evaporative and transpirative uptake of water during the day, with replenishment at night. It is expected this effect will decline in the off season and dominate during the spring to early autumn period.

3.5 Groundwater Quality

Groundwater samples have been collected from the majority of nearest residential wells, from both drilled wells in the metasedimentary rocks and dug wells in the surficial deposits. Since there are no private wells in the granite, groundwater samples were also collected from granite boreholes BP-5, BP-7, BP-8 and BP-9 on two occasions. On the first occasion, samples were collected using a bailer with a minimal purge of ten bailer volumes (~10 L) being removed from each borehole prior to sampling. On the second occasion, the wells were purged using a submersible pump until groundwater chemistry parameters including pH, electrical conductivity (EC), dissolved oxygen and temperature were considered to have stabilized. The water quality samples from both residential wells and granite boreholes were analysed for general chemistry and total metals for comparison purposes. Results of the water quality sampling are provided in Tables 2 to 4. A Piper plot and Box and Whisker Plots are presented Figures 5 to 7 in order to compare groundwater quality from various aquifer types at and around the site.

Figure 5 is a Piper plot showing the relationship between the relative abundance of the major cations and anions in the sampled water. These plots are helpful in understanding the differences between water types. The “field” that shows the water quality from granitic rock is

[4] It is noted that the hydrograph for the deep piezometer at MP2 has been rising in a smooth curve. This indicates that the level in this piezometer has not yet reached a static equilibrium with the surrounding groundwater and therefore the apparent downward gradient may not be accurate.

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shown in green on Figure 5. The field for the Meguma bedrock is shown in grey. These two fields overlap each other. This is because they are composed of similar mineralogies, even though their origin is different. The sandstone is composed of silicate minerals, as is the granite. The overburden water quality on the other hand overlaps in a small way, but lies on a mixing line that extends past the bedrock water fields. Since the local glacial till is composed of crushed local bedrock moved there by the glaciers, some similarity to the bedrock fields should be expected. The width of this field is probably due to mixing as discussed below.

On all three plots the stream water occupies a narrow field (shown in blue) exhibiting a sodium chloride rich water with little calcium or sulphate and with low alkalinity (expressed as HCO_3+CO_3). The typical field for clean meteoric water is shown in light blue on this figure for ease of comparison. The salty signature of the stream water is inferred to be due to the prevalence of salt spray at surface which then gets washed into the streams. The fact that many of the shallow overburden wells, which obtain their recharge from local meteoric water, lie on a mixing line from the stream water to the bedrock water, shows a mix of surface water and water influenced by the soil materials[5]. The part of the overburden field that extends to the left on the diagrams may be more greatly influenced by clean meteoric water with no salt spray content. The five wells to the left in the overburden field are wells that are well inland from the shore. The wells that plot to the right in the overburden field are generally within 200 m of the shore.

[5] There may be a contribution from road salt as wells often sit near the local road; however this has not been investigated as part of this assessment.

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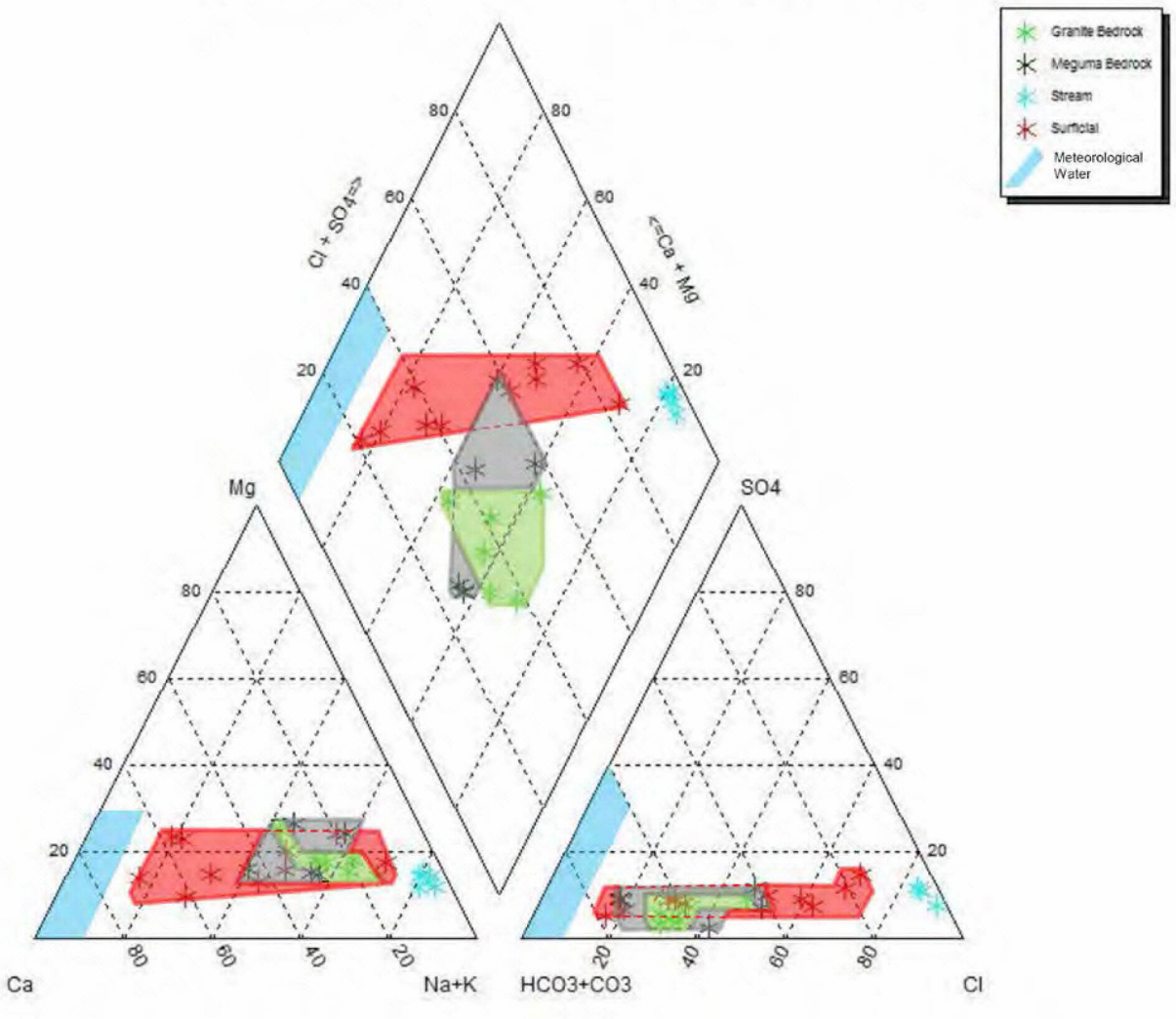

Figure 5
Piper Plot of Groundwater and Surface Water Quality Collected to Date

3.5.1 Surficial Deposits

Table 2 indicates that groundwater in the surficial deposits is of good quality for drinking, with the only exceedences of the Canadian Drinking Water Quality (CDWQ) guidelines occurring in the aesthetic objective parameters iron, manganese and pH, and a small number of exceedences of the turbidity CDWQ guideline. The groundwater quality in the surficial deposits is indicative of recharge from rainfall having a short residence time in the subsurface, where fewer parameters have time to dissolve in the groundwater. This is demonstrated on the Piper plot in Figure 5 which shows a distribution between Ca-HCO_3 waters typical of shallow, fresh groundwater and Na-Cl waters which are indicative of the influence of marine salinity provided in the recharge from precipitation (not saltwater intrusion). Concentrations of aluminium and iron as demonstrated in Figures 6 and 7 are low and consistent with the majority of recharge in the surficial deposits being provided by the infiltration of precipitation.

Table 2: Surficial (Dug) Residential Well Groundwater Quality Results

	Guideline (CDWQ)	Detection Limit	Units	BPRWA001	BPRWA002	BPRWA003	BPRWA004[1]	BPRWA006	BPRWA008	BPRWA012	BPRWA013	BPRWA014	BPRWA015[5]	BPRWA017
				16-July-2014	16-July-2014	16-July-2014	17-July-2014	17-July-2014	17-July-2014	18-July-2014	22-July-2014	25-July-2014	30-July-2014	29-Aug-14
Aluminium[2]	200 (OG)	5.0	ug/L	33	17	9.9	16	12	94	46	15	83	6.3	20
Ammonia (total)	NV	0.050	mg/L	<0.050	<0.050	0.053	<0.050	<0.050	0.056	<0.050	<0.050	<0.050	<0.050	<0.050
Antimony	6 (MAC)	1.0	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic	10 (MAC)	1.0	ug/L	<1.0	5.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	6.6	<1.0
Barium	1,000 (MAC)	1.0	ug/L	30	52	34	44	9.5	31	9	24	7.7	<1.0	19
Bicarbonate	NV	1	mg/L	31	94	30	6.4	16	49	10	51	36	99	98
Boron	5,000 (MAC)	50	ug/L	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium	5 (MAC)	0.010	ug/L	0.048	<0.010	0.034	0.025	<0.010	0.022	0.075	0.043	0.036	<0.010	<0.010
Calcium	NV	100	ug/L	11000	26000	11000	2200	6100	15000	2300	18000	13000	<100	34000
Chloride	<250 (AO)	1.0	mg/L	37	15	32	12	12	16	25	15	9.8	94	12
Chromium	50 (MAC)	1.0	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Colour	<15 (AO)	5.0	TCU	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	8.2
Copper	<1,000 (AO)	2.0	ug/L	38	<2.0	160	24	180	150	120	5.2	8.4	<2.0	<2.0
Iron	<300 (AO)	50	ug/L	160	<50	**1200**	<50	92	140	**2900**	<50	130	150	<50
Lead	10 (MAC)	0.50	ug/L	0.64	<0.50	1.9	<0.50	8.5	<0.50	2.1	<0.50	0.81	<0.50	<0.50
Magnesium	NV	100	ug/L	4000	6400	2900	1600	1100	2500	2000	4500	1200	<100	4100
Manganese	50 (AO)	2.0	ug/L	**210**	22	**330**	<2.0	2.3	3.3	**290**	<2.0	**320**	<2.0	<2.0
Molybdenum	NV	2.0	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel	NV	2.0	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nitrate (as N)	10 (MAC)	0.050	mg/L	0.082	<0.050	<0.050	1.2	<0.050	<0.050	0.067	1.1	<0.050	<0.050	0.16
Nitrite (as N)	1 (MAC)	0.010	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Potassium	NV	100	ug/L	1300	1100	5400	630	280	1200	660	930	2300	<100	1800
pH[3]	6.5 - 8.5	N/A	pH	6.76	8.1	6.55	**6.36**	6.73	7.12	**5.95**	7.68	6.83	7.41	7.90
Selenium	10 (MAC)	1.0	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver	NV	0.10	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium	<200,000 (AO)	100	ug/L	17000	9500	14000	6800	7000	9900	15000	7700	5800	99000	8200
Sulphate	<500 (AO)	2.0	mg/L	5.6	6.4	6.5	2.7	3.1	5.1	7	5.6	3.9	6.2	4.9
Thallium	NV	0.10	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total dissolved solids (TDS-Calculated)[4]	<500 (AO)	1.0	mg/L	100	130	95	42	46	89	70	99	62	270	140
Turbidity	1 (MAC)	0.10	NTU	0.5	0.34	**3.1**	0.26	0.28	**1.2**	**13**	0.37	0.19	**1.2**	0.73
Uranium	20 (MAC)	0.10	ug/L	<0.10	0.25	<0.10	<0.10	<0.10	0.11	<0.10	<0.10	<0.10	<0.10	0.65
Zinc	<5,000 (AO)	5.0	ug/L	11	8	19	8.8	52	27	20	20	13	5.7	<5.0

NOTES:

NV = no value

OG = Operational Guidance

AO = Aesthetic Objective

MAC = Maximum Allowable Concentration

Canadian Drinking Water Quality CDWQ Guidelines: Aug 2012

1. Duplicate Sample is BPRWA005
2. Aluminum Aesthetic Objective (CDWQ - AO): Conventional Treatment Plants = 0.1 mg/L (100 ug/L), Other Treatment Systems = 0.2 mg/L (200 ug/L)
3. pH Objective (CDWQ): 6.5 - 8.5
4. Calculated result only includes measured parameters. Actual TDS may be higher.
5. Sample results likely affected by water softner treatment system

BOLD RED Exceeds guideline

Table 3: Granite Borehole Water Quality Results

Sample Name			BPBH05	BPBH05_2	BPBH07	BPB07_2	BPBH08	BPBH08_2	BPBH09	BPBH09_2
Location			Unfiltered	Unfiltered	Unfiltered	Unfiltered	Unfiltered	Unfiltered	Unfiltered	Unfiltered
Parameter	**Unit**	**RDL**	**22-Jul-14**	**27-Aug-14**	**23-Jul-14**	**28-Aug-14**	**23-Jul-14**	**28-Aug-14**	**23-Jul-14**	**28-Aug-14**
Field Parameters										
pH		---	---	5.6	---	6.9	---	6.4	---	6.9
Water Temperature	°C	---	---	9.2	---	11.4	---	9.5	---	9.6
Conductivity	µS/cm	---	---	38.7	---	83.8	---	80.0	---	118.5
% Dissolved Oxygen	%	---	---	---	---	---	---	---	---	---
Dissolved Oxygen	mg/L	---	---	---	---	---	---	---	---	---
General Chemistry										
pH [4]		n/a	5.05	5.85	6.51	6.82	6.48	6.80	6.70	6.92
Reactive Silica as SiO2	mg/L	0.5	9.6	14.0	18.0	21.0	23.0	24.0	27.0	27.0
Chloride	mg/L	---	---	---	---	---	---	---	---	---
Dissolved Chloride (Cl)	mg/L	1.0	9.3	8.7	11.0	11.0	10.0	9.6	13.0	14.0
Fluoride	mg/L	---	---	---	---	---	---	---	---	---
Sulphate	mg/L	---	---	---	---	---	---	---	---	---
Dissolved Sulphate	mg/L	2.0	<2.0	<2.0	2.9	<2.0	2.8	2.5	<2.0	<2.0
Alkalinity	mg/L	---	<5.0	<5.0	18.0	38.0	29.0	38.0	41.0	54.0
True Color	TCU	50.0	110.0	99.0	210.0	140.0	<5.0	<5.0	62.0	130.0
Turbidity	NTU	0.1	40.0	6.0	19.0	17.0	39.0	3.2	37.0	7.6
Electrical Conductivity	umho/cm	1.0	46.0	55.0	84.0	120.0	92.0	110.0	120.0	140.0
Nitrate + Nitrite as N	mg/L	0.05	0.11	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Nitrate as N	mg/L	0.050	0.11	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Nitrite as N	mg/L	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Ammonia as N	mg/L	0.05	0.072	0.060	<0.050	<0.050	<0.050	<0.050	0.15	0.19
Total Organic Carbon	mg/L	5.0	13.0 (1)	7.9	10.0 (1)	9.5	1.4	0.87	5.2 (1)	11.0
Ortho-Phosphate as P	mg/L	0.01	0.013	0.061	0.065	0.041	0.12	0.16	0.14	0.30
Total Sodium	mg/L	100.0	6700.0	6300.0	11000.0	14000.0	12000.0	10000.0	15000.0	17000.0
Total Potassium	mg/L	100.0	1100.0	370.0	2700.0	1900.0	2200.0	880.0	4600.0	4500.0
Total Calcium	mg/L	100.0	740.0	2000.0	3300.0	5900.0	5800.0	6800.0	3400.0	5800.0
Total Magnesium	mg/L	100.0	660.0	750.0	1900.0	2400.0	2300.0	3200.0	1900.0	2500.0
Biarb. Alkalinity (as CaCO3)	mg/L	1.0	<1.0	<1.0	18.0	38.0	29.0	38.0	41.0	54.0
Carb. Alkalinity (as CaCO3)	mg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Hydroxide	mg/L	---	---	---	---	---	---	---	---	---
Calculated TDS [5]	mg/L	1.0	35.0	33.0	65.0	79.0	83.0	82.0	100.0	110.0
Hardness	mg/L	1.0	4.6	8.0	16.0	25.0	24.0	30.0	16.0	25.0
Langelier Index (@ 20C)	NA	---	---	---	---	-2.16	---	-2.12	---	-1.94
Langelier Index (@ 4C)	NA	---	---	---	---	-2.41	---	-2.37	---	-2.19
Saturation pH (@ 20C)	NA	---	---	---	---	8.98	---	8.92	---	8.86
Saturation pH (@ 4C)	NA	---	---	---	---	9.23	---	9.17	---	9.11
Anion Sum	me/L	n/a	0.27	0.25	0.75	1.07	0.95	1.10	1.21	1.49
Cation Sum	me/L	n/a	0.64	0.46	0.95	1.16	1.28	1.08	1.4	1.56

Sample Name			BPBH05	BPBH05_2	BPBH07	BPB07_2	BPBH08	BPBH08_2	BPBH09	BPBH09_2
Location			Unfiltered	Unfiltered	Unfiltered	Unfiltered	Unfiltered	Unfiltered	Unfiltered	Unfiltered
Parameter	Unit	RDL	22-Jul-14	27-Aug-14	23-Jul-14	28-Aug-14	23-Jul-14	28-Aug-14	23-Jul-14	28-Aug-14
% Difference / Ion Balance (NS)	%	n/a	40.7	29.6	11.8	4.04	14.8	0.92	7.28	2.3
Total Suspended Solids	mg/L	---	---	---	---	---	---	---	---	---
Total Phosphorus as P	mg/L	100.0	340.0	110.0	270.0	<100.0	820.0	200.0	420.0	310.0
Total Aluminum [3]	ug/L	5.0	2900.0	430.0	2700.0	510.0	3000.0	<5.0	1200.0	1000.0
Total Antimony	ug/L	1.0	2.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Arsenic	ug/L	1.0	9.5	4.8	39.0	16.0	2.1	1.0	31.0	60.0
Total Barium	ug/L	1.0	15.0	1.5	10.0	3.4	17.0	<1.0	14.0	15.0
Total Beryllium	ug/L	1.0	<1.0	<1.0	1.4	<1.0	<1.0	<1.0	<1.0	<1.0
Total Bismuth	ug/L	2.0	<2.0	<2.0	2.1	<2.0	<2.0	<2.0	<2.0	<2.0
Total Boron	ug/L	50.0	<50.0	<50.0	<50.0	<50.0	<50	<50.0	<50.0	<50.0
Total Cadmium	ug/L	0.01	0.35	0.47	1.8	1.1	0.17	0.074	0.11	0.043
Total Chromium	ug/L	1.0	18.0	<1.0	4.2	<1.0	9.4	<1.0	5.0	<1.0
Total Cobalt	ug/L	0.4	1.7	2.7	11.0	7.2	0.65	<0.40	3.1	1.60
Total Copper	ug/L	2.0	15.0	11.0	130.0	110.0	61.0	<2.0	22.0	11.0
Total Iron	ug/L	50.0	6100.0	290.0	2700.0	350.0	6600.0	<50.0	8200.0	4900.0
Total Lead	ug/L	0.5	7.3	0.71	5.7	0.9	48.0	<0.50	2.6	2.9
Total Manganese	ug/L	2.0	150.0	910.0	400.0	420.0	240.0	1100.0	1400.0	1900.0
Total Molybdenum	ug/L	2.0	3.9	<2.0	13.0	9.5	3.6	<2.0	7.0	14.0
Total Nickel	ug/L	2.0	3.0	<2.0	11.0	11.0	2.7	<2.0	4.9	2.7
Total Selenium	ug/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Silver	ug/L	0.1	73.0	0.64	75.0	6.7	17.0	<0.10	4.5	0.45
Total Strontium	ug/L	2.0	4.7	14.0	22.0	50.0	20.0	23.0	20.0	47.0
Total Thallium	ug/L	0.1	<0.10	<0.10	0.13	<0.10	<0.10	<0.10	<0.10	<0.10
Total Tin	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Titanium	ug/L	2.0	35.0	2.2	59.0	8.0	24.0	<2.0	22.0	18.0
Total Uranium	ug/L	0.1	17.0	47.0	260.0	430.0	14.0	4.2	20.0	37.0
Total Vanadium	ug/L	2.0	2.5	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Zinc	ug/L	5.0	390.0	130.0	1800.0	710.0	580.0	190.0	1500.0	350.0
Mercury	mg/L	---	---	---	---	---	---	---	---	---

Notes:

NV = no value; "--" = not measured

5. Calculated result only includes measured parameters. Actual TDS may be higher.

Table 4: Meguma Metasedimentary Residential Well Groundwater Quality Results

	Guideline (CDWQ)	Detection Limit	Units	BPRWA007	BPRWA007_A	BPRWA007_B	BPRWA009[2]	BPRWA011	BPRWA016[6]	BPRWA016
				17-July-2014	28-Aug-14	28-Aug-14	17-July-2014	17-July-2014	31-July-2014	29-Aug-14
Aluminium [3]	200 (OG)	5.0	ug/L	11	<5.0	<5.0	21	16	6.9	<5.0
Ammonia (total)	NV	0.050	mg/L	<0.050	0.051	<0.050	<0.050	<0.050	<0.050	0.38
Antimony	6 (MAC)	1.0	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic	10 (MAC)	1.0	ug/L	**50**	**46**	**46**	<1.0	<1.0	<1.0	<1.0
Barium	1,000 (MAC)	1.0	ug/L	<1.0	<1.0	<1.0	1.9	<1.0	<1.0	3.9
Bicarbonate	NV	1	mg/L	99	99	98	15	30	93	94
Boron	5,000 (MAC)	50	ug/L	60	58	60	<50	<50	<50	<50
Cadmium	5 (MAC)	0.010	ug/L	<0.010	<0.010	<0.010	0.026	0.044	<0.010	<0.010
Calcium	NV	100	ug/L	15000	15000	15000	5900	4200	<100	17000
Chloride	<250 (AO)	1.0	mg/L	14	14	14	10	21	21	40
Chromium	50 (MAC)	1.0	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Colour	<15 (AO)	5.0	TCU	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Copper	<1,000 (AO)	2.0	ug/L	<2.0	<2.0	<2.0	260	51	2.7	<2.0
Iron	<300 (AO)	50	ug/L	82	<50	<50	<50	<50	<50	<50
Lead	10 (MAC)	0.50	ug/L	<0.50	<0.50	<0.50	6	<0.50	<0.50	<0.50
Magnesium	NV	100	ug/L	4500	4600	4600	1300	3400	<100	9500
Manganese	50 (AO)	2.0	ug/L	**66**	4.3	<2.0	16	13	4.9	**1100**
Molybdenum	NV	2.0	ug/L	7.1	7.3	7.4	<2.0	<2.0	<2.0	<2.0
Nickel	NV	2.0	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	6.5
Nitrate (as N)	10 (MAC)	0.050	mg/L	0.059	0.066	0.065	1.3	<0.050	<0.050	<0.050
Nitrite (as N)	1 (MAC)	0.010	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Potassium	NV	100	ug/L	650	2100	2100	630	1200	<100	3700
pH[4]	6.5 - 8.5	N/A	pH	8.17	8.14	8.20	6.66	6.5	7.37	7.51
Selenium	10 (MAC)	1.0	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver	NV	0.10	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium	<200,000 (AO)	100	ug/L	31000	33000	33000	5800	15000	57000	29000
Sulphate	<500 (AO)	2.0	mg/L	9.1	9.5	9.7	3.3	3.9	12	2.9
Thallium	NV	0.10	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total dissolved solids (TDS-Calculated)[5]	<500 (AO)	1.0	mg/L	150	150	150	46	89	160	170
Turbidity	1 (MAC)	0.10	NTU	0.82	0.42	0.69	<0.10	<0.10	<0.10	**170**
Uranium	20 (MAC)	0.10	ug/L	<0.10	0.10	<0.10	<0.10	1.2	<0.10	<0.10
Zinc	<5,000 (AO)	5.0	ug/L	15	8.1	7.9	30	170	12	<5.0

NOTES:

NV = no value

OG = Operational Guidance

AO = Aesthetic Objective

MAC = Maximum Allowable Concentration

Canadian Drinking Water Quality CDWQ Guidelines: Aug 2012

1. Duplicate Sample is BPRWA005
2. Duplicate Sample is BPRWA010
3. Aluminum Aesthetic Objective (CDWQ - AO): Conventional Treatment Plants = 0.1 mg/L (100 ug/L), Other Treatment Systems = 0.2 mg/L (200 ug/L)
4. pH Objective (CDWQ): 6.5 - 8.5
5. Calculated result only includes measured parameters. Actual TDS may be higher.
6. Sample results likely affected by water softner treatment system

BOLD RED Exceeds guideline

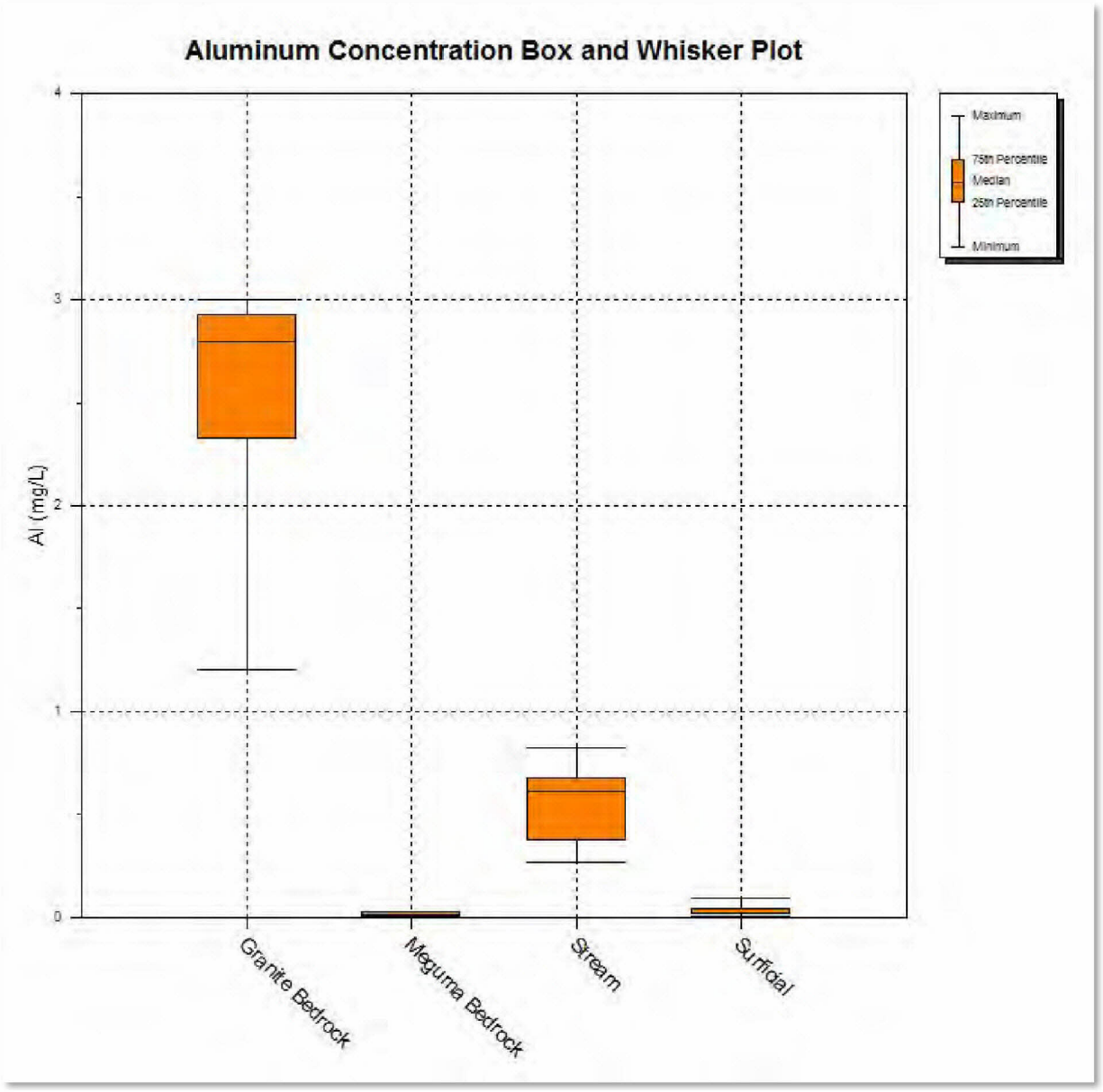

Figure 6
Box and Whisker Plot of Aluminium in Groundwater and Surface Water

3.5.2 Granite

Table 3 and Figures 6 and 7 indicate that groundwater in the granite has generally high concentrations of metals, with exceedences of aesthetic objectives for aluminium, colour, iron and manganese in the majority of samples, and exceedences of the maximum allowable concentrations within several samples for lead, arsenic and uranium. pH values were low in three of the eight samples, indicating slightly acidic conditions within the granite. We underline that the groundwater samples from within the granite have been assessed against the CDWQ

Guidelines for comparison purposes only: there are no residential or commercial wells in the granite bedrock and so, strictly speaking, these Guidelines do not apply. Regional maps indicate that concentrations of arsenic potentially exceeding national guidelines are considered very likely in the area (NSE 2005) and uranium is considered most likely to occur in areas containing granitic intrusions (NSE 2014).

The Piper plot in Figure 5 indicates that the majority of granite samples lie in a zone between Ca-HCO_3, Na-Cl, and Na-HCO_3 waters, which indicates a mixture of influences from shallow fresh water, marine water and deeper waters influenced by ion exchange. This would be consistent with the mixture of fresher waters from the upper fractured zone within the granite and water from deeper within the granite core holes.

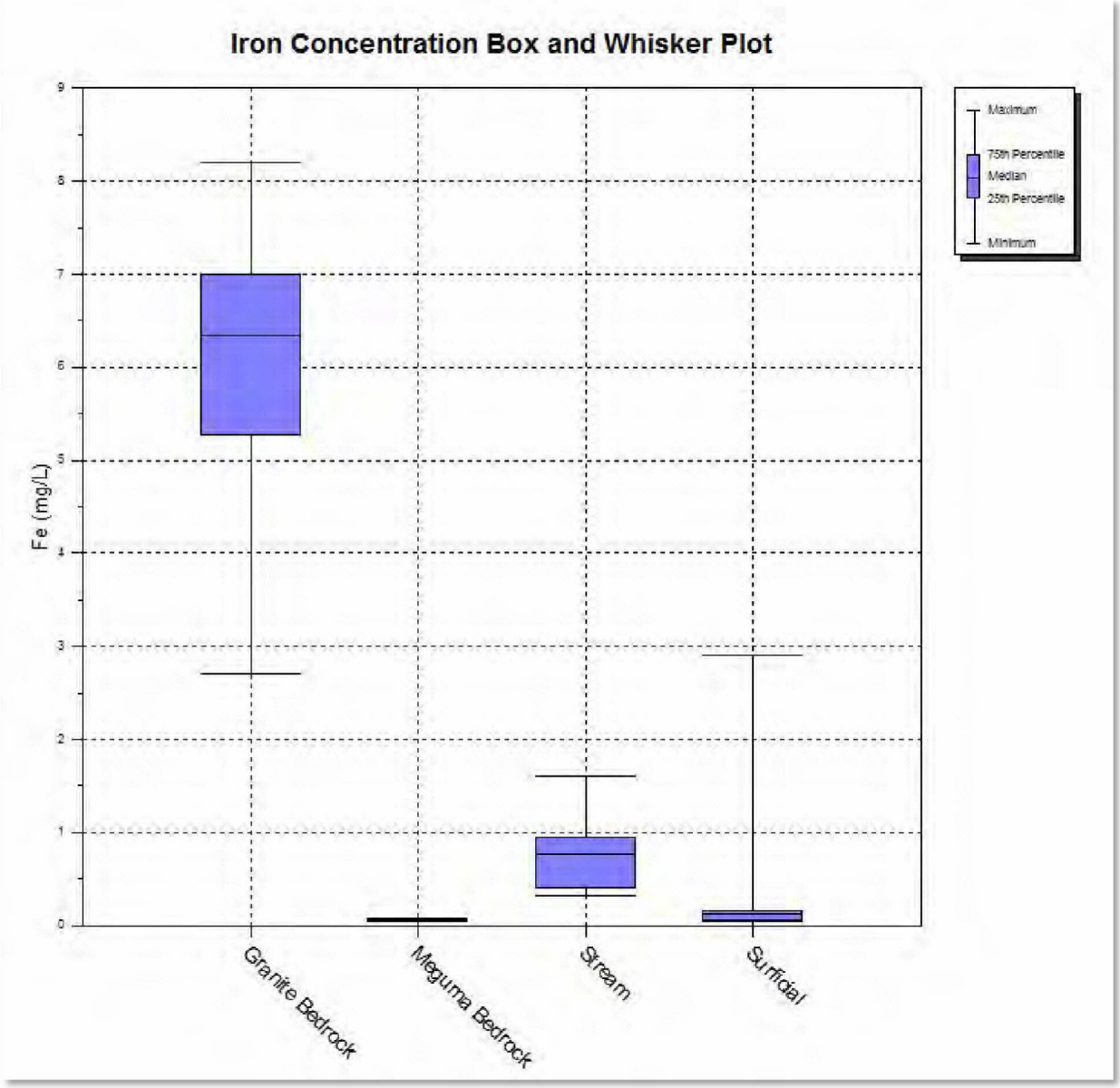

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Figure 7
Box and Whisker Plot of Iron in Groundwater and Surface Water

3.5.3 Meguma Metasediments

Table 5 indicates that groundwater in the metasediments is generally of good quality with only one or two samples exceeding the aesthetic objectives for manganese and turbidity. However, two samples, plus a field duplicate, from residential well BPRWA007 demonstrated arsenic concentrations which exceed the CDWQ guideline. Generally, a higher probability of arsenic concentrations in water wells occurs in certain formations within the Meguma Terrane, including the Goldenville Formation which is associated with arsenopyrite, and a lower probability in others including the Halifax Group (Dummer et al. 2014). The Piper plot in Figure 5 indicates that the majority of metasediment samples lie in a zone between Ca-HCO_3, Na-Cl, and Na-HCO_3 waters which indicates a mixture of influences from shallow fresh water, marine water and deeper waters influenced by ion exchange. This would be consistent with the mixture of fresher waters from the upper metasediments and water from deeper within the bedrock residential wells. Although the influences on the general water chemistry are similar to those within the granite, it is comparison of the metal concentrations which demonstrates the true difference between the two distinct groundwaters. Metal concentrations, as illustrated by Figures 6 and 7 and Table 5, are relatively low within the metasediments and significantly higher within the granite.

3.6 Conceptual Model Discussion

The site is characterized by the topographic high created by an erosion resistant granitic pluton, some 95 m above sea level. This feature was intruded into metasediments of the Meguma Formation. These metasediments surround the site and host those few local residential wells that extend into the bedrock. (Most private wells are shallow and tap the more permeable glacial till overburden). Water quality in the two bedrock types (granite and metasediments) is similar with the exception of higher levels of dissolved metals (e.g., iron, aluminium and lead) in the granite. Uranium is also found in the granite but not in the other groundwater types. Arsenic is present in both the granite and the metasediments. This groundwater chemistry is entirely from natural mineral concentrations in the bedrock. The overburden groundwater is much more dilute, reflects local recharge of meteoric water, and exhibits a salt signature where close to the coast.

Drawings 10 and 11 are vertical cross-sections that run along the lines shown on Drawing 7. They have been prepared to illustrate the relationship between the various geological units, the site topography and the local wells. The likely groundwater flow paths shown on Drawing 10 demonstrate the relationship between recharge and discharge areas. The relative low permeability of the bedrock (even when fractured) is responsible for the high water table, which is generally never deeper than 6 m below ground surface. Groundwater recharge occurs in all the upland areas of the site, with lateral discharge occurring in localized low areas and in some creeks.

Drawing 9, discussed above, shows that horizontal groundwater flow under existing conditions is outward from the granite, primarily along the upper, more weathered bedrock. Fracture frequency analysis shows there is a stronger presence of fracturing in the upper bedrock, above the dashed line shown on Drawings 10 and 11, at a depth of about 40 m. This line is in fact

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gradational as fracturing occurs throughout the geologic profile. Deeper water is more mineralized and shows the effects of a longer presence of water at depth. Stream water quality shows little influence of the bedrock; the relatively low pH is attributed to inflows from nearby wetlands. The distinct difference in the metals concentrations between the granite and the Meguma Formation indicates there is little mixing of groundwater between the two rock types. There will however be exchange of the shallow groundwater along the boundary between the two units, based on the higher degree of fracturing at the bedrock surface. All local water wells are very far away from this boundary and there are many intervening wetlands and creeks that act as discharge zones.

From a conceptual model point of view most recharge joins the shallow system and moves laterally to onsite low areas and ultimately offsite by the creek systems. To test this statement the quantity of water can be examined. Drawing 12 shows that the granitic pluton has about 200 mm/yr (0.2 m/yr) of recharge. A representative strip, one metre wide and 300 m long to the edge of the hill is examined. Multiplying the recharge by the area yields an annual average recharge volume of 60 m^3. Using Darcy's principle the amount of water conveyed by a 40 m deep fractured bedrock pathway can be determined. The horizontal gradient (dh/dL), measured off the pluton on Drawing 9 is 0.065 m/m. Darcy states that the flow (Q) is equal to the hydraulic conductivity (K) multiplied by the hydraulic gradient and the cross-sectional area of flow (A = 40 m x 1 m = 40 m^2).

This can be rearranged to express K as a function of these parameters:

$$K = Q / (dh/dL \times A)$$

$$= 60\ m^3/yr\ /\ (0.065 \times 40\ m^2)$$

$$= 23.1\ m/yr\ (= 7.3 \times 10^{-7}\ m/s)$$

This compares well to the upper end of the measured range of bedrock hydraulic conductivity (7 x 10^{-7} m/s). Based on this favourable comparison it may be reasonably concluded that the conceptual model for the granite works well. A similar calculation can be conducted on the more permeable (but thinner) overburden areas, which Drawing 12 shows has recharge rates typically around 400 mm/a. That calculation derives an overburden hydraulic conductivity of about 4 x 10^{-5} m/s which is about twice the top end of the measured range for the overburden. This of course will be lower because the greater depth of underlying bedrock will take some of this water. What is important is that these values fall within a reasonable measure of each other, providing further assurance that the conceptual model is apt.

It is helpful to understand the water balance for the site. The Surface Water Resources Technical Report (Main Report, Appendix C) provides the water budget and water balance for the existing condition. During operational conditions the precipitation that falls on the site will generate runoff, which will be collected and discharged to Chedabucto Bay. Section 3.7.2 below provides insight on groundwater inflow. Calculations indicate a likely maximum groundwater inflow of 66.2 m^3/yr per lineal metre of the quarry face at full Project build out. Table 5 in that section shows that considering contributions from 4,040 m of lineal quarry face this represents 267,450 m^3 of groundwater per year, or about 8.5 L/s. Design of the water handling facilities (i.e., pit sumps) will consider this amount, which will be lower at earlier stages

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of the quarry[6], as part of quarry discharge to Fox Bay. Once the quarry is closed, this amount (which comes from the surrounding rock) plus the direct precipitation on the quarry area will begin to fill the quarry, which will take in the order of a decade. At that point the surface water will decant to Fox Bay. Since the inflow is dependent on driving head, and the quarry water level will be 50 m higher than the quarry floor at that time, there will be a reduced rate of groundwater inflow at this new equilibrium. Section 3.7.2 estimates this to be at a rate of 6.2 L/s (Table 5). This is in addition to contributions from direct precipitation.

3.7 Anticipated Effects of Quarry Development on Water Supply

It is useful to understand what potential effects the proposed quarry may have on nearby bedrock groundwater uses. Removal of the rock will mean the creation of a "sink" in the groundwater system, up to 130 m deep in places at full Project build out. This will create an inward groundwater flow towards the quarry. Drawings 13 and 14 show the quarry at full build out, in 50 years. They also show the expected maximum drawdown to the water table, based on the following discussion.

3.7.1 Quarry Drawdown

It is prudent to examine the extent of drawdown back from the quarry to understand if there is potential for any impact to neighbouring potable water wells. Consideration was given to using a three dimensional groundwater flow model to achieve this, however given the size of the facility, insufficient groundwater monitors are present to properly calibrate such a model. However the size of the facility means that there are extensively long sidewalls, in the order of 500 to 1500 m long. Therefore a two dimensional vertical section along such a wall has been analysed by the method[7] of Fetter, 2001 for a maximum quarry depth of 130 m. This method considers the hydraulic conductivity of the weathered and unweathered bedrock and of the overburden soils, and the amount of average annual recharge, and calculates the water table surface, assuming a 5 m seepage face at the quarry wall. It is calibrated by ensuring the water table lies below the ground surface and that the lateral groundwater flows (overburden, weathered rock and unweathered rock) sum to the amount of recharge entering the system. To help represent the variability of the system (fractured rock, variable recharge rates) a reasonable range in parameters is applied to help bracket the likely results.

Figure 8 presents the base case for this analysis taken at the average recharge rate of 351 mm/yr for the site. A range of hydraulic conductivity (K) for the bedrock has been used to show its effect on the extent of the drawdown cone. The maximum measured K was 7×10^{-7} m/s in the open boreholes. As this is believed to be contributed by the more weathered rock at the top of the boreholes, it is very likely that the deeper rock is less permeable. For this reason two other cases of $K = 7 \times 10^{-8}$ m/s and $K = 7 \times 10^{-9}$ have been calculated to determine a conservative estimate for drawdown. These two values represent unweathered bedrock that is 10 to 100 times less permeable than the weathered bedrock assessed by the testing. Inherent in the calculation is a 5 m thick layer of overburden at $K_{overburden} = 2 \times 10^{-6}$ m/s, which conveys part of the recharge laterally away[8] from the quarry

[6] It will be lower because of a smaller area of the quarry, meaning less contributing quarry face and lower driving heads until the quarry floor reaches its final depth.

[7] Fetter details this methodology in Chapter 4.14 for Steady Flow in an unconfined aquifer, as adapted from other authors. This technique is widely used and often un-cited.

[8] This is because the ground slopes away from the quarry at almost every point around its circumference.

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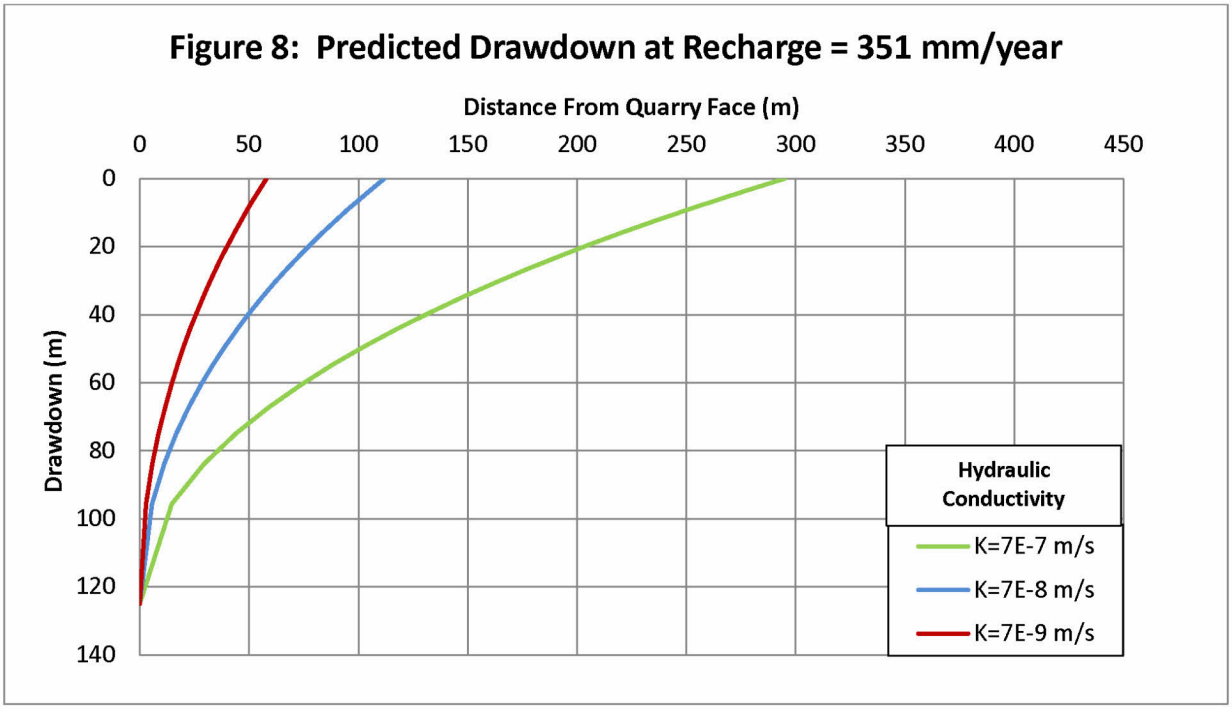
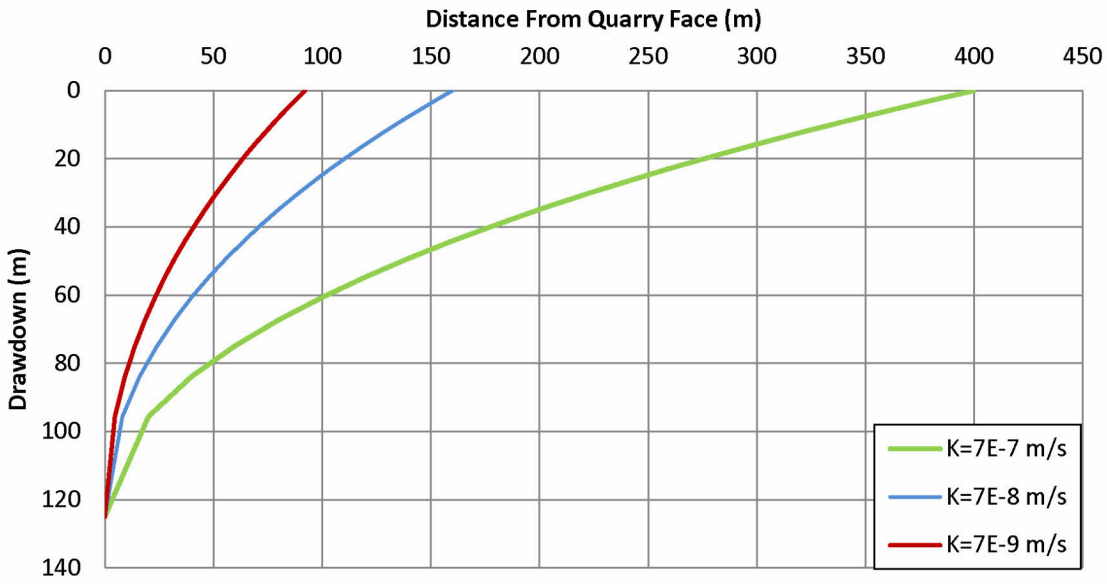


Figure 8 shows that the radius of drawdown reaches a distance from the quarry face of 300 m for the most permeable case of K = 7 x 10^{-7} m/s. Where the rock is less permeable this reduces to 115 m and then to 60 m where K = 7 x 10^{-9} m/s. This is intuitively correct as the rock is less capable of drainage at these lower values and thus affects less of an area of recharge.

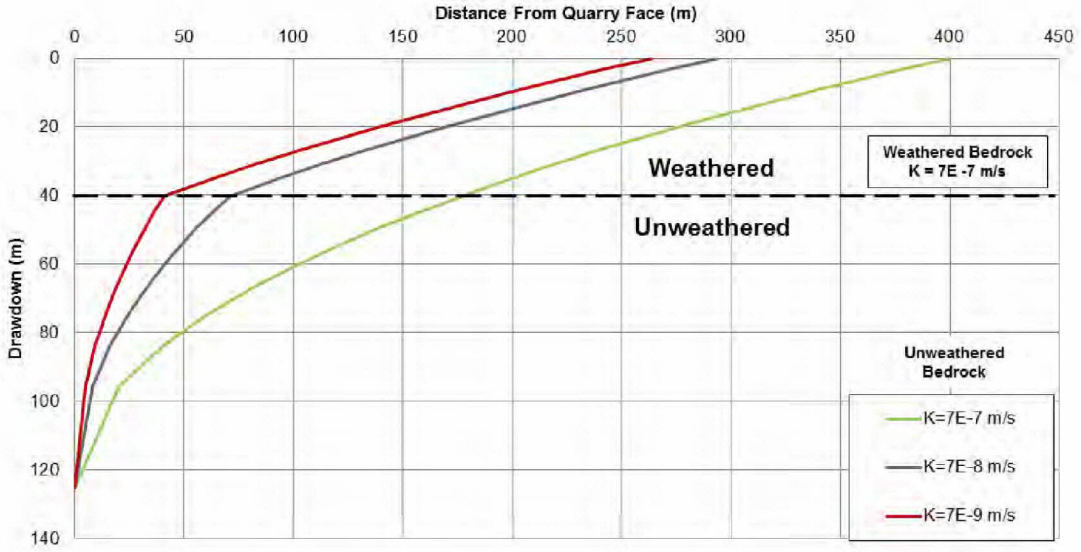
The system is also sensitive to the amount of recharge. In the above example, a recharge rate of 351 mm/yr was selected as that is the average for the site. However, examination of Drawing 12 shows that around the edges of the quarry the recharge rate is locally around 200 mm/yr. Figure 9 has been prepared to show the effect of this lower recharge rate on the drawdown for the range of hydraulic conductivities considered. Since the bedrock can convey a certain amount of water, the extent of the area of drawdown can be greater if there is less recharge to convey. That is, the drawdown of the water table extends further from the quarry in the lower recharge scenario. The radius of drawdown reaches a distance from the quarry face of just about 400 m for the permeable case of K = 7 x 10^{-7} m/s. Where the rock is less permeable this reduces to 160 m and then to 90 m where K = 7 x 10^{-9} m/s. This recharge rate is adopted as the most conservative "base case", as it reflects the lower recharge amounts at the top of the quarry walls.

Figure 9: Predicted Drawdown at Recharge = 200 mm/year



Consideration must now be given to the horizon that appears to me more fractured generally above 40 m depth. Section 3.2.2 identified that the transition is gradational, but for the sake of computation a discrete boundary has been used in Figure 10 on the base case. Figure 10 shows that the drawdown will extend further back from the face in a weathered zone of K = 7 x 10^{-7} m/s (the upper end of the measured range on site). The most conservative case for impact assessment would therefore be to assume the bedrock is at the high end of the hydraulic conductivity range, and that this extends to depth. This is because the extent of the drawdown cone is reduced when the lower unweathered zone is of lower hydraulic conductivity.

Figure 10: Predicted Drawdown with Weathered bedrock, K_{weath} = 7E-7 m/s, Rechage = 200 mm/yr



It is important to understand the amount of water that would enter the quarry through the bedrock for this critical case. Considering a 1 m wide slice the amount of recharge is 0.200 m/yr X 1 m 410 X m = 82 m^3/year. For the water table position derived by the calculation, 15.8 m^3/year flows laterally in the overburden[9] (and away from the quarry since it is constructed at the height of land). The remainder, 66.2 m^3/year, flows laterally in the bedrock into the quarry.

It is often prudent to cross-check theoretical calculations against field observations to understand if the calculated results are reasonable. In this case a similar condition is observed in nature. The groundwater under the 80 m scarp above the shore drains naturally to the north and is about 60% of the size that may be created inside the quarry. The water table follows this scarp quite closely as seen on Drawing 9, with a horizontal gradient of about 0.25. That is, for the 70 m or so drop in the water table on Drawing 9, there is a lateral distance of about 280 m back from the toe of the slope. The analytical model predicts up to a 400 m extent of lateral quarry drawdown, that is a horizontal gradient of 400/130 = 0.33. This is considered in very close agreement to the naturally observed condition. (For example, to achieve the same extent as observed in nature would require a hydraulic conductivity of about 1.2 x 10^{-7} m/s, that is only 70% greater than what was found in the core holes. This is reasonable since a naturally weathered surface is more permeable than the quarry face will be.) It is concluded that the drawdown from the completed quarry will be felt at a drawdown distance of 400 m or less. The nearest wells are many times that distance away and the presence of intervening watercourses (which act as hydraulic boundaries) dictates that these wells cannot be affected by the quarry.

[9] This is based on a water table slope of 0.05 m/m, a saturated thickness of 5 m and a hydraulic conductivity of 2 x 10^{-6} m/s, and was calculated by the method of Darcy.

3.7.2 Quarry Inflow of Groundwater

The above section described the anticipated drawdown of the water table from the excavation of the quarry. The most conservative case estimated 66.2 m^3/year per lineal metre of quarry under the full mined out condition. Once the quarry recovers to just 75 m of drawdown (as the water level recovers to 20 m above sea level), this value is reduced to 48.2 m^3/year per lineal metre of quarry. Table 5 below summarizes what the inflow will be for each scenario along each quarry wall. The north wall is assumed to contribute nothing as it will have been removed by quarrying.

Table 5. Annual Maximum Groundwater Contributions into Quarry

Quarry Face	Length (m)	At Full Depth (@66.2 m^3/yr/m)		After Closure (@48.2 m^3/yr/m)	
		m^3/yr	L/s	m^3/yr	L/s
North	0	0	0	0	0
West	1,375	91,025	2.89	66,275	2.10
South	1,540	101,950	3.23	74,230	2.35
East	1,125	74,475	2.36	54,225	1.72
Total	**4,040**	**267,450**	**8.48**	**194,730**	**6.17**

These values are conservative in nature, as they are based on the most critical case of the bedrock being the same permeability for its entire depth. The inflow will be considerably lower for those portions where a lower hydraulic conductivity exists and the lateral extent of drawdown is smaller. In addition, as the quarry begins development the initial inflow amounts will be very small and will steadily build to the above estimates.as the quarry expands and deepens.

3.7.3 Potential Effects on Wetlands and Streams

The potential effects of quarry drawdown in the subsurface on the watercourses or wetlands that lie inside the area so affected is considered here. This section does not deal with the reduction of catchment area for Reynolds Creek and other watercourses, which is presented in Section 6.0 of the Main Report. Section 3.4.1 above identified that the wetlands and streams on this site are generally “losing” systems. That is, there is a loss of surface water to the groundwater. Downward gradients dominate and are strong, whereas those few places with an upward gradient have only a weak upward gradient. This implies that these systems are surface water fed and not fed by groundwater discharge from the bedrock. Based on this there should be no depletion of these features by lowering of the water table in the underlying bedrock. It will be important to monitor these features as the quarry operations expand, and should impacts occur, mitigation and/or compensation can be undertaken.

3.7.4 Future Groundwater Monitoring

This section presents the foundation for confirmatory and precautionary groundwater monitoring of the site. The proposed monitoring program is based on the predicted effects of the quarry,

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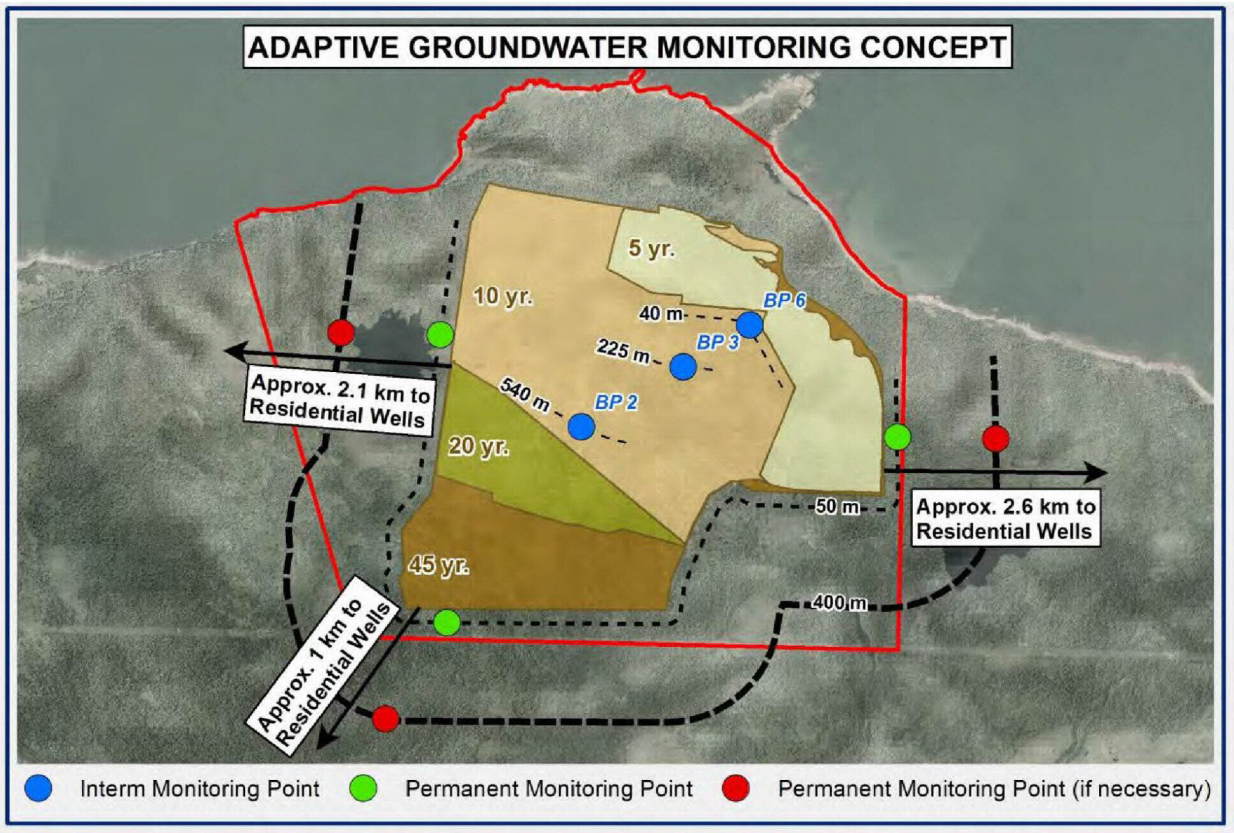
and will be adaptive to the conditions encountered as development proceeds and the quarry expands.

Due to the long term nature of the facility (50 year build out) the groundwater monitoring program will be phased in to establish background conditions as needed: the wells shown below would be installed over time, rather than all at once. As the results become known and actual quarry drawdowns are established and compared against predicted values, monitoring locations can be optimized or eliminated and monitoring frequency reduced if no effects are observed. It is anticipated that some monitoring locations will be temporary and will exploit existing boreholes (shown in blue, below) to help establish actual conditions, and that some will be permanent and newly installed (shown in green). The schematic below is intended to conceptually show what this would look like for the three areal phases of the Project.



Each groundwater monitoring station, both blue and green, would consist of at least a pair of drilled monitoring wells into the bedrock. One of the two wells will be equipped with a water level monitor in the upper 10 m of bedrock (the weathered zone), while the second well will be drilled to the anticipated final quarry depth. Packer testing would be used to select an appropriate permeable horizon within the deeper well to host the water level monitor. If the overburden is found to be substantive and water bearing, a shallow standpipe would be installed in the overburden for monitoring purposes.

The first blue sentry well pair would be drilled in year zero within the “10 yr zone”, 50 m or less from the 5 year pit face. They are intended to establish the drawdown condition to the south. The first green sentry well pair would also be drilled in year zero and would be placed 50 m east of the quarry face since quarry expansion between years zero and five will occur in an easterly

direction. The objective of these wells is to monitor drawdown to the east. A third well pair (in red) would be installed 400 m east from the quarry face to test the predicted drawdown condition in year three or four, depending on the results recorded in the first well pair installed at 50 m. If no effects were measured at 50 m east, then no wells would be required at 400 m east.

All groundwater monitors would be tested for field permeability for comparison to the original studies. This information would be used to aid in the design of future monitoring stations. All other well pairs would be installed progressively over the years in keeping with quarry expansion. For example, the green well pairs to the west would be installed sometime after year five as the 10-year pit wall extent is approaching.

Groundwater monitoring would consist of seasonal (quarterly) water level measurements plus the use of dataloggers in key sentry wells in line with residential wells. Since no impacts are predicted on private wells over a kilometre away and there is a high level of confidence with this prediction, no private well monitoring program is proposed at this time. However, the groundwater monitoring program is adaptive and if drawdowns at the sentry wells were greater than predicted, additional sentry wells could be added and/or a private well monitoring program could be instituted if deemed necessary following discussions with NSE. Once seasonal baseline conditions (water quality and water level fluctuations) are established the results would be used to determine future seasonal water level monitoring frequency.

Two baseline water samples per year would be collected, one each in the wet and dry seasons. Samples would be analysed for a basic suite of water quality parameters. Water quality samples would be taken again if/when quarry effects are observed in the sentry wells to determine if the drawdown has had adverse effects on water quality. The need for future water quality sampling would be re-evaluated based on these initial results.

Each well location would undergo quarterly baseline monitoring for a minimum of two years to establish seasonal variations over differing meteorological conditions.

The monitoring of ground-to-surface water interaction will be achieved using the existing shallow drive point piezometers located in key wetlands plus in Fogherty and Murphys Lakes. The objective of this program is to establish if there is a drying out of wetlands from their baseline conditions. Water level monitoring would be undertaken at the same frequency as in the groundwater monitors but no water samples would be taken. This methodology is non-intrusive to the ecologic features and largely employs equipment already in place.

In summary, the groundwater monitoring approach is designed to verify the drawdown predictions described above. It will be progressively implemented as the quarry expands over time and has the additional advantage of being adaptive and flexible, in terms of well locations and monitoring efforts, to initial results. This in turn results in a groundwater monitoring program that is reflective of actual quarry expansion and measured Project effects on groundwater.

4.0 REFERENCES

AECOM 2014a. Technical Memorandum: Black Point Hydrogeology June and July, 2014 Field Program

AECOM 2014b. Technical Memorandum: Black Point Hydrogeology August, 2014 Field Program

AMEC. 2006. Environmental Assessment. Keltic Petrochemicals Inc. Goldboro, Nova Scotia. Project No. TV61029.

CEAA: Canadian Environmental Assessment Agency. 2014. Guidelines for the Preparation of an Environmental Impact Statement pursuant to the *Canadian Environmental Assessment Act, 2012* and Nova Scotia Registration Document pursuant to the Nova Scotia *Environment Act*. Black Point Quarry Project, Morien Resources Corp.

Dalton, P. 2011. Field Report – Acid Rock Drainage Potential. Prepared for Erdene Resource Development. 7 pp.

Dummer, T.J.B., Yu, Z.M., Nauta, L., Murimboh, J.D. and Parker, L. 2014. Geostatistical modelling of arsenic in drinking water wells and related toenail arsenic concentrations across Nova Scotia, Canada.

Fetter, C.W. 2001. Applied Hydrogeology. 4th Edition. Prentice Hall, Inc.

Freeze, R.A., and J.A. Cherry. 1979. Groundwater. Prentice Hall, Inc.

Hilchey, J.D., Cann, D.B. and J.I. MacDougall. 1964. Soil Survey of Guysborough County, Nova Scotia. Report No. 14, Nova Scotia Soil Survey. Canada Department of Agriculture and Nova Scotia Depart of Agriculture and Marketing. 56 pp.

Hill, J.D. 1991. Petrology, Tectonite Setting, and Economic Potential of Devonian Peraluminous Granitoid Plutons in the Canso and Forest Hill Areas, Eastern Meguma Terrane, Nova Scotia. Energy Mines and Resources Canada.

Neily, P.D., Quigley, E., Benjamin, L., Stewart, B., Duke, T., 2003. "Ecological Land Classification for Nova Scotia, Volume 1 – Mapping Nova Scotia's Terrestrial Ecosystems." Nova Scotia Department of Natural Resources, Renewable Resources Branch, April 2003.

NSDNR: Nova Scotia Department of Natural Resources. 2007. Ecodistricts of Nova Scotia. Map DNR 2007-2 Ecological Land Classification Map. Scale 1:500,000.

NSE: Nova Scotia Environment. 2005. Test Your Water Well for Naturally Occurring Arsenic. Accessed online.

NSE: Nova Scotia Environment. 2009. Guide to Preparing an EA Registration Document for Pit and Quarry Developments in Nova Scotia. Revised September 2009. 36 pp.

NSE: Nova Scotia Environment. 2014. Naturally Occurring Uranium in Groundwater in Nova Scotia. Accessed online.

C 1340-800

SRI: Soil Research Institute. 1963. Soil Map of Guysborough County, Nova Scotia, East Sheet. Research BranCH, Canada Department of Agriculture, Ottawa. Scale 1 in. to 1 mile.

Stea. R.R. and Fowler, J.H. 1979. Pleistocene Geology – Eastern Shore Region, Nova Scotia – Sheet 1, 1:100,000 scale. Nova Scotia Department of Mines.

Stea. R.R., Conley, H. and Brown, Y. 1992. Surficial Geology of the Province of Nova Scotia. Map 92-3, 1:500,000 scale. Nova Scotia Department of Natural Resources.

Webb, K.T. and Marshall, I.B. 1999. Ecoregions and Ecodistricts of Nova Scotia. Crops and Livestock Research Centre. Research Branch, Agriculture and Agri-Food Canada, Truro, N.S.: Indicators and Assessment Office, Environmental Quality Branch, Environment Canada, Hull, Quebec. 39 pp.

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5.0 STATEMENT OF LIMITATIONS

This report has been prepared and the work referred to in this report has been undertaken by SLR for Vulcan Materials Company and Morien Resources Corp. (the Proponents). It is intended for the sole and exclusive use of the Proponents and its authorized agents for the purpose(s) set out in this report. Any use of, reliance on or decision made based on this report by any person other than the Proponents for any purpose, or by the Proponents for a purpose other than the purpose(s) set out in this report, is the sole responsibility of such other person or the Proponents. The Proponents and SLR make no representation or warranty to any other person with regard to this report and the work referred to in this report and they accept no duty of care to any other person or any liability or responsibility whatsoever for any losses, expenses, damages, fines, penalties or other harm that may be suffered or incurred by any other person as a result of the use of, reliance on, any decision made or any action taken based on this report or the work referred to in this report.

Any conclusions or recommendations made in this report reflect SLR's judgment based on the following limited investigations: visual site inspection(s) on the date(s) set out in this report; examination of public records; and interviews with individuals having information about the site. While efforts have been made to substantiate information provided by third parties, SLR makes no representation or warranty as to its completeness or accuracy.

This report has been prepared for specific application to this site. Unless otherwise stated, the findings cannot be extended to previous or future site conditions; portions of the site which were unavailable for direct investigation; subsurface locations which were not investigated directly; or chemical parameters, materials or analysis which were not addressed. Substances other than those addressed by the investigation described in this report may exist within the site; and substances addressed by the investigation may exist in areas of the site not investigated or in quantities not ascertained.

As the evaluation and conclusions reported herein do not preclude the existence of other chemical compounds and/or variations of conditions within the site that may be possible, this report should be used for informational purposes only and should absolutely not be construed as a comprehensive hydrogeological or chemical characterization of the site. If site conditions change or if any additional information becomes available at a future date, modifications to the findings, conclusions and recommendations in this report may be necessary.

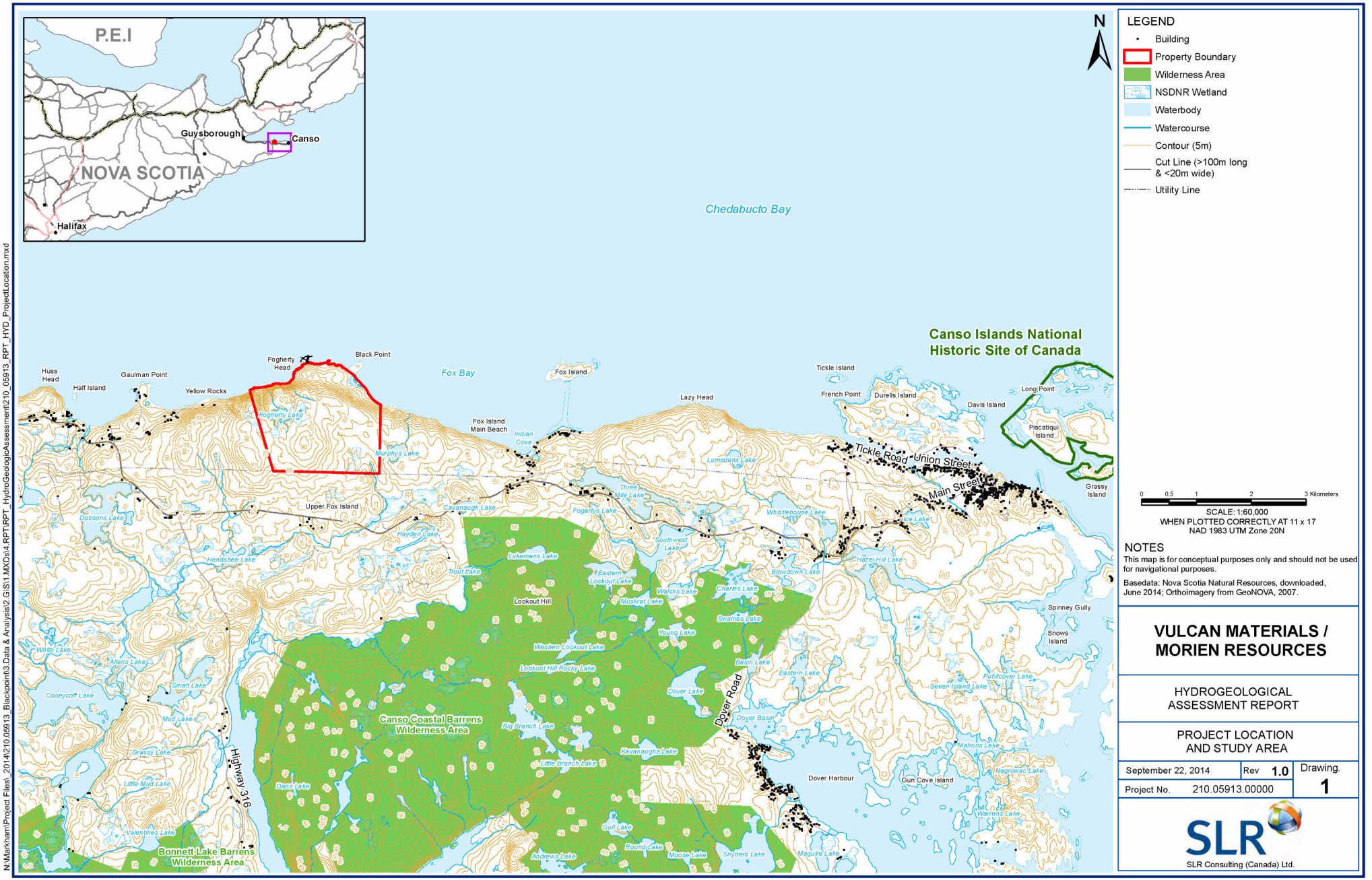
Nothing in this report is intended to constitute or provide a legal opinion. SLR makes no representation as to the requirements of or compliance with environmental laws, rules, regulations or policies established by federal, provincial or local government bodies. Revisions to the regulatory standards referred to in this report may be expected over time. As a result, modifications to the findings, conclusions and recommendations in this report may be necessary.

Other than by the Proponents and as set out herein, copying or distribution of this report or use of or reliance on the information contained herein, in whole or in part, is not permitted without the express written permission of SLR.

The Proponents may submit this report to Nova Scotia Environment and/or related environmental regulatory authorities or persons for review and comment purposes.

DRAWINGS
Hydrogeological Technical Study

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000



NOTES

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Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

VULCAN MATERIALS / MORIEN RESOURCES

HYDROGEOLOGICAL ASSESSMENT REPORT

PROJECT LOCATION AND STUDY AREA

September 22, 2014	Rev 1.0	Drawing. 1
Project No. 210.05913.00000		

SLR Consulting (Canada) Ltd.

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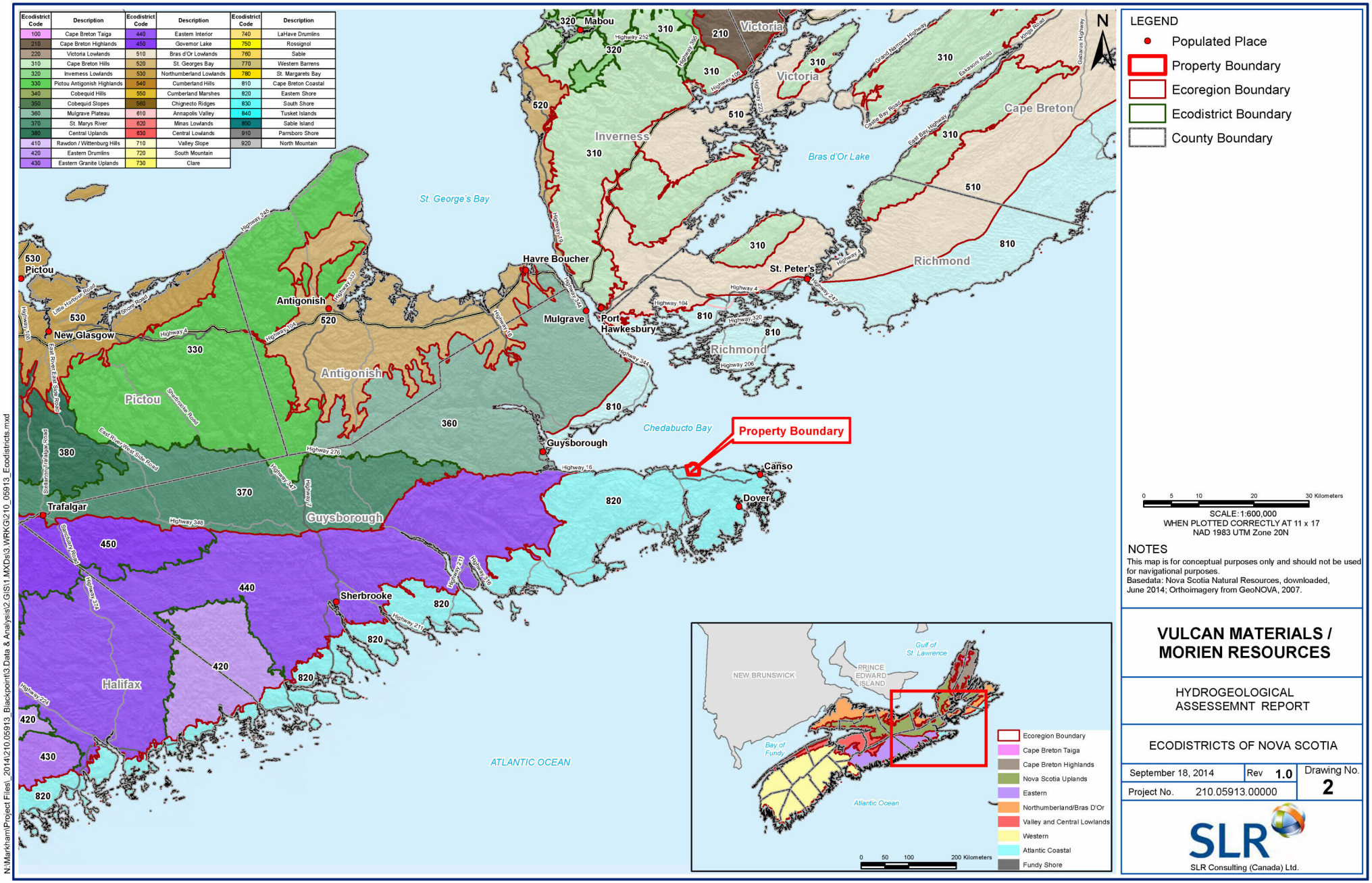
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310 Cape Breton Hills
320 Inverness Lowlands
330 Pictou Antigonish Highlands
340 Cobequid Hills
350 Cobequid Slopes
360 Mulgrave Plateau
370 St. Marys River
380 Central Uplands
410 Rawdon / Wittenburg Hills
420 Eastern Drumlins
430 Eastern Granite Uplands
440 Eastern Interior
450 Governor Lake
510 Bras d'Or Lowlands
520 St. Georges Bay
530 Northumberland Lowlands
540 Cumberland Hills
550 Cumberland Marshes
560 Chignecto Ridges
610 Annapolis Valley
620 Minas Lowlands
630 Central Lowlands
710 Valley Slope
720 South Mountain
730 Clare
740 LaHave Drumlins
750 Rossignol
760 Sable
770 Western Barrens
780 St. Margarets Bay
810 Cape Breton Coastal
820 Eastern Shore
830 South Shore
840 Tusket Islands
850 Sable Island
910 Parrsboro Shore
920 North Mountain
St. George's Bay
Bras d'Or Lake
Chedabucto Bay
ATLANTIC OCEAN
Property Boundary
Mabou
Inverness
Victoria
Cape Breton
Havre Boucher
St. Peter's
Richmond
Pictou
New Glasgow
Antigonish
Mulgrave
Port Hawkesbury
Guysborough
Canso
Dover
Trafalgar
Sherbrooke
Halifax
N
LEGEND
Populated Place
Property Boundary
Ecoregion Boundary
Ecodistrict Boundary
County Boundary
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WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N
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Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.
NEW BRUNSWICK
PRINCE EDWARD ISLAND
Gulf of St. Lawrence
Bay of Fundy
Atlantic Ocean
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Ecoregion Boundary
Cape Breton Taiga
Cape Breton Highlands
Nova Scotia Uplands
Eastern
Northumberland/Bras D'Or
Valley and Central Lowlands
Western
Atlantic Coastal
Fundy Shore
VULCAN MATERIALS / MORIEN RESOURCES
HYDROGEOLOGICAL ASSESSEMNT REPORT
ECODISTRICTS OF NOVA SCOTIA
September 18, 2014
Rev 1.0
Drawing No. 2
Project No. 210.05913.00000
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LEGEND

- Property Boundary
- Waterbody
- Wetland
- Watercourse
- Utility Line
- Elevation Contours (2m, derived from LiDAR, 5m from CANVEC)

0 250 500 1,000 Meters

SCALE: 1:22,500
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

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MORIEN RESOURCES AND VULCAN MATERIALS

HYDROGEOLOGICAL ASSESSMENT REPORT

STUDY AREA TOPOGRAPHY

October 23, 2014	Rev 1.0	Drawing 3
Project No. 210.05913.00000		

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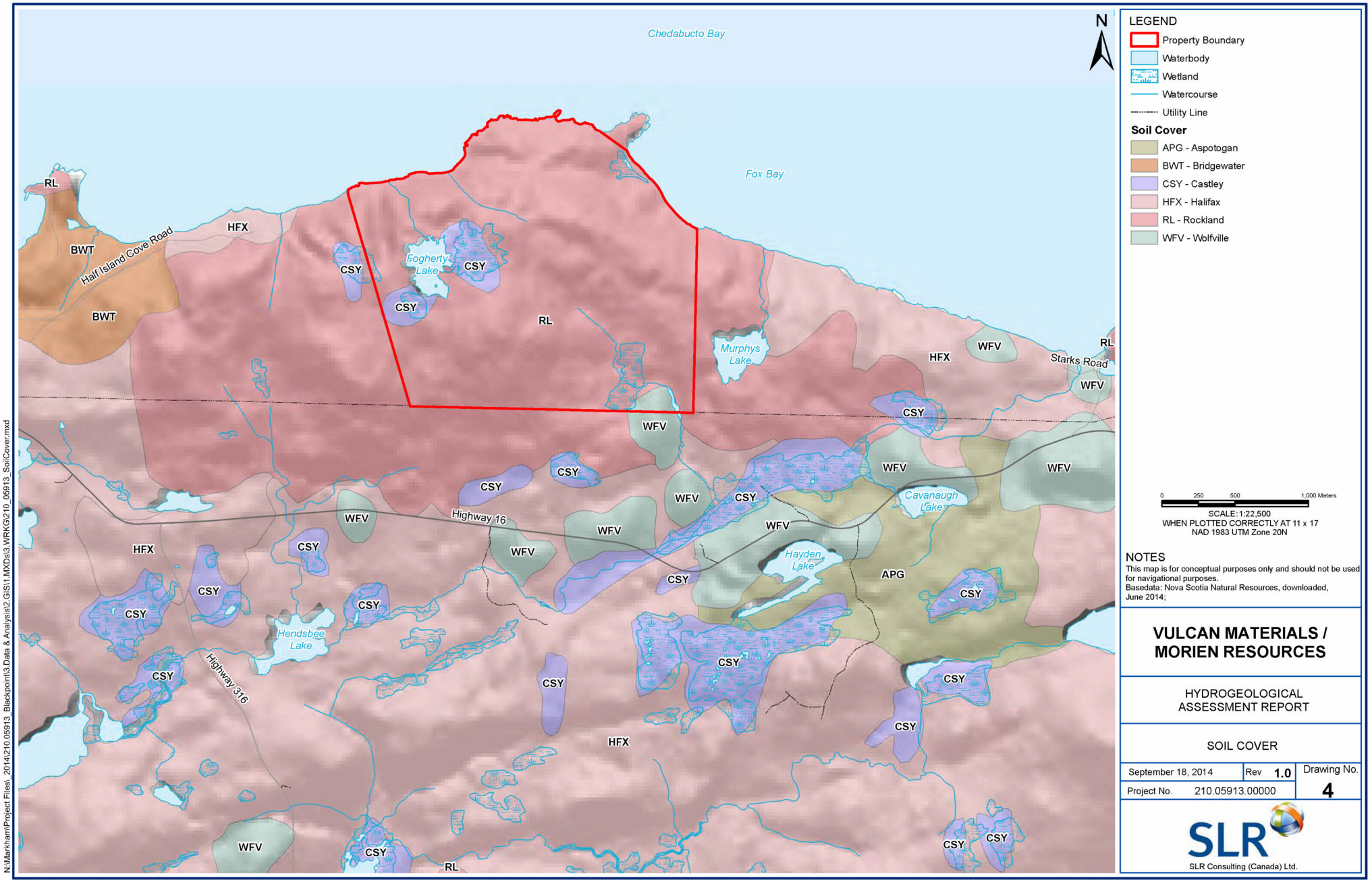
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Fox Bay
Half Island Cove Road
Fogherty Lake
Murphys Lake
Starks Road
Highway 16
Highway 316
Hendsbee Lake
Hayden Lake
Cavanaugh Lake
RL
BWT
HFX
CSY
WFV
APG
LEGEND
Property Boundary
Waterbody
Wetland
Watercourse
Utility Line
Soil Cover
APG - Aspotogan
BWT - Bridgewater
CSY - Castley
HFX - Halifax
RL - Rockland
WFV - Wolfville
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WHEN PLOTTED CORRECTLY AT 11 x 17
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Basedata: Nova Scotia Natural Resources, downloaded, June 2014;
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HYDROGEOLOGICAL ASSESSMENT REPORT
SOIL COVER
September 18, 2014
Rev 1.0
Drawing No. 4
Project No. 210.05913.00000
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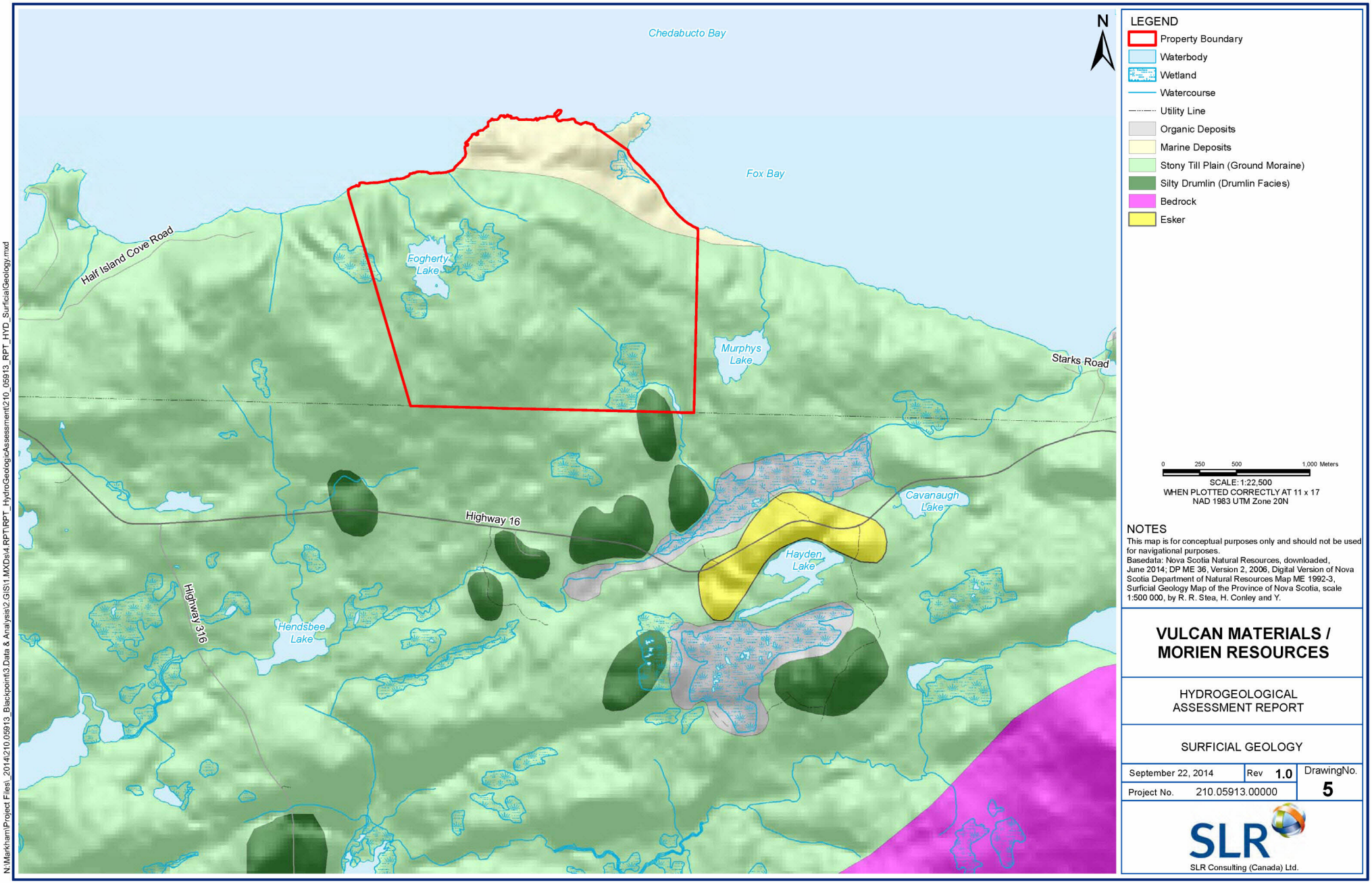

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Basedata: Nova Scotia Natural Resources, downloaded, June 2014; DP ME 36, Version 2, 2006, Digital Version of Nova Scotia Department of Natural Resources Map ME 1992-3, Surficial Geology Map of the Province of Nova Scotia, scale 1:500 000, by R. R. Stea, H. Conley and Y.

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HYDROGEOLOGICAL ASSESSMENT REPORT

SURFICIAL GEOLOGY

September 22, 2014	Rev 1.0	DrawingNo. 5
Project No. 210.05913.00000		

SLR Consulting (Canada) Ltd.

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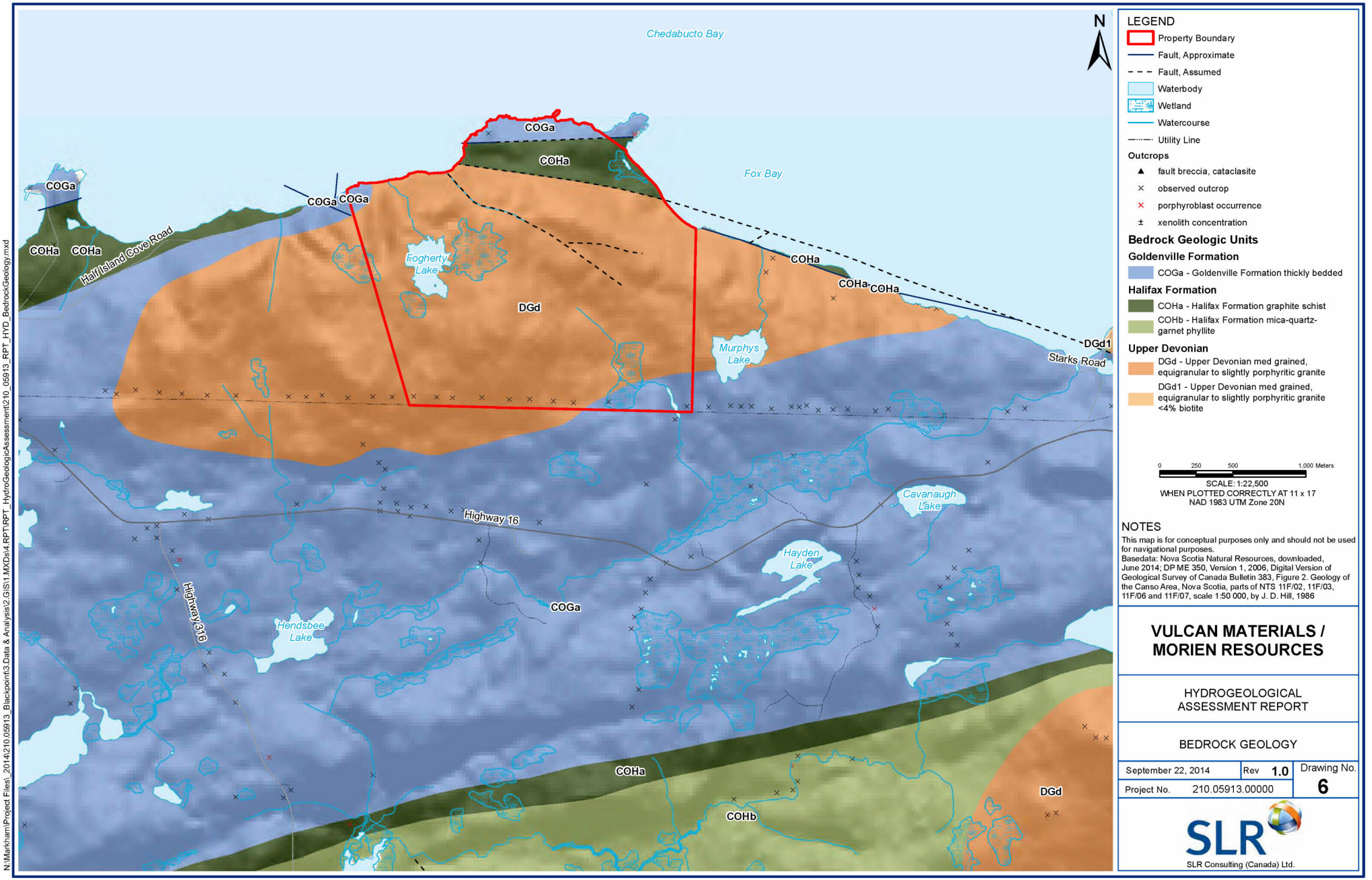

LEGEND

- Property Boundary
- Fault, Approximate
- Fault, Assumed
- Waterbody
- Wetland
- Watercourse
- Utility Line

Outcrops

- ▲ fault breccia, cataclasite
- × observed outcrop
- × porphyroblast occurrence
- ± xenolith concentration

Bedrock Geologic Units

Goldenville Formation

- COGa - Goldenville Formation thickly bedded

Halifax Formation

- COHa - Halifax Formation graphite schist
- COHb - Halifax Formation mica-quartz-garnet phyllite

Upper Devonian

- DGd - Upper Devonian med grained, equigranular to slightly porphyritic granite
- DGd1 - Upper Devonian med grained, equigranular to slightly porphyritic granite <4% biotite

0 250 500 1,000 Meters

SCALE: 1:22,500
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

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Basedata: Nova Scotia Natural Resources, downloaded, June 2014; DP ME 350, Version 1, 2006, Digital Version of Geological Survey of Canada Bulletin 383, Figure 2. Geology of the Canso Area, Nova Scotia, parts of NTS 11F/02, 11F/03, 11F/06 and 11F/07, scale 1:50 000, by J. D. Hill, 1986

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HYDROGEOLOGICAL ASSESSMENT REPORT

BEDROCK GEOLOGY

September 22, 2014	Rev 1.0	Drawing No. 6
Project No. 210.05913.00000		

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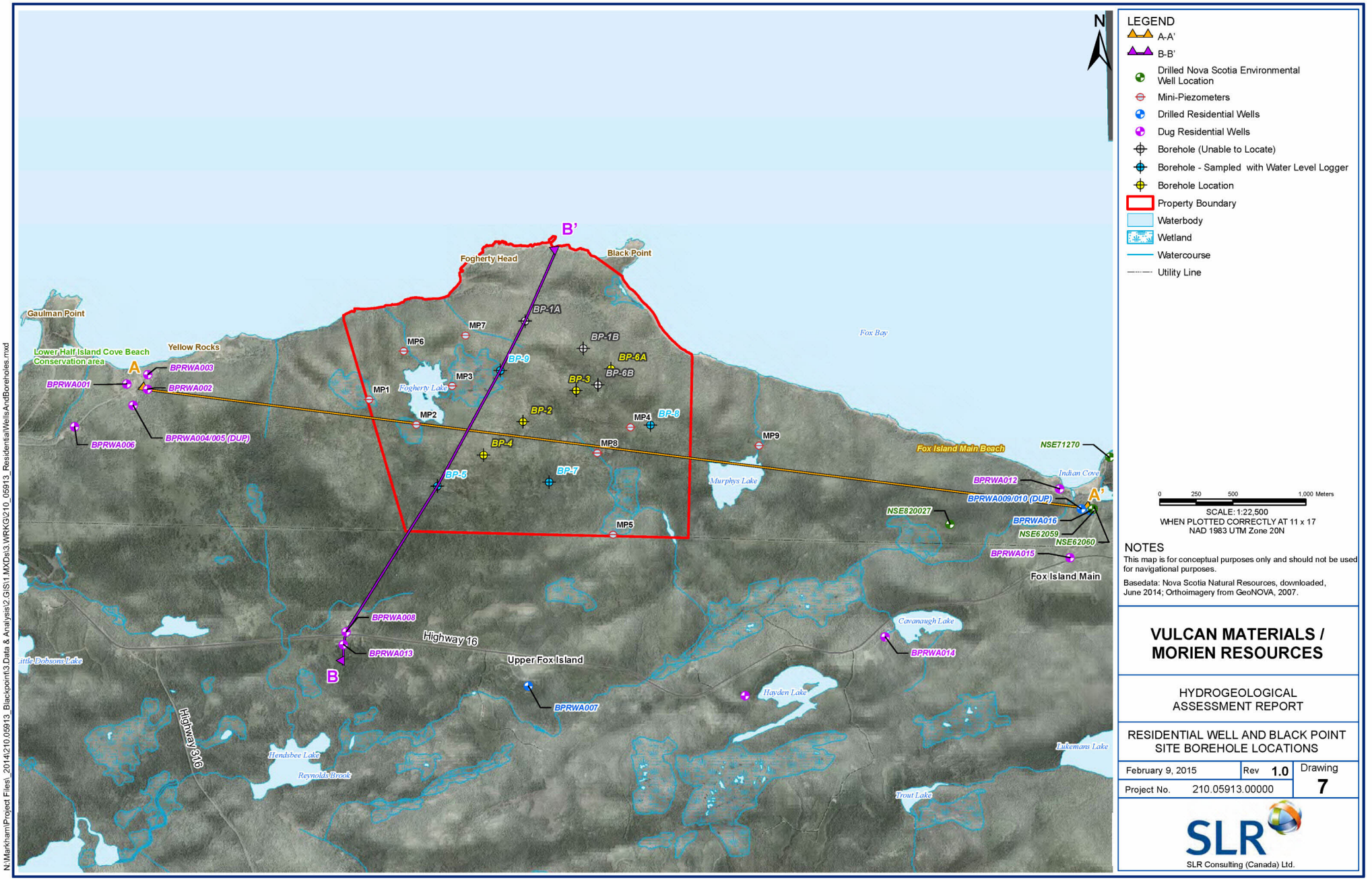


LEGEND

- A-A'
- B-B'
- Drilled Nova Scotia Environmental Well Location
- Mini-Piezometers
- Drilled Residential Wells
- Dug Residential Wells
- Borehole (Unable to Locate)
- Borehole - Sampled with Water Level Logger
- Borehole Location
- Property Boundary
- Waterbody
- Wetland
- Watercourse
- Utility Line

0 250 500 1,000 Meters

SCALE: 1:22,500
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

VULCAN MATERIALS / MORIEN RESOURCES

HYDROGEOLOGICAL ASSESSMENT REPORT

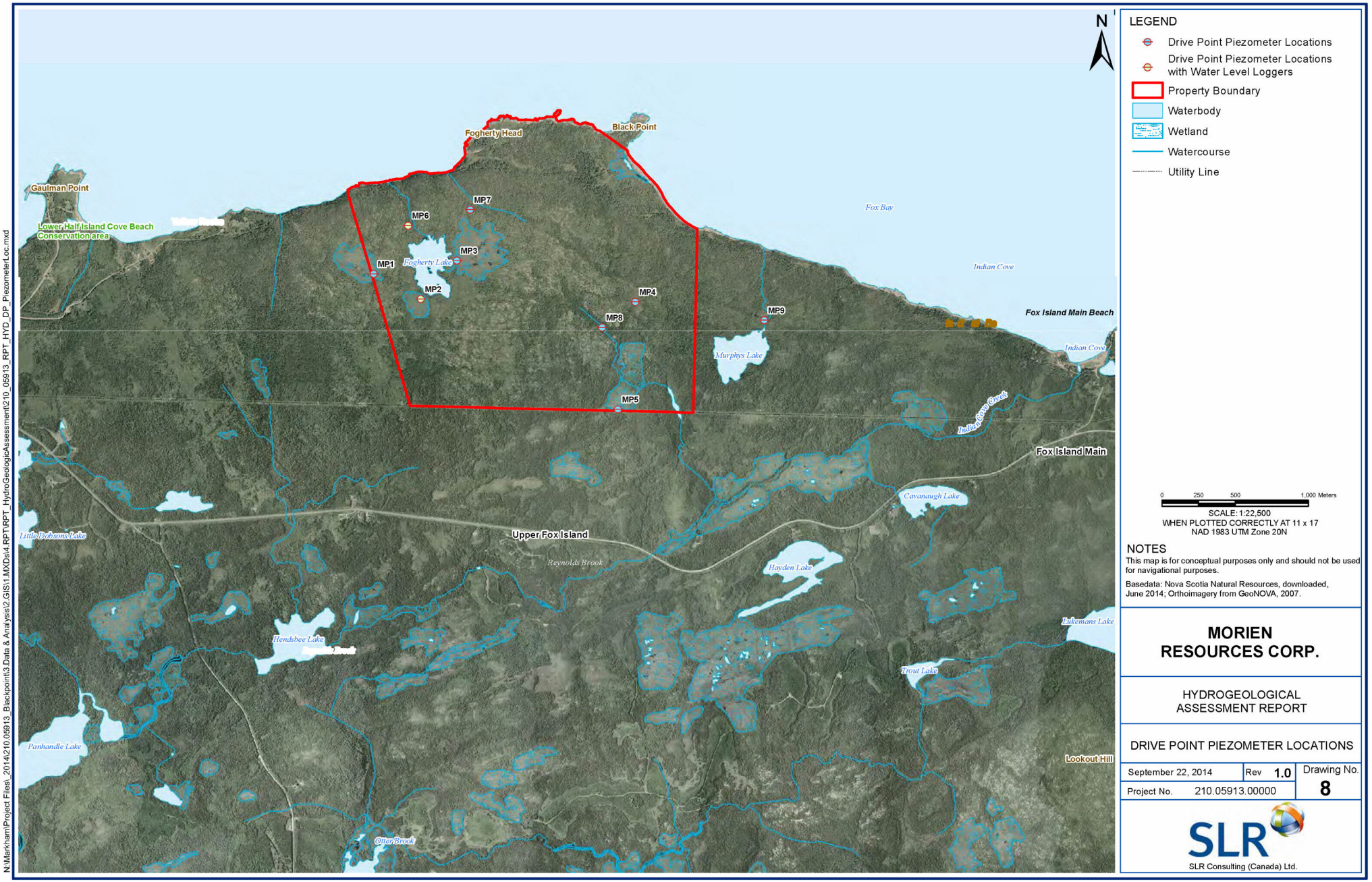
RESIDENTIAL WELL AND BLACK POINT SITE BOREHOLE LOCATIONS

February 9, 2015	Rev 1.0	Drawing 7
Project No. 210.05913.00000		

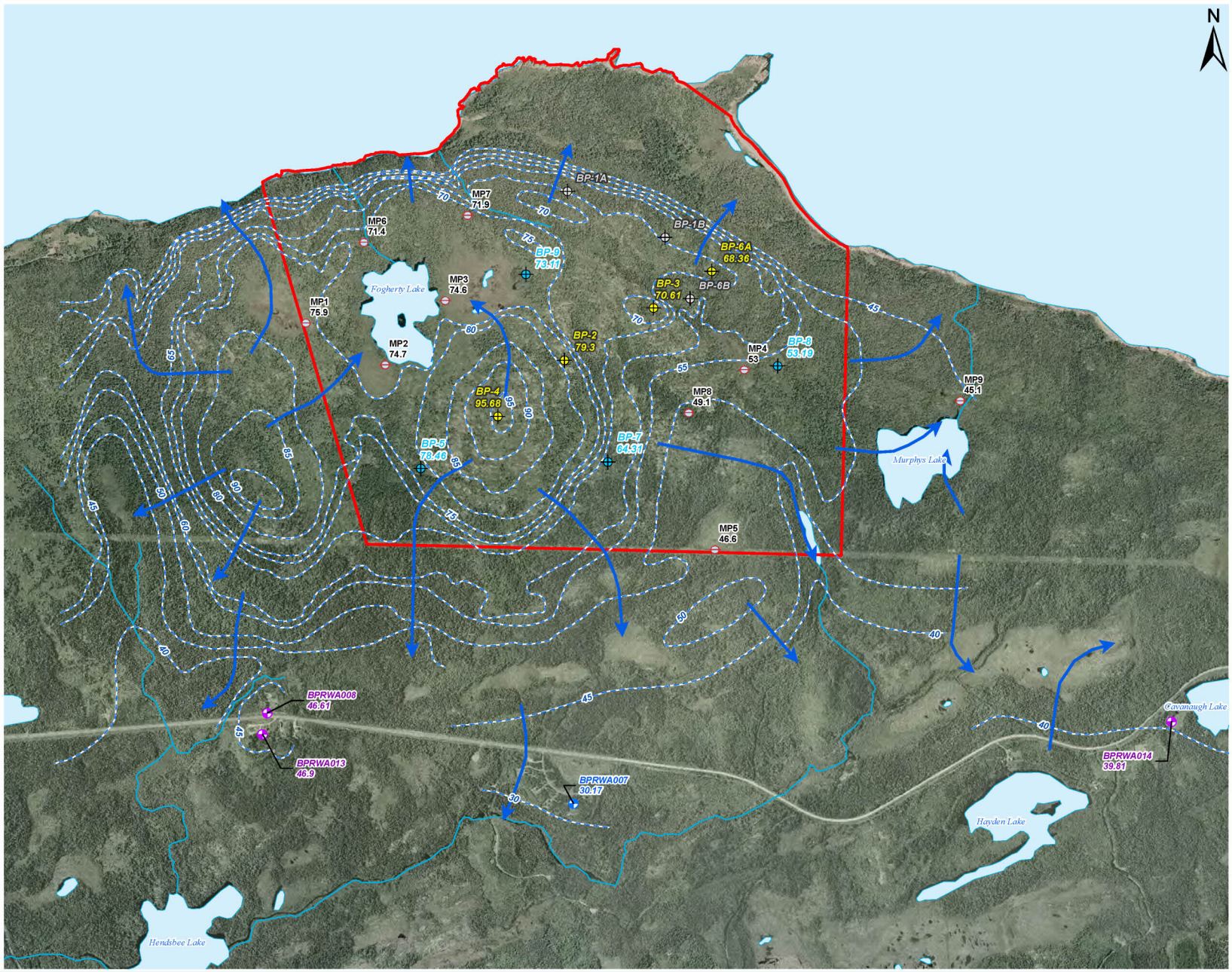
SLR Consulting (Canada) Ltd.

N:\Markham\Project Files_2014\210.05913_Blackpoint\3.Data & Analysis\2.GIS\1.MXDs\3.WRK\3\210_05913_ResidentialWellsAndBoreholes.mxd

C 1340-810


N
Fogherty Head
Black Point
Gaulman Point
Lower Half Island Cove Beach Conservation area
MP1
MP2
MP3
MP4
MP5
MP6
MP7
MP8
MP9
Fogherty Lake
Fox Bay
Indian Cove
Fox Island Main Beach
Murphys Lake
Indian Cove
Indian Cove Creek
Fox Island Main
Cavanaugh Lake
Little Dobsons Lake
Upper Fox Island
Reynolds Brook
Hayden Lake
Hendsbee Lake
Lukemans Lake
Trout Lake
Panhandle Lake
Lookout Hill
Otter Brook
LEGEND
Drive Point Piezometer Locations
Drive Point Piezometer Locations with Water Level Loggers
Property Boundary
Waterbody
Wetland
Watercourse
Utility Line
0 250 500 1,000 Meters
SCALE: 1:22,500
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N
NOTES
This map is for conceptual purposes only and should not be used for navigational purposes.
Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.
MORIEN RESOURCES CORP.
HYDROGEOLOGICAL ASSESSMENT REPORT
DRIVE POINT PIEZOMETER LOCATIONS
September 22, 2014
Rev 1.0
Drawing No. 8
Project No. 210.05913.00000
SLR
SLR Consulting (Canada) Ltd.
N:\Markham\Project Files_2014\210.05913_Blackpoint\3.Data & Analysis\2.GIS\1.MXDs\4.RPT\RPT_HydroGeologicAssessment\210_05913_RPT_HYD_DP_PiezometerLoc.mxd

C 1340-811



SCALE: 1:15,000
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

VULCAN MATERIALS / MORIEN RESOURCES

HYDROGEOLOGICAL ASSESSMENT REPORT

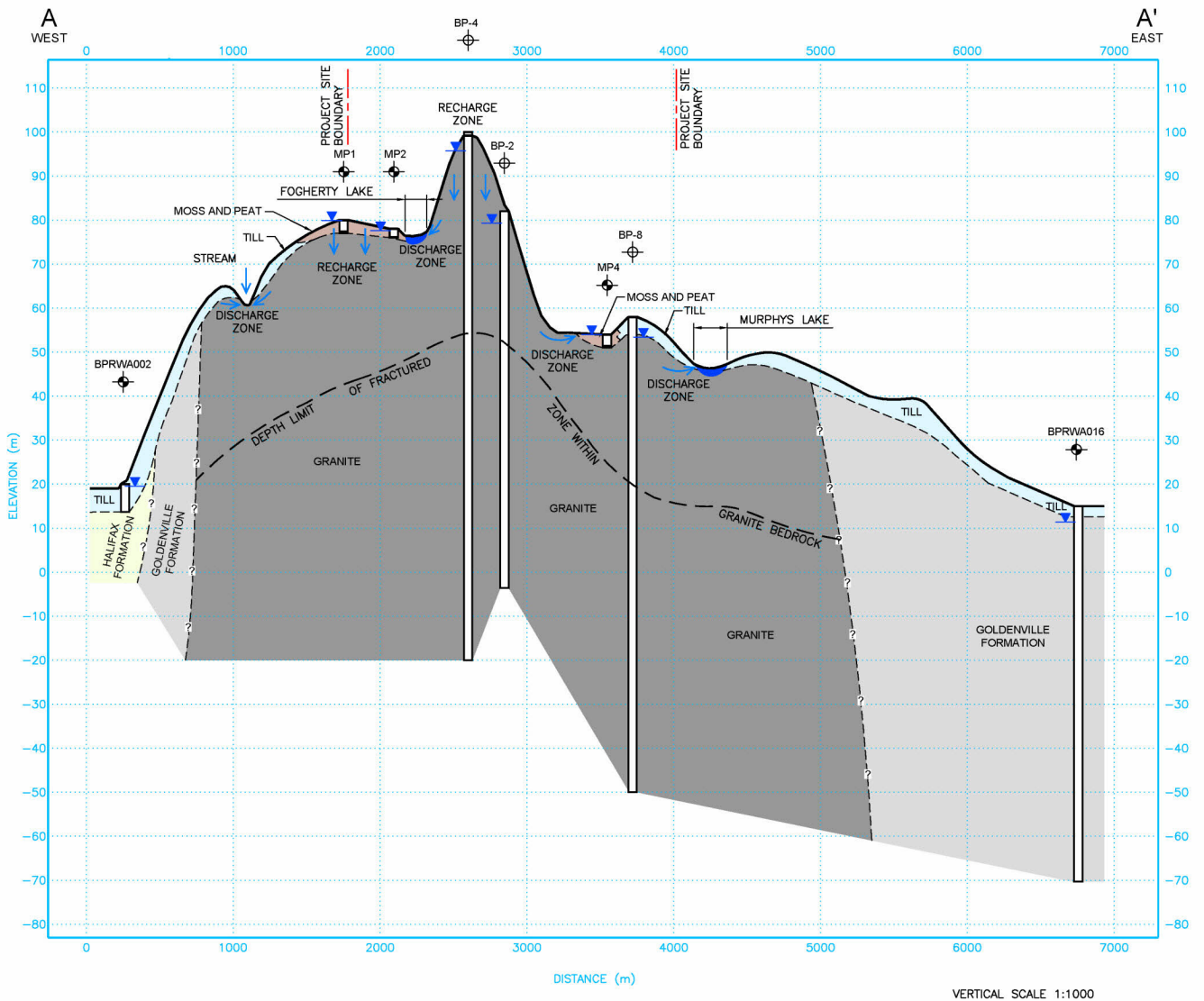
GROUNDWATER ELEVATIONS

September 26, 2014	Rev 1.0	Drawing No. 9
Project No. 210.05913.00000		

SLR Consulting (Canada) Ltd.

N:\Markham\Project Files_2014\210.05913_Blackpoint\3.Data & Analysis\2.GIS\1.MXDs\4.RPT\RPT_HydroGeologicAssessment\210_05913_RPT_HYD_GW_Contours.mxd

C 1340-812



VERTICAL SCALE 1:1000

0 10 20 40 60 m

HORIZONTAL SCALE 1:30,000

0 500 1000 2000 m

WHEN PLOTTED AT 11 x 17 PAGE SIZE

THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.

NOTES

LEGEND

- PROJECT SITE BOUNDARY
- RESIDENTIAL WELL
- DRIVE POINT PIEZOMETER
- BOREHOLE
- WELL
- SCREENED INTERVAL
- END OF HOLE
- WATER LEVEL (AUGUST 2014)
- DIRECTION OF GROUNDWATER FLOW
- TILL
- MOSS AND PEAT
- GRANITIC INTRUSION
- GOLDENVILLE FM. – METAWACKE
- HALIFAX FM. – GRAPHITE SCHIST

VULCAN MATERIALS COMPANY
BLACK POINT QUARRY
GUYSBOROUGH COUNTY
NOVA SCOTIA

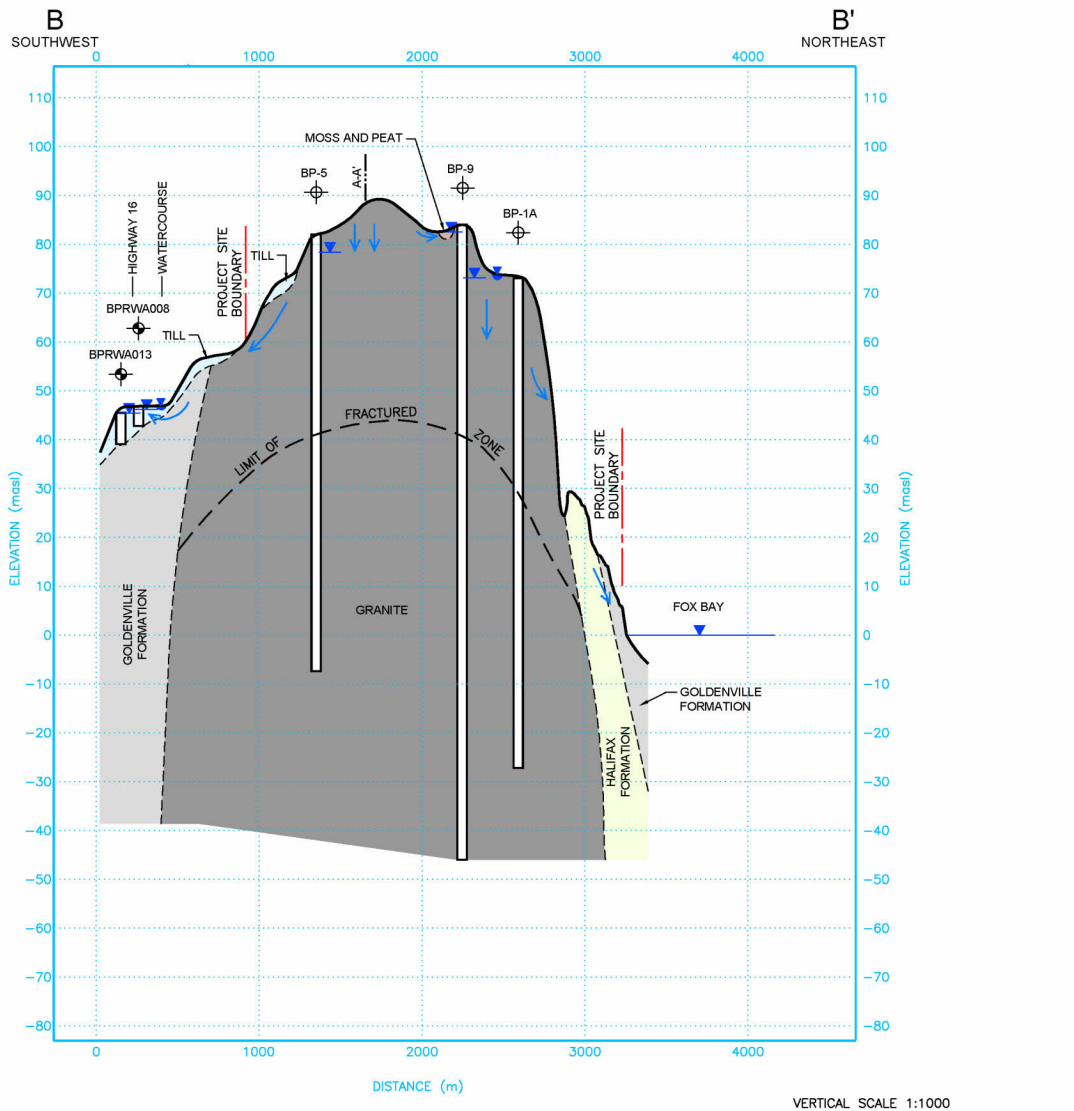
Report
HYDROGEOLOGICAL ASSESSMENT REPORT

Drawing
SCHEMATIC CONCEPTUAL
CROSS SECTION A - A'

Date JANUARY 30, 2015
Scale AS SHOWN
Drawing No. 10
File Name S_210-05913-00000-A2-1
Project No. 210.05913.00000

SLR

C 1340-813



VERTICAL SCALE 1:1000

0 10 20 40 60 m

HORIZONTAL SCALE 1:30,000

0 500 1000 2000 m

WHEN PLOTTED AT 11 x 17 PAGE SIZE

THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.

NOTES

LEGEND

- PROJECT SITE BOUNDARY
- RESIDENTIAL WELL
- DRIVE POINT PIEZOMETER
- BOREHOLE
- WELL
- SCREENED INTERVAL
- END OF HOLE
- WATER LEVEL (AUGUST 2014)
- DIRECTION OF GROUNDWATER FLOW
- TILL
- MOSS AND PEAT
- GRANITIC INTRUSION
- GOLDENVILLE FM. – METAWACKE
- HALIFAX FM. – GRAPHITE SCHIST

VULCAN MATERIALS COMPANY
BLACK POINT QUARRY
GUYSBOROUGH COUNTY
NOVA SCOTIA

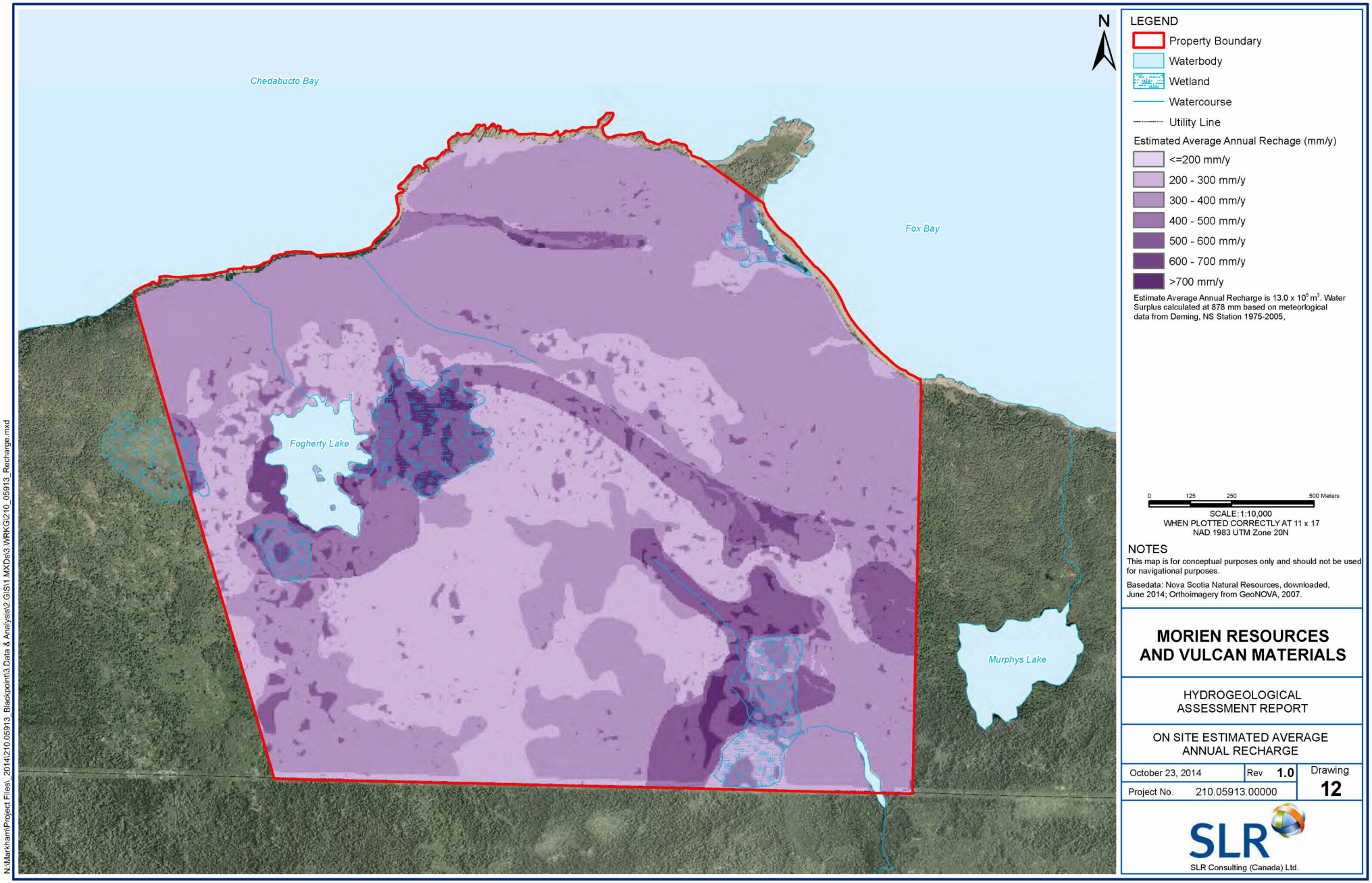
Report: HYDROGEOLOGICAL ASSESSMENT REPORT

Drawing: SCHEMATIC CONCEPTUAL CROSS SECTION B - B'

Date: JANUARY 30, 2015
Scale: AS SHOWN
Drawing No.: 11
File Name: S_210-05913-00000-A2-2
Project No.: 210.05913.00000

SLR

C 1340-814


N
Chedabucto Bay
Fox Bay
Fogherty Lake
Murphys Lake
LEGEND
Property Boundary
Waterbody
Wetland
Watercourse
Utility Line
Estimated Average Annual Rechage (mm/y)
<=200 mm/y
200 - 300 mm/y
300 - 400 mm/y
400 - 500 mm/y
500 - 600 mm/y
600 - 700 mm/y
>700 mm/y
Estimate Average Annual Recharge is 13.0 x 10^5 m^3. Water Surplus calculated at 878 mm based on meteorlogical data from Deming, NS Station 1975-2005,
0 125 250 500 Meters
SCALE:1:10,000
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N
NOTES
This map is for conceptual purposes only and should not be used for navigational purposes.
Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.
MORIEN RESOURCES AND VULCAN MATERIALS
HYDROGEOLOGICAL ASSESSMENT REPORT
ON SITE ESTIMATED AVERAGE ANNUAL RECHARGE
October 23, 2014
Rev 1.0
Drawing 12
Project No. 210.05913.00000
SLR
SLR Consulting (Canada) Ltd.
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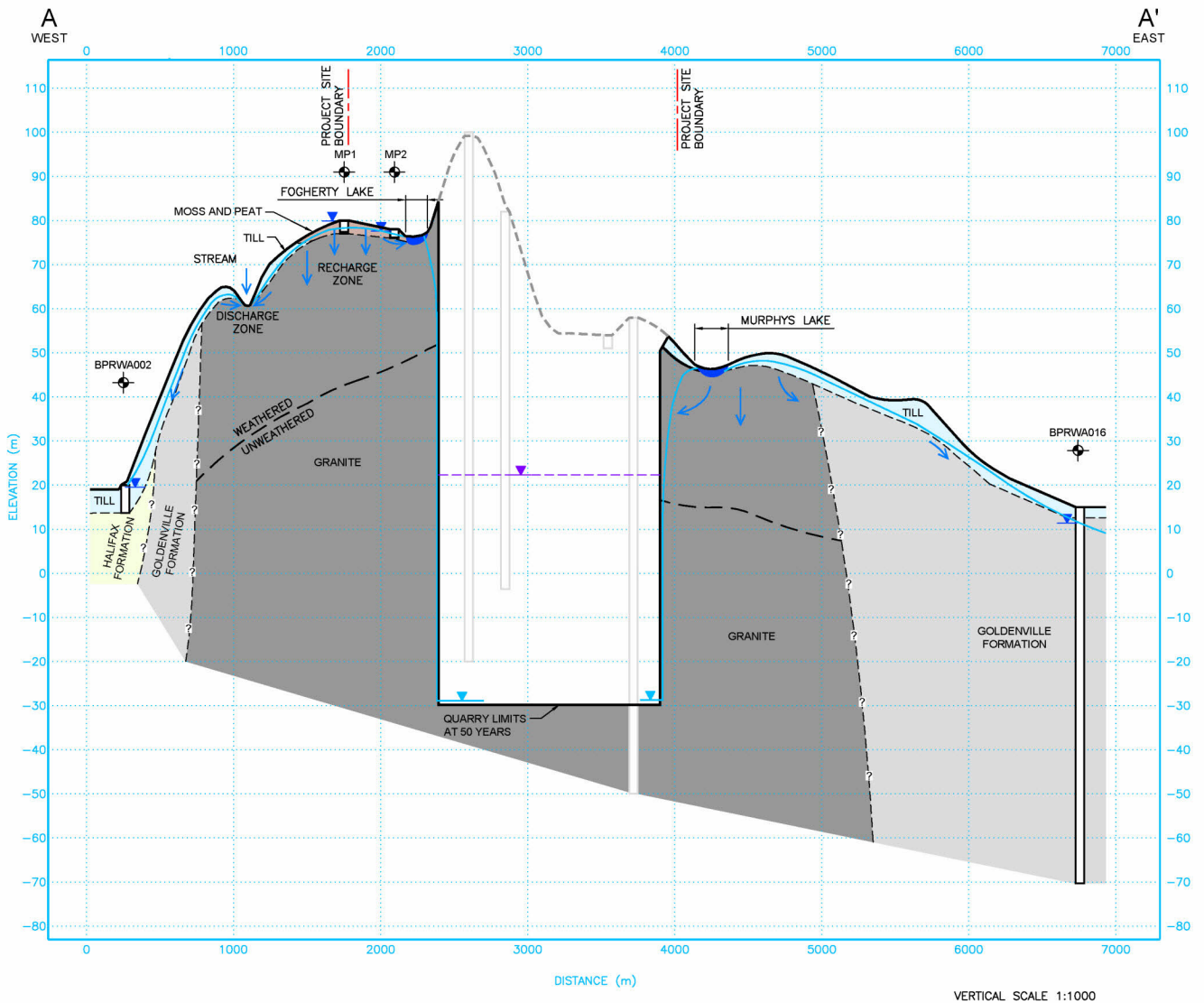
C 1340-815



VERTICAL SCALE 1:1000

0 10 20 40 60 m

HORIZONTAL SCALE 1:30,000

0 500 1000 2000 m

WHEN PLOTTED AT 11 x 17 PAGE SIZE

THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.

NOTES

LEGEND

- PROJECT SITE BOUNDARY
- RESIDENTIAL WELL
- DRIVE POINT PIEZOMETER
- BOREHOLE
- WELL
- SCREENED INTERVAL
- END OF HOLE
- WATER LEVEL (AUGUST 2014)
- DIRECTION OF GROUNDWATER FLOW
- TILL
- MOSS AND PEAT
- GRANITIC INTRUSION
- GOLDENVILLE FM. – METAWACKE
- HALIFAX FM. – GRAPHITE SCHIST
- WATER TABLE AT 50 YEARS
- POST CLOSURE WATER TABLE

VULCAN MATERIALS COMPANY
BLACK POINT QUARRY
GUYSBOROUGH COUNTY
NOVA SCOTIA

Report: HYDROGEOLOGICAL ASSESSMENT REPORT

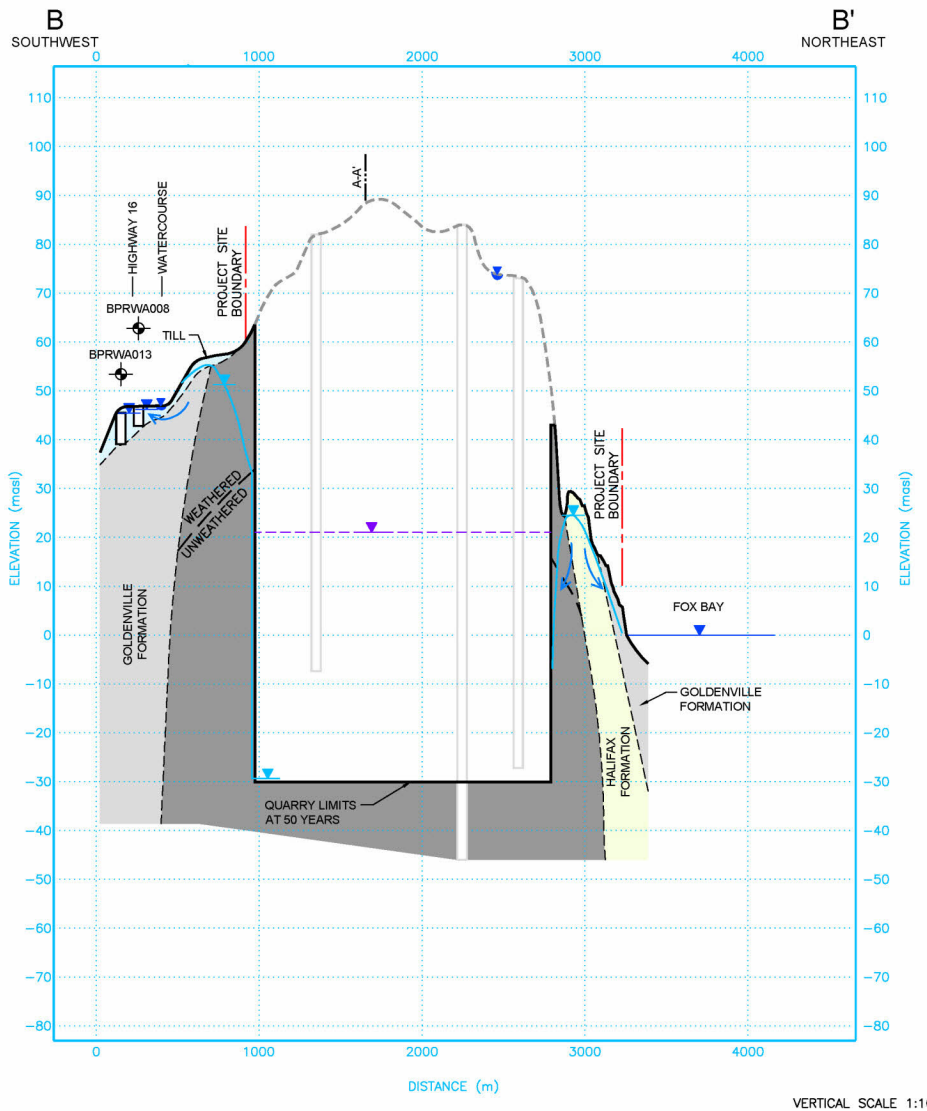
Drawing: QUARRY AND DRAW DOWN CROSS SECTION A - A'

Date: JANUARY 30, 2015 | Scale: AS SHOWN | Drawing No.: 13

File Name: S_210-05913-00000-A2-3 | Project No.: 210.05913.00000

SLR

C 1340-816



VERTICAL SCALE 1:1000

0 10 20 40 60 m

HORIZONTAL SCALE 1:30,000

0 500 1000 2000 m

WHEN PLOTTED AT 11 x 17 PAGE SIZE

THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.

NOTES

LEGEND

- PROJECT SITE BOUNDARY
- RESIDENTIAL WELL
- DRIVE POINT PIEZOMETER
- BOREHOLE
- WELL
- SCREENED INTERVAL
- END OF HOLE
- WATER LEVEL (AUGUST 2014)
- DIRECTION OF GROUNDWATER FLOW
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- GOLDENVILLE FM. – METAWACKE
- HALIFAX FM. – GRAPHITE SCHIST
- WATER TABLE AT 50 YEARS
- POST CLOSURE WATER TABLE

VULCAN MATERIALS COMPANY
BLACK POINT QUARRY
GUYSBOROUGH COUNTY
NOVA SCOTIA

Report
HYDROGEOLOGICAL ASSESSMENT REPORT

Drawing
QUARRY AND DRAW DOWN
CROSS SECTION B - B'

Date JANUARY 30, 2015
Scale AS SHOWN
Drawing No. 14
File Name S_210-05913-00000-A2-4
Project No. 210.05913.00000

SLR

C 1340-817

ATTACHMENT A
Site Borehole Logs

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

Collars

Hole_ID	Easting	Northing	Elev	TD	Az	Dip
BP-1A	644811	5023872	73	100.18		
BP-6A	645399	5023545	73	55.82		
BP-6B	645310	5023434	69	70.05		
BP-1B	645209	5023685	74	80.13		
BP-2	644798	5023183	82	85.61		
BP-3	645161	5023396	74	60		
BP-4	644527	5022955	100	119.8		
BP-5	644213	5022742	82	89.4		
BP-7	644975.	5022769	70	120		
BP-8	645668.	5023160	58	108		
BP-9	644642.	5023534	79	130		
BP-10	644556.	5024260	17	120	135	60
BP-11	644998.	5023990	27	120	135	60
Yellow highlighted holes are new holes						

Company 6531954 Canada Ltd
Drill Contractor Logan Drilling Company

PROJECT NAME:	**Black Point**	**HOLE DESCRIPTION**		**COLLAR LOCATION**	**CORE TYPE (Q)**	**LOGGING DETAILS**	
LICENSE INFORMATION:	**8372**	**ELEVATION: 73m**		**5023872mN**	**(P / H / N / B)**	**LOGGED BY**	**Peter Dalton**
DRILL HOLE NUMBER:	**BP-1A**	**AZM.: na**	°		**100.18: m**	**DATES:**	**Jan.16/08**
DATE COLLARED:	**Jan.11/2008**	**DIP: -90**	°	**644811mE**		**PAGE:**	**1 of 3**
DATE COMPLETED:	**Jan.13/2008**	**EOH: 100.18m**		**NAD 83 Zone 20**		**SIGNED:**	

Description	From	To	Grain Size	Foliation	Strength	Structure		Mineralization		Sample Code
(Colour, Texture, Mineralogy%, etc.)	m	m	(F/M/C/P)	(Null/W/M/S)	(S 1-6)	Joints/m	Angle with CA	Type	Intensity	
Casing. No core	0	0.6								**BP-1A (1)**
0.6-5m Rubbeled and fractured core, poor recovery. Medium (fine) equigranular	0.6	5	Mf	Null	6	>10	90-40			**0.6-33.2m**
granite weakley pink in colour. 50% Fldspar, 45% Quartz, 5% Biotite with moderate										LA Abrasion
chlorite alteration of the biotite.										SG
5-9.81m Medium (fine) equigranular granite weakly pink in colour. 50% Fldspar, 45%	5	6	Mf	Null	6	1	90			Absorption
Quartz, 5% Biotite with moderate chlorite alteration of the biotite. Long competent core	6	7	Mf	Null	6	0	na			
sticks	7	8	Mf	Null	6	2	80			Sodium Sulphate
	8	9	Mf	Null	6	0	na			Soundness Loss
	9	9.81	Mf	Null	6	1	45			Magnesium Sulfate
9.81-15m Orangy grey, medium(fine) grained syenogranite, equigranular,	9.81	10	Mf	Null	6	0	na			soundness loss
55%Fldspar, 48% Quartz, 2% Biotite (chloritic) <1% muscovite. Note Mica has	10	11	Mf	Null	6	1	10			Alkali Reactivity
decreased and K-spar has increased. Fe/MnOx coating on fracture surfaces										14day
11-11.1m Quartz/Plag pegmatite pod. Phenocrysts 1cm long. Pod is associated with a	11	11.1	P	Null	6	2	5			Micro Deval
fracture which occurs from 11m to 11.3m at 5 deg. To CA Fe/MnOx staining on										PN
	11.1	12	Mf	Null	6	0	na			
	12	13	Mf	Null	6	1	40			
	13	14	Mf	Null	6	1	40			
	14	15	Mf	Null	6	0	na			
15-19.82m Greyish white (weak pink), Medium(fine) grained granite potential	15	16	Mf	Null	6	0	na			
decrease in potassic feldspar. 50% Fldspar, 45%Quartz, 5% Mica, MnOx on joint	16	17	Mf	Null	6	3	90			
planes	17	18	Mf	Null	6	0	na			
	18	19.82	Mf	Null	6	0	na			
19.82- 37m Orangey grey syeno-granite 60% Fldspar, 35% Quartz, 5% (moderate	19.82	20	Mf	Null	6	0	na			
chlorite Alt) Mica Note:Gradula decrease in Quartz from prior interval	20	20.1	Mf	Null	6	2	10			
20.1-23m Orangey grey medium(fine) granied syenogranite 50% Fldspar, 45%	20.1	21	Mf	Null	6	0	na			
Quartz, 5% Mica, MnOx along joint planes	21	22	Mf	Null	6	2	10			
	22	23	Mf	Null	6	1	10			
23-26m Shallow angle fractureing Fe/MnOx coating fracture surface	23	24	Mf	Null	6	2	40			
	24	25	Mf	Null	6	4	40			
	25	26	Mf	Null	6	4	80			
26-26.4m Shallow angle fracturing	26	27	Mf	Null	6	2	80			
	27	28	Mf	Null	6	3	80			
	28	29	Mf	Null	6	1 / 2 #3	30 / 80			
	29	30	Mf	Null	6	4	90			
30.22-31m Elongated fracturing over interval. Fe/MnOx and clay on fracture surface.	30	31	Mf	Null	6	2	40			
	31	32	Mf	Null	6	2	40			
	32	33	Mf	Null	6	4	20			
33.29-33.8 Several low angle silicified hairline fracures	33	34	Mf	Null	6	4	20			**BP-1A (2)**
34-35m Low angle re fracture along previous silicified fracture. 1cm wide mica pod at	34	35	Mf	Null	6	2	90			**33.2-66.39m**
35.88m	35	36	Mf	Null	6	1	10			
Biotite increase to 10%	36	37	Mf	Null	6	1	90			
37-49m Greyish Pink medium grained equigranular syenomonzogranite 50% Fldspar,	37	38	Mf	Null	6	0	na			
40% Quartz, 10% mica (biotite dominit, moderate chlorite alt.)	38	39	Mf	Null	6	2	80			

Company 6531954 Canada Ltd
Drill Contractor Logan Drilling Company

PROJECT NAME:	Black Point	HOLE DESCRIPTION		COLLAR LOCATION	CORE TYPE (Q)	LOGGING DETAILS	
LICENSE INFORMATION:	8372	ELEVATION: 73m	m	5023872mN	(P / H / N / B)	LOGGED BY	Peter Dalton
DRILL HOLE NUMBER:	BP-1A	AZM.: na	°	644811mE	100.18: m	DATES:	Jan.16/08
DATE COLLARED:	Jan.11/2008	DIP: -90	°		% Recovery	PAGE:	2 of 3
DATE COMPLETED:	Jan.13/2008	EOH: 100.18m	m	NAD 83 Zone 20		SIGNED:	

Description	From	To	Grain Size	Foliation	Strength	Structure		Mineralization		Sample Code
(Colour, Texture, Mineralogy%, etc.)	m	m	(F/M/C/P)	(Null/W/M/S)	(S 1-6)	Fractures/m	Angle with CA	Type	Intensity	
	39	40	Mf	Null	6	0	na			**LA Abrasion**
	40	41	Mf	Null	6	2	80			**SG**
	41	42	Mf	Null	6	0	na			**Absorption**
42.57-42.93m shallow angle hairline fracture. Dark FeOx crust on fracture surface.	42	43	Mf	Null	6	2 / 1 #3	20 / 80			
	43	44	Mf	Null	6	1	80			**Sodium Sulphate**
	44	45	Mf	Null	6	0	na			**Soundness Loss**
45-49m Colour change to whitish grey/green medium(fine) grained equigranular	45	46	Mf	Null	6	0	na			**Magnesium**
granite. 50% Fldspar, 40% Quartz, 10% Mica (biotite dominant, moderate chlorite alt.)	46	47	Mf	Null	6	0	na			**Sulfate soundness**
Note only 2 hairline fractures over entire interval with weak clay alteration along	47	48	Mf	Null	6	2	20			**Alkali Reactivity**
42.57-42.93m Biotite band	48	49	Mf	Null	6	1	90			**14day**
49-50m Pinkish K-spar beginning to increase over interval returning to syenogranite	49	50	Mf	Null	6	0	na			**Micro Deval**
50-60m Medium(fine) grained equigranular syenogranite with fine grained chloritic	50	51	Mf	Null	5	2	5			
	51	52	Mf	Null	6	2	40			
	52	53	Mf	Null	6	1	40			
53-54m FeOx on fracture plane	53	54	Mf	Null	6	4 / 2 #6	80 / 05			
	54	55	Mf	Null	6	3	40			
55-56m Interval has been fractured and "healed" through silicification, moderate clay	55	56	Mf	Null	5	4 / 1 #5	90 / 20			
alteration on certain fracture planes.	56	57	Mf	Null	6	1	30			
58-60m Fractures with siliceous healing (mm width) Base of this interval gradually	57	58	Mf	Null	5	3 / 1 #4	90 / 05			
depletes in quartz and mica with increase in feldspar. FeOx on fractured surfaces.	58	59	Mf	Null	6	1	90			
	59	60	Mf	Null	5	1 / 1 #2	90 / 05			
60-61.33m Quartz Syenite. 80%Kspar, 15%Quartz, 5%Biotite. Intenses low angle	60	61.33	M	Null	6	>10				
hairline fracturing. Biotite occurs as fine grained laths and medium grained clots. Mica										
and quartz increase gradually toward base of interval										
61.33-75m Pinkish grey medium(fine) grained equigranular syenogranite with 50%	61.33	62	Mf	Null	6	0	na			
Fldspar, 40-45% Quartz, 5-10% mica (dominant chlorititc fine grained biotite)	62	63	Mf	Null	6	0	na			
	63	64	Mf	Null	6	2	40			
	64	65	Mf	Null	6	2	40			
	65	66	Mf	Null	6	2	40			
66.16m 1cm^2 Metasedimentary xenolith	66	67	Mf	Null	6	2	40			
	67	68	Mf	Null	6	2	40			**BP-1A (3)**
	68	69	Mf	Null	6	2	40			**66.39-100.18m**
	69	70	Mf	Null	6	0	na			
	70	71	Mf	Null	6	4	80			
71-72m Low angle hairline fracturing healed through silicification (mm width). Trace	71	72	Mf	Null	6	1	40	Pyrite	trace	
pyrite very fine grained observed in association with siliceous fracture healing.										
	72	73	Mf	Null	6	1	90			
72-74m Low angle silicified hairline fractures (mm width)	73	74	Mf	Null	6	1 / 1 #2	80 / 20			
	74	75	Mf	Null	6	1	30			
	75	76	Mf	Null	6	1	90			
75-82m Medium(fine granied equigranular syenogranite 50% Fldspar, 40% Quartz,	76	77	Mf	Null	6	2	90			
10% Mica (9% fine grained chloritic biotite, 1% muscovite) Kspar has darkened to a	77	78	Mf	Null	6	1	40			
dark orange.	78	79	Mf	Null	6	1	90			

Company 6531954 Canada Ltd
Drill Contractor Logan Drilling Company

PROJECT NAME:	Black Point	HOLE DESCRIPTION		COLLAR LOCATION	CORE TYPE (Q)	LOGGING DETAILS	
LICENSE INFORMATION:	8372	ELEVATION: 73m	m	5023872mN	(P / H / N / B)	LOGGED BY	Peter Dalton
DRILL HOLE NUMBER:	BP-1A	AZM.: na	°	644811mE	100.18: m	DATES:	Jan.16/08
DATE COLLARED:	Jan.11/2008	DIP: -90	°		% Recovery	PAGE:	3 of 3
DATE COMPLETED:	Jan.13/2008	EOH: 100.18m	m	NAD 83 Zone 20		SIGNED:	

Description	From	To	Grain Size	Foliation	Strength	Structure		Mineralization		Sample Code	
(Colour, Texture, Mineralogy%, etc.)	m	m	(F/M/C/P)	(Null/W/M/S)	(S 1-6)	Joints/m	Angle with CA	Type	Intensity		
	79	80	Mf	Null	6	1	40			LA Abrasion	
	80	81	Mf	Null	6	1	30			SG	
81-82m Pinkish syenogranite grades into whitish grey at interval base.	81	82	Mf	Null	6	2	40			Absorption	
82-83.2m Greenish white medium(fine) grained equigranular granite. Intense micro	82	83	Mf	Null	6	0	na				
hairline fractures at low angle to core axis	83	83.2	Mf	Null	6	0	na			Sodium Sulphate	
83.2-90m Pink Kspar gradually returns to granite over interval.	83.2	84	Mf	Null	6	0	na			Soundness Loss	
Biotite pod 1cm^2 at 84.54, metasediment 3cm^2 xenolith at 84.86m	84	85	Mf	Null	6	1 / 1 #2	40 / 80			Magnesium	
	85	86	Mf	Null	6	1	40			Sulfate soundness	
Intense silicified hairline fractures at 40deg to CA over interval	86	87	Mf	Null	6	1 / 1 #2	40 / 80			Alkali Reactivity	
87.76m K-Spar phenocryst (5cm^2)	87	88	Mf	Null	6	0	na			14day	
88.36m Mica pod	88	89	Mf	Null	6	0	na			Micro Deval	
	89	90	Mf	Null	6	2	80			Chloride Content	
90-92m Grey/green medium(fine) grained equigranular granite	90	91	Mf	Null	6	3	40				
91.08m Mica pod	91	92	Mf	Null	6	0	na				
92-95.18m Pinkish orange medium(fine) grained equigranular syenogranite. Intense	92	93	Mf	Null	6	1	90				
hairline fracturing at shallow angles to core axis.	93	94	Mf	Null	6	0	na				
	94	95	Mf	Null	6	0	na				
	95	95.18	Mf	Null	6	0	na				
	95.18	95.64	M-F	Null	6	0	na	Pyrite	trace		
95.64-98.55m Dark orange inequigranular medium to fine grained syenogranite	95.64	96	M-F		6	0	na				
	96	97	M-F		6	3	40				
	97	98	M-F		6	0	na				
	98	98.55	M-F	Null	6	0	na				
98.55- 100.18m EOH Inequigranular syenogranite	98.55	99	M-F	Null	6	0	na				
	99	100	M-F	Null	6	1	80				
	100	100.18	M-F	Null	6	0	na				

C 1340-822

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PROJECT NAME:	Black Point	HOLE DESCRIPTION		COLLAR LOCATION	CORE TYPE (Q)	LOGGING DETAILS	
LICENSE INFORMATION:	8372	ELEVATION: 82 m	m		(P / H / N / B)	LOGGED BY	Karen McNaulty
DRILL HOLE NUMBER:	BP-2	AZM.: na	°	644798E	85.61: m	DATES:	Jan. 23
DATE COLLARED:	Dec.13/2007	DIP: -90	°	5023183N	% Recovery	PAGE:	1of 3
DATE COMPLETED:	Dec.14/2007	EOH: 85.61 m	m	NAD 83 Zone 20		SIGNED:	

Description (Colour, Texture, Mineralogy%, etc.)	From m	To m	Grain Size (F/M/C/P)	Foliation (Null/W/M/S)	Strength (S 1-6)	Structure Joints/m	Structure Angle with CA	Mineralization Type	Mineralization Intensity	Sample Code	RQD Not done on hole	
2 ft (.6m) casing No core	0	0.6								**BP2(1)**		
2-6.05m Pink to orange equigranular syenogranite. Highly jointed with rust staining on	0.6	2	M	W	6	3	40/70/40			**0-28.54m**		
either side of joints. Fe-Mn earthy coating on some fractures. Bt alteration to chl.	2	3				2	0/30			LA Abrasion		
Feldspar 50%, kspar > plag. Qtz 35-40%, bt, 3-5%, musc. 2-3% .	3	4				8	0/85/20/60/45/45/88/88			SG		
	4	5				6	80/30/80/80/70/85			Absorption		
	5	6.05				2	40/80			Sodium Sulphate		
6.05-9.38m Light Pink Syenogranite. Less chl. alteration of bt. Feldspar 50%,	6.05	7	M	W	6	8	85/85/70/80/40/30/40/5			Magnesium Sulfate		
kspar~= plag. Qtz 35-40%, bt, 3-5%, musc. 2-3% .	7	8				5	85/85//70/80/90			Microdeval		
	8	9.38				7	50&30/0/80/60/40/40/75&80			Petrographic No.		
9.38-11.38 m White/grey syenogranite. Feldspar change, plag > kspar, Feldspar	9.38	10	Mf	W	6	1	30					
50%, Qtz - 40%, Bt. 3-4%, Musc. 2-3%. Chl. on fracture, yellow alt. of feldspar on	10	11				4	35/35//30/30			Alkali Reactivity		
fracture surfaces Smokey grey chl. tinge.	11	11.38								14day		
11.38-13.85m Pale Pink syenogranite. Feldspar 50%, Qtz-40-45%, Bt, 3-4%, Musc.	11.38	12	Mf	W	6	6	50/20/30/45/40/80					
3-4%. Mnr. rust staining @ 12m.	12	13				4	70/15/70/88					
	13	13.85				7	40/40/40/30/40/0/30					
13.85-14.2 m White to pnk monzogranite Qtz decreases, feldspar increases.	13.85	14.2	Mf	W	5							
Feldspar 60-65%, Qtz 25-30%, Bt, 2-3%, Musc. 3-4%.												
14.2-18.80m. Smokey gry, syenogranite. Chl.veinlets give a swirly texture to the	14.2	15	Mf	W	6	>10	50/20/40/0	pyr. Xls	<1%			
section. Minor Fe staining from 16-82 - 17.12 m. Mnr. Sericite alt. Core is brittle.	15	16				>10	30/ etc					
Feldspar 35%, Qtz 40-45%, Bt, 3-4%, Musc. 2-3%. Silicification?	16	17				>10	0/70/60/60/60/40					
Section is broken. Chl. on frac. surfaces.	17	18				8	15/40/40/40/40/0/60/50					
Core is highly fractured 14-16m.	18	18.8				5	85/60/50/0/30					
18.8 m - 19.75 m Light pnk syenogranite Same chl. alt. with mnr smky gry.	18.8	19.75	Mf	W	6	4	20/80/88/40					
Mineralogy as above but plag ~= kspar												
19.75-20.25m Smokey grey to white syenogranite. Feldspar 50% - plag > kspar.	19.75	20.25										
Min. same as above. Fe stained.												
20.25 - 23.0m pale pnk syenogranite, chl veinlets.	20.25	21	Mf			7	88/10/20/0/50/0/20	pyr. Xls	<1%			
Feldspar 45%, Qtz 50%, Bt 3-4%, Musc. 2%. Pyr. xls on fract. Surfaces <1%	21	22				8	0/40/20/60/0/40/40/45	pyr. Xls	<1%			
Core is fractured 22.0-24.0m. Chl. also on fractures.	22	23				7+	0/25/20/80/50/25/0					
23.0 - 23.87m Smky grey syenogranite, Broken, Mnr.chl alt. along veinlets and	23	23.87	Mf	W	6	6+	0/10/40/50/40/30					
on fracture surfaces. Qtz 40%, micas 5%, Feldspar 55%												
	23.87	24										
	24	25				6	0/60/20/0/50/80					
	25	26				7	60/55/0/30/40/20					
23.87 - 28.22m Gry granite/white feldspar dominated. Pyrite xls coating some	26	27				5+	40/45/30/40/20					
fractures. Silicification between 24.60-25.03 m. Qtz - 40%, 50% feldspar, bt. 3-4%,	27	28				11	30/0/30/70/60/65					
musc. 3-5%. Biotite altered.	28	28.22										
28.22-28.80 Heavily chloritized, clay alt.,orange feldspar.	28.22	28.8	Mf	W	5	8+	20/0/80/30/45/40			**BP2(2)**		
28.80-30.46 Pale pnk, syenogranite, Qtz 35%, feldspar 55%, bt.3-4%, musc. 3-4%.	28.8	29	Mf							**28.54 - 57.07m**		
Chlorite veinlets ~ 45 CA Broken between 28-29m.	29	30				5	80/70/40/40/30					

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Drill Contrator Logan Drilling Company

PROJECT NAME:	Black Point	HOLE DESCRIPTION		COLLAR LOCATION	CORE TYPE (Q)	LOGGING DETAILS	
LICENSE INFORMATION:	8372	ELEVATION: 82 m		644798E	(P / H / N / B)	LOGGED BY	Karen McNaulty
DRILL HOLE NUMBER:	BP-2	AZM.: na	°	5023183N	85.61: m	DATES:	Jan. 23
DATE COLLARED:	Dec.13/2007	DIP: -90	°		% Recovery	PAGE:	2 of 3
DATE COMPLETED:	Dec.14/2007	EOH: 85.61 m		NAD 83 Zone 20		SIGNED:	

Description	From	To	Grain Size	Foliation	Strength	Structure		Mineralization		Sample Code			
(Colour, Texture, Mineralogy%, etc.)	m	m	(F/M/C/P)	(Null/W/M/S)	(S 1-6)	Joints/m	Angle with CA	Type	Intensity				
Casing. No core										BP2(2)			
	30	30.46	M	W	6	2	60/30			28.54 - 57.07m			
	30.46	31	M	W						LA Abrasion			
	31	32				1	80			SG			
30.46- 33.55m White-gry monzogranite, Qtz 40%, Felds 55%, Musc. 5%, Bt. 5%, less	32	33				3	0/20/30			Absorption			
chlorite. Hairline fracture with f.g. py. Coating some frac. Surfaces, rust stained.	33	33.55				7	0/50/80/70&85/60/20/10						
	33.55	34	M							Sodium Sulphate			
	34	35		W	6	0				Soundness Loss			
33.55 - 36.73 m White monzogranite, Muscovite increases in this unit and decreases	35	36				0				Magnesium Sulfate			
near end from 10-5% at end of interval. Qtz 35%, feldspar 50%, bt. 3%	36	36.73				0				soundness loss			
	36.73	37	M			0				Alkali Reactivity			
	37	38		W	6	0				14day			
36.73 - 39.40m Pale pink syenogranite, Qtz - 40%, Feldspar 50%, Kspar>plag., bt.	38	39			1	88				Micro Deval			
5%, musc. 4-5%. Few mm sized bt clots. Hairline alt. biotite rehealed fractures.	39	39.4											
	39.4	40	Mf	W	1	0							
39.40 - 41.95 m Pale pink syenogranite, grain size change, bt. content fluctuates, bt 4-	40	41			0								
7%, plag~=kspar 50%, musc. 2%, qtz 40%	41	41.95			2	75/70							
	41.95	42											
	42	43			1	75							
	43	44			1	0							
41.95 - 44.84m Kspar>plag, 50%, qtz 35%, musc. 3-4%, bt 5%. Bt. Is chloritized.	44	44.84			1	40							
	44.84	45	M										
	45	46			0								
44.84 -47.44 m Pale pink syenogranite, kspar~=plag50%m qtz 40%, bt 5-7%, musc.	46	47			0								
2%.	47	47.44			2	80/0							
	47.44	48	M	W									
	48	49			2	70/0							
47.44 -49.95 m kspar>plag 55%, Qtz 40%, bt. 5-7%, musc. 2%.	49	49.95			0								
	49.95	50											
49.95 - 51.33 m~= plag 50%, qtz 40%, bt 3-5%, musc. 3%. Bt. clots range in size from	50	51			1								
mm to 1.5cm.	51	51.33			0								
	51.33	52	M	W	0								
	52	53			0								
51.33 -54.40 m kspar>plag 50%, qtz40%, bt 3-5%, musc. 3-4%. Bt. Is chloritized in	53	54			0								
places.	54	54.4			2	0-10/88							
	54.4	55											
	55	56			0								
	56	57			0					BP-2 (3)			
	57	58			2	88/25				57.07-85.61m			
	58	59			3	80/75/85							
54.40 - 61.0 m plag > kspar, pale pink to grey white. Chlorite hairline fractures	59	60			0								
110CA, f	60	61			0								
61.0 - 64.46 m Grey monzogranite, plag > kspar.	61	62			5	88/88/85/88/85							

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Drill Contractor Logan Drilling Company

PROJECT NAME:	Black Point	HOLE DESCRIPTION		COLLAR LOCATION	CORE TYPE (Q)	LOGGING DETAILS
LICENSE INFORMATION:	8372	ELEVATION: 82m	m	644798E	(P / H / N / B)	LOGGED BY: Karen McNaulty
DRILL HOLE NUMBER:	BP-2	AZM.: na	°	5023183N	85.61: m	DATES: Jan. 23
DATE COLLARED:	Dec.13/2007	DIP: -90	°		% Recovery	PAGE: 3 of 3
DATE COMPLETED:	Dec.14/2007	EOH: 85.61 m	m	NAD 83 Zone 20		SIGNED:

Description	From	To	Grain Size	Foliation	Strength	Structure		Mineralization		Sample Code	
(Colour, Texture, Mineralogy%, etc.)	m	m	(F/M/C/P)	(Null/W/M/S)	(S 1-6)	Fractures/m	Angle with CA	Type	Intensity		
61.0 -64.46 cont'd. 50% feldspar, qtz 40,%, musc. 3-4%, bt. 5%. Few biotote clots 1	62	63	Mf	W	6	1	0			LA Abrasion	
cm. @ 62.62-64.15 m f.g. pyrite on fracture surfaces rust hue. Fe/Mn on some	63	64				6	0/0/80/0/85/0			SG	
fracture surfaces.	64	64.46								Absorption	
	64.46	65	Mf	W	6						
	65	66				0				Sodium Sulphate	
64.46 -66.42 m Plag ~=kspar 50%, bt 3-5%, Qtz 40%, musc. 2%.	66	66.42				2	75/85			Soundness Loss	
	66.42	67	Mf	W	6					Magnesium Sulfate	
	67	68				0				soundness loss	
	68	69				1	75			Alkali Reactivity	
	69	70				0				14day	
	70	71				0				Micro Deval	
	71	72				1	40				
66.42 - 76.37 m kspar>plag 50-55%, qtz 35-40%, bt. 3-5%, musc 4%. Pink to orange	72	73				0					
at bottom of interval. Core fractured along bt concentration and broke at these	73	74				3	65/75/60				
intervals as a result of this @71.56, 73.11, 73.15, 73,44 m. Bt increases to 8%.	74	75				0					
Between 70.63-71.26m qtz veining, coarser kspar. 73-74m chlite and clay coated	75	76				0					
fractures, <.5% f.g. pyrite on fracture surfaces.	76	76.37									
76.37 -78.0 kspar ~=plag pale pink,50-55% feldspar, qtz 40-45%, bt. 3-4%, musc.1-	76.37	77	Mf	W	6	1	30				
2%.	77	78				0					
	78	79	Mf	W	6	2	0/0				
78.0 - 80.1 plag >kspar grey white monzogranite. Feldspar, 50%, qtz 335%, bt. 5-7%,	79	80				1	0				
musc. 1-2@. Chl rehealed fractures.	80	80.1				2	55/0				
	80.1	82		W	6	1	40				
	82	83				0					
	83	84				1	0				
	84	85				2	0/85				
kspar~= plag, 45-50%, qtz 35%, bt. 3-5%, musc. 2-4%. Bt. is chloritized. Bt clots up to	85	85.61				0					
3 cm. Pale pink	85.61	EOH									

C 1340-825

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Drill Contractor Logan Drilling Company

PROJECT NAME:	Black Point	HOLE DESCRIPTION		COLLAR LOCATION	CORE TYPE (Q)	LOGGING DETAILS	
LICENSE INFORMATION:	8372	ELEVATION: 60 m	m		(P / H / N / B)	LOGGED BY	Karen McNaulty
DRILL HOLE NUMBER:	BP-3	AZM.: na	°	645161m E	60: m	DATES:	Jan. 14-17
DATE COLLARED:	Dec. 20, 2007	DIP: -90	°	5023396m N	% Recovery	PAGE:	1 of 2
DATE COMPLETED:	Dec. 21, 2007	EOH: 60 m	m	NAD 83 Zone 20		SIGNED:	

Description (Colour, Texture, Mineralogy%, etc.)	From m	To m	Grain Size (F/M/C/P)	Foliation (Null/W/M/S)	Strength (S 1-6)	Structure Joints/m	Structure Angle with CA	Mineralization Type	Mineralization Intensity	Sample Code	RQD Not done on hole
2 ft (.6m) casing No core	0	0.6								**BP3(1)**	
	0.6	2	M	M	6	8	90/85/90/85/90/85/85/88			**0-20.0m**	
.6 - 7.23 m Medium grained equigranular syenogranite. Gry-pnk. Feldspar 50%	2	3		M	6	5	90/85/85/85/85/88			LA Abrasion	
kspar>plag, qtz. 35%, musc 3-5%, bt 5-7%. Bt. Clots 1-3cm in size. Fractures in this	3	4				6	85/85/85/85/85/85			SG	
section are Fe-Mn coated in places, ground white alternation powder on others, mnr	4	5				5	85/90/90/88/85			Absorption	
Fe staining while other fractures broke along concentrations of biotite and muscovite.	5	6				3	90/80/88			Sodium Sulphate	
Core stained on either side of joints at .6-.77m, 1.2-1.43m, 1.48-2.16m, 3.15-3.835m,	6	7				5	85/88/85/88/90			Magnesium Sulfate	
4-4.13m, 4.21-4.67m, 5.0-5.1m, 5.18-5.49m, 6.4-6.61m.	7	7.23								Microdeval	
	7.23	8	Mf	M	6	4	88/88/88/88			Alkali Reactivity	
	8	9				2	88/88			14- day	
	9	10				2	60/90				
	10	11				3	88/40/50&55				
7.23 - 18 42 m Textural change finer grained. Kspar>plag. Feldspar 50%, qtz. 40%,	11	12		W	6	1	88				
bt. 3-5%, musc. 2-3%. Increase in the number of bt clots, Avg. 1cm in size. Core	12	13				6	10/70/85/90/85/90				
stained on either side of fractures @ 7.40-7.53m, 8.18-8.50m, 10.39-10.43m, 10.52-	13	14			6	2	80/80				
10.68m, 12.33-12.40m, 12.93-13.05m, 16.96-17.91m. Appears to be alteration of	14	15				2	88/88				
biotite discolouring core for the most part. Pervasive rust staining between series of 3	15	16				4	90/0/10/90				
folded joints@15.49-16.80m. Qtz and bt/chl? filled hairline fractures between 15.71-	16	17				7	90/0/85/80/85/90/0				
17.48m. Between 13-14 fractures due to breakage along biotite conc. Between 16	17	18				0					
and 17 m white clay alteration on joint surfaces also.	18	18.42									
18.42 -23.83m Back into lighter gry pnk syenogranite, equigranular. kspar >plag,	18.42	19	M		6	0					
feldspar50%, qtz 35-40%, bt. 5%, musc. 3%. Between 22.07 and 22.11 Silicification.	19	20				1	80				
Between 20.39-22.49m hairline fract. Bt/chl? & qtz filled hairline fractures rehealed.	20	21			6	2	90/15			**BP2(2)**	
Some hairline fractures have no surface alteration while others are Fe stained and	21	22				1	10			**20.00 - 40.00m**	
ready to break. Rust staining 18-93-18.24m, 20.75-21.45m, 21.88-22.77m. @22-	22	23				2	40/45			LA Abrasion	
23m Fe-Mn coating fract. surf.	23	23.83	M	W	6	3	30/88/88			SG	
	23.83	24								Absorption	
23.83 - 25.56m kspar>>plag. Pnk equigran. Syenogranite Mnr. Kspar xls 2-4mm in	24	25				0				Sodium Sulphate	
size. Mnr bt clots, Feldspar 50%, qtz. 35%, musc. 2-3%, bt. 7%. Bt increases.	25	25.6				1	70			Magnesium Sulfate	
	25.6	26			6					Microdeval	
	26	27				0				Alkali Reactivity	
	27	28				2	50/35			14-day	
	28	29				0					
	29	30				0					
	30	31				2	60/60				
	31	32				2	85/70				
25.56- 48.04m whiter to light pink granite kspar~=plag. Feldspar 50%, quz. 40%, bt, 5-	32	33				3	80/88/88				
7%, musc. 2-3%. Mnr. Biotite clots	33	34				0					

Company/Licensee **6531954 Canada Ltd**
Drill Contractor **Logan Drilling Company**

PROJECT NAME:	Black Point	HOLE DESCRIPTION	COLLAR LOCATION	CORE TYPE (Q)	LOGGING DETAILS
LICENSE INFORMATION:		ELEVATION: 74m	645161m E	(P / H / N / B)	LOGGED BY: Karen McNaulty
DRILL HOLE NUMBER:	BP-3	AZM.: na °	5023396m N	60: m	DATES: Jan. 14 - 17
DATE COLLARED:	Dec. 20, 2007	DIP: -90 °		% Recovery	PAGE: 2 of 2
DATE COMPLETED:	Dec. 21, 2007	EOH: 60 m	NAD 83 Zone 20		SIGNED:

Description (Colour, Texture, Mineralogy%, etc.)	From m	To m	Grain Size (F/M/C/P)	Foliation (Null/W/M/S)	Strength (S 1-6)	Structure Joints/m	Structure Angle with CA	Mineralization Type	Mineralization Intensity	Sample Code
										BP2(2)
25.56 - 48.04 continued.	34	35	M		6	1	80			**20.00 - 40.00m**
	35	36				0				continued
	36	37				2	80/50			
	37	38				0				
	38	39				2	70/90			
	39	40				0				
	40	41				0				**BP3 (3)**
	41	42				2	90/40			**40.00-60.00m**
	42	43				0				LA Abrasion
	43	44				1	70			SG
	44	45				0				Absorption
	45	46				0				Alkali Reactivity
	46	47				2	90/70			14day
	47	48				0				Micro Deval
	48	48.04								
	48.04	49	M			0				Sodium Sulphate
	49	50				0				Soundness Loss
	50	51				1	88			Magnesium Sulfate
	51	52				2	88/90			soundness loss
48.04 -53.37m. Orange equigranular syenogranite. Kspar>plag, 50% feldspar, qtz.	52	53				1	70			
40%, bt. 5-7%, musc. 2-3%.	53	53.27								
53.37 - 54.50m, kspar~=plag, feldspar 50%, qtz. 40%, bt.5%, musc. 2-3%. Micas are	53.27	54	Mf			0				
weathering and stained core between 54-55.25m.	54	54.5				4	60/50/20/50			
	54.5	55	Mf							
	55	56				4	50/55/60/55			
	56	57				6	30/40/20/80/60/88			
54.50 - 58.28m plag > kspar, Feldspar 50%, qtz. 35-40%, bt.3-5%, musc. 2-3% White	57	58				4	20/0/80/10			
to yellow equigranular monzogranite.	58	58.28								
58.28m - 60.0 m kspar>plag, pink to light orange. feldspar 50%, qtz. 35-40%, bt.3-5%,	58.28	59	Mf			5	30-40/50/0-10/70/0-10			
musc. 2%. Between 55.52 -57.86 chlorite coated joints & veinlets. Qtz xls druse on	59	60				2	60/70			
surfaces, <1% pyr. Observed on some joint surfaces.	60	EOH								

Company/Licensee 6531954 Canada Ltd
Drill Contractor Logan Drilling Company

PROJECT NAME:	Black Point	HOLE DESCRIPTION		COLLAR LOCATION	CORE TYPE (Q)	LOGGING DETAILS	
LICENSE INFORMATION:	8372	ELEVATION: 100 m	m		(P / H / N / B)	LOGGED BY	Karen McNaulty
DRILL HOLE NUMBER:	BP-4	AZM.: na	°	644527m E	119.8: m	DATES:	Feb. 8-22
DATE COLLARED:	Dec. 6, 2007	DIP: -90	°	5022955m N	% Recovery	PAGE:	1of 4
DATE COMPLETED:	Dec. 7, 2007	EOH: 119.80	m	NAD 83 Zone 20		SIGNED:	

Description (Colour, Texture, Mineralogy%, etc.)	From m	To m	Grain Size (F/M/C/P)	Foliation (Null/W/M/S)	Strength (S 1-6)	Structure Joints/m	Structure Angle with CA	Mineralization Type	Mineralization Intensity	Sample Code		RQD
2 ft (.6m) casing No core	0	0.6								BP4(1)		
	0.6	2	M-Mf	M	6	5	90/85/75/88/?			0-39.93m	27	
	2	3				2	88/75			LA Abrasion	8	
	3	4				6	0/80/0/88/80/50			SG	26	
.6 -8.08 m Inequigranular pale pnk with rusty sections. Occ. bt clot up to 2 mm to 2cm. Scattered subhedral red orange kspar xls throughout section <5%. Kspar ~=plag, feldspar 50%, qtz 30-40%, bt. 7-10%, musc. 2-3%. Bt. chloritized in part giving a rusty appearance. F.g. pyrite along some fractures ~0 CA. Rusty either side of jnts. minor Mf sections as quartz % increase grain size decreases. Secondary quartz. Chloritized biotite.	4	5				8	70/0/0/85/88/85/10/85			Absorption	34	
	5	6				6	88/85/0/0&5/85/88			Sodium Sulphate		
	6	7				3	70/80/90			Magnesium Sulfate	9.5	
	7	8				2	10/20/1988			Microdeval		
	8	8.08								Petrographic No.		
8.08-8.74 m Or. Grad. change from unit above. Qtz incr. towards end of unit. Kspar>plag. Feldspar 45-55%, qtz 35-45%, musc. 2-3%, bt. 5-7%. Mnr clay alt.	8.08	8.74	M	W		4	90/80/80/85				10.5	
	8.74	9	M	W	6							
8.74 -10.1 m Salmon pnk, feldspar 50%, kspar>plag qtz 35-40%, bt 5-7%, musc. 3-4%. Rusty - bt chloritized, bt. Clots few mm in size. Pyr on fract. surf. f.g.	9	10				1	20			Alkali Reactivity 14day		
	10	10.1										
10.1 - 10.52 m. White plag>kspar, 50% feldspar, qtz 40%, bt 5-7%, musc. 2%. Angular contact with next unit.	10.1	10.52	M	W	6	3	10/30/1988					
	10.52	11	M	W	6						8.5	
	11	12				3	85/70/80					
	12	13				2	88/90				2	
	13	14				8	88 numerous all broken					
	14	15				0						
10.52 -16.09 m Pale pnk, 50% feldspar, plag >kspar, qtz 35-40%, bt 5-10%, musc. 2-4%. Bt. clots few mm in size. Chloritized biotite. Equigranular	15	16				3	88/85/20					
	16	16.09										
16.09 - 17.77m Rusty pale or. f.g. bt., Feldspar 50% plag >kspar, qtz. 35%, rare up to 40%, f.g. bt. 5%, musc. 3-5%. Rust caused by bt. weathering. Trace chl. veins.	16.09	17	M	W	6	5	60/35/40&65/55/55				3	
	17	17.77				10	10/10/0/15/85/15/20/25/70/80					
17.77 - 18.29 m Heavily chloritized, salmon pink but % of minerals variable. Feldspar 65%, kspar>plag, qtz 20-25%, bt. 5-7%, musc. 2-4%. Qtz varies from low of 20% at top . Num. rehealed hairline fractures.	17.77	18	M	W	6							
	18	18.29										
18.29 - 18.45m Rusty orange plag ~=kspar, 55%, qtz 35%, bt. 5%, musc. 2-4%. Numerous tiny hairline fractures parallel CA.	18.29	18.45	M	W	6							
18.45 -18.96 m Pale white to cream, highly chloritized. Feldspar 65-70%, qtz 25-35%, bt 7-10%, musc. 2%, plag>kspar. Pitted surf. chloritized bt.	18.45	18.96	M	W	6	7	50/80/35/80/70/30/40				17	
18.96 - 19.64 m Rusty or. Arbitrary cutoff. Feldspar 50%, qtz. 35%, bt.10, musc 2%. Heavily chloriitzed. Fractures along chlorite planes. Kspar >plag.	18.96	19	Mf	W	6							
	19	19.64				6	80/80/15/40/55/40					
19.64 - 22.0 m. Pale pnk, num. chl. veinlets in sect. Feldspar 50%, plag~=kspar, 5-10% bt., qtz. 40%, musc. 4-10%. Core broken along hairline frac. Chl on frac. Mnr section plag >kspar whiter grey arbitrary cut off.	19.64	20	M	W	6							
	20	21				11	10/50/75/50/30/75/55/80/40/45/30				26	
	21	22				10+	40/15/50/50/30&40/85/10/15/0				26.5	broken
22.0 - 22.91 Sal. Pnk broken, chl on jnt faces, feldspar 50%, qtz 35-40%, bt 5%, musc. 2-4%. Dirty white clay alt. Mnr rust on fracture surf. @28.88 end of pervasive chl alt. Section friable.	22	22.91	Mf	W	4	10+	0/25 broken				34	broken
22.91 - 23.80 m Gry and pale pnk angular contact with next unit. Feldspar 50%, plag>kspar qtz 40-50%, bt 7%, musc. 5-7%. Chlorite veins.	22.91	23	M	W	6							
	23	23.8				3	25/65/5					
23.80 - 24.48 m Pale pnk. Feldspar 40%, qtz 40%, bt 10%, musc 4-5%. Bt. is fine grained, rare bt clots.	23.8	24	Mf	W	6							
	24	24.48										
24.48 - 25.10 m pale pnk. feldspar, 45%, kspar >plag by a bit, qtz. 40$, bt 5-10%, musc. 3-4%. Rust on fractures due to alteration of bt.	24.48	25	M-Mf	W	6	5	80/85/25-30/40/10					
	25	25.1				0						
25.10-25.39 m Gry/white, feldspar 45%, qtz 40%, musc. 5%, bt. 10%	25.1	25.39	M	W	6	0					232	

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Drill Contractor Logan Drilling Company

PROJECT NAME:	Black Point	HOLE DESCRIPTION		COLLAR LOCATION	CORE TYPE (Q)	LOGGING DETAILS	
LICENSE INFORMATION:	8372	ELEVATION: 100 m		644527m E	(P / H / N / B)	LOGGED BY	Karen McNaulty
DRILL HOLE NUMBER:	BP-4	AZM.: na	°	5022955m N	: m	DATES:	Feb. 8-22
DATE COLLARED:	Dec. 6, 2007	DIP: -90	°		% Recovery	PAGE:	2of 4
DATE COMPLETED:	Dec. 7, 2007	EOH: 119.80		NAD 83 Zone 20		SIGNED:	

Description (Colour, Texture, Mineralogy%, etc.)	From m	To m	Grain Size (F/M/C/P)	Foliation (Null/W/M/S)	Strength (S 1-6)	Structure Joints/m	Structure Angle with CA	Mineralization Type	Mineralization Intensity	Sample Code	RQD cm	% RQD calculation
25.39 - 27.00 m Pale pnk. Feldspar 35%, qtz. 40-45%, bt. 7-10%, musc. 5%.	25.39	26	M	W	6	0						
Inequigranular, rare kspar xls 1-2mm. Brown earthy coating on frac. surf. Alt of bts.	26	27				4	85/85/90/90				6.5	
Chlorite veinlets mnr.												
	27	28	M-Mf	W	6	0				LA Abrasion		
27.0 -29.09 Salmon pnk. Kspar>plag. Felspar 55%, qt 40%, musc. 5%, bt. 10%.	28	29				2	25&50/80			SG	6	
Veinlets of chl. & qtz.	29	29.09										
	29.09	30	M-Mf	W	6	3	88/85/85			Absorption	2	
	30	31				0						
29.09 -32.31 Pale pnk. Feldspar 45%, plag ~=kspar, qtz 40%, bt. 10%, musc.5%, Fe	31	32		W	6	5	88/88/15/20/15			Sodium Sulphate	6.5	
stained 29.80-30.15m. Numerous fractures 20CA and chlorite coated.	32	32.31								Soundness Loss		
32.31 - 32.90 m Or. Fe stained, Feldspar 50%, kspar>plag., qtz 35%, musc. 2-3%, bt	32.31	32.9	Mf	W		4	70/40/80/40			Magnesium		
7-10%. Ang. contact with next unit. Chl &Fe Mn on fracture surfaces.										Sulfate soundness		
	32.9	33	M	W						loss		
32.90- 33.07 m Sal. pnk kspar>plag. 75% feldspar, qtz 20%, bt. 2-3%, musc. 1%.	33	33.07										
33.07 -34.78 m light orange/sal. pnk. Kspar>plag. Feldspar 50%, qtz, 35%, bt., 7-	33.07	34	M-Mf	W						Alkali Reactivity		
10%, musc. 3-4%. Mica clots 1-3cm, chl blebs & in fract, chl on fractures. Top of unit	34	34.78				4	20/10/20/40			14day		
more frac. Occ. kspar euhedral xls sev. mm in size. Qtz & fkspar veins. Fe-stained						4	10/30/60/70			Micro Deval		
from 34.53-34.79m. F.g. py. on fracture surfaces near 34 m.												
	34.78	35	M	W	6							
	35	36				0						
	36	37				1	70					
	37	38				1	30					
	38	39			4	4	85/80/70/25				3	24
	39	40				0				BP4(2)		
34.78 - 41.08 m Pale or. Kspar>plag. Feldspar 55%, qtz, 35%, bt. 5-10%, musc. 4%.	40	41				2	88/55			39.93 - 79.87m		
Bt. Clots several mm to several cm. Clay alteration on joints in this section	41	41.08				0				LA Abrasion		
41.08 - 43.38 m Cream grad change to salmon pnk. Feldspar 50%, qtz. 35%, bt. 10-	41.08	42	M	W	6	0				SG		
12%, musc. 5%. Changes from plag ~=kspar to plag dominated to kspar dominated	42	43				3	18/88/88			Absorption		
at end of interval. Drk grn to blk chl. on frac. Bt clots several mm to cm.	43	43.38										
43.38 - 44.1 Sal.pnk Kspar>plag, feldspar 50%, qtz 35%, bt.7-10%, musc. 5-7%. Chl.	43.38	44	M	W	6	4	20/70/0/0				3.5	
veinlets.	44	44.1										
44.1 - 45.47 m light sal. pnk kspar>plag. Feldspar 45%, qtz. 35%, bt. 7-10%, musc 3-	44.1	45	M	W	6	3	35/75/0			Sodium Sulphate	3.5	
5%. Several folded black chlorite veins.	45	45.47								Soundness Loss		
	45.47	46	M	W	6	5	88/82/20/10/80			Magnesium		
	46	47				0				Sulfate soundness		
	47	48				3	60/88/80			Alkali Reactivity		
45.57 - 49.98 m Cream to l. or. Feldspar 45%, Qtz. 40%, bt. 7-10%, musc. 5%.	48	49				1	40&60			14day		
Several linear flattened bt clots 2-8cm.	49	49.98				4	80/50&5/85/70					
49.98 - 51.52 m pale cream/sal. pnk. Feldspar 50%, qtz, 30-35%, bt. 10%, musc. 2-	49.98	50	M	W	6					Micro Deval		
5%. Subjective cut-ff gradational to lower unit, Bt. Is coarse and fine. Round bt. Clot	50	51				0				Petrographic No.		
at 51.32m.	51	51.52				0						
51.52 - 53.30 m White to pale sal. pnk. monzogranite. Plag>kspar. Feldspar 40-50%,	51.52	52	M-Mf	W	6	0						
qtz 30-40%, bt. 5-!0%, musc. 2-3%. Bt is fine. Grad. change to cream white, finer	52	53				1	20&5					
grained. Bt. clots <1cm. Equigran.	53	53.3										
	53.3	54	M	W	6	1	20&20					
53.30 -56.87 m Pale sal. pnk again grad. Change from last to next unit. Feldspar 45-	54	55				1	85					
50%, qtz 35-45%, musc. 5%, bt. 10%. Bt clot @ 54.37 m 2 cm in size. Mnr	55	56				0						
chloritized bt/musc. F.g. py on fracture @53 m <3%. Smaller bt. Clots <1 cm.	56	56.87				1	75					
56.87 - 58.94 m Drk gry to off white monzogranite. Plag>kspar. Qtz % decreases	56.87	57	M	W	6							
from top to bottom of interval. Feldspar 35-50%. qtz.50-35%, bt. 5-10%, cont'd	57	58				0						7

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PROJECT NAME:	Black Point	HOLE DESCRIPTION		COLLAR LOCATION	CORE TYPE (Q)	LOGGING DETAILS	
LICENSE INFORMATION:	8372	ELEVATION: 100 m	m	644527m E	(P / H / N / B)	LOGGED BY	Karen McNaulty
DRILL HOLE NUMBER:	BP-4	AZM.: na	°	5022955m N	119.8: m	DATES:	Feb. 8-22
DATE COLLARED:	Dec. 6, 2007	DIP: -90	°		% Recovery	PAGE:	3 of 4
DATE COMPLETED:	Dec. 7, 2007	EOH: 119.80	m	NAD 83 Zone 20		SIGNED:	

Description	From	To	Grain Size	Foliation	Strength	Structure		Mineralization		Sample Code	RQD	
(Colour, Texture, Mineralogy%, etc.)	m	m	(F/M/C/P)	(Null/W/M/S)	(S 1-6)	Fractures/m	Angle with CA	Type	Intensity		cm	
musc. 2-5%, Qtz eyes. Hairline chl. veinlets. Micas chloritzed. F.g. bt.	58	58.94				2	80/9O&45 curved.			BP4 (2)		
	58.94	59	M	W	6					39.93-79.87m		
	59	60				2	90/45&60/85			LA Abrasion		
	60	61				0						
	61	62				0				Sodium Sulphate		
	62	63				0				Soundness Loss		
	63	64				1	88			Absorption		
58.94 - 65.57 m Beige/cream monzogranite. Feldspar, 55-35%, qtz 30-40%, bt 7-	64	65				1	75					
12%, musc. 2-3%, Bt. clots are smaller and fewer than previous unit. F.g. bt.	65	65.57				1	85			Magnesium		
	65.57	66	Mf	S	5					Sulfate soundness		
	66	66.09				0				Alkali Reactivity		
66.09 -67.68 m Beige to cream monzogranite. Plag>kspar. Feldspar 50-55%, qtz. 30-	66.09	67.68	M	W	6	0				14day		
35%, bt. 7-10%, musc 2-3%. Good long sections of core, fracture along biotite												
	67.68	67.98	M	M-S	5	1	60			Micro Deval		
	67.98	68	M-Mf	M	6					Petrographic No.		
	68	69				0						
	69	70				1	45					
	70	71				0						
	71	72				0						
	72	73				1	50					
67.98 - 75.18 m Cream monzogranite. Feldspar 60-45%, qtz. 35-40%, bt. 5-12%,	73	74				1	50					
musc. 2-4%. Bt. Clots linear, clot circles, mm to 5 cm in range. However good long	74	75				0						
core pieces. Odd break along bt. Concentrations.	75	75.18										
75.18 - 77.0 Gry white monzo. Feldspar 60-40%, qtz 30-40%,, bt. 5-15%, musc. 5%.	75.18	76	M	W	6	1	30&45					
Coarse mica. Chlorite blebs ~ par. CA. @75.69 fract. along mica concentration.	76	77				0						
Otherwise good solid section.						0						
	77	78	M-Mf	W	6	0						
77.0 - 79.655 Cream monzo. Feldspar 40-45%, qtz. 35-40%, bt. 15%, musc. 2-3%.	78	79				0						
Increase in fineness and decrease in coarse mica. Chlorite blebs.	79	79.655				0						7
	79.655	80	M-Mf	M	6	0				BP 4 (3)		
	80	81				0				79.87 - 119.8 m		
	81	82				0				LA Abrasion		
	82	83				0				SG		
	83	84				0				Absorption		
	84	85				0						
	85	86				0						
79.655 - 88.1 Light cream to white monzo. Feldspar 55-30%, qtz. 35-40%, bt, 5-25%,	86	87				0						
musc. 2-3%. Good long core sections. Local bt. concentrations 81.67-81.25m,	87	88				0						
87.055-87.13 m. Bt. Clots wrapped around core axis at 85.54 - 85.94m.	88	88.1				0						
	88.1	89	M	W	6	3	35/70/45					
	89	90				1	88					
88.1 - 92.925 m light cream to white monzo. Feldspar 60-35%, qtz 25-40%, bt, 5-	90	91				0						
10%, musc. 2-3%. Chl. Blebs. Mnr Fe staining. Pervasive staining either side of jnt	91	92				0						
@ 89.535 m. 2 joints in this section broke along bt. Concentration	92	92.925				1	85			Sodium Sulphate		
	92.925	93	M	W	6					Soundness Loss		
92.925 - 94.085 m. White to gry monz. Feldspar 50-55%, qtz. 30-35%, bt. 10%,	93	94				1	60			Magnesium		
musc. 2-4%. One fracture in this section along bt. concentration.	94	94.085								Sulfate soundness		
	94.085	95	M-Mf	W	6	0				Alkali Reactivity		
	95	96				1	20			14day		
	96	97				1	80					
	97	98				0				Micro Deval		
94.085 - 100.92 m Light cream to cream monzogranite, In and out of medium to	98	99				0						
medium fine grained. Feldpar 60-40 plag., qtz. 25-35%, bt. 5-15%, musc. 3-5%.	99	100				0						
Core Fe stained from fracture at 95.40-96.67 m.	100	100.92				0				Chloride		
100.92 - 101.855 m Light cream, qtz. inc., 40-50%, grain size dec. plag 30%, bt. 10-	100.92	101	Mf	W	6	0						
15%, musc. 5-10%. Mnr mm sized bt clots.	101	101.855				0						

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PROJECT NAME:	Black Point	HOLE DESCRIPTION		COLLAR LOCATION		CORE TYPE (Q)	LOGGING DETAILS
LICENSE INFORMATION	8372	ELEVATION: 100 m	m	644527m E	N	(P / H / N / B)	LOGGED BY: Karen McNa
DRILL HOLE NUMBER:	BP-4	AZM.: na	°	5022955m N	E	119.8: m	DATES: Feb. 8-22
DATE COLLARED:	Dec. 6, 2007	DIP: -90	°		m	% Recovery	PAGE: 4 of 4
DATE COMPLETED:	Dec. 7, 2007	EOH: 119.80	m	NAD 83 Zone 20			SIGNED:

Description	From	To	Grain Size	Foliation	Strength	Structure		Mineralization			Sample Code	RQD	QRD
(Colour, Texture, Mineralogy%, etc.)	m	m	(F/M/C/P)	Null/W/M/S	(S 1-6)	Fractures/m	Angle with CA	Mineral	Type	Intensity			cm
	101.855	102	M	W	6	0					LA Abrasion		
	102	103				0					SG		
101.855 - 104.86 m Cream monz. Grain size increase. Chl. blebs parallel CA. Plag 45-50%,	103	104				0					Absorption		
qtz. 30-35%, bt. 10-15%, musc 5-10%. Bt. Clots several cm elong perpendicular to 45 CA.	104	104.86				0							
104.86 - 105.845 m Pale cream monz. Qtz. 35-40, feldspar 50-40%, bt. 7-10%, musc. 3-5%.	104.86	105	M-Mf	W	6	0					Sodium Sulphate Soundness		
Fe staining either side of joint @105.23m	105	105.845				1	75				Loss		
105.845 - 106.1 m Small interval. Beige, plag coarser, chl blebs parallel CA. Plag 50%, qtz.	105.845	106	M	W	6								
35-40%, bt. 5-7%, musc. 5-7%.	106	106.1				0							
	106.1	107	M	W	6	0					Magnesium Sulfate soundness		
106.1 - 108.33 m Same beige as above, feldspar xls, Darker grey matrix, inequigranular.	107	108				0					loss		
Plag 45%, musc. 2-4%, qtz, 40%, bt. 7-10%. Chl blebls and f.g. bt & chlorite.	108	108.33				0							
108.33 - 110.79 m Dirty cream to dark gry. Feldspar 40-45%, qtz 35-40%, musc. 2-10%	108.33	109	M-Mf	W	6	2	35/30				Alkali Reactivity 14day		
(mnr), bt. 10%. Core break along joints of bt. concentration. @108.37-108.45m bt. Clot	109	110				1	85				Micro Deval		
@109.47. Rust stained on either side of joint.	110	110.79				1	30&85						
	110.79	111	M	W	6								
	111	112				1	85						
	112	113				1	88						
	113	114				2	65/85						
	114	115				0							
110.79 - 116.28 m Dirty cream, plag. 50-45%, qtz. 30-35%, bt 7-12%, musc. 5-7%. Coarse &	115	116				0							
fine bt. Fe stained core from 111.34-111.60m	116	116.28				0							
	116.28	117	M	W	6	0							
116.28 - 118.74 m Cream Plag 60-45%, qtz. 25-35%, bt 5-10%, musc 3-5%. Fe stained core	117	118				1	60&80 zig zag						
118.56-118.74m. Chl blebs. Series of folded mica/chl blebs, core broke along these planes.	118	118.74				1	88						
	118.74	119	Mf	W	6	0							
118.74 - 119.81 m Dirty beige. Plag. 45%, qtz 40%, bt 10-12%, musc. 2-3%, Bt. clots	119	119.81				0					chloride		
perpendicular CA.	119.81	EOH										RQD 100%	
This hole is unique on the lower half. Its mineralogy range is broader than other holes.													
Mica concentrations are higher. Plag dominated.													

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PROJECT NAME:	Black Point	HOLE DESCRIPTION	COLLAR LOCATION	CORE TYPE (Q)	LOGGING DETAILS
LICENSE INFORMATION:	8372	ELEVATION: 82 m	m	(P / H / N / B)	LOGGED BY: Karen McNaulty
DRILL HOLE NUMBER:	BP-5	AZM.: na	° 644213m E	89.40: m	DATES: Jan 29 -Feb. 7
DATE COLLARED:	Dec. 4, 2007	DIP: -90	° 5022742m N	% Recovery	PAGE: 1of 3
DATE COMPLETED:	Dec. 6, 2007	EOH: 89.405	m NAD 83 Zone 20		SIGNED:

Description (Colour, Texture, Mineralogy%, etc.)	From m	To m	Grain Size (F/M/C/P)	Foliation (Null/W/M/S)	Strength (S 1-6)	Structure Joints/m	Structure Angle with CA	Mineralization Type	Mineralization Intensity	Sample Code	RQD
2 ft (.6m) casing No core	0	0.6								**BP5(1)**	QRD not done on this interval
	0.6	2	M	M	6	4+	90/0			**0-29.80m**	
	2	3				2	0/0-10			LA Abrasion	
1.65 m recovered, assume a .35m loss. Pale pnk to white equigranular syenogranite	3	4				2	85/60			SG	
with Fe staining on either side of fractures plag~= kspar, feldspar 45-50%, qtz 40-45.	4	5				4	0-10/80/88/80			Absorption	
Occasional bt clot up to 1 cm in size.%, bt. 5-7%, musc. 2-4%,	5	5.51								Sodium Sulphate	
5.51 - 7.62 m kspar>plag, Feldspar 50%, qtz., 35-40%, bt. 3-5%, musc. 2-4%. pnk	5.51	6	M	M	6	9	80/50/80/0/88/75/88/30/88			Magnesium Sulfate	
inequigranular. Bt. Clots 2mm-1.5cm, occasional perthitic textured large kspar xls	6	7				2	80/88			Microdeval	
2cm, Fe staining in the section < than above. Chlorite filled rehealed hairline fractures	7	7.62				2	90/90			Petrographic No.	
0 deg. to CA.											
	7.62	8	Mf	M	6						
	8	9				1	75			Alkali Reactivity	
	9	10				0				14day	
7.62 - 12.62 m pale pnk. Increase in biotite and quartz. Feldspar 50%, plag ~=kspar,	10	11				0					
qtz 40%, bt.5-7%, musc. 5%. Biotite clots 4mm - 1cm.	12	12.62				3	0/0/75				
12.62 -13.37m kspar>plag pink equigranular syenogranite, 50% feldspar, 35-40% qtz,	12.62	13	M	W	6	0					
bt. 5-7%, musc. 3-4%.	13	13.37				0					
13.37 - 14.35m pnk equigranular as above, bt decreases. Feldspar 50%, qtz. 35%, bt	13.37	14	M	W	6	0					
3-5%, musc. 3-4%. Fe staining on either side of jnts. Kspar >plag	14	14.35									
14.35 - 16.36 m kspar~=plag, pale pnk syenogranite, 45-55% feldspar, qtz 40%, bt,	14.35	15	M	W	6	3	35/90/65				
5%, musc. 3%. Xenolith @16.12-12.25m 13cm in size. Chl filled rehealed hairline	15	16				3	60/88/35				
fract. ~45 CA. Fractures in this section are rust stained.	16	16.36									
	16.36	17	M	W	6	1	85				
	17	18				2	75/15				
	18	19				2	85/90				
16.36 -20.82 m kspar slightly>plag, orange to salmon pink, Feldspar 50%, qtz35%, bt	19	20				3	85/90/15				
3-5%, musc. 3%.	20	20.82				1	5				
20.82 - 22.19m plag > kspar plag>spar, grey-white, Feldspar 50%, qtz. 45%, bt 5-	20.82	21	M	W	6						
10%, musc. 3-4%, Gradual increase in kspar at base of interval. Section is	21	22				4	40/40/40/85				
pervasively Fe stained.	22	22.19									
	22.19	23	M	W	6	2	88/80				
22.19 - 25.0m Salmon pink to orange, equigranular syenogranite, kspar 40%, plag	23	24				2	55/88				
10%, qtz. 40%, bt 5-7%, musc 3-4%.	24	25				1	0-10				
25.0 -26.79 m kspar ~= plag, feldspar 35-55%, qtz. 35-55%, bt 3-5%, musc. 2-3%.	25	26	M-Mf	W	6	1	0				
Mnr bt clots avg. 3mm. Pnk. Greater range of percentages of feldspar and quartz.	26	26.79				2	20/0				
26.79 -27.24 m kspar>plag, feldpsar 50%, bt., 5%, musc. 3-5%, Between 27.06-	26.79	27	Mf	W	6						
27.74 it appears that kspar secondary has formed along hairline fractures. Pnk.	27	27.74				0					
	27.74	28	Mf	W	6	0					
26.79 -31.44 m plag>kspar, feldspar 50%, qtz. 45%, bt 5%, musc. 2-3%, white grey to	28	29				0					
weak pnk. Silica filled fractures, chloritized 30.70-31.10m. Fe staining from 30.30-	29	30				0				**BP5(2)**	
31.1m	30	31				3	15/30/30			**29.80 - 59.6m**	

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PROJECT NAME:	Black Point	8372		COLLAR LOCATION	CORE TYPE (Q)	LOGGING DETAILS	
LICENSE INFORMATION:		ELEVATION: 82 m		644213m E	(P / H / N / B)	LOGGED BY	Karen McNaulty
DRILL HOLE NUMBER:	BP-5	AZM.: na	°	5022742m N	: m	DATES:	Jan 29 -Feb. 7
DATE COLLARED:	Dec. 4, 2007	DIP: -90	°		% Recovery	PAGE:	2 of 3
DATE COMPLETED:	Dec. 6, 2007	EOH: 89.405		NAD 83 Zone 20		SIGNED:	

Description	From	To	Grain Size	Foliation	Strength	Structure		Mineralization		Sample Code		QRD cm	% QRD
(Colour, Texture, Mineralogy%, etc.)	m	m	(F/M/C/P)	(Null/W/M/S)	(S 1-6)	Joints/m	Angle with CA	Type	Intensity				
										BP5(2)			
26.79 -31.44 m cont'd.	31	31.44		W	6	0				29.80 - 59.6m			
31.44 -32.94m Light pnk equigranular syenogranite. Kspar >plag., 50% feldspar, qtz. 40%, bt 3-	31.44	32	M	W	6	0				LA Abrasion			
5%, musc. 3-4%. Chlorite filled hairline veinlets cutting section.	32	32.94				1	85			SG			
	32.94	33	M-Mf		6								
	33	34				0				Absorption			
	34	35				1	10						
	35	36	M			0				Sodium Sulphate			
	36	37				0				Soundness Loss			
	37	38				0				Magnesium Sulfate			
	38	39				1	88			soundness loss			
	39	40				0				Alkali Reactivity			
	40	41				3	85/85/30			14day		18	QRD started
	41	42				0				Micro Deval			Assume 0 if
32.94- 44.41m Pale pink to orange syenogranite. Feldspar 50%, kspar>plag., qtz 35%, bt 7-	42	43				0							no number present.
10%, musc. 3-4%. Silicification in this section in addition to thin qtz veining at the top of the	43	44			6	0							
interval. Bt. Content changes. Sub parallel chl. Veining. Bt. clots more common.	44	44.41											
44.41- 46.90 m plag>kspar, 50% feldspar, qtz. 35%, bt. 5-7%, musc. 2-5%. Grey white. Bt.	44.41	45		W		2	80/80					17.5	
Clots 1mm - 2cm.	45	46				2	30/70						
	46	46.9				2	20/30						
46.90 - 47.35 m kspar~=plag. Pale pink, 50% feldspar, , bt 5-7%, musc. 2-4%, qtz. 40%. Kspar	46.9	47	M-Mf		6								
gradually increases downward.	47	47.35											
	47.35	48	M			2	30/80						
	48	49				0							
	49	50		N		0							
	50	51				2	80/88					9	
	51	52				0							
	52	53				0				Sodium Sulphate			
	53	54				0				Soundness Loss			
47.35 - 55.75m. Orange to pink, good solid secretions, kspar> plag, feldspar 55%, qtz., 35%,	54	55				0				Magnesium Sulfate			
bt 5-7%, musc. 2-3%. Fine bt., bt clots 2mm-4cm in range.	55	55.75		W		0				soundness loss			
55.75 - 56.15 m plag ~=kspar, pale orange to cream, feldspar 50%, qtz., 35-40%, bt 5%, musc.	55.75	56	M		6	0				Alkali Reactivity			
2-4%. Gradual change to next unit.	56	56.15								14day			
	56.15	57	M			3	20/20/30						
56.15 - 57.49 m plag > kspar, gry to cream, feldspar 50%, qtz 35%, bt. 5-7%, musc. Chled bt.,	57	57.49			6					Micro Deval			
Py iron staining either side of jnts., hairline qtz veinlets 45 CA. Gradual change to next unit.													
	57.49	58	Mf	W		4	30/30/25/0					7	
57.49 -59.40m plag~=kspar, 40% feldspar, qtz. 40%, bt. 7%, musc. 3-4%. Pale cream,	58	59				7	0/40/30/30/0/30/30					41	
numerous 2ndary qtz. Veinlets~ 45CA	59	59.4											
59.40 - 60.37 m Salmon pnk syenogranite, feldspar 50%, qtz. 40%, musc. 3-5%, bt. 4-7%. 5cm	59.4	60	M	W		2	10/20					92.5	29.8
mica clot @ end of interval. Few chl veins parallel CA.	60	60.37			6					BP5 (3)			
	60.37	61	M-Mf	W		1	20			59.60-89.405m			
	61	62				4	20/20/0/50			LA Abrasion			
60.37 -63.30 m pale orange to cream, plag~=kspar, 50% feldspar, qtz. 35-40%, bt 5%, musc.	62	63				2	30/60			SG			
5%. Medium to finer grained at bottom. Pyrite on joint surfaces.	63	63.3			6					Absorption			
63.30 - 68.35 m kspar>plag, orange in colour.	63.3	64	M-Mf			4	60/70/30/30					10	

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PROJECT NAME:	Black Point	HOLE DESCRIPTION		COLLAR LOCATION	CORE TYPE (Q)	LOGGING DETAILS	
LICENSE INFORMATION:	8372	ELEVATION: 82 m	m	644213m E	(P / H / N / B)	LOGGED BY	Karen McNaulty
DRILL HOLE NUMBER:	BP-5	AZM.: na	°	5022742m N	89.40: m	DATES:	Jan 29 -Feb. 7
DATE COLLARED:	Dec. 4, 2007	DIP: -90	°		% Recovery	PAGE:	3 of 3
DATE COMPLETED:	Dec. 6, 2007	EOH: 89.405	m	NAD 83 Zone 20		SIGNED:	

Description (Colour, Texture, Mineralogy%, etc.)	From m	To m	Grain Size (F/M/C/P)	Foliation (Null/W/M/S)	Strength (S 1-6)	Structure Fractures/m	Structure Angle with CA	Mineralization Type	Mineralization Intensity	Sample Code	QRD cm
	64	65				1	40			LA Abrasion	
	65	66				1	10			SG	
	66	67				1	45			Absorption	
cont'd. Unit goes in and out of medium to fine grain size. Musc.coarse 4-5%, bt. 5-7%,	67	68			6	3	85/75/10				
qtz 35%, 50% feldspar. Fine grained pyrite coating fracture surfaces <2%.	68	68.35								Sodium Sulphate	
68.35 -68.84 m kspar~=plag pale or./cream. Feldspar 45-50%, qtz. 40%, bt. 5-7%,	68.35	68.84	Mf	W	6	4	55/60/60/65			Soundness Loss	7
musc. 2-3%. Pyrite coating fracture surfaces.											
68.84 - 69.73 m kspar>plag 50% feldspar, qtz. 40-50%, musc. 3-4%, bt. 4-5%. Odd	68.84	69	Mf	W	6						
mica clot 2-3 cm. Salmon pnk.	69	69.73				3	50/40/?			Magnesium Sulfate	
	69.73	70		W	6					soundness loss	
69.73 -71.15 m cream to pale orange, secondary fine grained quartz veining with trace	70	71				4	20/20/10/0			Alkali Reactivity	
of chl. Feldspar 50%, qtz 35-40%, bt. 5%, musc. 2-3%. Trace of chl?	71	71.15								14day	
71.15 -72.30m Orange syenogranite, equigranular, kspar>plag. 50% feldspar, qtz.	71.15	72	M	W	6	1	45			Micro Deval	
35%, bt. 5-7%, musc. 5%. Fractured along concentration of bt.	72	72.3									
	72.3	72.54	M	W	6	1	60				
72.30 - 72.54 m plag>kspar, 50% feldspar, qtz. 40%, bt. 3-5%, musc. 2-3%. Drk gry											
72.54 - 73.40 m kspar>plag. Orange, feldspar 50%, qtz 40%, bt 5-7%, musc. 2-3%.	72.54	73	M	W	6						
Rare bt. clots 2mm.	73	73.4									
73.40 - 74.30 m kspar~=plag. Pale orange, cream, qtz 40%, bt. F.g. 3-5%, musc. 2-	73.4	74	Mf	W	6	1	85				
3%, feldspar 50% chlorite on fractures and in veinlets through section.	74	74.3									
74.30-74.95 m kspar>plag, or., feldspar 50%, bt. 3-5%v.f., qtz 35-40%, musc. 2%.	74.3	74.95	M-Mf	W	6	2	20/25				
	74.95	75		W	6						
74.95 - 76.27 m cream.buff plag>kspar, feldspar 50%, qtz. 35%, bt, 5-7%, musc. 2-	75	76				4	75/30/65/75				15
4%. Trace of hairline qtz. and chl. Veinlets. Gradual change to lower unit.	76	76.27									
76.27 -77.22 m Or. f.g. bt. 7-10%, qtz 35%, musc. 3-4% feldspar 50%. Qtz inundated	76.27	77	M	W	6	1	85				
fracture on bottom of interval. Qtz veinlets cutting CA.	77	77.22									
77.22 - 77.38 m kspar ~=plag 60%, qtz 35%, bt 5%, musc 2%, cream to pale or.	77.22	77.38	M	W	6						
77.38 - 79.64 m kspar>plag50% feldspar, 35% qtz., bt 7-10%, musc. 2-4%.coarse,	77.38	78	M	W	6	3	25/30/35				
Orange syenogranite. Sev. bt clots mm to 4 cm. xenolith @78.87 3.5cm. Hairline chl	78	79				0					
veinlets ~ parallel CA.	79	79.64				1	75				8.5
	79.64	80	Mf	W	6						
79.64 - 80.6m cream, feldspar 45%, qtz. 35-40%, bt 5-10%, musc. 2-4%.	80	80.6				1	20				
80.6 - 81.60m or. Feldspar, 50%, qtz 30-35%, musc. 3-5%, bt f.g. 7%. Chl veinlets	80.6	81	Mf	W	6						
parallel CA. grad.change to next unit. Secondary bt?	81	81.6				1	30				
81.60 - 82.25 m Cream orange, mica clots sev. mm in size. Clay alt. of feldspar on	81.6	82	M								
jnt surfaces. Feldspar 50%, qtz 35%, bt. 7-10%, mica 2-3%.	82	82.25									
82.25 - 83.09 m Orange, kspar 45%, kspar>plag, qtz 40%, bt 5-7%, musc. 2-4%.	82.25	83	M			2	40/88				
Rare bt. Clots sev mm in size. Hairline fracture ~par. CA chl. and qtz filled.	83	83.09									
83.09 -84.25 m Cream to pale or. Plag ~=kspar, Feldspar 45%, qtz. 40%, bt 5-10%,	83.09	84	M	M		4	35/60/70/30				7
musc. 3-4%. Bt. clots sev mm and finge grained bt. Chl. on frac. surf.	84	84.25									
84.25-84.81m or. Feldspar 45%, kspar>plag, qtz. 40%, bt 7-10%, musc. 2-3%. Qtz	84.25	84.81				1	50				
clot @ 84.66.											
84.81-85.82m Cream to mnr org. feldspar 45%, qtz 40%, bt. 7-10%, musc. 2-4%.	84.81	85	M	W							
Hairline qtz veinlet ~45CA @ 85.63 m. Trace of clay alteration of feldspars.	85	85.82				1	40				
	85.82	86									
85.82 -87.22 m cream to mnr orange feldspar 40-50%, qtz 40%, musc. 2-5%	86	87				4	55/60/30/30				
concentrated in certain sec., bt. 5-7%. Chl blebs hairline qtz veins curved.	87	87.22									
87.22 - 88.0 or. Bt &chl clots & blebs parallel CA. Feldspar 45%, qtz 40%, bt. 7-10%,	87.22	88	M	W		0					
coarse musc. 2-4% Qtz & chl. veinlets.											
88.0 - 88.40 pale or. Cream, feldspar 50%, qtz 40%, musc. 2-4%, bt 7%. Qtz filled	88	88.4	M	W							
rehealed veinlets.											
	88.4	89	M	W		1	40				
88.40- 89.405 m Cream feldspar 55%, qtz 35%, bt. 5-7%, musc. 2%. Sericite?, pale	89	89.405				2	30/20				
green chlorite? V.f.g. silica on fracture surfaces.	89.405	EOH									37.5

47.5 .475/29.80x100 -100 98.41%

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PROJECT NAME:	Black Point	HOLE DESCRIPTION		COLLAR LOCATION	CORE TYPE (Q)	LOGGING DETAILS	
LICENSE INFORMATION:	8372	ELEVATION: 73m		5023545mN	(P / H / N / B)	LOGGED BY	Peter Dalton
DRILL HOLE NUMBER:	BP-6A	AZM.: na	°		55.82: m	DATES:	Jan.23/08
DATE COLLARED:	Jan.6/2008	DIP: -90	°	645399mE	% Recovery	PAGE:	1 of 2
DATE COMPLETED:	Jan.7/2008	EOH: 55.82m		NAD 83 Zone 20		SIGNED:	

Description	From	To	Grain Size	Foliation	Strength	Structure		Mineralization		Sample Code
(Colour, Texture, Mineralogy%, etc.)	m	m	(F/M/C/P)	(Null/W/M/S)	(S 1-6)	Joints/m	Angle with CA	Type	Intensity	
Casing. No core	0	0.6								**BP-6A (1)**
0.6-5.59m Medium grained, equigranular Pinkish grey syenogranite. 50% K-Spar	0.6	1	Mc	W	6	0				**0.6-18.6m**
30% Quartz 20% Mica (2% muscovite). Foliation planes observed in medium granied	1	2	Mc	W	6	1	80			LA Abrasion
biotite. Biotite has a "grungy" surface (chloritic). Note: a Yellowish amber colour on	2	3	Mc	W	6	2/2 #4	45 / 90			SG
feldspar surfaces (possible iron staining) Potential Smectite alteration of feldspar	3	4	Mc	W	6	6	90			Absorption
over 3-4m. High angle fracturing becomes frequent from 4-5.59m, moderate to	4	5	Mc	Wm	4	>10				
intense FeOx staining/mineralization on surficial fracture surfaces.	5	5.59	Mc	Wm	4	>10				Sodium Sulphate
5.59-31.93m Medium grained, equigranular pinkish grey syenogranite. 42% Kspar	5.59	6	M	Wm	6	0				Soundness Loss
42% Quartz 15% Mica (2-3% muscovite) Chlorititc Biotite. 20-30cm Iron stained	6	7		W	6	2	90			
aureole around fracture/joints.	7	8	M	W	6	0				
	8	9	M	W	6	2	45			Alkali Reactivity
	9	10	M	W	6	1	20			14day
	10	11	M	W	6	0				Micro Deval
	11	12	M	W	4	>10				
Interval highly fractured (high and Low angle) with FeOx staining on surfaces	12	12.84	M	W	4	>10				
	12.84	13	M	Wm	6	0				
Metasedimentary Xenoliths at 13.03m and 13.22m size 1cm²	13	14	M	Wm	6	0				
Fracture over interval 0º to core axis. FeOx on fracture surface	14	14.39	Mc	Wm	6	1	0	Pyrite	Trace	
	14.39	15	Mc	Wm	6	4 / 1 #5	90 / 20			
	15	16	M	W	6	2	80			
Silicified hair line fracture 20º to core axis	16	17	M	W	6	0				
	17	18	M	W	6	1 / 1 #2	90 / 80			
	18	19	M	W	6	1	45			
	19	20	M	W	6	2	90			**BP-6A (2)**
	20	20.3	M	W	6	0	na			**18.6-37.2m**
20.3-21.0m Highly fractured low to high angle. Weak to moderate FeOx staining.	20.3	21	M	W	4	>10		Pyrite	1-2%	LA Abrasion
Disseminated pyrite mineralization on fracture planes. Pervasize clay alteration to										SG
host rock around fractures.										Absorption
FeOx and clay alteration on Fracture surfaces	21	22	M	W	4	1 / 1 / 1 #3	90 / 0 / 45			
Low angle silicified fractures (mm width)	22	23	M	W	4	1 / 2 #3	10 / 80			Sodium Sulphate
Low angle silicified fractures (mm width) FeOx on fracture-Joint planes.	23	24	M	W	6	2 / 1 #3	80 / 0			Soundness Loss
24-31.93m Medium grained, equigranular Pinkish grey syenogranite 45% K-spar 45%	24	25	M	W	6	3 / 1 / 1 #5	80 / 90 / 20			Magnesium Sulfate
	25	26	M	W	6	0				soundness loss
	26	27	M	W	6	3 / 3 #6	70 / 90			Alkali Reactivity
	27	28	M	W	6	4	80			14day
	28	29	M	Wm	6	1 / 1 / 1 #3	60 / 45 / 80			Micro Deval
Several short and thin silicified fractures 0º to core axis	29	30	M	W	6	7 / 1	80 / 10			
	30	30.26	M	W	6	1	80			
	30.26	31	M	Wm	6	6	70			
Intensely Jointed and iron stained feldspar foliation weak to moderate in biotite.	31	31.93	M	Wm	6	9 / 1	70 / 10			

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PROJECT NAME:	Black Point	HOLE DESCRIPTION		COLLAR LOCATION	CORE TYPE (Q)	LOGGING DETAILS	
LICENSE INFORMATION:		ELEVATION: 73m	m	5023545mN	(P / H / N / B)	LOGGED BY	Peter Dalton
DRILL HOLE NUMBER:	BP-6A	AZM.: na	°	645399mE	55.82: m	DATES:	Jan.23/08
DATE COLLARED:	Jan.6/2008	DIP: -90	°		% Recovery	PAGE:	2 of 2
DATE COMPLETED:	Jan.7/2008	EOH: 55.82m	m	NAD 83 Zone 20		SIGNED:	

Description	From	To	Grain Size	Foliation	Strength	Structure		Mineralization		Sample Code
(Colour, Texture, Mineralogy%, etc.)	m	m	(F/M/C/P)	(Null/W/M/S)	(S 1-6)	Fractures/m	Angle with CA	Type	Intensity	
31.93-36.8m Medium grained inequigranular grey/green monzogranite. Highly fractured and jointed. 50% Feldspar 49% Quartz 1% mica. Smecitite alteration of feldspar moderate (soft and green). Sulphide mineralization on fracture planes (Marcasite?) trace-10%. trace hematite observed (steel grey). Sulphides are bronze with irridessent tarnish (twined and striated). Also noted dark circles with pyrititc rims (mm scale) All mineralization appears to be related to smecitite alteration and fracture planes. Potential fault at 33.12-33.25m	31.93	32	M	Wm	6	0	0			
	32	33	M	Wm	6	>10				
	33	34	M	W	6					
Smectite and Sulphide rich	34	34.28	M	W	6	4	90	Marcasite	10%	
Patches of intense smectite alteration (no sulphides)	34.28	35	M	W	6	4 / 3 #7	80 / 45			
	35	36	M	W	6	5 / 1 #6	80 / 90			
	36	36.71	M	W	6	3 / 2 #5	70 / 90			
Oxidized, intense iron staining	36.71	36.8	M	W	5	3	80			
36.8-41m Pyrite mineralization tends to be localized to fracture planes and also occuring as rims to dark circular patches (mm scale) Note gradual colour change over interval into a pinkish grey.	36.8	37	M	W	6	2	80	Pyrite	trace	
	37	37.77	M	W	6	6 / 1 / 1 #8	80 / 10 / 0	Pyrite	trace-2%	
	37.77	38	M	W	6	2	90			**BP-6A (3)**
Medium grained equigranular pinkish grey syenogranite 45% kspar 45% Quartz 10% Mica biotite weakly chlorititc and moderately foliated.	38	39	M	W	6	4 / 3 / #7	80 / 45			**37.32-55.82m**
	39	39.2	M	W	6	1	10	Pyrite	5%	LA Abrasion
	39.2	40	M	W	6	1	0			SG
	40	41	M	W	6	3 / 1 #4	70 / 10			Absorption
41-42m Grey/green monzogranite	41	42	M	W	6	1 / 2 / 1 #4	80 / 90 / 45			
42-55.82(EOH) Medium grained equigranular syenogranite pinkish grey 40% K-spar 35% Quartz 15% Mica. Foliation observed along mica planes.	42	43	M	W	6	2 / 2 #4	70 / 90			Sodium Sulphate
	43	44	M	W	6	1 / 1 #2	90 / 10			Soundness Loss
	44	45	M	W	6	2	80			Magnesium Sulfate
	45	46	M	W	6	3 / 1 #4	45 / 90			soundness loss
	46	47	M	W	6	2 / 1 #3	20 / 80			Alkali Reactivity
	47	48	M	W	6	2	90			14day
	48	49	M	W	6	1	90			Micro Deval
	49	49.7	M	W	6	1	10			
No return/core loss Bit Malfunction	49.7	50	M	W	6	0	0			
	50	51	M	W	6	1 / 1 / 2 #4	90 / 80 / 45			
	51	52	M	W	6	1 / 1 #2	10 / 90			
	52	53	M	W	6	1	80			
	53	54	M	W	6	1	80			
	54	55	M	W	6	3	90			
Forced to abandon hole due to stuck bit	55	55.82	M	W	6	3 / 1 #4	20 / 90			

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Drill Contractor Logan Drilling Company

PROJECT NAME:	Black Point	HOLE DESCRIPTION		COLLAR LOCATION	CORE TYPE (Q)	LOGGING DETAILS	
LICENSE INFORMATION:	8372	ELEVATION: 69m		5023434mN	(P / H / N / B)	LOGGED BY	Peter Dalton
DRILL HOLE NUMBER:	BP-6B	AZM.: na	°		70.05: m	DATES:	Jan.31/08
DATE COLLARED:	Jan.13/2008	DIP: -90	°	645310mE	% Recovery	PAGE:	1 of 2
DATE COMPLETED:	Jan.15/2008	EOH: 70.05m		NAD 83 Zone 20		SIGNED:	

Description	From	To	Grain Size	Foliation	Strength	Structure		Mineralization		Sample Code	RQD
(Colour, Texture, Mineralogy%, etc.)	m	m	(F/M/C/P)	(Null/W/M/S)	(S 1-6)	Joints/m	Angle with CA	Type	Intensity		
0-4m Overburden, surficial boulders (granite/Metasediments)	0	4								LA Abrasion	
4-20m Medium grained equigranular pinkish off white granite. 50% Kspar, 45% Quartz 5%Mica (1-2% muscovite - 3-4% biotite) biotite is moderately chlorititc. Feldspar can increase to 55-60% while quartz can decrease to 40-35%	4	5	M	Wn	6	2 / 3 #5	80 / 90			SG Absorption Sodium/Magnesium	
Trace sulphide "blebs" (mm scale) and FeOx on fracture planes Interval is Highly fractured.	5	6	M	Wn	3	>10		Pyrite	Trace	Sulphate Soundness Loss	
	6	7	M	Wn	6	3 / 1 #4	50 / 90				
Few low angle hairline fractures with clay alteration along fracture plane	7	8	M	Wn	6	1	40				
Fe staining of feldspar within a 5cm aurole of joint.	8	8.57	M	Wn	6	1 / 2 #3	80 / 45			Alkali reactivity 14 day	
8.57-14.0m Intense hairline fractures chloritic and silicified. Fractures are both high and low angles	8.57	9	M	Wn	6	1 / 1 / 1 / #4	30 / 70 / 80 / 90				
	9	9.95	M	Wn	6					Micro Deval	
Missing/ lost core	9.95	10.55	M	Wn	6					PN Number	92.35%
	10.55	11	M	Wn	6	2 / 2 / 1 #5	90 / 80 / 10				
	11	12	M	Wn	6	6 / 1 #7	80 / 40				
	12	13	M	Wn	6	3 / 1 / 1 #5	80 / 40 / 90				
	13	14	M	Wn	6	3	60				
Mica 5-7% slight increase in Quartz	15	16	M	Wn	6	2 / 2 #4	80 / 20				
	16	17	M	Wn	6						
17.5m 1cm² biotite pod	17	18	M	Wn	6	1	60				
	18	19	M	Wn	6	1 / 2 / 1 #4	10 / 60 / 40	Pyrite	Trace		
FeOx on shallow angle fracture planes associated trace pyrite.	19	20	M	Wn	6	4	40				
20-50m Medium grained equigranular syenogranite. Kspar is pinkish off white. Biotite is medium to fine grained weakly chloritic with a weak to null foliation. 47% Kspar 47% Quartz 6% micas (1% muscovite) <1% Plag	20	21	M	Wn	6	3	45				
	21	22	M	Wn	6						
23.47m Biotite pod	22	23	M	Wn	6	1 / 1 #2	90 / 45				
	23	24	M	Wn	6					BP6B(1) 0.6m- 23.4m	
	24	25	M	Wn	6					LA Abrasion	
	25	26	M	Wn	6					SG	
	26	27	M	Wn	6					Absorption	
	27	28	M	Wn	6	1	90				
	28	29	M	Wn	6					Sodium/Magnesium	
	29	30	M	Wn	6					Sulphate Soundness	
	30	31	M	Wn	6					Loss	
	31	32	M	Wn	6					Alkali Reactivity 14 Da	
Increase to 10% biotite over interval	32	33	M	Wn	6	1	40			Micro Deval	95.51%
	33	34	M	Wn	6						
	34	35	M	Wn	6	1	80				
Biotite has moderate chlorite alteration. Chlorite and clay on fracture surface	35	36	M	Wn	6	1 / 3 #4	20 / 70				
	36	37	M	Wn	6	1 / 1 #2	90 / 45				
	37	38	M	Wn	6	2	40				
Fractures have a soft bright yellow coating on feldspar faces (clay?)	38	39	M	Wn	6	2 / 1 / 1 #4	30 / 80 / 60				
	39	40	M	Wn	6	3	70				
	40	40.14	M	Wn	6						
Missing/Lost Core	40.14	40.77	M	Wn	6						

Company/Licensee 6531954 Canada Ltd
Drill Contractor Logan Drilling Company

PROJECT NAME:	Black Point	HOLE DESCRIPTION		COLLAR LOCATION	CORE TYPE (Q)	LOGGING DETAILS	
LICENSE INFORMATION:	8372	ELEVATION: 69m	m	5023434mN	(P / H / N / B)	LOGGED BY	Peter Dalton
DRILL HOLE NUMBER:	BP-6B	AZM.: na	°	645310mE	70.05: m	DATES:	Jan.31/08
DATE COLLARED:	Jan.13/2008	DIP: -90	°		% Recovery	PAGE:	2 of 2
DATE COMPLETED:	Jan.15/2008	EOH: 70.05m	m	NAD 83 Zone 20		SIGNED:	

Description (Colour, Texture, Mineralogy%, etc.)	From m	To m	Grain Size (F/M/C/P)	Foliation (Null/W/M/S)	Strength (S 1-6)	Structure Fractures/m	Structure Angle with CA	Mineralization Type	Mineralization Intensity	Sample Code	RQD
Rounded and tumbled core (technical drill issues?)	40.77	41	M	Wn	6						
Few low angle fractures with clay altered surfaces	41	41.72	M	Wn	2	3	60				
	41.72	42	M	Wn	6	1	5				
Slight increase in grain size. Increase in clay alteration associated with joint planes	42	43	M	Wn	6	1 / 2 #3	10 / 30				
Yellow clay coating on feldspar associated with joint and fracture planes	43	44	M	Wn	6	2 / 1 / 1 #4	20 / 70 / 0				
Low angle fracturing with surficial intense clay alteration of feldspar. Trace pyrite mineralization as "blebs" smells of sulphur with HCL	44	45	M	Wn	6	1 / 1 #2	10 / 60	Pyrite	Trace		
	45	46	M	Wn	6	4 / 1 #5	70 / 40				
	46	47	M	Wn	6	2 / 3 #5	40 / 70			**BP6B(2) 23.4m-46.8m**	
	47	48	M	Wn	6	2 / 1 #3	40 / 90				
Chlorititc clays on fracture surface	48	49	M	Wn	6	1 / 2 #3	10 / 70			**LA Abrasion**	
Top 20cm of interval is fractured and rubbled (note clay alteration on fracture and joint planes)	49	50	M	Wn	6	4	40			**SG**	
										Absorption	
50-70.05m EOH Medium grained equigranular granite (syenogranite) Creamy off-white colour. 50% Kspar, 40% Quartz, 10% mica (3% muscovite). Biotite moderately to intense chloritic alteration. Feldspar is moderately altered to clay on fracture surfaces (yellowish green) fracture surfaces contain 7-10% very fine grained sulphide (pyrite) very grungy in appearance and restricted to surficial fracture planes.	50	51	M	Wn	6	2 / 1 / 1 #4	30 / 45 / 10	Pyrite	7-10%	**Sodium/Magnesium Sulphate Soundness Loss 14 day Alkali Reactivit Micro Deval**	
	51	52	M	Wn	6	1	30				
	52	53	M	Wn	6						
Lithological composition remains constant. Increased clay and rock flour on joint planes may indicate greater movement along on joints.	53	54	M	Wn	6	3	40				
Sulphides restricted to fracture planes	54	55	M	Wn	6	4 / 1 #5	40 / 70	pyrite	trace-3%		
	55	56	M	Wn	6	2	45				
	56	57	M	Wn	6	2	90				
	57	58	M	Wn	6	1 / 1 #2	90 / 40				96.20%
	58	59	M	Wn	6						
	60	61	M	Wn	6	1	90				
	61	62	M	Wn	6						
Mica decrease to 3%	62	62.53	M	Wn	6	1	45				
Mica increase back to 7-10%	62.53	63	M	Wn	6						
	63	64	M	Wn	6	2	30				
	64	65	M	Wn	6						
	65	66	M	Wn	6						
	66	67	M	Wn	6						
	67	67.3	M	Wn	6						
Decrease in Mica 3-5% (biotite)	67.3	68	M	Wn	6						
Mica 1%	68	68.13	M	Wn	6						
Medium grained equigranular pinkish off-white syenogranite 50% Kspar, 40% Quartz, 10% Mica (1% muscovite, 9% chlorititc Biotite)	68.13	69	M	W	6						
69.72-70.05m Quartz vein 1.5cm thick 10º to Core Axis	69.72	70	M	W	6	1	10			**BP6B(3) 46.8m-**	
	70	70.27	M	W	6	1	10			**70.27m**	

Drill Log Header Sheet

Hole: BP-7

Project	Black Point (6706)
Geologist	Peter Dalton, P.Geo.
Designed By	Vulcan Materials

Commenced	February.27 2014
Completed	March.1 2014
Drill Contractor	Logan Drilling Group
Drill Rig	Duralite 1000N
Drill Foreman	Andy McGinnis

Objective

Geological confirmation of the southeastern portion of the projected Black Point granitic resource.

Location and Collar Detail

Datum	UTM NAD 83 Zone 20
Easting	0644981mE
Northing	5022750mN
Elevation	68m
Azimuth	0
Dip°	-90
Depth(m)	120
Core Size	NQ
RQD Ave. %	98.30%
RQD Range %	65% to 100%
Recovery Ave. %	98.80%
Recovery Range %	73% to 100%
Significant Core loss	0-0.54m

Geological Summary

BP-7 consists of a medium grained, moderately foliated, micaceous monzogranite. Mineralology remains fairly consistent throughout the entire hole with 50% Plagioclase, 40% Quartz and 10% Mica (5% Biotite + 5% muscovite) although minor fluxuations in the mica component does occur. From 96m to 102m the monzogranite becomes realtivley more potassic with the presence of orthoclase; the increase in orthoclase is suffice enough to consider a lithology change to that of a syenogranite within this interval. This transition is subtle and represents mineralogical variations within the granite body and does not represent dyking or intrusive discontinuity. Alteration within BP-7 is limited to selective, weak chlorite alteration of biotite. The BP-7 monzogranite is a hard and competent rock with a limited structral component. A reoccuring, low angle joint + fracture orientation of 10-30° to core axsis is present. Minor quartz and chlorite veinlets of the same orientation suggest this particular fracture set was a preferred conduit for fluid flow after pluton crystalization. Reoccuring micaceous clusters ~ 1-2cm² may also contrubute to preferred zones of weakness within the granite as it was noted that mechanical fractures to the core during and post drilling tended to occur conicidently with these clusters. Evidence of groud water flow and oxidation was noted to a depth of 5m. Observed mineralization is limited to trace amounts of pyrite occuring as a crust along a joint plane at 106m.

Drill Core Recovery and RQD Sheet

Project: Black Point
Drill Hole: BP-7
Date: Feb.28 2014

From (m)	To (m)	Drilled (m)	Recieved (m)	Recovery (%)	RQD (m)	RQD (%)	Comments
0.54	2	2	1.46	73.0	1.3	65.0	RUN1 Box 1 / 0-0.54 loss
2	5	3	3	100.0	2.73	91.0	RUN2 Box 1-2
5	8	3	2.79	93.0	2.73	91.0	RUN3 Box 2
8	11	3	3.07	102.3	2.9	96.7	RUN4 Box 3
11	14	3	2.95	98.3	2.81	93.7	RUN5 Box 3-4
14	17	3	3	100.0	3	100.0	RUN6 Box 4
17	20	3	2.98	99.3	2.98	99.3	RUN7 Box 4-5
20	23	3	3	100.0	2.91	97.0	RUN8 Box 5-6
23	26	3	3	100.0	2.8	93.3	RUN9 Box 6
26	29	3	3	100.0	3	100.0	RUN10 Box 6-7
29	32	3	2.97	99.0	2.97	99.0	RUN11 Box 7-8
32	35	3	2.93	97.7	2.84	94.7	RUN12 Box 8
35	38	3	3.13	104.3	2.96	98.7	RUN13 Box 8-9
38	41	3	3.02	100.7	2.96	98.7	RUN14 Box 9
41	44	3	3	100.0	3	100.0	RUN15 Box 10
44	47	3	3	100.0	2.98	99.3	RUN16 Box 10-11
47	50	3	3	100.0	3	100.0	RUN17 Box 11-12
50	53	3	2.97	99.0	2.95	98.3	RUN18 Box 12
53	56	3	3.04	101.3	3.04	101.3	RUN19 Box 12-13
56	59	3	2.98	99.3	2.98	99.3	RUN20 Box 13-14
59	62	3	3	100.0	3	100.0	RUN21 Box 14
62	65	3	3.03	101.0	2.97	99.0	RUN22 Box 15
65	68	3	2.98	99.3	2.98	99.3	RUN23 Box 15-16
68	71	3	3.05	101.7	3.05	101.7	RUN24 Box 16-17
71	74	3	3.06	102.0	3.06	102.0	RUN25 Box 17-18
74	77	3	3.11	103.7	3.11	103.7	RUN26 Box 18
77	80	3	2.88	96.0	2.88	96.0	RUN27 Box 18-19
80	83	3	3.05	101.7	3.05	101.7	RUN28 Box 19
83	86	3	2.95	98.3	2.95	98.3	RUN29 Box 19-20
86	89	3	3.05	101.7	3.05	101.7	RUN30 Box 20-21
89	92	3	2.99	99.7	2.99	99.7	RUN31 Box 21
92	95	3	2.97	99.0	2.97	99.0	RUN32 Box 21-22
95	98	3	3	100.0	3	100.0	RUN33 Box 22-23
98	101	3	3.03	101.0	3.03	101.0	RUN34 Box 23
101	104	3	3.02	100.7	3.02	100.7	RUN35 Box 23-24
104	107	3	3.03	101.0	2.94	98.0	RUN36 Box 24-25
107	110	3	2.98	99.3	2.98	99.3	RUN37 Box 25
110	113	3	3	100.0	3	100.0	RUN38 Box 25-26
113	116	3	3	100.0	3	100.0	RUN39 Box 26-27
116	119	3	3	100.0	3	100.0	RUN40 Box 27
119	120	1	1.14	114.0	1.14	114.0	RUN41 Box 28
	EOH						

PROJECT NAME:	Black Point	LITHOLOGICAL LOG			Collar Survey Data		CORE TYPE (Q)	LOGGING DETAILS
LICENSE INFORMATION:		ELEVATION:	68m	°Lat	5022750	mN	(P / H / N / B)	LOGGED BY: P.Dalton
DRILL HOLE NUMBER: BP-7		AZM°:	-90	°Long	644981	mE	: m	DATES:
DATE open: Feb.27 2014		DIP:	120m				% Average Recovery	PAGE: 1 of
DATE closed: March 1 2014		EOH:120m	Drilling Contractor: Logan Drilling Group		NAD 83 Zone 20		% Average RQD	SIGNED:

Description	From	To	Code	Graphic	Grain Size	Foliation	Weather	Strength	Structure (J-Joint F-Fault, Bx-Breccia, Fr- fracture, Fs>10, Fx:S>20, mf-mechanical fracture)				Veining				Mineralization (v-vein, D- Disseminated, M-massive)			Alteration (P/V/S - 1,2,3)				Notes
(Colour, Texture, Mineralogy, Structure etc.)	m	m			(F/M/C/P)	(Null/W/M/S)	W(1-6)	(R 0-6)	Type	F/m	α°		Type	mm	v/m	σ	Min.	Occ.	Intensity	Type	Occ.	Intensity		
0-0.54m; Core loss/ 0.54-96m; Medium Grained, Equigranular, Micaceous Monzogranite, ~50% Plag, 40% Quartz, 5% Biotite, 5% Muscovite. Selective weak chlorite alteration of Biotite	0	1	MzGr	********	M	Wm	2	5	J	3	90									Chl	S	1		
	1	2	MzGr	********	M	Wm	2	5	J	2	90									Chl	S	1		
	2	3	MzGr	********	M	Wm	2	5	J	2	90									Chl	S	1		
	3	4	MzGr	********	M	Wm	1	5	J	4	90									Chl	S	1		
0.54-5m; Weak signs of weathering and oxidation (meteoric waters)	4	5	MzGr	********	M	Wm	1	5	J	3	90									Chl	S	1		
	5	6	MzGr	********	M	Wm	1	5	J	6	90									Chl	S	1		
	6	7	MzGr	********	M	Wm	1	5	J	2	90									Chl	S	1		
	7	8	MzGr	********	M	Wm	1	5	J	3	90									Chl	S	1		
	8	9	MzGr	********	M	Wm	1	5	J	1	90									Chl	S	1		
	9	10	MzGr	********	M	Wm	1	5	J	1	90									Chl	S	1		
	10	11	MzGr	********	M	Wm	1	5	J	3	90	40								Chl	S	1		
	11	12	MzGr	********	M	Wm	1	5	J	3	90	40								Chl	S	1		
	12	13	MzGr	********	M	Wm	1	5	J	2	90									Chl	S	1		
	13	14	MzGr	********	M	Wm	1	5	mf	0										Chl	S	1		
	14	15	MzGr	********	M	Wm	1	5	J	1	90		QTZ	2	1	70				Chl	S	1		
	15	16	MzGr	********	M	Wm	1	5	J	3	40									Chl	S	1		
Micaceous (biotite) Cluster ≤ 1cm	16	17	MzGr	********	M	Wm	1	5	mf	0			QTZ	1	1	60				Chl	S	1		
Micaceous (biotite) Cluster 2 cm x 1cm	17	18	MzGr	********	M	Wm	1	5	J	2	90									Chl	S	1		
	18	19	MzGr	********	M	Wm	1	5	J	1	90									Chl	S	1		
	19	20	MzGr	********	M	Wm	1	5	mf	0										Chl	S	1		
Micaceous (biotite) cluster ≤ 1cm	20	21	MzGr	********	M	Wm	1	5	mf	0										Chl	S	1		
	21	22	MzGr	********	M	Wm	1	5	J	1	90									Chl	S	1		
Micaceous (biotite) cluster ≤ 1cm	22	23	MzGr	********	M	Wm	1	5		0										Chl	S	1		
	23	24	MzGr	********	M	Wm	1	5	mf	0										Chl	S	1		
	24	25	MzGr	********	M	Wm	1	5	mf	0										Chl	S	1		
	25	26	MzGr	********	M	Wm	1	5	mf	0										Chl	S	1		
	26	27	MzGr	********	M	Wm	1	5	J	1	90									Chl	S	1		
	27	28	MzGr	********	M	Wm	1	5	mf	0										Chl	S	1		
	28	29	MzGr	********	M	Wm	1	5	mf	0										Chl	S	1		
	29	30	MzGr	********	M	Wm	1	5	J	1	90									Chl	S	1		
	30	31	MzGr	********	M	Wm	1	5	J	1	80									Chl	S	1		
	31	32	MzGr	********	M	Wm	1	5		0										Chl	S	1		
	32	33	MzGr	********	M	Wm	1	5	J	2	40									Chl	S	1		
	33	34	MzGr	********	M	Wm	1	5	mf	0										Chl	S	1		
	34	35	MzGr	********	M	Wm	1	5	mf	0										Chl	S	1		
35.08-35.17m; weak FeOx staining on joint plane surfaces	35	36	MzGr	********	M	Wm	1	5	J	3	30	60								Chl	S	1		
	36	37	MzGr	********	M	Wm	1	5	mf	0										Chl	S	1		
Foliation becoming slightly more pronounced	37	38	MzGr	********	M	M	1	5	mf	0										Chl	S	1		
38.26m; K-Spar phenocryst 0.5cm / 38.43m; Biotite Cluster 1cm x 1cm	38	39	MzGr	********	M	M	1	5	mf	0										Chl	S	1		
	39	40	MzGr	********	M	M	1	5	J	1	50									Chl	S	1		
	40	41	MzGr	********	M	M	1	5	Fr	2	90									Chl	S	1		

	41	42	MzGr		M	M	1	5	mf	0											Chl	S	1		
	42	43	MzGr		M	M	1	5	Fr	1	90										Chl	S	1		
	43	44	MzGr		M	M	1	5	mf	0											Chl	S	1		
	44	45	MzGr		M	M	1	5	mf	0											Chl	S	1		
44.0-47.0m; Biotite decreases to 3%	45	46	MzGr		M	M	1	5	Fr	2	90										Chl	S	1		
	46	47	MzGr		M	M	1	5	mf	0											Chl	S	1		
47.32-47.43 m Quartz vein	47	48	MzGr		M	M	1	5	Fr/J	4	55	90		QTZ	1	1	20				Chl	S	1		
	48	49	MzGr		M	M	1	5	Fr/J	3	40	10									Chl	S	1		
49.36m;Chlorite veinlet cluster / 49.9m; Micaceous cluster 1x2cm	49	50	MzGr		M	M	1	5	J	2	40			Chl	1	3	10				Chl	S	1		
	50	51	MzGr		M	M	1	5	Fr	2	90										Chl	S	1		
	51	52	MzGr		M	M	1	5	mf	0											Chl	S	1		
	52	53	MzGr		M	M	1	5	mf	0											Chl	S	1		
	53	54	MzGr		M	M	1	5	mf	0											Chl	S	1		
	54	55	MzGr		M	M	1	5	J	1	80										Chl	S	1		
	55	56	MzGr		M	M	1	5	mf	0											Chl	S	1		
56m-62m; Muscovite 8% , Biotite 5%	56	57	MzGr		M	M	1	5	mf	0											Chl	S	1		
	57	58	MzGr		M	M	1	5	mf	0											Chl	S	1		
	58	59	MzGr		M	M	1	5	mf	0											Chl	S	1		
59.53m; Plag phenocryst	59	60	MzGr		M	M	1	5	mf	0											Chl	S	1		
	60	61	MzGr		M	M	1	5	Fr	1	80										Chl	S	1		
61.15m; Chloritized biotite clusters / 61.5-62m; Muscovite ≤1%	61	62	MzGr		M	M	1	5	J	1	50										Chl	S	1		
Biotite intensifies to 5%	62	63	MzGr		M	M	1	5	J/Fr	3	40	10									Chl	P	1		
62.6m; Quartz veinlets / 63.85m; Chlorite veinlets	63	64	MzGr		M	M	1	5	mf	2	40			QTZ / Chl	2	3	20/20				Chl	S	1		
	64	65	MzGr		M	M	1	5	mf	0											Chl	S	1		
	65	66	MzGr		M	M	1	5	mf	0											Chl	S	1		
	66	67	MzGr		M	M	1	5	mf	0											Chl	S	1		
67.12m; micaceous cluster 2.5 x 0.5cm	67	68	MzGr		M	M	1	5	mf	0											Chl	S	1		
68.72 - 69.71m; Quartzhealed fracture 0deg CA	68	69	MzGr		M	M	1	5	mf	0											Chl	S	1		
	69	70	MzGr		M	M	1	5	mf	0											Chl	S	1		
	70	71	MzGr		M	M	1	5	mf	0											Chl	S	1		
	71	72	MzGr		M	M	1	5	mf	0											Chl	S	1		
	72	73	MzGr		M	M	1	5	mf	0											Chl	S	1		
	73	74	MzGr		M	M	1	5	mf	0											Chl	S	1		
	74	75	MzGr		M	M	1	5	J	5	55	20									Chl	S	1		
	75	76	MzGr		M	M	1	5	J	1	55										Chl	S	1		
	76	77	MzGr		M	M	1	5	mf	0											Chl	S	1		
	77	78	MzGr		M	M	1	5	mf	0											Chl	S	1		
	78	79	MzGr		M	M	1	5	mf	0											Chl	S	1		
	79	80	MzGr		M	M	1	5	mf	0											Chl	S	1		
	80	81	MzGr		M	M	1	5	mf	0											Chl	S	1		
	81	82	MzGr		M	M	1	5	mf	0											Chl	S	1		
	82	83	MzGr		M	M	1	5	mf	0											Chl	S	1		
	83	84	MzGr		M	M	1	5	mf	0											Chl	S	1		
	84	85	MzGr		M	M	1	5	mf	0											Chl	S	1		
	85	86	MzGr		M	M	1	5	mf	0											Chl	S	1		
Rare 2cm x 1cm biotite clusters observed on mechanical fractures. Clusters may contribute to zones of weakness	86	87	MzGr		M	M	1	5	mf	0											Chl	S	1		
87.7m; Mica cluster 1cm x 1cm	87	88	MzGr		M	M	1	5	mf	0											Chl	S	1		

88.1m; Mica cluster 1cm x 1cm	88	89	MzGr	********	M	M	1	5	mf	0											Chl	S	1		
89.6 - 90.3m; Quartz-Chlorite veinlets (healed fractures) 20deg CA	89	90	MzGr	********	M	M	1	5	mf	0				QTZ/CHL	1	>5	20				Chl	S	1		
	90	91	MzGr	********	M	M	1	5	J	2	55										Chl	S	1		
91.43m; Biotite cluster 1cm x 0.5cm	91	92	MzGr	********	M	M	1	5	mf	0											Chl	S	1		
92.9m; Joint surfaces have weak carbonate precipitate on surface, Joints intersect	92	93	MzGr	********	M	M	1	5	J	2	10	60									Chl	S	1		
	93	94	MzGr	********	M	M	1	5	mf	0											Chl	S	1		
	94	95	MzGr	********	M	M	1	5	mf	0											Chl	S	1		
	95	96	MzGr	********	M	M	1	4.5	mf	0											Chl	S	1		
96.7m; Quartz veinlet / Monzogranite is becoming more potassic with increased K-spar(pink) being observed dominately as plag crystal centers	96	97	MzSyGr	≈/≈/≈/≈	M	M	1	5	mf	0				QTZ	2	1	20				Chl	S	1		
	97	98	MzSyGr	≈/≈/≈/≈	M	M	1	5	mf	0											Chl	S	1		
98m-101m;Plag has become nearly all pink-orange K-spar, enough to call syenogranite. Quartz and mica values remain consistent. Texture is weakly inequigranular with presence of K-spar phenocryts	98	99	SyGr	********	M	M	1	5	mf	0											Chl	S	1		
	99	100	SyGr	********	M	M	1	5	mf	0											Chl	S	1		
	100	101	SyGr	********	M	M	1	5	mf	0											Chl	S	1		
Plag 40%, Quartz40%, Mica 10-15% Kspar 5-10%	101	102	MzSyGr	≈/≈/≈/≈	M	M	1	5	mf	0											Chl	S	1		
K-spar decreasing but still visable. Rare plag phenocryts	102	103	MzGr	********	M	M	1	5	mf	0											Chl	S	1		
	103	104	MzGr	********	M	M	1	5	mf	0											Chl	S	1		
Trace K-spar	104	105	MzGr	********	M	M	1	5	mf	0											Chl	S	1		
	105	106	MzGr	********	M	M	1	5	J	4	50	20						pyrite	massive	Trace	Chl	S	1		
	106	107	MzGr	********	M	M	1	5	mf	2		25									Chl	S	1		
	107	108	MzGr	********	M	M	1	5	mf	0											Chl	S	1		
	108	109	MzSyGr	≈/≈/≈/≈	M	M	1	5	mf	0											Chl	S	1		
	109	110	MzGr	********	M	M	1	5	mf	0											Chl	S	1		
	110	111	MzGr	********	M	M	1	5	mf	0											Chl	S	1		
	111	112	MzGr	********	M	M	1	5	mf	0											Chl	S	1		
	112	113	MzGr	********	M	M	1	5	mf	0											Chl	S	1		
Potassic Monzogranite (Trace K-spar)	113	114	MzGr	********	M	M	1	5	mf	0											Chl	S	1		
114.45m; Quartz-Chlorite healed fracture veinlets	114	115	MzGr	********	M	M	1	5	Fr	1	20			QTZ/CHL	1	1	20				Chl	S	1		
	115	116	MzGr	********	M	M	1	5	mf	0											Chl	S	1		
	116	117	MzGr	********	M	M	1	5	mf	0											Chl	S	1		
117.08m; K-spar phenocryst	117	118	MzGr	********	M	M	1	5	mf	0											Chl	S	1		
	118	119	MzGr	********	M	M	1	5	mf	0											Chl	S	1		
EOH	119	120	MzGr	********	M	M	1	5	mf	0											Chl	S	1		

PROJECT NAME:	Black Point						GEOTECHNICAL LOG				Collar Survey Data							LOGGING DETAILS	
LICENSE INFORMATION:							ELEVATION:	68m						°Lat		mN		LOGGED BY: P. Dalton	
DRILL HOLE:	BP-7						AZM°: 000							°Long		mE		DATES:	Feb.28 - Mar.3 2014
DATE COLLARED:	Feb.27 2014						DIP: -90									NAD 83 Zone 20		PAGE:	of
DATE COMPLETED:	Mar. 1 2014						EOH: 120m			Drilling Contractor		Logan Drilling Group						SIGNED:	

From	To		Rock Strength	Weathering	Total Fracture	Fracture Type	Jointing											Comments
		Rock Type					J set	λ/m	λ/m	λ/m	α°	α°	α°	J roughness	Infill/Cement			
m	m	Litho Code	R(0-6)	(1-6)	(/m)		0.5-20	set1	set2	set3	set1	set2	set3	0.5-5	Comp.	Width (mm	Strength (0-2)	
0	1	MzGr	5	2	3	J	1	3			90			1.5				
1	2	MzGr	5	2	2	J	1	2			90			1.5				
2	3	MzGr	5	2	2	J	1	2			90			1.5				
3	4	MzGr	5	1	4	J	1	4			90			1.5				
4	5	MzGr	5	1	3	J	1	3			90			1.5				
5	6	MzGr	5	1	6	J	1	6			90			1.5				
6	7	MzGr	5	1	2	J	1	2			90			1.5				
7	8	MzGr	5	1	3	J	1	3			90			1.5				
8	9	MzGr	5	1	1	J	0.5	1			90			1.5				
9	10	MzGr	5	1	1	J	0.5	1			90			1.5				
10	11	MzGr	5	1	3	J	2				90	40		1.5				
11	12	MzGr	5	1	3	J	2				40	90		1.5				
12	13	MzGr	5	1	2	J	1				90			1.5				
13	14	MzGr	5	1	0	mf												
14	15	MzGr	5	1	1	J	0.5	1			90			1.5				
15	16	MzGr	5	1	3	J/Fr	1.5	2			40	90		1.5				
16	17	MzGr	5	1	0	mf												
17	18	MzGr	5	1	2	J	1	1			90			1.5				
18	19	MzGr	5	1	1	J	0.5	1			90			1.5				
19	20	MzGr	5	1	0	mf												
20	21	MzGr	5	1	0	mf												
21	22	MzGr	5	1	1	J	0.5	1			90			1.5				
22	23	MzGr	5	1	0													
23	24	MzGr	5	1	0	mf												
24	25	MzGr	5	1	0	mf												
25	26	MzGr	5	1	0	mf												
26	27	MzGr	5	1	1	J	0.5	1			90			1.5				
27	28	MzGr	5	1	0	mf												
28	29	MzGr	5	1	0	mf												
29	30	MzGr	5	1	1	J	0.5	1			90			1.5				
30	31	MzGr	5	1	1	J	0.5	1			80			1.5				
31	32	MzGr	5	1	0													
32	33	MzGr	5	1	2	J	1	2			40			3				
33	34	MzGr	5	1	0	mf												
34	35	MzGr	5	1	0	mf												
35	36	MzGr	5	1	3	J	2	1			30	60		3/1.5				
36	37	MzGr	5	1	0	mf												
37	38	MzGr	5	1	0	mf												
38	39	MzGr	5	1	0	mf												
39	40	MzGr	5	1	1	J	1	1			50			3				
40	41	MzGr	5	1	2	Fr					90			3				
41	42	MzGr	5	1	0	mf		1			90			3				
42	43	MzGr	5	1	1	Fr												
43	44	MzGr	5	1	0	mf												
44	45	MzGr	5	1	0	mf												
45	46	MzGr	5	1	2	Fr												
46	47	MzGr	5	1	0	mf												
47	48	MzGr	5	1	4	Fr/J	2	2	2		55	90		1.5				
48	49	MzGr	5	1	3	Fr/J	1.5	2	1		40	10		3				
49	50	MzGr	5	1	2	J	1	2			40			3				
50	51	MzGr	5	1	2	Fr	0.5				90			1.5				
51	52	MzGr	5	1	0	mf												
52	53	MzGr	5	1	0	mf												
53	54	MzGr	5	1	0	mf												
54	55	MzGr	5	1	1	J	0.5	1			80			1.5				
55	56	MzGr	5	1	0	mf												
56	57	MzGr	5	1	0	mf												

57	58	MzGr	5	1	0	mf																		
58	59	MzGr	5	1	0	mf																		
59	60	MzGr	5	1	0	mf																		
60	61	MzGr	5	1	1	Fr	0.5	1			80			3										
61	62	MzGr	5	1	1	J	0.5	1			50			3										
62	63	MzGr	5	1	3	J/Fr	1.5	2	1		40	10		1.5										
63	64	MzGr	5	1	2	mf	0.5	1			40			1.5										
64	65	MzGr	5	1	0	mf																		
65	66	MzGr	5	1	0	mf																		
66	67	MzGr	5	1	0	mf																		
67	68	MzGr	5	1	0	mf																		
68	69	MzGr	5	1	0	mf																		
69	70	MzGr	5	1	0	mf																		
70	71	MzGr	5	1	0	mf																		
71	72	MzGr	5	1	0	mf																		
72	73	MzGr	5	1	0	mf																		
73	74	MzGr	5	1	0	mf																		
74	75	MzGr	5	1	5	J	2	3	2		55	20		1.5/3										
75	76	MzGr	5	1	1	J	0.5	1			55			1.5										
76	77	MzGr	5	1	0	mf																		
77	78	MzGr	5	1	0	mf																		
78	79	MzGr	5	1	0	mf																		
79	80	MzGr	5	1	0	mf																		
80	81	MzGr	5	1	0	mf																		
81	82	MzGr	5	1	0	mf																		
82	83	MzGr	5	1	0	mf																		
83	84	MzGr	5	1	0	mf																		
84	85	MzGr	5	1	0	mf																		
85	86	MzGr	5	1	0	mf																		
86	87	MzGr	5	1	0	mf																		
87	88	MzGr	5	1	0	mf																		
88	89	MzGr	5	1	0	mf																		
89	90	MzGr	5	1	0	mf																		
90	91	MzGr	5	1	2	J	1	2			55			1.5										
91	92	MzGr	5	1	0	mf																		
92	93	MzGr	5	1	2	J	2	1	1		10	60		1.5/3										
93	94	MzGr	5	1	0	mf																		
94	95	MzGr	5	1	0	mf																		
95	96	MzGr	4.5	1	0	mf																		
96	97	MzSyGr	5	1	0	mf																		
97	98	MzSyGr	5	1	0	mf																		
98	99	SyGr	5	1	0	mf																		
99	100	SyGr	5	1	0	mf																		
100	101	SyGr	5	1	0	mf																		
101	102	MzSyGr	5	1	0	mf																		
102	103	MzGr	5	1	0	mf																		
103	104	MzGr	5	1	0	mf																		
104	105	MzGr	5	1	0	mf																		
105	106	MzGr	5	1	4	J	2	2	2		50	20		3										
106	107	MzGr	5	1	2	mf	1	2			25			1.5										
107	108	MzGr	5	1	0	mf																		
108	109	MzSyGr	5	1	0	mf																		
109	110	MzGr	5	1	0	mf																		
110	111	MzGr	5	1	0	mf																		
111	112	MzGr	5	1	0	mf																		
112	113	MzGr	5	1	0	mf																		
113	114	MzGr	5	1	0	mf																		
114	115	MzGr	5	1	1	Fr	0.5	1			20													
115	116	MzGr	5	1	0	mf																		
116	117	MzGr	5	1	0	mf																		
117	118	MzGr	5	1	0	mf																		
118	119	MzGr	5	1	0	mf																		
119	120	MzGr	5	1	0	mf																		

Project: Black Point
Drill Hole: BP-7
Date: Feb.28 - March 3

Picture ID/#	Core Box No.	Depth Interval		Comments
		From(m)	To(m)	
BP-7-P1	1	0.54	4.93	0 to 0.54 core loss
BP-7-P2	2	4.93	9.34	
BP-7-P3	3	9.34	13.71	
BP-7-P4	4	13.71	18.13	
BP-7-P5	5	18.13	22.56	
BP-7-P6	6	22.56	26.93	
BP-7-P7	7	26.93	31.35	
BP-7-P8	8	31.35	35.84	
BP-7-P9	9	35.84	40.14	
BP-7-P10	10	40.14	44.42	
BP-7-P11	11	44.42	48.81	
BP-7-P12	12	48.81	53.17	
BP-7-P13	13	53.17	57.59	
BP-7-P14	14	57.59	62	
BP-7-P15	15	62	66.39	
BP-7-P16	16	66.39	70.9	
BP-7-P17	17	70.9	75.16	
BP-7-P18	18	75.16	79.44	
BP-7-P19	19	79.44	83.91	
BP-7-P20	20	83.91	88.39	
BP-7-P21	21	88.39	92.68	
BP-7-P22	22	92.68	97.1	
BP-7-P23	23	97.1	101.46	
BP-7-P24	24	101.46	105.86	
BP-7-P25	25	105.86	110.22	
BP-7-P26	26	110.22	114.57	
BP-7-P27	27	114.57	119	
BP-7-P28	28	119	120	EOH

Drill Log Header Sheet

Hole: BP-8

Project	Black Point (6706)	Commenced	March.2 2014
Geologist	Peter Dalton, P.Geo.	Completed	March.4 2014
Designed By	Vulcan Materials	Drill Contractor	Logan Drilling Group
		Drill Rig	Duralite 1000N
		Drill Foreman	Andy McGinnis

Objective

Geological confirmation of the eastern portion of the projected Black Point granitic resource.

Location and Collar Detail

Datum	UTM NAD 83 Zone 20
Easting(m)	645658
Northing(m)	5023133
Elevation(m)	63
Azimuth	0
Dip°	-90
Depth(m)	108
Core Size	NQ
RQD Ave. %	95.30%
RQD % Range	78.5% to 100%
Recovery Ave. %	99.20%
Recovery % Range	82% to 100%
Significant Core loss	0-0.36m

Geological Summary

The lithology of BP-8 is dominated by a medium grained equigranular, micaceous syenogranite to potassic monzogranite. The granite has a pervasive weak to moderate foliation indicated by alignment of biotite and in some cases quartz clasts. Mineralogy consists of 50% (±10%) Feldspar, 40% (±5) Quartz and 7% (±5%) Biotite and ±3% Muscovite. The entire drill hole exhibits weak and selective chlorite alteration of the biotite. An oxidation zone occurs from 0-12m occurring as moderate to intense iron oxide staining associated along joint and fracture planes. Lithological variability within BP-8 occurs over two separate intervals: 20-21m and 34-39m; Both of these intervals represent zones of post crystalline, siliceous fluid flow within the granite body. These intervals are dominated by porphyritic textured quartz/feldspar breccia veins and stockworking. Breccia zone contacts with the syenogranite wall rock are abrupt at 50°CA. Abducted, angular clasts of wall rock and feldspar are visible within a aphanititc, siliceous quartz matrix suggesting a high energy emplacement. Vugs and cavities (3-9cm²) filled with euhedral quartz (1-3mm) associated with these intervals of breccia indicate high fugacity with this event. A pervasive low angle 10-30°CA vein and fracture set occurs throughout the entire hole represented by veins and fractures dominated by a combinations of ±quartz, ±chlorite alteration. Zones of intensified veining tend to exhibit orange iron oxide and limonite staining within vein salvage and joint planes suggesting oxidation of pyrite mineralization. Fresh pyrite mineralization (rare) was observed in trace concentrations along joint planes. Two zones of fault gouge were encountered between 93-95m. Granite from 95m to 108m(EOH) appears very fresh, hard and silicifed with minimal fracture/jointing.

Drill Core Recovery and RQD Sheet

Project: Black Point
Drill Hole: BP-8
Date: March.4 2014

From (m)	To (m)	Drilled (m)	Recieved (m)	Recovery (%)	RQD (m)	RQD (%)	Comments
0.36	2	2	1.64	82.0	1.57	78.5	RUN1 Box1 /Core Loss 0-0.36
2	5	3	3.11	103.7	2.72	90.7	RUN2 Box 1-2
5	8	3	3.09	103.0	3.09	103.0	RUN3 Box 2-3
8	11	3	3	100.0	2.88	96.0	RUN4 Box 3
11	14	3	2.96	98.7	2.21	73.7	RUN5 Box 3-4
14	17	3	3	100.0	2.93	97.7	RUN6 Box 4
17	20	3	3	100.0	2.7	90.0	RUN7 Box 4-5
20	23	3	2.96	98.7	2.81	93.7	RUN8 Box 5
23	26	3	3	100.0	2.92	97.3	RUN9 Box 6
26	29	3	3	100.0	2.69	89.7	RUN10 Box 7
29	32	3	3	100.0	2.86	95.3	RUN11 Box 7-8
32	35	3	3	100.0	2.97	99.0	RUN12 Box 8-9
35	38	3	3	100.0	2.85	95.0	RUN13 Box 9
38	41	3	3	100.0	2.9	96.7	RUN14 Box 10
41	44	3	3	100.0	2.95	98.3	RUN15 Box 10-11
44	47	3	3	100.0	3	100.0	RUN16 Box 11
47	50	3	2.95	98.3	2.95	98.3	RUN17 Box 12
50	53	3	2.95	98.3	2.95	98.3	RUN18 Box 12-13
53	56	3	3	100.0	3	100.0	RUN19 Box 13
56	59	3	3	100.0	2.93	97.7	RUN20 Box 13-14
59	62	3	3	100.0	3	100.0	RUN21 Box 14-15
62	65	3	3	100.0	3	100.0	RUN22 Box 15
65	68	3	3	100.0	3	100.0	RUN23 Box 15-16
68	71	3	3	100.0	3	100.0	RUN24 Box 17
71	74	3	3	100.0	3	100.0	RUN25 Box 17-18
74	77	3	2.98	99.3	2.9	96.7	RUN26 Box 18-19
77	80	3	2.96	98.7	2.96	98.7	RUN27 Box 19-20
80	83	3	3	100.0	2.95	98.3	RUN28 Box 20
83	86	3	3	100.0	2.95	98.3	RUN29 Box 19-20
86	89	3	3	100.0	3	100.0	RUN30 Box 21
89	92	3	3	100.0	2.15	71.7	RUN31 Box 21-22
92	95	3	3	100.0	2.33	77.7	RUN32 Box 22
95	98	3	2.92	97.3	3	100.0	RUN33 Box 22-23
98	101	3	3	100.0	3	100.0	RUN34 Box 23-24
101	104	3	3	100.0	2.92	97.3	RUN35 Box 24
104	107	3	3	100.0	3	100.0	RUN36 Box 24-25
107	108	1	1	100.0	1.06	106.0	RUN37 Box 25
	EOH						

PROJECT NAME:	Black Point (6706)	LITHOLOGICAL LOG		Collar Survey Data		CORE TYPE (Q)	LOGGING DETAILS
LICENSE INFORMATION:		ELEVATION:	63m °Lat	5023133 mN		(P / H / N / B)	LOGGED BY: P.Dalton
DRILL HOLE NUMBER: BP-8		AZM*:	0 *Long	645658 mE		: m	DATES:
DATE open: March.2 2014		DIP:	-90			% Average Recovery	PAGE: 1 of
DATE closed: March 4 2014		EOH:108m	Drilling Contractor: Logan Drilling Group	NAD 83 Zone 20		% Average RQD	SIGNED:

Description (Colour, Texture, Mineralogy, Structure etc.)	From	To	Code	Graphic	Grain Size	Foliation	Weather	Strength	Structure (J-Joint F-Fault, Bx-Breccia, Fr- fracture, Fx>10, FxS>20, mf-mechanical fracture)				Veining				Mineralization (v-vein, D- Disseminated, M-massive)			Alteration (P/V/S - 1,2,3)												Notes
																				Type				Occ.				Intensity						
	m	m			(F/M/C/P)	(Null/W/M/S)	W(1-6)	(R 0-6)	Type	F/m	α°		Type	mm	v/m	σ	Min.	Occ.	Intensity														
0-0.36; Core loss/ Equigranular 50% Plag, 40%Quartz, 10% Mica (Biotite Dominant)	0	1	MzSyGr		M	M	2ox	5	J	5	80	30								Chl	FeOx			S	P			1	1					
Moderate FeOx staining giving a slightly orange appearance	1	2	MzSyGr		M	M	2ox	5	J	5	20	50	90							Chl	FeOx			S	S			2	2					
	2	3	MzSyGr		M	M	2ox	4	Fr/J	12	10	90		QTZ	5	5	10-30			Chl	FeOx	Ser	Lim	S	P	P	P	1	2	2	2			
Pervasive 20-30° CA closed fractures sometimes quartz and or chlorite filled	3	4	MzSyGr		M	M	2ox	5	Fr/J	5	30	90		QTZ	1	5	20			Chl	FeOx			S	S			1	2					
>20 closed fractures 20° CA, Quartz/Chlorite filled veins (1-2mm veinlets). FeOx-MnOx staining	4	5	MzSyGr		M	M	2ox	5	Fr/J	15	30	90	30	QTZ	2	>20	20			Chl	FeOx			S/V	P			1	1					
Pervasive and intense Quartz veining 0-10° CA (1-5mm) clay and limonite alteration in Quartz vugs	5	6	MzSyGr		M	W	2ox	5	Fr/J	5				QTZ/CHL	5	>10	0-10			Chl	FeOx	Lim	Clay	S	S	S	S	1	1	1	2			
Intense 10-20° closed fractures and veins (Quartz-Chlorite). Intense FeOx staining of Feldspar	6	7	MzSyGr		M	W	1ox	5	Fr/J	5	70	10		QTZ/CHL	5	>10	10-20			Chl	FeOx			S/V	P			1	2					
7.5m; Quartz vein (5mm)	7	8	MzSyGr		M	Wm	1ox	5	Fr	3	70			QTZ	5	1	10-20			Chl	FeOx			S	P			1	2					
8.5m; Quartz Vein (3mm)	8	9	MzSyGr		M	Wm	1ox	5	J	3	80	35		QTZ	3	1	20			Chl				S/V				1						
	9	10	MzSyGr		M	Wm	1ox	5	J	5	80	50	20	QTZ/CHL	2	>10	20			Chl				S/V				1						
FeOx Staining on joint planes; Pervasive 20° CA closed fracture/veinlets	10	11	SyGr		M	Wm	1ox	5	J	4	80	10	20	QTZ/CHL	1	5	20			Chl	FeOx	Lim		S	P	P		1	2	2				
11.2m; Sheeted veinlets and closed fractures 80°CA; FeOx/limonite staining (oxidized pyrite); Fresh pyrite on joint plane	11	12	SyGr		M	Wm	1ox	5.5	J	6	80	20		QTZ/CHL	3	3	80	Pyrite	M	T	Chl	FeOx	Lim		S	P	P		1	2	2				
Pervasive closed fractures/ Quartz-Chlorite veinlets 20° CA.	12	13	SyGr		M	Wm	1	5.5	J	4	70	20		QTZ	5	>10	20			Chl	FeOx	Lim		S				1						
13.5m; Open cavity with euhedral quartz crystals. 13.5m; Open quartz-chlorite veins 10mm thick. Intense hematite and limonite staining associated with QTZ veining suggesting oxidized pyrite	13	14	SyGr		M	Wm	1	5.5	Fr/J	3	80			QTZ/CHL	10	1	20			Chl				S/V	S	S		1	1	1				
14.05m; trace pyrite on 20°CA joint surface. Rock is hard and silicified	14	15	SyGr		M	Wm	1	5.5	Fr/J	4	20	80		CHL	2	1	20	Pyrite	M	T	Chl				S/V				1						
	15	16	SyGr		M	Wm	1	5.5	Fr	1	90										Chl				S				1						
16.2m; Hematite vein (10mm) 90°CA. 16.7m; Hematite vein (3mm) 90°CA. 16.9m; Quartz-Chlorite vein 20°CA (Hematite staining vein salvage)	16	17	SyGr		M	Wm	1	5.5	Fr	2	90			HEM / QTZ-CHL	10-3 / 2	2 / 1	90 / 20				Chl	Hem			S	V			1	3					
17.9m; Quartz-Chlorite veinlets 20°CA	17	18	SyGr		M	W	1	5.5	Fr	3	90			QTZ-CHL	2	1	20				Chl				S/V				1						
18.2m; Quartz-Chlorite veinlets 20°CA	18	19	SyGr		M	W	1	5.5	Fr/J	1	80			QTZ-CHL	2	1	20				Chl				S/V				1						
19.1m and 19.6m; Quartz-Chlorite vein 30° (Heamitite staining halo around Veining) - 19.3m; Kspar phenocryts (rare)	19	20	SyGr		M	W	1	5.5	Fr/J	8	80			QTZ-CHL	2	1	30				Chl				S/V				1						
20.5m; Quartz-Chlorite veinlets with associated hemaitite staining; 20.9m to 21.25m Quartz-Kspar porphyritic breccia zone,	20	21	SyGr Bx		M	W	1	5.5	Fr	5											Chl	QTZ			S/V	P/V			2	2					
	21	22	SyGr		M	W	1	5.5	Fr/J	1	40										Chl				S				1						
	22	23	SyGr		M	W	1	5.5	Fr/J	3	50	20									Chl				S				1						
	23	24	SyGr		M	W	1	5.5	J	2	50										Chl				S				1						
24-24.3m; Quartz vein (2mm) 20°CA; 24.4m FeOx staining on 90°CA fracture	24	25	SyGr		M	W	1	5.5	Fr	2	90	10		QTZ	2	1	20				Chl				S				1						
	25	26	SyGr		M	W	1	5.5	J	5	70			QTZ	2	5	20				Chl				S				1						
	26	27	SyGr		M	Wm	1	5.5	J	3	60										Chl				S				1						
27-27.6m; Highly fractured zone stained hematitic	27	28	SyGr		M	Wm	1	5.5	Fr/J	4	50	20		QTZ	20	3	80/50/20				Chl	Clay	FeOx		S	P			1	2					
	28	29	SyGr		M	Wm	1	5.5	Fr/J	3	70			QTZ	3	1	40				Chl				S				1						
	29	30	SyGr		M	Wm	1	5.5	Fr/J	3	70			QTZ	2	2	30				Chl				S				1						
	30	31	SyGr		M	Wm	1	5.5	J	4	70	30		QTZ	5	2	30				Chl				S				1						
31.73m; Clay and Chlorite alteration on planer smooth 50°CA joint surfaces	31	32	SyGr		M	Wm	1	5.5	Fr/J	3	50	80									Chl	Clay			S	S			1	1					
Hematite staining halos around joint planes	32	33	SyGr		M	Wm	1	5.5	J	1	80										Chl				S				1						
Hematite stainig halos around joint planes	33	34	SyGr		M	Wm	1	5.5	J/Fr	2	30	70									Chl				S				1						
34-39m; Porphyritic textured Quartz-Feldspar breccia / stockwork zone 50° CA	34	35	SyGr Bx		M	Wm	1	5.5	Fr/J	3	30	70									Chl	QTZ			S	P			1	2					
	35	36	SyGr Bx		M	W	1	5.5	J/Fr	4	50	60	10								Chl	QTZ			S	P			2	2					
36.9m; 1.5x2cm cavity associated with quartz vein. Euhedral quartz crystal growth and chlorite alteration	36	37	SyGr Bx		M	W	1	5.5	J	2	70			QTZ-CHL	3	10	50				Chl	QTZ			S	P			2	2					
Abundant Quartz-Chlorite-clay cavities associated with breccia stockwork intervals	37	38	SyGr Bx		M	W	1	5.5	J	1	80										Chl				S				1						
Intense quartz-feldspar breccia stockwork. Angular wallrock fragments in breccia	38	39	SyGr Bx		M	W	1	5.5	Fr/J	5	80										Chl	QTZ			S	P			2	2					
	39	40	SyGr		M	W	1	5.5	Fr/J	4	30			QTZ	2	5	30				Chl				S				11						
	40	41	SyGr		M	W	1	5.5	J	2	60			QTZ-CHL	5	1	20				Chl				S				1						
	41	42	SyGr		M	W	1	5	J	2	40										Chl				S				1						
	42	43	SyGr		M	W	1	5	J	2	30										Chl				S				1						
	43	44	SyGr		M	W	1	5	J	1	30										Chl				S				1						
Mica fraction decrease to ≤5% combined. Plag25%, Kspar25%, Quartz45%, Biotite 2%, muscovite 3%	44	45	SyGr		M	Wm	1	5.5	J	4	3	70	40	QTZ	1	5	50				Chl				S/V				1						
45.65m; Coarse grained Kspar clasts is QTZ-CHL vein	45	46	SyGr		M	Wm	1	5.5	Fr	1				QTZ	1	5	20				Chl				S/V				1						
	46	47	SyGr		M	Wm	1	5.5	J	1	50										Chl				S				1						
Biotite increasing to 5-7% with rare Kspar phenocryts	47	48	SyGr		M	Wm	1	5.5	Fr	1											Chl				S				1						
	48	49	SyGr		M	Wm	1	5.5	J/Fr	2	70	30									Chl				S				1						
	49	50	SyGr		M	Wm	1	5.5	mf	0											Chl				S				1						
	50	51	SyGr		M	Wm	1	5.5	J	1	80										Chl				S				1						

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	51	52	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	J	1	80										Chl				S				1					
	52	53	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	mf	0											Chl				S				1					
Weakly porphyritic textureed with Kspar phenocryts 1cm²	53	54	SyGr	≈≈≈≈≈≈≈≈	M	Mw	1	5.5	mf	0											Chl				S				1					
Chlorite on joint surface	54	55	SyGr	≈≈≈≈≈≈≈≈	M	Mw	1	5.5	J	1	20			QTZ-CHL	1	2	20				Chl				S/V				1					
Rare, euhedral Kspar phenocryts	55	56	SyGr	≈≈≈≈≈≈≈≈	M	Mw	1	5.5	Fr/J	4	20	40	90								Chl				S				1					
Rare, euhedral Kspar phenocryts and Biotite clusters	56	57	SyGr	≈≈≈≈≈≈≈≈	M	Mw	1	5	Fr	6	10	80									Chl				S				1					
	57	58	SyGr	≈≈≈≈≈≈≈≈	M	Mw	1	5	Fr	3	80	10	70								Chl				S				1					
	58	59	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5	Fr	1	10										Chl				S				1					
	59	60	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5	Fr/J	3	70	20		QTZ-CHL	2	2	20				Chl				S				1					
Chlorite-Quartz veinlets and stockworking oriented 10-20°CA. 60.15m; Pyrite mineralization (weak) on 30°CA joint surface	60	61	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5	Fr/J	3	70	30		QTZ-CHL	<1	10	10-20	Pyrite	M	1	Chl				S/V				2					
Biotite decrease to 5%	61	62	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5	mf	0				QTZ-CHL	1	1	30				Chl				S				1					
	62	63	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl				S				1					
	63	64	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5	mf	0				CHL	<1	1	30				Chl				S				1					
	64	65	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5	mf	0				CHL	<1	7	30				Chl				S				1					
	65	66	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl				S				1					
	66	67	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5	J	2	60	30									Chl				S				1					
	67	68	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5	Fr/J	2	50	30									Chl				S				1					
Biotite 5-8%	68	69	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	J	1	40										Chl				S				1					
	69	70	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	Fr	1	30										Chl				S				1					
Becoming more monzogranitic	70	71	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	Fr	1	10										Chl				S				1					
71.1m; Biotite cluster 5 x 1cm	71	72	MzGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	J	1	30			QTZ	5	1	30				Chl				S				1					
	72	73	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	Fr/J	2	20	80									Chl				S				1					
	73	74	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	Fr/J	2	80	30									Chl				S				1					
	74	75	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	J	1	80										Chl				S				1					
Rare Kspar Phenocryts	75	76	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	mf	0											Chl				S				1					
	76	77	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	mf	0											Chl				S				1					
	77	78	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	J	4	80										Chl				S				1					
Mica 5%	78	79	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	Fr	1	40										Chl				S				1					
	79	80	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	J	1	70										Chl				S				1					
	80	81	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	Fr	1	90										Chl				S				1					
	81	82	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	mf	0											Chl				S				1					
	82	83	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	J	2	20	90									Chl				S				1					
	83	84	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	J/Fr	3	20	90	30	QTZ-CHL	2	1	0				Chl				S				1					
	84	85	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	J	3	50	90									Chl				S				1					
85.5m; Biotite cluster 1cm²	85	86	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	J	1	30										Chl				S				1					
	86	87	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	Fr/J	3	50	20									Chl				S				1					
	87	88	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	Fr	1	10			QTZ	3	1	10				Chl				S				1					
	88	89	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	J	1	50										Chl				S				1					
	89	90	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	J	5	70	30									Chl				S				1					
Nearing Fault	90	91	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	Fr/J	7	70	30									Chl	Clay			S	S			1	2				
Nearing Fault	91	92	SyGr	≈≈≈≈≈≈≈≈	M	M	2	5.5	Fr/J	14	50	30									Chl	Clay			S	S			1	2				
	92	93	SyGr	≈≈≈≈≈≈≈≈	M	M	2	5	Fr	10	50	10									Chl	Clay			P	P			2	2				
93.25-93.57 Fault Gouge	93	94	SyGr FG	≈≈≈≈≈≈≈≈	M	M	3	3-5	F	>20	40										Chl	Clay			P	P			3	3				
94.17-94.2 Fault Gouge	94	95	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5	Fr/F	1	70										Chl	Clay			S	S			2	2				
95-108m; Granite appears very fresh and hard, silicified. Mica ≤5%	95	96	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	mf	0																								
	96	97	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	mf	0																								
	97	98	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	mf	0																								
	98	99	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	J	1	40																							
	99	100	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	J/Fr	3	50	70	10	CHL	2	1	10				Chl				V				1					
	100	101	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	Fr	2	70			CHL-QTZ	2	4	20				Chl	Qtz			V	V			1	1				
	101	102	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	J	1	50			CHL-QTZ	2	1	10				Chl	Qtz			V	V			1	1				
	102	103	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	J	1	50																							
	103	104	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	J	2	50	70		CHL	≤1	5	20				Chl													
	104	105	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	mf	0				CHL-QTZ	3	1	40				Chl	Qtz			V	V			1	1				
	105	106	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	Fr/J	3	50	20	50	CHL	1	3	20				Chl								1					
	106	107	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	mf	0																								
	107	108	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	J	2	60	40																						
EOH	EOH	EOH																																

PROJECT NAME:	Black Point (6706)						GEOTECHNICAL LOG					Collar Survey Data					LOGGING DETAILS	
LICENSE INFORMATION:							ELEVATION:	63m						°Lat	5023133 mN		LOGGED BY: P. Dalton	
DRILL HOLE:	BP-8						AZM°: 000							°Long	0645658 mE		DATES:	Mar.4 - Mar.8 2014
DATE COLLARED:	March 2 2014						DIP: -90								NAD 83 Zone 20		PAGE:	of
DATE COMPLETED:	March 4 2014						EOH: 108m				Drilling Contractor		Logan Drilling Group				SIGNED:	

From	To		Rock Strength	Weathering	Total Fracture	Fracture Type	Jointing										Comments
		Rock Type					J set	λ/m	λ/m	λ/m	α°	α°	α°	J roughness	Infill/Cement		
m	m	Litho Code	R(0-6)	(1-6)	(/m)		0.5-20	set1	set2	set3	set1	set2	set3	0.5-5	Comp.	Width (mm	Strength (0-2)	
0	1	MzSyGr	5	2ox	5	J	2	2	3		80	30		3/1.5				0-0.36m core loss
1	2	MzSyGr	5	2ox	5	J	3	2	1	2	20	50	90	3/1.5/3				
2	3	MzSyGr	4	2ox	12	Fr/J	2	3	7		10	90		1.5/3				Highly fractured and broken core. FeOx/MnOx staining
3	4	MzSyGr	5	2ox	5	Fr/J	2	3	2		30	90		1.5/1.5				
4	5	MzSyGr	5	2ox	15	Fr/J	0.5	2	3	>10	30	90	30	1.5				>10 closed fractures
5	6	MzSyGr	5	2ox	5	Fr/J	2	2	3		30	80		1.5				
6	7	MzSyGr	5	1ox	5	Fr/J	1.5	4	1		70	10		3/1.5				
7	8	MzSyGr	5	1ox	3	Fr	1	3			70			1.5				closed fracture 10°CA
8	9	MzSyGr	5	1ox	3	J	2	2	1		80	35		1.5				
9	10	MzSyGr	5	1ox	5	J	3	2	1	1	80	50	20	1.5				
10	11	SyGr	5	1ox	4	J	3	2	1	1	80	10	20	1.5				
11	12	SyGr	5.5	1ox	6	J	2	5	1		80	20		1.5-1				
12	13	SyGr	5.5	1	4	J	2	3	1		70	20		3				
13	14	SyGr	5.5	1	3	Fr/J	1	3			80			1.5				
14	15	SyGr	5.5	1	4	Fr/J	2	2	2		20	80		3				
15	16	SyGr	5.5	1	1	Fr	0.5	1			90			3				
16	17	SyGr	5.5	1	2	Fr	0.5	2			90			3				
17	18	SyGr	5.5	1	3	Fr	0.5	3			90			3				
18	19	SyGr	5.5	1	1	Fr/J	1	1			80			1.5				
19	20	SyGr	5.5	1	8	Fr/J	1	3	4	1	80	30	70	1.5				
20	21	SyGr8x	5.5	1	5	Fr	1	5			70			1.5				
21	22	SyGr	5.5	1	1	Fr/J	0.5	1			40			3				
22	23	SyGr	5.5	1	3	Fr/J	1	2	1		50	20		1.5				
23	24	SyGr	5.5	1	2	J	1	2			50			1.5				
24	25	SyGr	5.5	1	2	Fr	0.5	1	1		90	10		3				
25	26	SyGr	5.5	1	5	J	1	5			70			1.5				
26	27	SyGr	5.5	1	3	J	1	3			60			3				
27	28	SyGr	5.5	1	4	Fr/J	2	2	2		50	20		1.5				All fractures occur from 27.0-27.6m
28	29	SyGr	5.5	1	3	Fr/J	1	3			70			1.5				
29	30	SyGr	5.5	1	3	Fr/J	1	3			70			3				
30	31	SyGr	5.5	1	4	J	2	3	1		70	30		3/1.5				
31	32	SyGr	5.5	1	3	Fr/J	2	2	1		50	80		1/3				
32	33	SyGr	5.5	1	1	J	0.5	1			80			3				
33	34	SyGr	5.5	1	2	J/Fr	0.5	1	1		30	70		1.5				
34	35	SyGr8x	5.5	1	3	Fr/J	2	2	1		30	70		3/1.5				
35	36	SyGr8x	5.5	1	4	J/Fr	1	3	1		50	60	10	3				
36	37	SyGr8x	5.5	1	2	J	1	2			70			3				
37	38	SyGr8x	5.5	1	1	J	0.5	1			80			3				
38	39	SyGr8x	5.5	1	5	Fr/J	0.5	5			80			1.5				
39	40	SyGr	5.5	1	4	Fr/J	1.5	2	2		30	80		1.5				
40	41	SyGr	5.5	1	2	J	1	2			60			1.5				
41	42	SyGr	5	1	2	J	1	2			40			3				
42	43	SyGr	5	1	2	J	1	2			30			1.5				
43	44	SyGr	5	1	1	J	0.1	1			30			3				
44	45	SyGr	5.5	1	4	J	1	3	1		70	40		3				
45	46	SyGr	5.5	1	1	Fr	1				90			1.5				
46	47	SyGr	5.5	1	1	J	0.5	1			50			3				
47	48	SyGr	5.5	1	1	Fr	0.5	1			80			3				
48	49	SyGr	5.5	1	2	J/Fr	0.5	1	1		70	30		3				
49	50	SyGr	5.5	1	0	mf								1.5				
50	51	SyGr	5.5	1	1	J	0.5	1			80			1.5				
51	52	SyGr	5.5	1	1	J	0.5	1			80			1.5				
52	53	SyGr	5.5	1	0	mf												
53	54	SyGr	5.5	1	0	mf								1.5				
54	55	SyGr	5.5	1	1	J	0.5	1			20			1.5				
55	56	SyGr	5.5	1	4	Fr/J	0.5	2	1	1	20	40	90	1.5				
56	57	SyGr	5	1	6	Fr	2	2	4		10	80		1.5				Low angle fracturing
57	58	SyGr	5	1	3	Fr	0.5	1	1	1	80	10	70	3				
58	59	SyGr	5	1	1	Fr	0.5	1			10			3				

59	60	SyGr	5	1	3	Fr/J	1	2	1		70	20		3															
60	61	SyGr	5	1	3	Fr/J	1	2	1		70	30		3															
61	62	SyGr	5	1	0	mf																							
62	63	SyGr	5	1	0	mf																							
63	64	SyGr	5	1	0	mf																							
64	65	SyGr	5	1	0	mf																							
65	66	SyGr	5	1	0	mf								1.5															
66	67	SyGr	5	1	2	J	0.5	1	1		60	30		1.5															
67	68	SyGr	5	1	2	Fr/J	0.5	1	1		50	30		1.5															
68	69	SyGr	5.5	1	1	J	0.5	1			40			3															
69	70	SyGr	5.5	1	1	Fr	0.5				30			3															
70	71	SyGr	5.5	1	1	Fr	0.5	1			10			1															
71	72	MzGr	5.5	1	1	J	0.5	1			30			3															Smooth joint surface along quartz vein
72	73	SyGr	5.5	1	2	Fr/J	0.5	1	1		20	80		1.5															
73	74	SyGr	5.5	1	2	Fr/J	0.5	1	1		80	30		1.5															
74	75	SyGr	5.5	1	1	J	0.5	1			80			1.5															
75	76	SyGr	5.5	1	0	mf																							
76	77	SyGr	5.5	1	0	mf																							
77	78	SyGr	5.5	1	4	J	1	4			80			1.5															
78	79	SyGr	5.5	1	1	Fr	0.5		1		40			3															
79	80	SyGr	5.5	1	1	J	0.5	1			70			3															
80	81	SyGr	5.5	1	1	Fr	0.5	1			90			3															
81	82	SyGr	5.5	1	0	mf																							
82	83	SyGr	5.5	1	2	J	0.5	1	1		20	90		1.5															
83	84	SyGr	5.5	1	3	J/Fr	0.5	1	1	1	20	90	30	1.5															
84	85	SyGr	5.5	1	3	J	1	2	1		50	90		1.5															
85	86	SyGr	5.5	1	1	J	0.5	1			30			1.5															
86	87	SyGr	5.5	1	3	Fr/J	1	2	1		50	20		1.5															
87	88	SyGr	5.5	1	1	Fr	1	1			10			1.5															
88	89	SyGr	5.5	1	1	J	0.5	1			50			3															
89	90	SyGr	5.5	1	5	J	2	4	1		70	30		1.5															
90	91	SyGr	5.5	1	7	Fr/J	2	5	2		70	30		3															
91	92	SyGr	5.5	2	14	Fr/J	1	12	2		50	30		3															
92	93	SyGr	5	2	10	Fr	0.5	10			50	10		3															
93	94	SyGr FG	3-5	3	>20	F	0.5	20			40	90		3															Fault Gouge
94	95	SyGr	5	1	1	Fr/F	0.5	1			70			1.5															
95	96	SyGr	5.5	1	0	mf																							
96	97	SyGr	5.5	1	0	mf																							
97	98	SyGr	5.5	1	0	mf																							
98	99	SyGr	5.5	1	1	J	0.5	1			40			1.5															
99	100	SyGr	5.5	1	3	J/Fr	0.5	1	1	1	50	70	10	1.5															
100	101	SyGr	5.5	1	2	Fr	0.5	2			70			3															
101	102	SyGr	5.5	1	1	J	0.5	1			50			1.5															
102	103	SyGr	5.5	1	1	J	0.5	1			50			1.5															
103	104	SyGr	5.5	1	2	J	0.5	1	1		50	70		1.5															
104	105	SyGr	5.5	1	0	mf																							
105	106	SyGr	5.5	1	3	Fr/J	0.5	1	1	1	90	20	50	3/1.5															
106	107	SyGr	5.5	1	0	mf																							
107	108	SyGr	5.5	1	2	J	0.5	1	1		60	40		3															
	EOH																												

Project: Black Point
Drill Hole: BP-8
Date: March 5- 8 2014

Picture ID/#	Core Box No.	Depth Interval		Comments
		From(m)	To(m)	
BP-8-P1	1	0.36	4.63	0-0.36m core loss
BP-8-P2	2	4.63	8.66	
BP-8-P3	3	8.66	13	
BP-8-P4	4	13	17.29	
BP-8-P5	5	17.29	21.48	
BP-8-P6	6	21.48	25.96	
BP-8-P7	7	25.96	30.3	
BP-8-P8	8	30.3	34.74	
BP-8-P9	9	34.74	39.04	
BP-8-P10	10	39.04	43.54	
BP-8-P11	11	43.54	47.76	
BP-8-P12	12	47.76	52.32	
BP-8-P13	13	52.32	56.6	
BP-8-P14	14	56.6	60.96	
BP-8-P15	15	60.96	65.24	
BP-8-P16	16	65.24	69.61	
BP-8-P17	17	69.61	73.87	
BP-8-P18	18	73.87	78.18	
BP-8-P19	19	78.18	82.55	
BP-8-P20	20	82.55	86.72	
BP-8-P21	21	86.72	91.18	
BP-8-P22	22	91.18	95.28	
BP-8-P23	23	95.28	99.85	
BP-8-P24	24	99.85	104.13	
BP-8-P25	25	104.13	108	EOH

Drill Log Header Sheet

Hole: BP-9

Project	Black Point (6706)	Commenced	March.6 2014
Geologist	Peter Dalton, P.Geo.	Completed	March.8 2014
Designed By	Vulcan Materials	Drill Contractor	Logan Drilling Group
		Drill Rig	Duralite 1000N
		Drill Foreman	Andy McGinnis

Objective

Geological confirmation of the northwest portion of the projected Black Point granitic resource.

Location and Collar Detail

Datum	UTM NAD 83 Zone 20
Easting(m)	644665
Northing(m)	5023542
Elevation(m)	84
Azimuth	0
Dip°	-90
Depth(m)	130.13
Core Size	NQ
RQD Ave. %	96.80%
RQD % Range	47% - 100%
Recovery Ave. %	98.70%
Recovery % Range	57% - 100%
Significant Core loss	0-0.8 m

Geological Summary

The lithology of BP-9 is dominated by a medium grained equigranular, micaceous syenogranite to potassic monzogranite. The granite has a pervasive weak to moderate foliation indicated by alignment of biotite. Mineralogy consists of 50% (±10%) Feldspar, 40% (±5) Quartz and 7% (±5%) Biotite and ±3% Muscovite. The entire drill hole exhibits weak and selective chlorite alteration of biotite. Lithological variability within BP-9 occurs over two separate intervals: 9-11m and 27-30m; Both of these intervals represent zones of highly silicified quartz-chlorite-feldspar porphyritic breccia (60-70% quartz and feldspar phenocryts within an aphanitic quartz and chlorite matrix). Reoccurring low angle 5-30°CA vein and fracture sets dominated by combinations of ±quartz, ±chlorite alteration exist throughout the entire hole. The presence of iron oxide and limonite on various joint and fracture planes indicate the presence of oxidized pyrite. Rare, trace to weak intensity fresh pyrite mineralization was observed on various joint planes. Fault gouge was encountered between 20.32-20.72m. Granite from 102m to 130m(EOH) exhibits minimal fracture/jointing.

Drill Core Recovery and RQD Sheet

Project: Black Point
Drill Hole: BP-9
Date: March.9 2014

From (m)	To (m)	Drilled (m)	Recieved (m)	Recovery (%)	RQD (m)	RQD (%)	Comments
0	2	2	1.14	57.0	0.94	47.0	RUN1 Box1/ 0-0.8m Core Loss
2	5	3	3	100.0	3	100.0	RUN2 Box 1
5	8	3	2.93	97.7	2.64	88.0	RUN3 Box 2
8	11	3	2.97	99.0	2.92	97.3	RUN4 Box 2-3
11	14	3	3	100.0	2.9	96.7	RUN5 Box 3-4
14	17	3	3	100.0	2.76	92.0	RUN6 Box 4
17	20	3	3	100.0	2.83	94.3	RUN7 Box 4-5
20	23	3	2.97	99.0	2.47	82.3	RUN8 Box 5-6
23	26	3	3	100.0	2.8	93.3	RUN9 Box 6
26	29	3	3	100.0	3	100.0	RUN10 Box 6-7
29	32	3	3	100.0	3	100.0	RUN11 Box 7-8
32	35	3	3	100.0	3	100.0	RUN12 Box 8
35	38	3	3	100.0	3	100.0	RUN13 Box 9
38	41	3	3	100.0	2.91	97.0	RUN14 Box 9-10
41	44	3	3	100.0	3	100.0	RUN15 Box 10-11
44	47	3	3	100.0	2.93	97.7	RUN16 Box 11
47	50	3	3	100.0	3	100.0	RUN17 Box 11-12
50	53	3	3	100.0	2.98	99.3	RUN18 Box 12
53	56	3	2.96	98.7	2.96	98.7	RUN19 Box 13
56	59	3	3	100.0	3	100.0	RUN20 Box 13-14
59	62	3	3	100.0	3	100.0	RUN21 Box 14-15
62	65	3	3	100.0	3	100.0	RUN22 Box 15
65	68	3	3	100.0	2.9	96.7	RUN23 Box 15-16
68	71	3	3.08	102.7	3.08	102.7	RUN24 Box 16-17
71	74	3	3.06	102.0	2.86	95.3	RUN25 Box 17
74	77	3	2.95	98.3	2.95	98.3	RUN26 Box 18
77	80	3	2.96	98.7	2.93	97.7	RUN27 Box 18-19
80	83	3	3.12	104.0	3.12	104.0	RUN28 Box 19
83	86	3	2.95	98.3	2.95	98.3	RUN29 Box 20
86	89	3	3	100.0	2.9	96.7	RUN30 Box 20-21
89	92	3	3	100.0	2.65	88.3	RUN31 Box 21-22
92	95	3	3	100.0	3	100.0	RUN32 Box 22
95	98	3	3	100.0	2.92	97.3	RUN33 Box 22-23
98	101	3	2.95	98.3	2.95	98.3	RUN34 Box 23-24
101	104	3	3	100.0	2.89	96.3	RUN35 Box 24
104	107	3	3	100.0	3	100.0	RUN36 Box 25
107	110	3	3	100.0	3	100.0	RUN37 Box 25-26
110	113	3	3	100.0	3	100.0	RUN38 Box 26-27
113	116	3	3	100.0	3	100.0	RUN39 Box 27
116	119	3	2.95	98.3	2.95	98.3	RUN40 Box 27-28
119	122	3	2.96	98.7	2.96	98.7	RUN41 Box 28
122	125	3	3.05	101.7	3.05	101.7	RUN42 Box 29
125	128	3	3	100.0	3	100.0	RUN43 Box 29-30
128	130.13	2	2.13	106.5	2.13	106.5	RUN44 Box 30
EOH	EOH						

PROJECT NAME:	Black Point (6706)	LITHOLOGICAL LOG		Collar Survey Data		CORE TYPE (Q)	LOGGING DETAILS
LICENSE INFORMATION:		ELEVATION:	84m *Lat	5023133 mN		(P / H / N / B)	LOGGED BY: P.Dalton
DRILL HOLE NUMBER:	BP-9	AZM*:	0 *Long	645658 mE		: m	DATES:
DATE open:	March.6 2014	DIP:	-90			% Average Recovery	PAGE: 1 of
DATE closed:	March.8 2014	EOH:130m	Drilling Contractor: Logan Drilling Group	NAD 83 Zone 20		% Average RQD	SIGNED:

Description	From	To	Code	Graphic	Grain Size	Foliation	Weather	Strength	Structure (J-Joint F-Fault, Bx-Breccia, Fr- fracture, Fs>10, FxS>20, mf-mechanical fracture)				Veining				Mineralization (v-vein, D- Disseminated, M-massive)			Alteration (P/V/S - 1,2,3)										Notes
(Colour, Texture, Mineralogy, Structure etc.)	m	m			(F/M/C/P)	(Null/W/M/S)	W(1-6)	(R 0-6)	Type	F/m	α°		Type	mm	v/m	Ơ	Min.	Occ.	Intensity	Type				Occ.				Intensity			
0-0.8m; Core loss	0	2	SyGr	=======	M	Wm	2	5	Fr	4	10	80	CHL	1	1	10				CHL	FeOx			S	S			1			
Syenogranite, equigranular: 40% Kspar, 40% Quartz, 10% Plag, 10% Mica (biotite dominant. FeOx staining on	2	3	SyGr	=======	M	Wm	1	5	Fr/J	5	80	10								CHL	FeOx			S	S			1	1		
	3	4	SyGr	=======	M	Wm	1	5	J	1	10									CHL				S				1			
rare Kspar phenocryts	4	5	SyGr	=======	M	Wm	1	5	Fr	1	80		CHL	1	1	10				CHL				S/V				1			
5.35m; Quartz-Feldspar breccia vein 5°CA. Oxidized pyrite (FeOx and Limonite) on fracture surfaces.	5	6	SyGr	=======	M	Wm	1	5	Fr/J	7	80	5	CHL-QTZ	5	1	5				CHL	FeOx	Lim		S	S	S		1	1	1	
FeOx on fracture Surface	6	7	SyGr	=======	M	Wm	1	5	Fr	3	80	60	10	CHL	1	6	5-10				CHL				S/V				1			
FeOx on fracture Surface	7	8	SyGr	=======	M	Wm	1	5	J	3	20	80		CHL	2	3	5-10				CHL	FeOx	Lim	Ser	S	S	s		1	2	2	2
Chlorite veinlets and fracture fill 10°CA	8	9	SyGr	=======	M	Wm			J	4	30	10		CHL	1	6	10				CHL				S				1			
9.0m; 20°CA joint marks transition to new lithology (QTZ-CHL-Feldspar Breccia) Porphyritic texture	9	10	Bx	XXXXXXXX	M	Wm	1	5	J	5										CHL	Qtz			P	P			2	3		
	10	11	Bx	XXXXXXXX	Fm	null	1	5	Fr/J	1	30									CHL	Qtz			P	P			2	3		
Mica ≤ 5% (Chloritized biotite)	11	12	SyGr	=======	Fm	null	1	5	J	1	70		CHL	2	3	0				CHL				P				2			
	12	13	SyGr	=======	M	W	1	5	Fr	3	80	30	CHL	2	5	20				CHL				P				2			
	13	14	SyGr	=======	M	W	1	5	J	2	30		CHL	1	3	20				CHL				P/V				1			
	14	15	SyGr	=======	M	W	1	5	Fr	7	80	50	QTZ	1	1	0				CHL				S				1			
	15	16	SyGr	=======	M	W	1	5	J	3	80	5								CHL				S				1			
	16	17	SyGr	=======	M	W	1	5	J/Fr	3	50	10	30	QTZ-CHL	20	1	30				CHL				P				2			
	17	18	SyGr	=======	M	W	1	5	Fr	0				QTZ	2	1	20				CHL				S				1			
	18	19	SyGr	=======	M	Wm	1	5	J	1	40			CHL	1	2	20				CHL				S/V				2			
19.15m-19.2m; QTZ-Feldspar Breccia. FeOx, Sericite on fracture Surface	19	20	SyGr	=======	M	Wm	1	5	J	5	30	70	5							CHL	Qtz			P	P			2	2		
20.32m-20.72m; Fault Zone rubble, surfacesof rubble are smooth and slick. FeOx on Fracture Surfaces	20	21	SyGr	=======	M	Wm	1	5	Fr/J	>20	10	90	FxS							CHL	FeOx			S	S			2	2		
FeOx and Sericite on Fracture Surfaces	21	22	SyGr	=======	M	Wm	1	5	J	5	60	80		CHL	2	1	10				CHL	FeOx	Ser		S	S			1	1	1	
Prone to fracture on 20°-30° CA Plane.	22	23	SyGr	=======	M	Wm	1	5	J	6	60	70	30	CHL	1	2	30				CHL				S				1			
	23	24	SyGr	=======	M	Wm	1	5	J	2	60	20								CHL				S				1			
24.63m-24.84m Fault rubble	24	25	SyGr	=======	M	Wm	1	5	J/Fr	>20	80	20	Fx							CHL	FeOx	Ser		S	S			1	2	1	
	25	26	SyGr	=======	M	Wm	1	5	Fr/J	6	80	5								CHL	FeOx			S	S			1	1		
26.45m-30.6m; Abundant low angle (0-5°CA) closed fracturing: Chlorite, FeOx and silicified	26	27	SyGr	=======	M	Wm	1	5	J/Fr	4	80	5								CHL	Qtz	FeOx		P	P	P		2	2	2	
	27	28	Bx	XXXXXXXX	M	Null	1	5	Fr	5	10	70		QTZ-CHL	<1	>10	5				CHL	FeOx	Qtz		P	P	P		2	2	2	
Trace pyrite on 5-10°CA fracture surface	28	29	Bx	XXXXXXXX	M	Null	1	5	Fr	3	10	5					Pyrite	M	Trace	CHL	FeOx	Qtz		P	P	P		2	2	2	
Quartz-Chlorite veinlet stockworking and breccia	29	30	Bx	XXXXXXXX	M	W	1	5	Fr/J	4	70	90		QTZ-CHL	5	3	10				CHL	Qtz			P/V	P/V			2	2		
30.0m-30.45m; Chlorite veinlets	30	31	SyGr	=======	M	W	1	5	J	2	90	40		CHL	<1	4	40				CHL				S/V				1			
	31	32	SyGr	=======	M	W	1	5		2				CHL	<1	2	0				CHL				S				1			
	32	33	SyGr	=======	M	W	1	5		0				CHL	2	2	0				CHL				S				1			
	33	34	SyGr	=======	M	W	1	5	J	4	30	90								CHL				S				1			
	34	35	SyGr	=======	M	W	1	5		0										CHL				S				1			
	35	36	SyGr	=======	M	W	1	5	Fr/J	5	40	3		QTZ	2	1	5				CHL				S				1			
	36	37	SyGr	=======	M	Wnull	1	5	J/Fr	3	40	5		QTZ-CHL	3	1	10				CHL	Qtz			S/V	V			1			
	37	38	SyGr	=======	M	Wnull	1	5	J/Fr	3	40	5		QTZ-CHL	2	2	5				CHL	Qtz			S/V	V			2	2		
	38	39	SyGr	=======	M	Wnull	1	5	J/Fr	4	80	20		QTZ-CHL	1	2	5				CHL	Qtz			S/V	V			2	2		
	39	40	SyGr	=======	M	Wnull	1	5	J/Fr	5	40	80		QTZ-CHL	2	4	0				CHL	Qtz			S/V	V			2	2		
40.15m; Quartz-Chlorite breccia and stockworking veins	40	41	SyGr	=======	M	Wnull	1	5	Fr/J	2	40	80		QTZ-CHL	15	1	30				CHL	Qtz			S/V	V			2	2		
41.5m; becoming slightly monzogranitic	41	42	SyGr	=======	M	Wnull	1	5	Fr/J	1	20									CHL				S				1			
	42	43	SyGr	=======	M	W	1	5	J	1	30									CHL				S				1			
	43	44	SyGr	=======	M	W	1	5	J	1	5									CHL				S				1			
	44	45	SyGr	=======	M	W	1	5	Fr	2	60	40								CHL				S				1			
	45	46	SyGr	=======	M	W	1	5	J/Fr	2	40									CHL				S				1			
	46	47	SyGr	=======	M	W	1	5	J	1	40									CHL				S				1			
Monzogranitic with orange FeOx with pervasive FeOx staining	47	48	MzGr	=======	M	W	1	5	J/Fr	4	60	5	90	QTZ-CHL	6	1	5				CHL				S				1			
	48	49	MzGr	=======	M	W	1	5	Fr/J	2	90	10								CHL				S				1			
	49	50	MzGr	=======	M	W	1	5	J	1	60									CHL				S				1			
	50	51	SyGr	=======	M	W	1	5	J	2	90									CHL				S				1			
51.8m; Schistous xenolith 1cm x 4cm coincident with 90°CA joint	51	52	SyGr	=======	M	W	1	5	J	1	90									CHL				S				1			
small (1-3cm long) discontinuous chlorite veinlets	52	53	SyGr	=======	M	W	1	5		0				CHL	1	5	0				CHL				S				1			
	53	54	SyGr	=======	M	W	1	5		0										CHL				S				1			
	54	55	SyGr	=======	M	Wm	1	5		0										CHL				S				1			
	55	56	SyGr	=======	M	Wm	1	5	J	1	20									CHL				S				1			
	56	57	SyGr	=======	M	Wm	1	5	J	2	20									CHL				S				1			
57.7m; Transition to monzogranite	57	58	SyMzGr	=======	M	Wm	1	5	J	4	40	60	90							CHL				S				1			
58.5m; FeOx staining on 90°CA Joint Plane	58	59	MzGr	=======	M	Wm	1	5	J	3	90	20	50							CHL				S				1			
	59	60	SyGr	=======	M	Wm	1	5	J	3	30									CHL				S				1			
	60	61	SyGr	=======	M	W	1	5		0										CHL				S				1			
	61	62	SyGr	=======	M	W	1	5	J	4	40	80	70							CHL				S				1			
	62	63	SyGr	=======	M	W	1	5	J	1	20									CHL				S				1			
	63	64	SyGr	=======	M	Wm	1	5	J	2	20			CHL	2	1	0				CHL				S/V				1			
	64	65	SyGr	=======	M	Wm	1	5	J	1	80			CHL	2	1	0				CHL				S/V				1			
FeOx/Sericite on joint planes	65	66	SyGr	=======	M	Wm	1	5	J	7	20	90	60	QTZ-CHL	3	1	40				CHL	FeOx	Ser		S	S	S		1	1	1	
rare Kspar phenocryts, 66.95m; Quartz phenocryts 1cm²	66	67	SyGr	=======	M	Wm	1	5	J	2	70	30								CHL				S				1			
67.4-71m; Abundant Kspar, potassic	67	68	SyGr	=======	M	Wm	1	5	J	2	70			QTZ-CHL	2	1	30				CHL				S				1			
68.44m; Biotite cluster 3cm x 1cm	68	69	SyGr	=======	M	Wm	1	5	J	2	70									CHL				S				1			
	69	70	SyGr	=======	M	Wm	1	5	J	2	40	30								CHL				S				1			
	70	71	SyGr	=======	M	Wm	1	5	J	1	60			QTZ-CHL	3	2	40				CHL				S				1			
	71	72	SyGr	=======	M	Wm	1	5	J	3	20	60		CHL	<1	2	30				CHL				S				1			
	72	73	SyGr	=======	M	Wm	1	5		4				CHL	<1	2	30				CHL				S				1			
	73	74	SyGr	=======	M	Wm	1	5		0				QTZ	3	1	30				CHL				S				1			
	74	75	SyGr	=======	M	Wm	1	5		0										CHL				S				1			
	75	76	SyGr	=======	M	Wm	1	5		0				QTZ-CHL	1	1	20				CHL				S				1			
Biotite clusters 1cm² @ 76.35, 76.50 and 76.70m	76	77	SyGr	=======	M	Wm	1	5		0										CHL				S				1			
	77	78	SyGr	=======	M	Wm	1	5	Fr	2	5	90								CHL				S				1			
	78	79	SyGr	=======	M	Wm	1	5		0										CHL				S				1			
	79	80	SyGr	=======	M	Wm	1	5	J	2	90									CHL				S				1			
Monzogranititc	80	81	MzGr	=======	M	Wm	1	5	J	2	20									CHL				S				1			
	81	82	MzGr	=======	M	Wm	1	5	J	1	40									CHL				S				1			
FeOx and Sericite on 40° CA joint plane	82	83	MzGr	=======	M	Wm	1	5	J	4	20	40								CHL	FeOx	Ser		S	S	S		1	1	1	
83.72m; Biotite cluster 1cm²	83	84	MzSyGr	=======	M	Wm	1	5	J	1	60									CHL				S				1			
84.8m; Biotite Cluster 1cm²	84	85	MzGr	=======	M	Wm	1	5	J	2	10	80								CHL				S				1			
Trace pyrite on 20°CA joint plane surface	85	86	MzGr	=======	M	Wm	1	5	J	1	20						Pyrite	M	trace	CHL				S				1			
Trace pyrite on 10° CA joint plane surface, Mica 3%	86	87	MzGr	=======	M	Wm	1	5	J	7	10	40	20				Pyrite	M	trace	CHL				S				1			
	87	88	MzGr	=======	M	Wm	1	5	J	4	80	20								CHL				S				1			

C 1340-856

88.5m; Xenolith 2cm x 2cm	88	89	MzSyGr	########	M	Wm	1	5	J	3	40	80									CHL				S				1				
	89	90	SyGr	########	M	Wm	1	5	Fr/J	6	20	80	40								CHL				S				1				
	90	91	SyGr	########	M	Wm	1	5	J	4	90										CHL				S				1				
	91	92	SyGr	########	M	Wm	1	5	J	6	80										CHL				S				1				
	92	93	SyGr	########	M	Wm	1	5	J	1	50										CHL				S				1				
	93	94	SyGr	########	M	Wm	1	5	J	3	40	30		CHL	<1	2	50				CHL				S				1				
94.3m, 94.94; Biotite Cluster 1cm²	94	95	SyGr	########	M	Wm	1	5	J	3	50	70									CHL				S				1				
	95	96	SyGr	########	M	Wm	1	5	J	5	50	20		CHL	<1	6	50				CHL				S/V				1				
	96	97	SyGr	########	M	Wm	1	5		3	30			CHL	<1	7	30				CHL				S/V				1				
	97	98	SyGr	########	M	Wm	1	5		4	20	50	90	CHL	1	8	30				CHL				S/V				1				
Trace pyrite on 30°CA joint plane	98	99	SyGr	########	M	Wm	1	5	J	2	30	60						Pyrite	M	trace	CHL				S				1				
	99	100	SyGr	########	M	Wm	1	5	J	2	80	50									CHL				S				1				
101.3m; Slickenside 40°CA joint plane	100	101	SyGr	########	M	Wm	1	5	J	2	80	40		CHL	<1	3	40				CHL				S				1				
Weak pyrite mineralization on 5°CA fracture	101	102	SyGr	########	M	W	1	5	J/Fr	4	50	30						Pyrite	M	1	CHL				S				1				
	102	103	SyGr	########	M	W	1	5	J	1	40										CHL				S				1				
	103	104	SyGr	########	M	W	1	5	Fr	1	5										CHL				S				1				
	104	105	SyGr	########	M	W	1	5	J	1	10										CHL				S				1				
105.02m; Biotite Cluster 1cm²	105	106	SyGr	########	M	W	1	5		0				CHL	3	1	10				CHL				S				1				
	106	107	SyGr	########	M	W	1	5		0											CHL				S				1				
	107	108	SyGr	########	M	W	1	5		0											CHL				S/V				1				
	108	109	SyGr	########	M	Wm	1	5	J	3	40			QTZ-CHL	3	1	40				CHL				S				1				
Rare Kspar Phenocryts	109	110	SyGr	########	M	Wm	1	5		0											CHL				S				1				
	110	111	SyGr	########	M	W	1	5	J	1	40										CHL				S				1				
	111	112	SyGr	########	M	W	1	5		0				QTZ	3	1	50				CHL				S/V				1				
Mica 3-5%	112	113	SyGr	########	M	W	1	5		0											CHL				S				1				
	113	114	SyGr	########	M	W	1	5		0											CHL				S				1				
114.77 Biotite cluster 1cm²	114	115	SyGr	########	M	W	1	5	J	1	10										CHL				S/V				1				
	115	116	SyGr	########	M	W	1	5		1											CHL				S/V				1				
	116	117	SyGr	########	M	W	1	5	J	2	30										CHL				S/V				1				
	117	118	SyGr	########	M	W	1	5		0											CHL				S/V				1				
	118	119	SyGr	########	M	W	1	5	J	2	40	30									CHL				S/V				1				
	119	120	SyGr	########	M	W	1	5	J	2	40	70									CHL				S				1				
	120	121	SyGr	########	M	W	1	5	J	5	40	30	50								CHL				S/V				1				
	121	122	SyGr	########	M	Wm	1	5	J	1	30										CHL				S/V				1				
	122	123	MzGr	########	M	Wm	1	5	J	3	40										CHL				S				1				
	123	124	SyGr	########	M	Wm	1	5		0											CHL				S/V				1				
	124	125	SyGr	########	M	Wm	1	5		0											CHL				S				1				
	125	126	SyGr	########	M	Wm	1	5		0											CHL				S				1				
	126	127	SyGr	########	M	Wm	1	5		0											CHL				S/V				1				
127.18m; 1cm x 2cm Schistous xenolith	127	128	SyGr	########	M	Wm	1	5		0											CHL				S				1				
	128	129	SyGr	########	M	Wm	1	5		0											CHL				S				1				
	129	130	SyGr	########	M	Wm	1	5		0											CHL				S				1				

PROJECT NAME:	Black Point (6706)						GEOTECHNICAL LOG				Collar Survey Data						LOGGING DETAILS	
LICENSE INFORMATION:							ELEVATION:	84m						°Lat			LOGGED BY: P. Dalton	
DRILL HOLE:	BP-9						AZM°: 000							°Long			DATES:	
DATE COLLARED:	March 6 2014						DIP: -90								NAD 83 Zone 20		PAGE:	of
DATE COMPLETED:	March 8 2014						EOH: 130.13m			Drilling Contractor				Logan Drilling Group			SIGNED:	

From	To		Rock	Weathering			Jointing											Comments
		Rock Type	Streng		Total Fracture	Fracture Type	J set	λ/m	λ/m	λ/m	α°	α°	α°	J roughness	Infill/Cement			
m	m	Litho Code	R(0-6)	(1-6)	(/m)		0.5-20	set1	set2	set3	set1	set2	set3	0.5-5	Comp.	Width (mm	Strength (0	
0	2	SyGr	5	2	4	Fr	2	2	2		10	80		3				
2	3	SyGr	5	1	5	Fr/J	1.5	4	1		80	10		3				
3	4	SyGr	5	1	1	J	0.5	1			10			1.5				
4	5	SyGr	5	1	1	Fr	0.5	1			80			3				
5	6	SyGr	5	1	7	Fr/J	1.5	6	1		80	5		3				
6	7	SyGr	5	1	3	Fr	0.5	1	1	1	80	60	10	3				
7	8	SyGr	5	1	3	J	1.5	2	1		20	80		1.5				
8	9	SyGr	5	1	4	J	1.5	3	1		30	10		1.5/3				
9	10	Bx	5	1	5	Fr/J	2	3	2					3/1.5				
10	11	Bx	5	1	1	J	0.5	1			30			1.5				
11	12	SyGr	5	1	1	Fr	0.5	1	2		70			3				
12	13	SyGr	5	1	3	J	1.5	1			80	30		1.5				
13	14	SyGr	5	1	2	Fr	1	2			30			1.5				
14	15	SyGr	5	1	7	J	1.5	6	1		80	50		1.5				
15	16	SyGr	5	1	3	J/Fr	1.5	2	1		80	5		3				
16	17	SyGr	5	1	3	Fr	0.5	1	1	1	50	10	30	3/1.5				
17	18	SyGr	5	1	0													
18	19	SyGr	5	1	1	J	0.5	1			40			3				
19	20	SyGr	5	1	5	Fr/J	2.5	2	2	1	30	70	5	1.5/3				
20	21	SyGr	5	1	>20	Fx/Fr/J	1.5	2	>20		10	90	FxS	1.5-1				Fault Rubble 20.32-20.72m
21	22	SyGr	5	1	5	J	2	2	3		60	80		3				
22	23	SyGr	5	1	6	F	1.5	4	1	1	60	70	30	1.5				Closed fractures @ 30°CA
23	24	SyGr	5	1	2	J	0.5	1	1		60	20		1.5/2				
24	25	SyGr	5	1	>20	J/Fs/F	1.5	4	1	>20	80	20	Fx	1.5/2/3				Fault Rubble 24.63-24.84m
25	26	SyGr	5	1	6	Fr/J	1.5	5	1		80	5		1.5/3				
26	27	SyGr	5	1	4	J/Fr	1.5	3	1		80	5		3				
27	28	Bx	5	1	5	Fr/J	2	2	3		10	70		3-Jan				
28	29	Bx	5	1	3	Fr	0.5	2	1		10	5		3				
29	30	Bx	5	1	4	Fr/J	1.5	2	1	1	70	90		1.5/3				
30	31	SyGr	5	1	2	J	0.5	1	1		90	40		3				
31	32	SyGr	5	1	2													
32	33	SyGr	5	1	0													
33	34	SyGr	5	1	4	J	1.5	3	1		30	90		3				
34	35	SyGr	5	1	0													
35	36	SyGr	5	1	5	Fr/J	1.5	2	3		40	3		1.5				
36	37	SyGr	5	1	3	J/Fr	1.5	2	1		40	5		1.5				
37	38	SyGr	5	1	3	J/Fr	1.5	2	1		40	5		1.5				
38	39	SyGr	5	1	4	J/Fr	1.5	1	3		80	20		1.5				
39	40	SyGr	5	1	5	Fr/J	2	3	2		40	80		1.5				
40	41	SyGr	5	1	2	Fr/J	1.5	2	1		40	80		1.5				
41	42	SyGr	5	1	1	J	0.5	1			20			1.5				
42	43	SyGr			1	J	0.5	1			30			1.5				
43	44	SyGr			1	Fr	0.5	1			5			2				
44	45	SyGr			2	J/Fr	0.5	1	1		60	40		1.5				
45	46	SyGr			2	J	1	2			40			1.5				
46	47	SyGr			1	Fr	0.5	1			40			1.5				
47	48	MzGr			4	J/Fr	1.5	2	1	1	60	5	90	3				
48	49	MzGr			2	Fr/J	0.5	1	1		90	10		3				
49	50	MzGr			1	J	0.5	1			60			3				
50	51	SyGr			2	J	1	2			90			3				
51	52	SyGr			1	J	0.5	1			90			3				
52	53	SyGr			0													
53	54	SyGr			0													
54	55	SyGr			0													
55	56	SyGr			1	J	0.5	1			20			1.5				
56	57	SyGr			2	J	0.5	1	1		20			1.5				
57	58	SyMzGr			4	J	1.5	2	1	1	40	60	90	1.5				
58	59	MzGr			3	J	0.5	1	1		90	20	50	1.5				
59	60	SyGr			3	J	1	3			30			1.5				
60	61	SyGr			0													
61	62	SyGr			4	J	1.5	1	2	1	40	30	70	1.5				
62	63	SyGr			1	J	0.5	1			20							

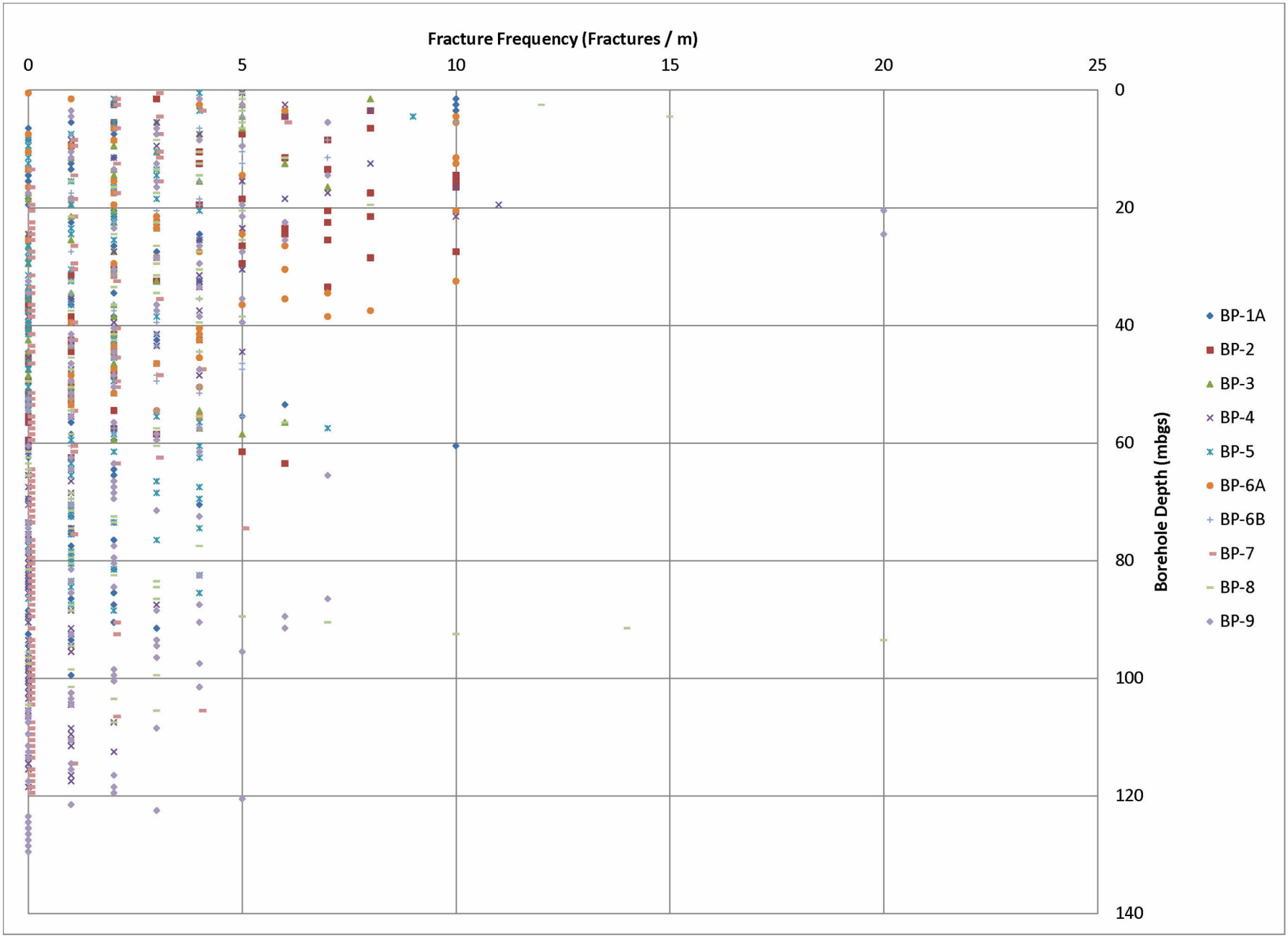
53	54	SyGr			2	J	1	2			20			1.5																	
54	55	SyGr			1	J	0.5	1			80			3																	
55	56	SyGr			7	J	1.5	4	2	1	20	90	60	1.5/3																	
56	57	SyGr			2	J	0.5	1	1		70	30																			
57	58	SyGr			2	J	1	2			70			1.5																	
58	59	SyGr			2	J	1	2			70			1.5																	
59	70	SyGr			2	J	0.5	1	1		40	30		1.5																	
70	71	SyGr			1	J	0.5	1			60			1.5																	
71	72	SyGr			3	J	1.5	2	1		20	60		1.5																	
72	73	SyGr			4	J/Fr	1.5	2	1	1				1.5/3																	
73	74	SyGr			0																										
74	75	SyGr			0																										
75	76	SyGr			0																										
76	77	SyGr			0																										
77	78	SyGr			2	Fr	0.5	2			5	90		3/1.5																	
78	79	SyGr			0																										
79	80	SyGr			2	J	1	2			90			1.5																	
80	81	MzGr			2	J	1	2			20			1.5																	
81	82	MzGr			1	J	0.5	1			40			1.5																	
82	83	MzGr			4	J	1.5	3	1		20	40		1.5																	
83	84	MzSyGr			1	J	0.5	1			60			3																	
84	85	MzGr			2	J	0.5	1	1		10	80		3/1.5																	
85	86	MzGr			1	J	0.5	1			20			3																	
86	87	MzGr			7	J	2.5	1	4	2	10	40	20	3/1.5																	
87	88	MzGr			4	J	2	2	2		80	20		3																	
88	89	MzSyGr			3	J	1.5	1	2		40	80		1.5/3																	
89	90	SyGr			6	J	2.5	1	3	2	20	80	40	1.5																	
90	91	SyGr			4	J	1	4			90			1.5																	
91	92	SyGr			6	J	1	6			80			1.5																	
92	93	SyGr			1	J	0.5	1			50			1.5																	
93	94	SyGr			3	J	1.5	1	2		40	30		1.5																	
94	95	SyGr			3	J	1.5	1	2		50	70		1.5																	
95	96	SyGr			5	J	2.5	2	2	1	50	20		1.5																	
96	97	SyGr			3	J	1	3			30			1.5																	
97	98	SyGr			4	J	1.5	1	2	1	20	50	90	1.5																	
98	99	SyGr			2	J	0.5	1	1		30	60		1.5																	
99	100	SyGr			2	J	0.5	1	1		80	50		3																	
100	101	SyGr			2	J	0.5	1	1		80	40		3/0.5																	Slickensided on 40° joint
101	102	SyGr			4	J/Fr	1.5	3	1		50	30		1.5/3																	
102	103	SyGr			1	J	0.5	1			40			1.5																	
103	104	SyGr			1	Fr	0.5	1			5																				
104	105	SyGr			1	J	0.5	1			10			3																	
105	106	SyGr			0																										
106	107	SyGr			0																										
107	108	SyGr			0																										
108	109	SyGr			3	J	1	3			40			0.5																	
109	110	SyGr			0																										
110	111	SyGr			1	J	0.5	1			40			1.5																	
111	112	SyGr			0																										
112	113	SyGr			0																										
113	114	SyGr			0																										
114	115	SyGr			1	J	0.5	1			10			3																	
115	116	SyGr			1	J	0.5	1						1.5																	
116	117	SyGr			2	J	1	2			30			1.5																	
117	118	SyGr			0																										
118	119	SyGr			2	J	0.5	1	1		40	30		3/1.5																	
119	120	SyGr			2	J	0.5	1	1		40	70		3																	
120	121	SyGr			5	J	2.5	2	2	1	40	30	50	1.5-4																	
121	122	SyGr			1	J	0.5	1			30			1																	
122	123	MzGr			3	J	1	3			40			1																	
123	124	SyGr			0																										
124	125	SyGr			0																										
125	126	SyGr			0																										
126	127	SyGr			0																										
127	128	SyGr			0																										
128	129	SyGr			0																										
129	130.1	SyGr			0																										

Project: Black Point
Drill Hole: BP-9
Date: March 10-13 2014

Picture ID/	Core Box No.	Depth Interval		Comments
		From(m)	To(m)	
BP-9-P1	1	0.8	5.09	0-0.8 core loss
BP-9-P2	2	5.09	9.53	
BP-9-P3	3	9.53	13.83	
BP-9-P4	4	13.83	18.17	
BP-9-P5	5	18.17	22.48	
BP-9-P6	6	22.48	26.65	
BP-9-P7	7	26.65	30.71	
BP-9-P8	8	30.71	35.07	
BP-9-P9	9	35.07	39.5	
BP-9-P10	10	39.5	43.78	
BP-9-P11	11	43.78	48.08	
BP-9-P12	12	48.08	52.49	
BP-9-P13	13	52.49	56.84	
BP-9-P14	14	56.84	61.23	
BP-9-P15	15	61.23	65.44	
BP-9-P16	16	65.44	69.84	
BP-9-P17	17	69.84	74	
BP-9-P18	18	74	78.5	
BP-9-P19	19	78.5	82.88	
BP-9-P20	20	82.88	87.22	
BP-9-P21	21	87.22	91.55	
BP-9-P22	22	91.55	95.81	
BP-9-P23	23	95.81	100.17	
BP-9-P24	24	100.17	104.34	
BP-9-P25	25	104.34	108.77	
BP-9-P26	26	108.77	113.13	
BP-9-P27	27	113.13	117.51	
BP-9-P28	28	117.51	122	
BP-9-P29	29	122	126.33	
BP-9-P30	30	126.33	130.13	

ATTACHMENT B
Fracture Frequency Plot

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000


Fracture Frequency (Fractures / m)
0
5
10
15
20
25
0
20
40
60
80
100
120
140
Borehole Depth (mbgs)
BP-1A
BP-2
BP-3
BP-4
BP-5
BP-6A
BP-6B
BP-7
BP-8
BP-9

C 1340-862

ATTACHMENT C
2014 Granite Analytical Chemistry Results

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

Attachment C: On-Site Granite Boreholes Water Chemistry Results

Sample Name			BPBH05	BPBH05_2	BPBH07	BPB07_2	BPBH08	BPBH08_2	BPBH09	BPBH09_2
Location			Unfiltered	Unfiltered	Unfiltered	Unfiltered	Unfiltered	Unfiltered	Unfiltered	Unfiltered
Parameter	**Unit**	**RDL**	**22-Jul-14**	**27-Aug-14**	**23-Jul-14**	**28-Aug-14**	**23-Jul-14**	**28-Aug-14**	**23-Jul-14**	**28-Aug-14**
Field Parameters										
pH		---	---	5.6	---	6.9	---	6.4	---	6.9
Water Temperature	°C	---	---	9.2	---	11.4	---	9.5	---	9.6
Conductivity	µS/cm	---	---	38.7	---	83.8	---	80.0	---	118.5
% Dissolved Oxygen	%	---	---	---	---	---	---	---	---	---
Dissolved Oxygen	mg/L	---	---	---	---	---	---	---	---	---
General Chemistry										
pH [4]		n/a	5.05	5.85	6.51	6.82	6.48	6.80	6.70	6.92
Reactive Silica as SiO2	mg/L	0.5	9.6	14.0	18.0	21.0	23.0	24.0	27.0	27.0
Chloride	mg/L	---	---	---	---	---	---	---	---	---
Dissolved Chloride (Cl)	mg/L	1.0	9.3	8.7	11.0	11.0	10.0	9.6	13.0	14.0
Fluoride	mg/L	---	---	---	---	---	---	---	---	---
Sulphate	mg/L	---	---	---	---	---	---	---	---	---
Dissolved Sulphate	mg/L	2.0	<2.0	<2.0	2.9	<2.0	2.8	2.5	<2.0	<2.0
Alkalinity	mg/L	---	<5.0	<5.0	18.0	38.0	29.0	38.0	41.0	54.0
True Color	TCU	50.0	110.0	99.0	210.0	140.0	<5.0	<5.0	62.0	130.0
Turbidity	NTU	0.1	40.0	6.0	19.0	17.0	39.0	3.2	37.0	7.6
Electrical Conductivity	umho/cm	1.0	46.0	55.0	84.0	120.0	92.0	110.0	120.0	140.0
Nitrate + Nitrite as N	mg/L	0.05	0.11	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Nitrate as N	mg/L	0.050	0.11	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Nitrite as N	mg/L	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Ammonia as N	mg/L	0.05	0.072	0.060	<0.050	<0.050	<0.050	<0.050	0.15	0.19
Total Organic Carbon	mg/L	5.0	13.0 (1)	7.9	10.0 (1)	9.5	1.4	0.87	5.2 (1)	11.0
Ortho-Phosphate as P	mg/L	0.01	0.013	0.061	0.065	0.041	0.12	0.16	0.14	0.30
Total Sodium	mg/L	100.0	6700.0	6300.0	11000.0	14000.0	12000.0	10000.0	15000.0	17000.0
Total Potassium	mg/L	100.0	1100.0	370.0	2700.0	1900.0	2200.0	880.0	4600.0	4500.0
Total Calcium	mg/L	100.0	740.0	2000.0	3300.0	5900.0	5800.0	6800.0	3400.0	5800.0
Total Magnesium	mg/L	100.0	660.0	750.0	1900.0	2400.0	2300.0	3200.0	1900.0	2500.0
Biarb. Alkalinity (as CaCO3)	mg/L	1.0	<1.0	<1.0	18.0	38.0	29.0	38.0	41.0	54.0
Carb. Alkalinity (as CaCO3)	mg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Hydroxide	mg/L	---	---	---	---	---	---	---	---	---
Calculated TDS [5]	mg/L	1.0	35.0	33.0	65.0	79.0	83.0	82.0	100.0	110.0
Hardness	mg/L	1.0	4.6	8.0	16.0	25.0	24.0	30.0	16.0	25.0
Langelier Index (@ 20C)	NA	---	---	---	---	-2.16	---	-2.12	---	-1.94
Langelier Index (@ 4C)	NA	---	---	---	---	-2.41	---	-2.37	---	-2.19
Saturation pH (@ 20C)	NA	---	---	---	---	8.98	---	8.92	---	8.86
Saturation pH (@ 4C)	NA	---	---	---	---	9.23	---	9.17	---	9.11
Anion Sum	me/L	n/a	0.27	0.25	0.75	1.07	0.95	1.10	1.21	1.49
Cation Sum	me/L	n/a	0.64	0.46	0.95	1.16	1.28	1.08	1.4	1.56
% Difference / Ion Balance (NS)	%	n/a	40.7	29.6	11.8	4.04	14.8	0.92	7.28	2.3
Total Suspended Solids	mg/L	---	---	---	---	---	---	---	---	---

Attachment C (con't): On-Site Granite Boreholes Water Chemistry Results

Total Phosphorus as P	mg/L	100.0	340.0	110.0	270.0	<100.0	820.0	200.0	420.0	310.0
Total Aluminum [3]	ug/L	5.0	2900.0	430.0	2700.0	510.0	3000.0	<5.0	1200.0	1000.0
Total Antimony	ug/L	1.0	2.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Arsenic	ug/L	1.0	9.5	4.8	39.0	16.0	2.1	1.0	31.0	60.0
Total Barium	ug/L	1.0	15.0	1.5	10.0	3.4	17.0	<1.0	14.0	15.0
Total Beryllium	ug/L	1.0	<1.0	<1.0	1.4	<1.0	<1.0	<1.0	<1.0	<1.0
Total Bismuth	ug/L	2.0	<2.0	<2.0	2.1	<2.0	<2.0	<2.0	<2.0	<2.0
Total Boron	ug/L	50.0	<50.0	<50.0	<50.0	<50.0	<50	<50.0	<50.0	<50.0
Total Cadmium	ug/L	0.01	0.35	0.47	1.8	1.1	0.17	0.074	0.11	0.043
Total Chromium	ug/L	1.0	18.0	<1.0	4.2	<1.0	9.4	<1.0	5.0	<1.0
Total Cobalt	ug/L	0.4	1.7	2.7	11.0	7.2	0.65	<0.40	3.1	1.60
Total Copper	ug/L	2.0	15.0	11.0	130.0	110.0	61.0	<2.0	22.0	11.0
Total Iron	ug/L	50.0	6100.0	290.0	2700.0	350.0	6600.0	<50.0	8200.0	4900.0
Total Lead	ug/L	0.5	7.3	0.71	5.7	0.9	48.0	<0.50	2.6	2.9
Total Manganese	ug/L	2.0	150.0	910.0	400.0	420.0	240.0	1100.0	1400.0	1900.0
Total Molybdenum	ug/L	2.0	3.9	<2.0	13.0	9.5	3.6	<2.0	7.0	14.0
Total Nickel	ug/L	2.0	3.0	<2.0	11.0	11.0	2.7	<2.0	4.9	2.7
Total Selenium	ug/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Silver	ug/L	0.1	73.0	0.64	75.0	6.7	17.0	<0.10	4.5	0.45
Total Strontium	ug/L	2.0	4.7	14.0	22.0	50.0	20.0	23.0	20.0	47.0
Total Thallium	ug/L	0.1	<0.10	<0.10	0.13	<0.10	<0.10	<0.10	<0.10	<0.10
Total Tin	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Titanium	ug/L	2.0	35.0	2.2	59.0	8.0	24.0	<2.0	22.0	18.0
Total Uranium	ug/L	0.1	17.0	47.0	260.0	430.0	14.0	4.2	20.0	37.0
Total Vanadium	ug/L	2.0	2.5	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Zinc	ug/L	5.0	390.0	130.0	1800.0	710.0	580.0	190.0	1500.0	350.0
Mercury	mg/L	---	---	---	---	---	---	---	---	---

Notes:

NV = no value; "--" = not measured

5. Calculated result only includes measured parameters. Actual TDS may be higher.

ATTACHMENT D

Metasedimentary Rock and Surface Water Analytical Chemistry Results

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

Stream and Lake Water Quality Analytical Results 2010

Sample Name				GRQ-1	GRQ-2	GRQ-3	GRQ-4
Location			CCME FWAL	Unnamed Watercourse 3 East Stream	Fogherty Lake	Unnamed Watercourse 2 North Stream	Unnamed Watercourse 1 Fogherty Lake Outflow
Parameter	**Unit**	**RDL**	**Guideline**	**24-Aug-10**	**27-Aug-10**	**22-Sep-10**	**22-Sep-10**
Field Parameters							
pH			6.5-9	3.41	2.94	3.15	2.95
Water Temperature	°C			21.4	22.7	14.9	16.0
Conductivity	µS/cm			62.0	43.0	91.0	53.0
% Dissolved Oxygen	%			79.2	100.6	79.8	47.0
Dissolved Oxygen	mg/L			6.67	8.67	8.47	4.52
General Chemistry							
pH			6.5-9	4.3	4.3	3.9	4.2
Reactive Silica as SiO2	mg/L	0.5		7.2	0.9	10.2	1.8
Chloride	mg/L	1		14.0	10.0	18.0	13.0
Fluoride	mg/L	0.1	0.12	<0.1	<0.1	0.4	<0.1
Sulphate	mg/L	2		<2	<2.0	<2.0	<2.0
Alkalinity	mg/L	5		<5	<5.0	<5.0	<5.0
True Color	TCU	5	Narrative	395	198.0	411.0	195.0
Turbidity	NTU	0.1	Narrative	1.0	0.7	2.8	0.7
Electrical Conductivity	umho/cm	1		59.0	52.0	102.0	61.0
Nitrate + Nitrite as N	mg/L	0.05		<0.05	<0.05	0.24	<0.05
Nitrate as N	mg/L	0.05	2.9	<0.05	<0.05	0.24	<0.05
Nitrite as N	mg/L	0.05	0.06	<0.05	<0.05	<0.05	<0.05
Ammonia as N	mg/L	0.03	Fact Sheet	<0.03	0.03	0.06	0.11
Total Organic Carbon	mg/L	0.5		35.6	15.4	46.6	17.5
Ortho-Phosphate as P	mg/L	0.01		<0.01	<0.01	0.02	<0.01
Total Sodium	mg/L	0.1		8.8	6.8	10.0	6.8
Total Potassium	mg/L	0.1		0.3	0.4	0.4	0.5
Total Calcium	mg/L	0.1		0.5	0.3	0.5	0.4
Total Magnesium	mg/L	0.1		0.7	0.6	1.1	0.6
Biarb. Alkalinity (as CaCO3)	mg/L	5		<5.0	<5.0	<5.0	<5.0
Carb. Alkalinity (as CaCO3)	mg/L	10		<10.0	<10.0	<10.0	<10.0
Hydroxide	mg/L	5		<5.0	<5.0	<5.0	<5.0
Calculated TDS	mg/L	1		26	19.0	33.0	22.0
Hardness	mg/L			4.1	3.2	5.8	3.5
Langelier Index (@ 20C)	NA			-6.84	-7.05	-7.25	-7.03
Langelier Index (@ 4C)	NA			-7.16	-7.37	-7.57	-7.35
Saturation pH (@ 20C)	NA			11.1	11.3	11.1	11.2
Saturation pH (@ 4C)	NA			11.5	11.7	11.5	11.5
Anion Sum	me/L			0.39	0.28	0.52	0.37
Cation Sum	me/L			0.68	0.47	0.84	0.49
% Difference / Ion Balance (NS)	%			26.2	25.2	23.3	14.8
Total Suspended Solids	mg/L	5	Narrative	n/a	n/a	<5.0	<5.0
Total Phosphorus as P	mg/L	0.002	Fact Sheet	0.157	0.035	0.03	0.012

Total Aluminum	ug/L	5	5	1050	335.0	1050.0	272.0
Total Antimony	ug/L	2		<2.0	<2.0	<2.0	<2.0
Total Arsenic	ug/L	2	5	<2.0	<2.0	5.0	<2.0
Total Barium	ug/L	5		<5.0	<5.0	16.0	<5.0
Total Beryllium	ug/L	2		<2.0	<2.0	<2.0	<2.0
Total Bismuth	ug/L	2		<2.0	<2.0	<2.0	<2.0
Total Boron	ug/L	5		14.0	11.0	20.0	14.0
Total Cadmium	ug/L	0.017	0.017	0.025	0.023	0.102	<0.017
Total Chromium	ug/L	1		4.0	<1.0	<1.0	<1.0
Total Cobalt	ug/L	1		<1.0	<1.0	<1.0	<1.0
Total Copper	ug/L	2	2	<2.0	<2.0	<2.0	<2.0
Total Iron	ug/L	50	300	976	319.0	936.0	415.0
Total Lead	ug/L	0.5	1	3.1	2.6	2.2	0.7
Total Manganese	ug/L	2		37	16.0	87.0	15.0
Total Molybdenum	ug/L	2	73	<2.0	<2.0	<2.0	<2.0
Total Nickel	ug/L	2	25	<2.0	<2.0	<2.0	<2.0
Total Selenium	ug/L	1	1	1.0	<1.0	<1.0	<1
Total Silver	ug/L	0.1	0.1	<0.1	<0.1	<0.1	<0.1
Total Strontium	ug/L	5		<5.0	<5.0	9.0	<5.0
Total Thallium	ug/L	0.1	0.8	<0.1	<0.1	<0.1	<0.1
Total Tin	ug/L	2		<2.0	<2.0	<2	<2.0
Total Titanium	ug/L	2		5.0	2.0	5.0	<2.0
Total Uranium	ug/L	0.1		0.3	0.1	0.3	<0.1
Total Vanadium	ug/L	2		<2.0	<2.0	<2.0	<2.0
Total Zinc	ug/L	5	30	9.0	26.0	20.0	10.0
Mercury	mg/L	0.00005	0.000026	<0.00005	<0.00005	<0.00005	<0.00005

Stream and Lake Water Quality Analytical Results 2014

Sample Name				BPSTR06	BPSTR08	BPSTR09	BPSTR10	BPSTR11	BPSTR12
Location			CWQG PAL Freshwater	Watercourse 1 Fogherty Discharge	Watercourse 2	Watercourse 4 Murphy's Discharge	Fox Island Main Indian Cove Cr.	DUPLICATE Fox Island Main Indian Cove Cr.	Waterourse 3 Transmission Line East
Parameter	**Unit**	**RDL**	**Guideline**	**24-Jul-14**	**24-Jul-14**	**31-Jul-14**	**25-Jul-14**	**25-Jul-14**	**31-Jul-14**
Field Parameters									
pH		---	---	4.1	---	4.0	---	---	3.4
Water Temperature	°C	---	---	18.3	---	21.9	---	---	21.8
Conductivity	µS/cm	---	---	56.0	---	48.0	---	---	53.0
% Dissolved Oxygen	%	---	---	---	---	---	---	---	---
Dissolved Oxygen	mg/L	---	---	4.5	---	2.8	---	---	2.7
General Chemistry									
pH [15]		n/a	6.5-9.0	4.35	4.35	4.70	4.65	4.66	4.330
Reactive Silica as SiO2	mg/L	0.5	NV	2.3	9.7	<0.50	4.5	4.5	5.0
Chloride [6]	mg/L	---	NV	---	---	---	---	---	---
Dissolved Chloride (Cl)	mg/L	1.0	120	12.0	11.0	12.0	22.0	22.0	12.0
Fluoride	mg/L	---	NV	---	---	---	---	---	---
Sulphate	mg/L	---	NV	---	---	---	---	---	---
Dissolved Sulphate	mg/L	2.0	NV	<2.0	<2.0	<2.0	2.4	2.4	<2.0
Alkalinity	mg/L	---	NV	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
True Color	TCU	50.0	NV	300.0	220.0	91.0	350.0	320.0	300.0
Turbidity	NTU	0.1	NV	1.0	1.2	0.93	0.69	0.640	1.6
Electrical Conductivity	umho/cm	1.0	NV	57.0	57.0	54.0	84.0	84.0	60.0
Nitrate + Nitrite as N	mg/L	0.05	NV	<0.050	<0.050	<0.050	<0.050	0.055	<0.050
Nitrate as N [12]	mg/L	0.050	3	<0.050	<0.050	<0.050	<0.050	0.055	<0.050
Nitrite as N	mg/L	0.01	0.06	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Ammonia as N [5]	mg/L	0.05	0	0.086	<0.050	0.084	<0.050	<0.050	<0.050
Total Organic Carbon	mg/L	5.0	NV	11.0 [20]	13.0 [20]	7.300	17.0 [20]	14.0 [20]	24 [20]
Ortho-Phosphate as P	mg/L	0.01	NV	0.032	0.019	<0.010	0.011	0.011	<0.010
Total Sodium	mg/L	100.0	NV	5600.0	6000.0	6000.0	12000.0	11000.0	6400.0
Total Potassium	mg/L	100.0	NV	360.0	370.0	280.0	750.0	720.0	290.0
Total Calcium	mg/L	100.0	NV	320.0	240.0	220.0	1000.0	920.0	410.0
Total Magnesium	mg/L	100.0	NV	550.0	450.0	570.0	930.0	920.0	620.0
Biarb. Alkalinity (as CaCO3)	mg/L	1.0	NV	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Carb. Alkalinity (as CaCO3)	mg/L	1.0	NV	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Hydroxide	mg/L	---	NV	---	---	---	---	---	---
Calculated TDS [19]	mg/L	1.0	NV	23.0	28.0	20.0	45.0	45.0	26.0
Hardness	mg/L	1.0	NV	3.0	2.4	2.9	6.3	6.1	3.6
Langelier Index (@ 20C)	NA	---	NV	---	---	---	---	---	---
Langelier Index (@ 4C)	NA	---	NV	---	---	---	---	---	---
Saturation pH (@ 20C)	NA	---	NV	---	---	---	---	---	---
Saturation pH (@ 4C)	NA	---	NV	---	---	---	---	---	---
Anion Sum	me/L	n/a	NV	0.35	0.31	0.34	0.66	0.67	0.33
Cation Sum	me/L	n/a	NV	0.39	0.38	0.36	0.73	0.71	0.44
% Difference / Ion Balance (NS)	%	n/a	NV	5.41	10.1	2.86	5.04	2.9	14.3
Total Suspended Solids	mg/L	---	NV	---	---	---	---	---	---

Total Phosphorus as P	mg/L	100.0	NV	110.0	<100.0	<100.0	110.0	<100.0	100.0
Total Aluminum [4]	ug/L	5.0	5	**370.0**	**680.0**	**270.0**	**610.0**	**610.0**	**820.0**
Total Antimony	ug/L	1.0	NV	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Arsenic	ug/L	1.0	5	1.7	2.0	<1.0	<1.0	<1.0	1.5
Total Barium	ug/L	1.0	NV	1.6	2.6	1.4	5.6	5.6	2.8
Total Beryllium	ug/L	1.0	NV	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Bismuth	ug/L	2.0	NV	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Boron	ug/L	50.0	NV	<50.0	<50.0	<50.0	<50.0	<50	<50.0
Total Cadmium	ug/L	0.01	0.017	**0.021**	**0.018**	0.016	**0.032**	**0.026**	**0.019**
Total Chromium	ug/L	1.0	NV	<1.0	<1.0	<1.0	1.1	<1.0	<1.0
Total Cobalt	ug/L	0.4	NV	<0.40	<0.40	<0.40	0.7	0.690	<0.40
Total Copper	ug/L	2.0	NV	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Iron	ug/L	50.0	300	**760.0**	**390.0**	**320.0**	**1600.0**	**1500.0**	**950.0**
Total Lead [10]	ug/L	0.5	1	0.96	0.860	<0.50	**1.2**	**1.2**	**1.2**
Total Manganese	ug/L	2.0	NV	19.0	17.0	56.0	200.0	200.0	46.0
Total Molybdenum	ug/L	2.0	73	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Nickel [11]	ug/L	2.0	25	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Selenium	ug/L	1.0	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Silver	ug/L	0.1	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Strontium	ug/L	2.0	NV	4.2	2.8	2.8	7.5	7.4	4.2
Total Thallium	ug/L	0.1	0.8	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Tin	ug/L	2.0	NV	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Titanium	ug/L	2.0	NV	3.1	4.9	<2.0	10.0	9.8	7.1
Total Uranium	ug/L	0.1	NV	0.1	0.490	<0.10	<0.10	<0.10	0.410
Total Vanadium	ug/L	2.0	NV	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Zinc	ug/L	5.0	30	7.5	18.0	8.2	18.0	9.0	10.0
Mercury	mg/L	---	NV	---	---	---	---	---	---

Notes:

NV = no value

Canadian Water Quality Guidelines (CWQG) Protection for Aquatic Life (PAL) Freshwater Guidelines Update 7.0: Sep 2007

4. Aluminum Guideline (CWQG Aquatic Life - Freshwater): if pH < 6.5 then 0.005 mg/L (5 ug/L), else if pH >= 6.5 then 0.1 mg/L (100 ug/L)
5. Ammonia (CWQG Aquatic Life - Freshwater) - guidelines vary with pH and temperature. See fact sheet for details
6. Chloride Guideline value is for long term exposure. Short term exposure value is 640 mg/L
7. Copper Guideline (CWQG Aquatic Life - Freshwater): if $CaCO_3$ < 120 mg/L then 0.002 mg/L (2 ug/L), if CaCO3 = 120-180 mg/L then 0.003 mg/L (3 ug/L), if CaCO3 > 180 mg/L then 0.004 mg/L (4 ug/L),
8. Dissolved Oxygen Guideline (CWQG Aquatic Life - Freshwater): Warm-water biota (WWB) early life stages 6000 ug/L, WWB other life stages 5500 ug/L, Cold-water biota (CWB) early life stages 9500 ug/L, other life stages 6500 ug/L
9. Dissolved Oxygen Guideline (CWQG Aquatic Life - Marinewater): > 8000 ug/L
10. Pb Guideline (CWQG A.L - Freshwater): if $CaCO_3$ < 60 mg/L then 0.001 mg/L, if CaCO3 = 60-120 mg/L then 0.002 mg/L, if CaCO3 = 120-180 mg/L then 0.004 mg/L, if CaCO3 > 180 mg/L then 0.007 mg/L,
11. Ni Guideline (CWQG A.L. - Freshwater): if $CaCO_3$ < 60 mg/L then 0.025 mg/L, if CaCO3 = 60-120 mg/L then 0.065 mg/L, if CaCO3 = 120-180 mg/L then 0.110 mg/L, if CaCO3 > 180 mg/L then 0.150 mg/L
12. Nitrate Canadian Water Quality Guidelines (CWQG) for Aquatic Life represents lower value for "Long Term Exposure". Short Term exposure values are 124 and 339 for Freshwater and Marine respectively
15. pH Guideline (CWQG Aquatic Life): Freshwater 6.5 - 9, Marine 7.0 - 8.7
16. Salinity Guideline (CWQG Aquatic Life - Marinewater): < 10% fluctuation.
17. Taste Aesthetic Objective (CDWQ): "Inoffensive"
18. Temperature Aesthetic Objective (CDWQ): <= 15°C
19. Calculated result only includes measured parameters. Actual TDS may be higher.
20. Elevated reporting limit due to sample matrix.

BOLD RED Exceeds guideline

Dug and Drilled Well Water Results, Metasedimentary Bedrock, 2014

Sample Name				BPRWA001	BPRWA002	BPRWA003	BPRWA004	BPRWA005	BPRWA006	BPRWA007	BPRWA007_A	BPRWA007_B
			CDWQ	Dug Well Unfiltered	Dug Well Unfiltered	Dug Well Unfiltered	Dug Well Unfiltered	DUPLICATE of 004	Dug Well Unfiltered	Drilled Well Unfiltered	Filtered (Dissolved Values)	Unfiltered
Sample Date	**Unit**	**RDL**	**Guideline**	**16-Jul-14**	**16-Jul-14**	**16-Jul-14**	**17-Jul-14**	**17-Jul-14**	**17-Jul-14**	**17-Jul-14**	**28-Aug-14**	**28-Aug-14**
Field Parameters												
pH		---	---	6.57	7.52	6.15	6.33	---	6.67	7.53	---	---
Water Temperature	°C	---	---	12.8	15.1	15.7	12.1	---	17.3	12.6	---	---
Conductivity	µS/cm	---	---	140.0	272.0	398.0	108.0	---	257.0	354.0	---	---
% Dissolved Oxygen	%	---	---	---	---	---	---	---	---	---	---	---
Dissolved Oxygen	mg/L	---	---	---	---	---	---	---	---	---	---	---
General Chemistry												
pH[4]		n/a	NV	6.76	8.10	6.55	6.36	6.37	6.73	8.17	8.14	8.20
Reactive Silica as SiO2	mg/L	0.5	NV	6.9	9.1	4.6	6.9	6.9	5.7	11.0	10.0	10.0
Chloride	mg/L	---	NV	---	---	---	---	---	---	---	---	---
Dissolved Chloride (Cl)	mg/L	1.0	NV	37.0	15.0	32.0	12.0	12.0	12.0	14.0	14.0	14.0
Fluoride	mg/L	---	NV	---	---	---	---	---	---	---	---	---
Sulphate	mg/L	---	NV	---	---	---	---	---	---	---	---	---
Dissolved Sulphate	mg/L	2.0	NV	5.6	6.4	6.5	2.7	2.6	3.1	9.1	9.5	9.7
Alkalinity	mg/L	---	NV	31.0	95.0	30.0	6.4	6.6	17.0	100.0	100.0	100.0
True Color	TCU	50.0	NV	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Turbidity	NTU	0.1	NV	0.5	0.34	3.1	0.26	<0.10	0.28	0.82	0.42	0.69
Electrical Conductivity	umho/cm	1.0	NV	190.0	230.0	180.0	67.0	67.0	76.0	250.0	250.0	260.0
Nitrate + Nitrite as N	mg/L	0.05	NV	0.082	<0.050	<0.050	1.2	1.2	<0.050	0.059	0.066	0.065
Nitrate as N	mg/L	0.050	10	0.082	<0.050	<0.050	1.2	1.2	<0.050	0.059	0.066	0.065
Nitrite as N	mg/L	0.01	NV	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Ammonia as N	mg/L	0.05	NV	<0.050	<0.050	0.053	<0.050	<0.050	<0.050	<0.050	0.051	<0.050
Total Organic Carbon	mg/L	5.0	NV	0.71	0.56	1.4	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Ortho-Phosphate as P	mg/L	0.01	NV	<0.010	0.032	<0.010	0.025	0.027	<0.010	0.019	0.019	0.019
Total Sodium	mg/L	100.0	NV	17000.0	9500.0	14000.0	6800.0	6700.0	7000.0	31000.0	33000.0	32000.0
Total Potassium	mg/L	100.0	NV	1300.0	1100.0	5400.0	630.0	680.0	280.0	2300.0	2100.0	2100.0
Total Calcium	mg/L	100.0	NV	11000.0	26000.0	11000.0	2200.0	2200.0	6100.0	15000.0	15000.0	15000.0
Total Magnesium	mg/L	100.0	NV	4000.0	6400.0	2900.0	1600.0	1600.0	1100.0	4500.0	4600.0	4500.0
Biarb. Alkalinity (as CaCO3)	mg/L	1.0	NV	31.0	94.0	30.0	6.4	6.6	16.0	99.0	99.0	98.0
Carb. Alkalinity (as CaCO3)	mg/L	1.0	NV	<1.0	1.1	<1.0	<1.0	<1.0	<1.0	1.4	1.3	1.5
Hydroxide	mg/L	---	NV	---	---	---	---	---	---	---	---	---
Calculated TDS[5]	mg/L	1.0	NV	100.0	130.0	95.0	42.0	42.0	46.0	150.0	150.0	150.0
Hardness	mg/L	1.0	NV	44.0	91.0	39.0	12.0	12.0	20.0	57.0	57.0	57.0
Langelier Index (@ 20C)	NA	---	NV	-2.06	0.128	-2.28	-3.79	-3.76	-2.57	-0.017	-0.049	0.009
Langelier Index (@ 4C)	NA	---	NV	-2.31	-0.122	-2.53	-4.04	-4.01	-2.82	-0.268	-0.299	-0.241
Saturation pH (@ 20C)	NA	---	NV	8.82	7.987	8.83	10.1	10.1	9.3	8.19	8.19	8.19
Saturation pH (@ 4C)	NA	---	NV	9.07	8.22	9.08	10.4	10.4	9.55	8.44	8.44	8.44
Anion Sum	me/L	n/a	NV	1.79	2.47	1.64	0.61	0.61	0.74	2.59	2.59	2.60
Cation Sum	me/L	n/a	NV	1.63	2.26	1.55	0.55	0.55	0.71	2.55	2.62	2.62
% Difference / Ion Balance (NS)	%	n/a	NV	4.68	4.44	2.82	5.17	5.17	2.07	0.78	0.58	0.38

Total Suspended Solids	mg/L	---	NV	---	---	---	---	---	---	---	---	---
Total Phosphorus as P	mg/L	100.0	NV	<100.0	<100.0	<100.0	<100.0	110.0	<100.0	<100.0	<100.0	<100.0
Total Aluminum[3]	ug/L	5.0	NV	33.0	17.0	9.9	16.0	22.0	12.0	11.0	<5.0	5.7
Total Antimony	ug/L	1.0	6	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Arsenic	ug/L	1.0	10	<1.0	5.1	<1.0	<1.0	<1.0	<1.0	**50**	**46.0**	**48.0**
Total Barium	ug/L	1.0	1000	30.0	52.0	34.0	44.0	44.0	9.5	<1.0	<1.0	<1.0
Total Beryllium	ug/L	1.0	NV	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Bismuth	ug/L	2.0	NV	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Boron	ug/L	50.0	5000	<50.0	<50.0	<50.0	<50	<50.0	<50.0	60.0	58.0	59.0
Total Cadmium	ug/L	0.01	5	0.048	<0.010	0.034	0.025	0.022	<0.010	<0.010	<0.010	<0.010
Total Chromium	ug/L	1.0	50	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.3
Total Cobalt	ug/L	0.4	NV	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Total Copper	ug/L	2.0	NV	38.0	<2.0	160.0	24.0	24.0	180.0	<2.0	<2.0	3.6
Total Iron	ug/L	50.0	NV	160.0	<50.0	1200.0	<50.0	<50.0	92.0	82.0	<50.0	76.0
Total Lead	ug/L	0.5	10	0.64	<0.50	1.9	<0.50	<0.50	8.5	<0.50	<0.50	<0.50
Total Manganese	ug/L	2.0	NV	210.0	22.0	330.0	<2.0	<2.0	2.3	66.0	4.3	65.0
Total Molybdenum	ug/L	2.0	NV	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	7.1	7.3	7.3
Total Nickel	ug/L	2.0	NV	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2
Total Selenium	ug/L	1.0	10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Silver	ug/L	0.1	NV	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Strontium	ug/L	2.0	NV	30.0	51.0	52.0	13.0	14.0	25.0	98.0	100.0	100.0
Total Thallium	ug/L	0.1	NV	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Tin	ug/L	2.0	NV	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Titanium	ug/L	2.0	NV	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Uranium	ug/L	0.1	20	<0.10	0.25	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	<0.10
Total Vanadium	ug/L	2.0	NV	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Zinc	ug/L	5.0	NV	11.0	8.0	19.0	8.8	11.0	52.0	15.0	8.1	20.0
Mercury	mg/L	---	NV	---	---	---	---	---	---	---	---	---

NOTES:

NV = no value

Canadian Drinking Water Quality CDWQ Guidelines: Aug 2012

3. Aluminum Aesthetic Objective (CDWQ - AO): Conventional Treatment Plants = 0.1 mg/L (100 ug/L), Other Treatment Systems = 0.2 mg/L (200 ug/L)
4. pH Objective (CDWQ): 6.5 - 8.5
5. Calculated result only includes measured parameters. Actual TDS may be higher.
6. Sample results likely affected by water softner treatment system

BOLD RED Exceeds guideline

Dug and Drilled Well Water Results, Metasedimentary Bedrock, 2014

Sample Name			BPRWA008	BPRWA009	BPRWA010	BPRWA011	BPRWA012	BPRWA013	BPRWA014	BPRWA015[6]	BPRWA016[6]	BPRWA016	BPRWA017
			Dug Well Unfiltered	Drilled Well Unfiltered	DPLICATE of 009	Drilled Well Unfiltered	Dug Well Unfiltered	Dug Well Unfiltered	Dug Well Unfiltered	Dug Well Unfiltered	Drilled Well Unfiltered	DUPLICATE of 016 w/out Treat. Sys.	Dug Well Unfiltered
Sample Date	**Unit**	**RDL**	**17-Jul-14**	**17-Jul-14**	**17-Jul-14**	**17-Jul-14**	**18-Jul-14**	**22-Jul-14**	**25-Jul-14**	**30-Jul-14**	**31-Jul-14**	**29-Aug-14**	**29-Aug-14**
Field Parameters													
pH		---	6.79	6.56	---	6.28	5.99	6.72	6.62	---	7.46	---	7.68
Water Temperature	°C	---	19.7	12.6	---	14.3	18.9	16.4	17	---	10.7	---	14
Conductivity	µS/cm	---	---	---	---	104.0	260.0	240.0	165.0	---	249.0	---	197.0
% Dissolved Oxygen	%	---	---	---	---	---	---	---	---	---	---	---	---
Dissolved Oxygen	mg/L	---	---	---	---	---	---	---	---	---	---	---	---
General Chemistry													
pH[4]		n/a	7.12	6.66	6.80	6.50	5.95	7.68	6.83	7.41	7.37	7.51	7.9
Reactive Silica as SiO2	mg/L	0.5	9.6	4.9	4.9	22.0	8.0	11.0	5.7	13.0	19.0	4.8	11
Chloride	mg/L	---	---	---	---	---	---	---	---	---	---	---	---
Dissolved Chloride (Cl)	mg/L	1.0	16.0	10.0	9.9	21.0	25.0	15.0	9.8	94.0	21.0	40.0	12.0
Fluoride	mg/L	---	---	---	---	---	---	---	---	---	---	---	---
Sulphate	mg/L	---	---	---	---	---	---	---	---	---	---	---	---
Dissolved Sulphate	mg/L	2.0	5.1	3.3	3.4	3.9	7.0	5.6	3.9	6.2	12.0	2.9	4.9
Alkalinity	mg/L	---	49.0	15.0	14.0	30.0	10.0	52.0	36.0	100.0	93.0	94.0	99
True Color	TCU	50.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	8.2
Turbidity	NTU	0.1	1.2	<0.10	0.54	<0.10	13.0	0.37	0.19	1.2	<0.10	170.0	0.73
Electrical Conductivity	umho/cm	1.0	140.0	75.0	75.0	120.0	120.0	170.0	100.0	490.0	260.0	320.0	230.0
Nitrate + Nitrite as N	mg/L	0.05	<0.050	1.3	1.3	<0.050	0.067	1.1	<0.050	<0.050	<0.050	<0.050	0.16
Nitrate as N	mg/L	0.050	<0.050	1.3	1.3	<0.050	0.067	1.1	<0.050	<0.050	<0.050	<0.050	0.16
Nitrite as N	mg/L	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Ammonia as N	mg/L	0.05	0.056	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.38	<0.050
Total Organic Carbon	mg/L	5.0	60	0.99	1	0.52	1.4	0.64	1.2	0.95	0.79	3.6	0.75
Ortho-Phosphate as P	mg/L	0.01	<0.010	<0.010	<0.010	0.15	<0.010	0.012	<0.010	0.04	0.015	<0.010	0.012
Total Sodium	mg/L	100.0	9900.0	5800.0	5900.0	15000.0	15000.0	7700.0	5800.0	99000.0	57000.0		8200.0
Total Potassium	mg/L	100.0	1200.0	630.0	630.0	1200.0	660.0	930.0	650.0	<100.0	400.0		1800.0
Total Calcium	mg/L	100.0	15000.0	5900.0	6000.0	4200.0	2300.0	18000.0	13000.0	<100.0	<100.0	17000.0	34000.0
Total Magnesium	mg/L	100.0	2500.0	1300.0	1300.0	3400.0	2000.0	4500.0	1200.0	<100.0	<100.0	9500.0	4100.0
Biarb. Alkalinity (as CaCO3)	mg/L	1.0	49.0	15.0	14.0	30.0	10.0	51.0	36.0	99.0	93.0	94.0	98.0
Carb. Alkalinity (as CaCO3)	mg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Hydroxide	mg/L	---	---	---	---	---	---	---	---	---	---	---	---
Calculated TDS[5]	mg/L	1.0	89.0	46.0	46.0	89.0	70.0	99.0	62.0	270.0	160.0	170.0	140.0
Hardness	mg/L	1.0	47.0	20.0	20.0	25.0	14.0	64.0	38.0	<1.0	<1.0	82.0	100.0
Langelier Index (@ 20C)	NA	---	-1.36	-2.7	-2.58	-2.73	-4.02	-0.696	-1.81	---	---	-0.65	0.061
Langelier Index (@ 4C)	NA	---	-1.61	-2.96	-2.83	-2.99	-4.27	-0.947	-2.06	---	---	-0.9	-0.188
Saturation pH (@ 20C)	NA	---	8.48	9.36	9.38	9.23	9.97	8.37	8.64	---	---	8.16	7.84
Saturation pH (@ 4C)	NA	---	8.73	9.62	9.63	9.49	10.2	8.62	8.89	---	---	8.41	8.09
Anion Sum	me/L	n/a	1.54	0.74	0.72	1.28	1.07	1.66	1.07	4.78	2.69	3.08	2.44
Cation Sum	me/L	n/a	1.41	0.67	0.68	1.17	1.05	1.63	1.04	4.32	2.48	3.04	2.44
% Difference / Ion Balance (NS)	%	n/a	4.41	4.96	2.86	4.49	0.94	0.91	1.42	5.05	4.06	0.65	0

Total Suspended Solids	mg/L	---	---	---	---	---	---	---	---	---	---	---	---
Total Phosphorus as P	mg/L	100.0	110.0	<100.0	<100.0	280.0	<100.0	<100.0	110.0	<100.0	<100.0	<100.0	<100.0
Total Aluminum[3]	ug/L	5.0	94.0	21.0	21.0	16.0	46.0	15.0	83.0	6.3	6.9	<5.0	20.0
Total Antimony	ug/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Arsenic	ug/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	6.6	<1.0	<1.0	<1.0
Total Barium	ug/L	1.0	31.0	1.9	2.0	<1.0	9.0	24.0	7.7	<1.0	<1.0	3.9	19.0
Total Beryllium	ug/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	---
Total Bismuth	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	---
Total Boron	ug/L	50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0
Total Cadmium	ug/L	0.01	0.022	0.026	0.028	0.044	0.075	0.043	0.036	<0.010	<0.010	<0.010	<0.010
Total Chromium	ug/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Cobalt	ug/L	0.4	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.63	---
Total Copper	ug/L	2.0	150.0	260.0	280.0	51.0	120.0	5.2	8.4	<2.0	2.7	<2.0	<2.0
Total Iron	ug/L	50.0	140.0	<50.0	<50.0	<50.0	2900.0	<50.0	130.0	150.0	<50.0	<50.0	<50.0
Total Lead	ug/L	0.5	<0.50	6.0	7.0	<0.50	2.1	<0.50	0.81	<0.50	<0.50	<0.50	<0.50
Total Manganese	ug/L	2.0	3.3	16.0	13.0	13.0	290.0	<2.0	320.0	<2.0	4.9	1100.0	<2.0
Total Molybdenum	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Nickel	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	6.5	<2.0
Total Selenium	ug/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Silver	ug/L	0.1	<0.10	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10
Total Strontium	ug/L	2.0	33.0	44.0	45.0	24.0	15.0	46.0	29.0	<2.0	<2.0	57.0	93.0
Total Thallium	ug/L	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Tin	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Titanium	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Uranium	ug/L	0.1	0.11	<0.10	<0.10	1.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.65
Total Vanadium	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Zinc	ug/L	5.0	27.0	30.0	28.0	170.0	20.0	20.0	13.0	5.7	12.0	<5.0	<5.0
Mercury	mg/L	---	---	---	---	---	---	---	---	---	---	---	---

NOTES:

NV = no value

Canadian Drinking Water Quality CDWQ Guidelines: Aug 2012

3. Aluminum Aesthetic Objective (CDWQ - AO): Conventional Treatment Plants = 0.1 mg/L (100 ug/L), Other Treatment Systems = 0.2 mg/L (200 ug/L)
4. pH Objective (CDWQ): 6.5 - 8.5
5. Calculated result only includes measured parameters. Actual TDS may be higher.
6. Sample results likely affected by water softner treatment system

BOLD RED Exceeds guideline

ATTACHMENT E
AECOM Technical Memo – June / July 2014 Fieldwork

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

AECOM
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Memorandum

To	Russell Dmytriw	Page	1
CC	Robert Till, Steve Usher		
Subject	Technical Memorandum: Black Point Hydrogeology June and July, 2014 Field Program		
From	Timothy Bachiu		
Date	September 23, 2014	Project Number	60323234

In support of an Environmental Assessment, hydrological and hydrogeological field work was completed by AECOM and SLR Consulting (Canada) staff at the Black Point Quarry site (the Site) in June and July, 2014. This memo documents field activities and presents data compiled from field tests and measurements completed during these field visits.

1. Residential Well Assessment

The objectives of the residential well assessment are:

- To establish baseline water quality.
- To determine the aquifer units used by residences for potable water supply.
- To provide a preliminary assessment of hydraulic parameters of aquifers near the proposed quarry.

A total of 14 residential wells within 4.0 km of the Site boundary were sampled and a subset of these wells was subjected to drawdown tests. At each residential well, a questionnaire was completed to document the type of well (drilled or dug), well completion details, water levels and whether the well user reported any issues with water quality or quantity. A yield test was completed on two wells, and two data loggers were deployed to monitor long term water levels.

Figure 1 identifies the locations of the residential wells and **Table 1** summarizes the information collected from the questionnaires.

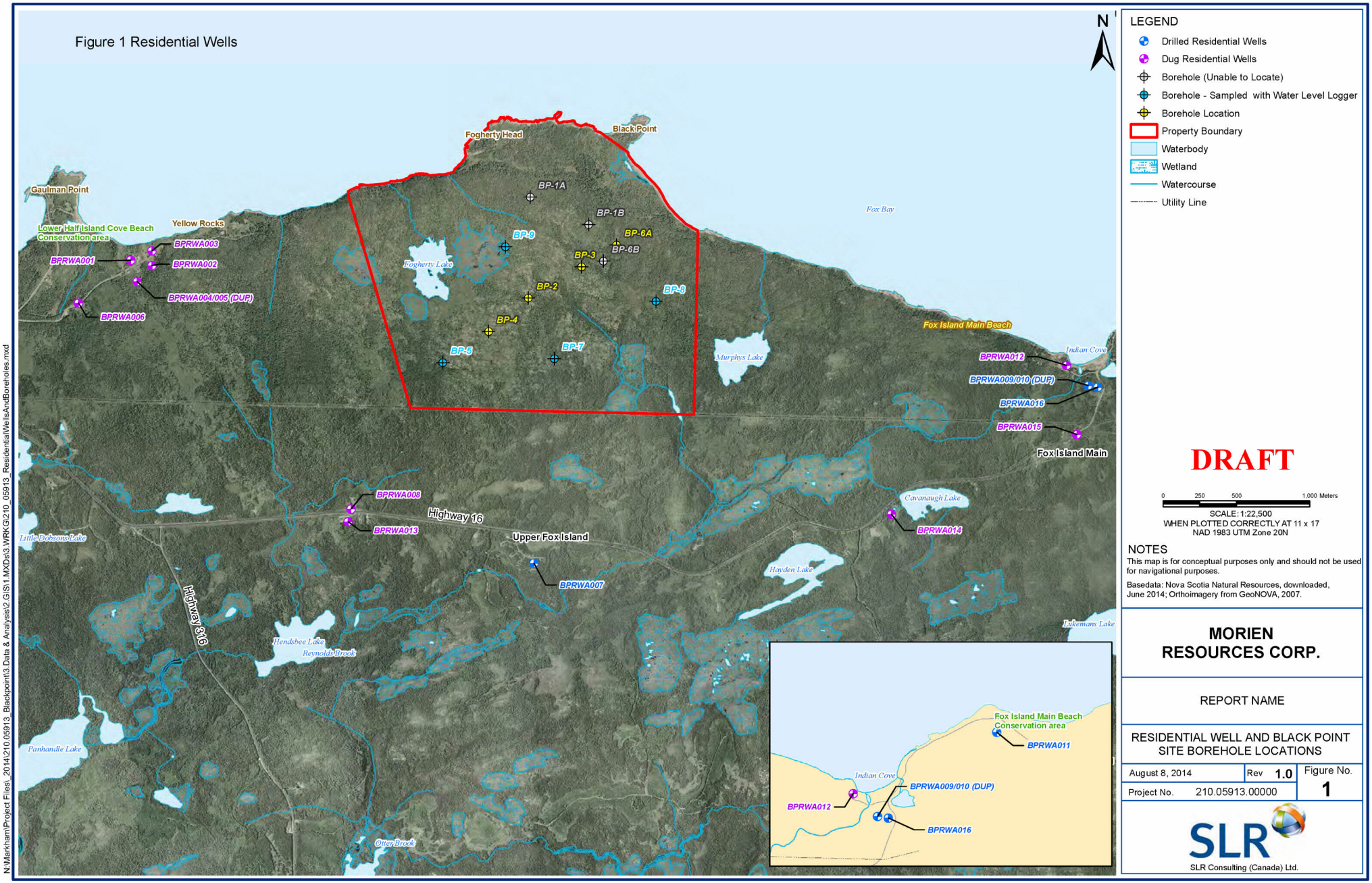
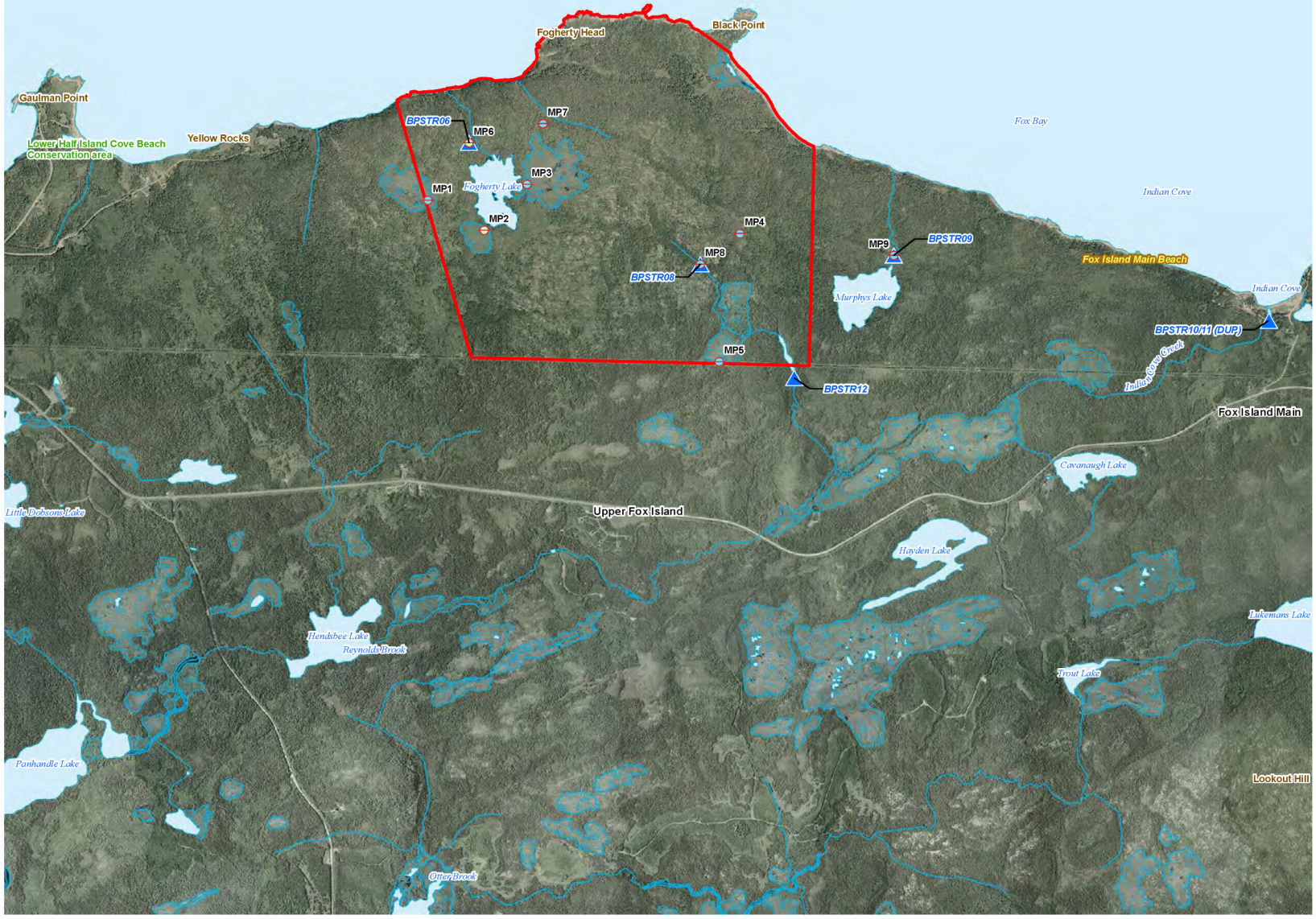


Figure 1 Residential Wells
N
Fogherty Head
Black Point
Gaulman Point
Yellow Rocks
Lower Half Island Cove Beach Conservation area
BPRWA001
BPRWA002
BPRWA003
BPRWA004/005 (DUP)
BPRWA006
BP-1A
BP-1B
BP-2
BP-3
BP-4
BP-5
BP-6A
BP-6B
BP-7
BP-8
BP-9
Fogherty Lake
Fox Bay
Murphys Lake
Fox Island Main Beach
Indian Cove
BPRWA012
BPRWA009/010 (DUP)
BPRWA016
BPRWA015
Fox Island Main
Cavanaugh Lake
BPRWA014
BPRWA008
BPRWA013
Highway 16
Upper Fox Island
BPRWA007
Little Dobsons Lake
Hayden Lake
Tukemans Lake
Highway 316
Hendsbee Lake
Reynolds Brook
Panhandle Lake
Otter Brook
Fox Island Main Beach Conservation area
BPRWA011
Indian Cove
BPRWA009/010 (DUP)
BPRWA012
BPRWA016
LEGEND
Drilled Residential Wells
Dug Residential Wells
Borehole (Unable to Locate)
Borehole - Sampled with Water Level Logger
Borehole Location
Property Boundary
Waterbody
Wetland
Watercourse
Utility Line
DRAFT
0 250 500 1,000 Meters
SCALE: 1:22,500
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N
NOTES
This map is for conceptual purposes only and should not be used for navigational purposes.
Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.
MORIEN RESOURCES CORP.
REPORT NAME
RESIDENTIAL WELL AND BLACK POINT SITE BOREHOLE LOCATIONS
August 8, 2014
Rev 1.0
Figure No. 1
Project No. 210.05913.00000
SLR
SLR Consulting (Canada) Ltd.
N:\Markham\Project Files_2014\210.05913_Blackpoint\3.Data & Analysis\2.GIS\1.MXDs\3.WRKG\210_05913_ResidentialWellsAndBoreholes.mxd

C 1340-877

Figure 2 Stream Sample Locations and Drive Point Piezometer Locations



LEGEND

- Drive Point Piezometer Locations
- Drive Point Piezometer Locations with Water Level Loggers
- Stream Sample
- Property Boundary
- Waterbody
- Wetland
- Watercourse
- Utility Line

DRAFT

0 250 500 1,000 Meters

SCALE: 1:22,500
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

MORIEN RESOURCES CORP.

REPORT NAME

STREAM SAMPLE AND DRIVE POINT PIEZOMETER LOCATIONS

August 8, 2014	Rev 1.0	Figure No. 2
Project No. 210.05913.00000		

SLR Consulting (Canada) Ltd.

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C 1340-878

Table 1: Summary of the Residential Well Assessment Questionnaires

Sample ID	Sample Date	Well Type	Water Level (mTOC)*	Total Depth (mTOC)	Stick up (m)	Quality or Quantity Concerns
BPRWA001[1]	16-Jul-14	Dug	2.89	5.89	0.6	None
BPRWA002[2]	16-Jul-14	Dug	2.06	6.3	0.6	None
BPRWA003	16-Jul-14	Dug	1.82	4.19	0.7	None
BPRWA004	17-Jul-14	Dug	0.55	1.89	0.3	None
BPRWA006	17-Jul-14	Dug	2.86	6.19	0.8	None
BPRWA007[1,3,5]	17-Jul-14	Drilled	12.13	85.34[a]	0.3	None
BPRWA008	17-Jul-14	Dug	1.99	4.55	0.6	Quantity
BPRWA009	17-Jul-14	Drilled	n/a	n/a	n/a	None
BPRWA011	17-Jul-14	Drilled	n/a	n/a	n/a	None
BPRWA012	18-Jul-14	Dug	2.27	3.4	0	Quantity
BPRWA013	22-Jul-14	Dug	3.7	7	0.6	Quantity
BPRWA014	25-Jul-14	Dug	1.79	3.04	0.6	None
BPRWA015	30-Jul-14	Dug	n/a	n/a	n/a	None
BPRWA016[5]	31-Jul-14	Drilled	n/a	n/a	n/a	Unknown
BPRWA017	29-Aug-14	Dug	2.69	n/a	n/a	Unknown
1 - Well yield test completed.						
2 - Location has two dug wells. The unused dug well was instrumented with a data logger.						
3 - Location has two drilled wells. The unused drilled well was instrumented with a data logger.						
4 - Well cover could not be removed.						
5 – Resampled in August 2014						
a - Depth not measured. Depth estimated from resident's recollection of well record						
mTOC* = meters below top of casing						

As shown on **Figure 1**, the area west of the Site along Half Island Cove Road utilizes dug wells for potable water. In July, water levels were within 3.0 m of the ground surface and no concerns of water quantity or quality were expressed. Two residents (BPRW003 and BPRW004) reported that springs emerge from the hill to the south of Half Island Cove Road.

A cluster of three residences is located southwest of the Site and utilize dug wells for potable water. Two of these residential wells were sampled and questionnaires were completed (BPRWA008, BPRWA013). Yield tests were not permitted at these residences due to concerns regarding temporary water supply shortages during the dry summer months.

A set of four cottages and one residence are located south of the Site. These dwellings are serviced by a drilled well completed in the Goldenville Formation metasedimentary bedrock. A yield test was completed on the drilled well. An unused drilled well is located ~30 m from the water supply well. The unused drilled well was monitored during the yield test and following the yield test was instrumented with a data logger recording at 15 minute intervals to monitor water levels over the longer term.

One well was sampled (BPRWA014) near Cavanaugh Lake. This shallow dug well has a reportedly high yield that may be related to the permeable sand and gravel associated with a nearby esker mapped on the provincial surficial geology map (Stea et al. 1992).

In the Fox Island Main area east of the Site, both dug and drilled wells are utilized for potable water supplies. The drilled wells are completed in the metasedimentary bedrock.

Results of the water quality analyses are presented in Table A1 (**Appendix A**). The water quality results indicate the water quality of dug and drilled wells meets the Canadian Drinking Water Quality Guidelines (CDWQ) for all parameters, with one exception. The drilled well sampled as BPRWA007 arsenic concentration (50 µg/L) exceeds the CDWQ for arsenic (10 µg/L).

Two yield tests were completed to provide a preliminary assessment of the hydraulic conductivity of the surficial deposits and the metasedimentary bedrock.

Yield Test 1

A yield test was completed at the sampling location BPRWA001 on Half Island Cove Road. Prior to the initiation of the yield test, the static water level and total depth were measured (**Table 1**), the dimensions of the well were measured (0.92 m diameter) and a data logger was installed to monitor the changes in water level. The well was pumped using the resident's jet pump and pressure tank system that provides water to the residence. An exterior tap was opened to allow water to flow for 1 hour. The flow rate (0.28 L/sec) was estimated by monitoring the length of time required to fill a container of known volume. The estimated total volume pumped from the well in 1 hour was 1,028 L. This volume would displace 1.55 m of water in the well, if no recovery occurred.

The data recorded during the test is presented in **Figure 3**. The maximum drawdown was 0.495 m. Recovery of 0.198 m of recovery was observed over a period of 1,110 minutes (18.5 hours). The data were analyzed using the Theis equation in Aqtesolv software and the results are presented in **Appendix B**. The curve was matched to the late recovery period. The drawdown data have considerable uncertainty because the true pumping rate in the well is not known and the pump may have been turned off and on intermittently during the pumping portion of the test as governed by the pressure tank. The initial recovery data appear to be influenced by the pump coming on from household use. The time of day corresponding to early recovery data is the early evening when household water use is expected. The portion of the data used to match the Theis curve corresponds to the overnight period when water usage is expected to be minimal. The estimated transmissivity of the unconsolidated surficial deposits that provide water to the well is 2.5×10^{-6} m^2/sec, corresponding to a hydraulic conductivity of 8×10^{-7} m/sec. These values are consistent with glacial till deposits in Nova Scotia and appear to represent a reasonable order of magnitude approximation.

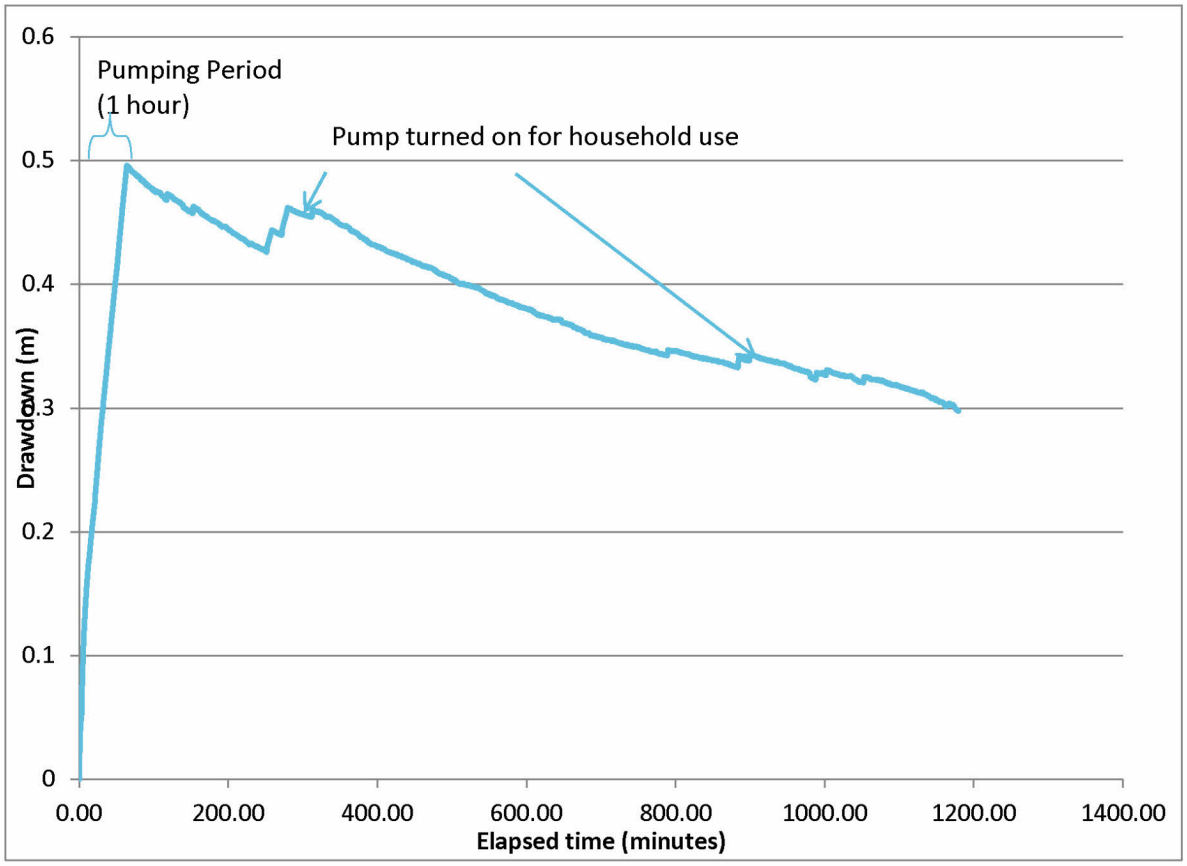


Figure 3: BPRWA001 Yield Test Observations

Yield Test 2

A yield test was completed in the drilled well at the sampling station BPRWA007 located south of the site (**Appendix B**). A second drilled well is located approximately 30 m from the pumping well and was used as an observation well during the yield test. Both wells have a casing diameter of 15.2 cm and the total depth is estimated from the recollection of the residents. Prior to the yield test, the water levels of each well were measured. The water level in the pumping well was 11.83 meters below ground surface (mbgs) and the water level in the observation well was 9.21 mbgs at 13:00 on July 17, 2014.

A data logger (10 m depth range) was installed in the observation well at a depth of ~5 m below the water level and a second data logger (10 m depth range) was installed in the pumping well at a depth of ~ 9 m below the water level. The water supply system consists of a submersible pump in the well that transfers water to a holding tank. Water supply to the cottages/residence is drawn from the holding tank and when the holding tank water level is drawn down to a particular level, the pump in the well is turned on. Therefore, during the yield test, the pump was turned on several times. The data logger information from the yield test is presented in **Figure 4**.

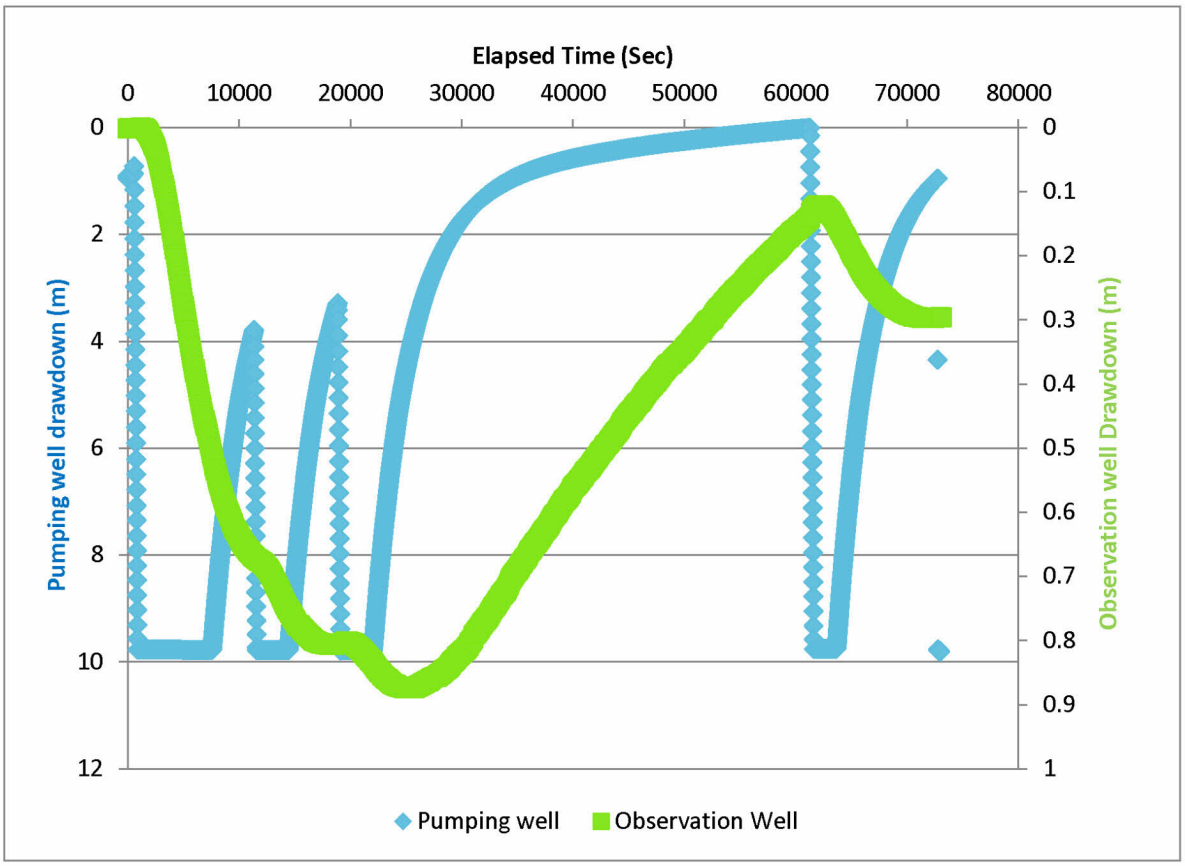


Figure 4: BPRWA007 Yield Test observations

The well was pumped by the resident turning on the pump at the electrical board to measure the water level response. Drawdown in the pumping well exceeded 9 m within 300 seconds (5 minutes) of pumping. The water level was below the level of the data logger for 121 minutes from the initiation of the pumping. The data loggers were left in the wells overnight and retrieved the next morning. The most complete recovery occurred during the overnight hours. The observation well experienced a maximum drawdown of 0.87 m and displayed recovery of 0.77 m during the overnight period. The observation of drawdown at a well 30 m from the pumping well indicates the wells are hydraulically connected, likely through fractures in the bedrock.

The pumping rate during the test is not known and was not possible to estimate because of the configuration of the water supply system. Also, portions of the drawdown during the pumping were not captured by data logger because the depth range of the data logger did not allow for proper positioning. For these reasons, it is impractical to evaluate the data as a pumping test. To provide an approximation of the hydraulic conductivity, the most complete recovery curve is treated as a slug test. The recovery data was analyzed using the KGS method in Aqtesolv and results in a hydraulic conductivity of 5.8 $x10^{-8}$ m/sec (**Appendix B**).

2. Granite Hydrogeology

The hydrogeology of the granite for the proposed quarry was investigated by:

- Completing two water level (piezometric) surveys,
- Long term monitoring of water levels with data loggers,
- Completing four slug tests to estimate hydraulic conductivity, and
- Collecting water quality samples from four existing boreholes.

Boreholes locations are shown on **Figure 1**.

2.1 Piezometric Surveys

Eight exploration boreholes installed between 2007 and 2014 to assess the granite aggregate resource were used to complete piezometric surveys on June 5, 2014 and July 21, 2014. Results of the surveys are summarized in **Table 2**. The meters above sea level (masl) elevations in **Table 2** are from the borehole logs.

Table 2: Borehole Piezometric Surveys

Borehole ID	Elevation (masl)[1]	Total depth (m)	Stick up (m)[2]	Water Level (mTOC)[3]	Water Level (mbgs)[4]	Water level elevation (masl)[1]	Water Level (mTOC)[3]	Water Level (mbgs)[4]	Water level elevation (masl)[1]
				5-Jun-14			21-Jul-14		
BP-1A	73	100	-	-	-	-	-	-	-
BP-6A	73	56	n/a	n/a	3.73	69.27	n/a	4.01	68.99
BP-6B	69	70	n/a	-	-	-	-	-	-
BP-1B	74	80	-	-	-	-	-	-	-
BP-2	82	86	n/a	n/a	2.51	79.49	n/a	2.64	79.36
BP-3	74	60	n/a	n/a	3.12	70.88	n/a	3.27	70.73
BP-4	100	120	n/a	n/a	2.46	97.54	n/a	3.37	96.63
BP-5	82	89	n/a	n/a	2.33	79.67	n/a	2.33	79.67
BP-7	70	120	0.68	5.56	4.88	65.12		-0.68	70.68
BP-8	58	108	0.7	5.31	4.61	53.39	5.36	4.66	53.34
BP-9	79	130	0.68	6.17	5.49	73.51	6.3	5.62	73.38
1 – masl: meters above sea level									
2 – Stick up of casing above ground surface.									
3 – mTOC: meters below the top of casing									
4 – mbgs: meters below ground surface									

2.2 Long Term Data Loggers

Pressure transducer data loggers were installed on June 5 in boreholes BP-5, BP-7, BP-8 and BP-9. The data loggers were programmed to collect readings at 15 minute intervals. Data were downloaded on July 21, compensated for barometric pressure and plotted in **Appendix C**.

Figure C1 displays fluctuations in water levels in BP-5 are up to 1.6 m and closely follow precipitation events, suggesting surface water enters the borehole at surface. This is consistent with observations from the field and the borehole completion. Bedrock is exposed at the surface at BP5 and the casing is not securely installed in the borehole.

Fluctuations in water levels of BP-7 are up to 4.0 m and also closely follow the precipitation events **(Figure C1**). Offsets in fluctuations and precipitation may be a result of a delayed response or the offsets may be a potential artifact produced from using daily precipitation data combined with relatively high frequency water level recordings (15 minute intervals). Field observations indicate the well is properly cased and no obvious pathways for surface water to enter the borehole were observed.

The long term water level data for BP-8 are presented on **Figure C2** to allow for a water level scale range that displays water level variations. The fluctuations in water level in BP-8 are a maximum of 0.16 m and are influenced by precipitation events in the same pattern as BP-7

The long term water level data for BP-9 are presented on **Figure C3** to allow for a water level scale range that displays water level variations. The fluctuations in water level in BP-9 are a maximum of 0.3 m and are influenced by precipitation events in a similar pattern as observed with BP-7.

These loggers will remain at these locations to collect long term data. Monthly manual water will be collected from all the boreholes to provide information on the seasonal variations of the groundwater table.

2.3 Granite Borehole Hydraulic Conductivity Tests

Preliminary hydraulic conductivity (k) tests were completed on four boreholes (BP-5, BP-7, BP-8 and BP-9) in the granite bedrock. The tests were completed using a 1.82 m long by 0.0381 m diameter slug with a total displacement volume of 2.07 L. The boreholes were drilled using NQ bits, resulting in a borehole diameter of 0.0757 m. The water displacement in the boreholes is calculated to be 0.47 m. The tests were completed using the following steps:

- Manual water level measurement.
- Preliminary testing of response using the slug and water level tape.
- Programming and installing data loggers at appropriate time interval and depth.
- Complete submersion (injection) of slug.
- Manual water level measurements to assess recovery.
- Removal (withdrawal) of slug from the borehole.
- Manual water level measurements to assess recovery.
- Retrieval of data logger and download of data.

BP-5 k-test

The static water level and total depth of BP-5 are included in **Table** 2. The maximum displacement recorded during the slug test was 0.44 m. The slug-out test was used to assess the hydraulic conductivity using the KGS method in Aqtesolv (**Appendix D**). The analysis indicates the hydraulic conductivity of BP-5 is 4 $x10^{-7}$ m/s.

BP-7 k-test

The static water level and total depth of BP-7 are included in **Table 2**. The maximum displacement recorded during the slug test was 0.05 m. The slug-out test was used to assess the hydraulic conductivity because the data logger was not installed during the slug in test. The small displacement recorded suggests the slug may not have been fully submerged or that the re-deployment of the data logger was not fast enough to record the initial part of the recovery. Using the limited data from the test, the Bouwer-Rice method in Aqtesolv was used to estimate a hydraulic conductivity of 2 $x10^{-6}$ m/s (**Appendix D**).

BP-8 k-test

The static water level and total depth of BP-8 are included in **Table 2**. The maximum displacement recorded during the slug test was 0.27 m. A rapid recovery was observed with static water level reached within 20 seconds. The slug withdrawal data were used assess the hydraulic conductivity with Bouwer-Rice method in Aqtesolv. The hydraulic conductivity of BP-8 is estimated to be $1x10^{-5}$ m/s.

BP-9 k-test

The maximum displacement recorded during the BP-9 slug test was 0.47 m. Recovery to static water level occurred within 300 seconds. The slug injection portion of the test was used for analysis because the data logger became tangled with the slug rope when the slug was removed. The data were analyzed in Aqtesolv using the Bouwer-Rice method to estimate a hydraulic conductivity of 6 x 10^{-7} m/s.

The results of the slug test are documented in **Appendix D** and summarized in **Table 3**. These results provide a preliminary estimate of the bulk hydraulic conductivity of the granite. The results suggest some of the granite may be highly permeable, at least near surface, as represented by BP-8 and suggests the granite has a general hydraulic conductivity of 10^{-7} m/s. The hydraulic conductivity tests do not provide any insight to where the water is entering the well, but it is assumed the water entering the boreholes are from fractures intersecting the boreholes. The estimates of hydraulic conductivity do not provide any indication of the connectivity of the granite aquifer through the fracture network.

Table 3: Summary of Hydraulic Conductivity Tests

Borehole ID	Hydraulic conductivity (m/s)
BP-5	4×10^{-7}
BP-7	2×10^{-6}
BP-8	6×10^{-5}
BP-9	6×10^{-7}

2.4 Granite Groundwater Quality

Groundwater samples were collected from BP-5, BP-7, BP-8 and BP-9 using a bailer. Ten bailer volumes (~10 L) were removed from each borehole prior to sampling. The water quality samples were analyzed for general chemistry and total metals. Results of the water quality sampling are provided in Table A2 (**Appendix A)**. The granite groundwater is high in aluminum and iron compared to the water samples collected from the bedrock wells completed in the metasedimentary bedrock (**Table A1**). The granite groundwater also contains dissolved total uranium concentrations ranging from 14 to 260 µg/L. These uranium values merit further investigation including re-sampling with a more thorough purge of the borehole and review of core logs and core bulk chemistry.

3. Surface Water and Wetlands

The surface water and wetlands at the Site were investigated by completing:

- Stream flow measurements.
- Stream water sampling.
- Installation of mini-piezometers in wetlands.

3.1 Stream Flow Measurements

The stream locations investigated during the hydrogeology field program are identified on **Figure 2.**

Stream flows were measured July 25, 30 and 31, 2014 and are representative of dry (baseflow) conditions (no precipitation for the three days preceding discharge measurements). The area-velocity method was used to determine stream discharge. Discharge (Q) is calculated as the product of the mean stream velocity (V) and the cross-sectional area (A) of the channel; or Q=VA. Velocity measurements were taken at selected intervals across the channel cross-section. Stream velocity was measured using a Marsh McBirney Flo-Mate current meter. At each interval, the current meter operator measured water depth and mean velocity. Mean velocity measurements were taken at 0.6 of the depth and were observed for 40 seconds.

3.1.1 Stream Descriptions

BPSTR06

The discharge measurement at BPSTR06 was measured approximately 10 m downstream from the discharge of Fogherty Lake. The channel width varied from approximately 0.50 to 1.0 m, depth up to 0.3 m and had a moderate slope. The stream bed substrate consisted of gravel and boulders scattered throughout. The discharge measurement section was 0.50 m wide, well-defined with boulders at each bank, and had consistent flow throughout the entire section as shown in **Appendix E**.

BPSTR08

No discharge measurement was completed at BPSTR08 due to marginal/zero-flow conditions. BPSTR8 is located in a small headwater stream with sand, gravel and cobbles in the stream bed.

BPSTR09

The discharge measurement at BPSTR09 was measured approximately 20 m downstream of the discharge from Murphys Lake. The typical channel width was 1.0 m or less and had a moderate slope. The stream bed was muddy with fine gravel. The discharge measurement section was 0.80 m

wide, had well-defined banks on each side, and had consistent flow throughout the entire section. The cross section of the stream flow measurement location is shown in **Appendix E**.

BPSTR10

The discharge measurement at BPSTR10 was located 2.0 km east of the Site boundary and was measured approximately 10.0 m upstream from the bridge crossing at Starks Road. The typical full-bank channel width was approximately 3.0 m wide and a moderate slope. The stream was in low-flow conditions at the time of measurement. The stream bed substrate consisted of a mix of gravel, cobbles and boulders. The discharge measurement section was 1.1 m wide, well-defined with boulders at each bank, with flow concentrated primarily in middle of the cross-section and negligible at the banks.

BPSTR12

The discharge measurement at BPSTR12 was measured where a wetland (WL1) on the southeast portion of the Site outflows and crosses an ATV trail. The channel was 2.0 to 10.0 m wide with low, gradual banks, and moderate slope. The stream bed consisted primarily of a mix of sand, cobbles and boulders. The discharge measurement was located at a narrow, well-contained section 1.0 m wide with boulders on each side, and consistent flow throughout the section.

Table 4 presents a summary of the stream discharge measurements.

Table 4: Stream Discharge Summary

ID	Location Description	Discharge (L/s)	Date Measured
BPSTR06	Fogherty Lake Outflow	0.031	July 30
BPSTR08	Wetland 17 Inflow	n/a	n/a
BPSTR09	Murphys Lake Outflow	0.170	July 31
BPSTR12	Wetland 1 Outflow	7.73	July 31
BPSTR10	Fox Island Creek Outflow	4.24	July 25

3.2 Stream Water Samples

Stream water samples were collected at locations BPSTR06, BPSTR08, BPSTR09, BPSTR10 and BPSTR12 just prior to taking the flow measurements. Stream samples were analyzed for general chemistry and total metals. Results are included in **Appendix A**.

3.3 Mini-piezometers

Mini-piezometers (MPs) were installed in wetlands and streams to assess the vertical gradient of shallow groundwater. In wetlands, the mini-piezometers were installed as nested pairs with one deep and one shallow piezometer. In streams, one mini-piezometer was installed in the stream bed. The locations of the mini-piezometers are identified in **Figure 2**. One wetland pair (MP2) and one stream mini-piezometer (MP6) were instrumented with a data logger to record water levels and temperature at 15 minute intervals over the longer term.

Mini-piezometer sizes were 1.9 cm (¾") and 2.54 (1") diameters. Galvanized steel pipe and couplers were used to construct the piezometers. Teflon tape was used on all pipe threads to ensure water-

tight seals at the joints of the piezometers. The pipe was next hand-tightened into the piezometer tip, and then tightened to finish, using two 18" pipe wrenches. A coupler and pipe were then added to the piezometer using the same method as described above. Measurements were then taken of the length of the screen interval, the length from the bottom of the screen interval to the top of the MP tip, and the length from the top of the tip to the top of the first coupler.

A fence post driver was then used to hammer the piezometer into the ground. In wetland areas, where sphagnum moss and peat layered bedrock were encountered, the piezometers were easily pushed to refusal by hand. In areas where the soil consisted of boulders and packed gravel, it was very difficult to hammer the piezometers into the ground - on occasion several locations were attempted before a suitable location was found. As the piezometer was hammered further into the ground, subsequent couplers and pipes were added, as necessary, with measurements between coupler tops taken each time. Once hammered to refusal, the length of pipe sticking up above the ground was measured.

A differential survey was then completed using a rod and level. Three permanent benchmarks were installed at each site. Benchmarks consisted of either a nail hammered into a tree and marked by spray paint and flagging, or a location on a sturdy boulder marked by spray paint.

Water levels were measured in some of the mini-piezometers following installation, but these measurements are not considered to be representative of equilibrated, static water level conditions and should not be used to estimate the vertical hydraulic gradient. Water level measurements and logger downloads will be completed at all MP's and existing boreholes on the site at a minimum in the fall of 2014, spring of 2015 and summer of 2015.

Completion details of the MPs are summarized in **Table** 5 and the locations of the MPs are identified on **Figure 2**.

Table 5: Summary of Mini-piezometer Completions

Mini piezometer	UTM		Pipe diameter (cm)	Bottom of perforated interval	Top of perforated interval	DL	Stick up	water level
	Easting	Northing		(mbgs)	(mbgs)	(m)	(m)	(m below top of pipe)
P1 shallow	643746	5023335	1.9	2.158	1.807	0.826	0.667	2.205
P1 deep	643746	5023335	1.9	3.334	2.984		0.72	2.98
P2 shallow	644068	5023164	2.54	1.39	0.938	0.487	0.817	nm
P2 deep	644068	5023164	2.54	2.227	1.877		1.815	nm
P3 shallow	644313	5023427	1.9	1.99	1.64	0.789	0.86	1.47
P3 deep	644313	5023427	1.9	3.132	2.779		0.915	1.59
P4 shallow	645531	5023145	1.9	2.058	1.709	0.641	0.771	nm
P4 deep	645531	5023145	1.9	3.042	2.699		1.01	nm
P5 shallow	645412	5022411	1.9	1.812	1.461	1.285	1.005	dry
P5 deep	645412	5022411	1.9	3.447	3.097		0.605	3.51
P6 stream	643981	5023665	n/a	0	n/a	0.985	n/a	-0.088

Mini piezometer	UTM		Pipe diameter (cm)	Bottom of perforated interval	Top of perforated interval	DL	Stick up	water level
P6 deep	643981	5023665	2.54	1.335	0.985		0.897	nm
P7 shallow	644404	5023774	1.9	1.719	1.369	1.07	1.11	nm
P7 deep	644404	5023774	1.9	3.14	2.789		0.904	nm
P8 stream	645305	5022969	n/a	0	n/a	0.44	n/a	-0.075
P8 deep	645305	5022969	1.9	0.79	0.44		0.796	nm
P9 stream	646411	5023019	n/a	0	n/a	1.003	n/a	-0.18
P9 deep	646411	5023019	1.9	1.353	1.003		1.46	nm
nm - not measured								
mbgs – meters below ground surface								

MP 1

MP 1 is located in a wetland west of Fogherty Lake. The wetland was relatively dry at the time of installation. Thick sphagnum moss and peat is found to a depth > 1.5 m. Bedrock was consistently encountered at a depth of ~ 3 m in this area.

MP2

MP 2 is located in a wetland south of Fogherty Lake. Thick sphagnum moss and peat is found to a depth > 1.5 m. Bedrock was consistently encountered at a depth of 2 to 2.5 m in the wetland.. Both the shallow and deep piezometers are instrumented with data loggers.

MP3

MP3 is located east of Fogherty Lake. Thick sphagnum moss and peat is found to a depth > 1.5 m. Bedrock was consistently encountered at a depth of 2 to 3 m in the wetland area.

MP4

MP4 is located in a small wetland area in the eastern portion of the property. Topography indicates the wetland drains to Murphys Lake. The wetland was wetter than those hosting the MPs installed near Fogherty Lake. Outcrops of bedrock are visible within 50.0 m of MP4. Bedrock was encountered at a depth of ~ 3 m.

Photo 1: MP4

MP5

MP5 is located in a large wetland area at the southern end of the property. The wetland feeds a stream discharging to the south (BPSTR012 stream monitoring location). Thick sphagnum moss and peat is found to a depth >1.5 m. Bedrock depth is variable from 1.5 m to 3.5 m.

Photo 2: MP5

MP6

MP6 is a single 1 inch piezometer installed in the stream discharging from Fogherty Lake. The stream bed has sand, gravel, cobbles and boulders. Piezometer refusal was common at a depth of 0.5 m. Stream flow measurement, surface water sampling and field parameters measurements were completed at MP6. The piezometer is instrumented with a data logger.

Photo 3: MP6 with Data Logger

MP7

MP7 is located in a northwest trending lineament with ~ 10 m of relief, which is 5 to 10 m wide. No water was running at the location and there is no indication of a stream bed. A nested set of MPs were installed. Moss is found to a depth of 0.5 m, followed by sediment/till. Bedrock/piezometer refusal was not encountered, but piezometer insertion was increasingly difficult past the first pipe length.

Photo 4: MP7

MP8

MP8 is single piezometer located in a small stream in the southeastern portion of the property. The stream bed is composed of sand, gravel, cobbles and boulders. Piezometer refusal was common at a depth of < 0.5 m. Stream flow was negligible and a flow measurement was not completed. A surface water sample was collected.

MP9

MP9 is a single piezometer installed in the stream discharging from Murphys Lake. The stream bed is muddy with sand and cobbles beneath the mud. A stream flow measurement was made, surface water sample collected and field parameters recorded.

4. Summary

Field activities completed in support of the Black Point Quarry environmental assessment provide preliminary information to assess the hydrology and hydrogeology of the Site. Key findings from the field program include:

- There are no residential wells completed in the quarry granite.
- Residences west of the Site utilize dug wells to access potable water.
- Four residences (one south and three east of the Site) utilize drilled wells to obtain potable water.
- The groundwater elevation in the granite is between 53 and 93 masl.
- The granite groundwater exhibits elevated metals including uranium, relative to stream water samples.
- The granite hydraulic conductivity ranges from 10^{-5} m/s to 10^{-8} m/s.

Follow up monitoring should include:

- Mini-piezometer water level measurements in the fall, spring, and summer.
- Downloading of borehole data loggers in the fall, spring, and summer.
- Sampling from the boreholes using a pump to purge the wells prior to sampling.
- A repeat hydraulic conductivity test (k-test) of BP-7.

5. References

Stea R.R., Conley H., Brown Y. 1992. Surficial Geology of the Province of Nova Scotia. Map 92-3. Nova Scotia Department of Natural Resources Mines and Energy Branches.

Table A1: Residential Well Assessment Groundwater Quality Results
Black Point Quarry Hydrogeology Program

	Guideline (CDWQ)	Detection Limit	Units	Dug Wells (Surficial Deposits)											Drilled Wells (Meguma Metasedimentary Bedrock)				
				BPRWA001 16-July-2014	BPRWA002 16-July-2014	BPRWA003 16-July-2014	BPRWA004[1] 17-July-2014	BPRWA005[1] 17-July-2014	BPRWA006 17-July-2014	BPRWA008 17-July-2014	BPRWA012 18-July-2014	BPRWA013 22-July-2014	BPRWA014 25-July-2014	BPRWA015[6] 30-July-2014	BPRWA007 17-July-2014	BPRWA009[2] 17-July-2014	BPRWA010[2] 17-July-2014	BPRWA011 17-July-2014	BPRWA016[6] 31-July-2014
Aluminium (ug/L)[3]	NV	5.0	ug/L	33	17	9.9	16	22	12	94	46	15	83	6.3	11	21	21	16	6.9
Ammonia (total)	NV	0.050	mg/L	<0.050	<0.050	0.053	<0.050	<0.050	<0.050	0.056	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Antimony	6	1.0	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic	10	1.0	ug/L	<1.0	5.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	6.6	50	<1.0	<1.0	<1.0	<1.0
Barium	1000	1.0	ug/L	30	52	34	44	<1.0	9.5	31	9	24	7.7	<1.0	<1.0	1.9	<1.0	<1.0	<1.0
Beryllium		1	ug/L	<1.0	<1.0	<1.0	<1.0	44	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.0	<1.0	<1.0
Bicarbonate	NV	1	mg/L	31	94	30	6.4	<1.0	16	49	10	51	36	99	99	15	<1.0	30	93
Bismuth		2	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Boron	5000	50	ug/L	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	60	<50	<50	<50	<50
Cadmium	5	0.010	ug/L	0.048	<0.010	0.034	0.025	0.022	<0.010	0.022	0.075	0.043	0.036	<0.010	<0.010	0.026	0.028	0.044	<0.010
Calcium	NV	100	ug/L	11000	26000	11000	2200	2200	6100	15000	2300	18000	13000	<100	15000	5900	6000	4200	<100
Chloride	NV	1.0	mg/L	37	15	32	12	12	12	16	25	15	9.8	94	14	10	9.9	21	21
Chromium (ug/L)	50	1.0	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cobalt		0.04	ug/L	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Colour	NV	5.0	TCU	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Copper (ug/L)	NV	2.0	ug/L	38	<2.0	160	24	24	180	150	120	5.2	8.4	<2.0	<2.0	260	280	51	2.7
Iron (ug/L)	NV	50	ug/L	160	<50	1200	<50	<50	92	140	2900	<50	130	150	82	<50	<50	<50	<50
Lead (ug/L)	10	0.50	ug/L	0.64	<0.50	1.9	<0.50	<0.50	8.5	<0.50	2.1	<0.50	0.81	<0.50	<0.50	6	7.0	<0.50	<0.50
Magnesium	NV	100	ug/L	4000	6400	2900	1600	1600	1100	2500	2000	4500	1200	<100	4500	1300	1300	3400	<100
Manganese (ug/L)	NV	2.0	ug/L	210	22	330	<2.0	<2.0	2.3	3.3	290	<2.0	320	<2.0	66	16	13	13	4.9
Molybdenum	NV	2.0	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	7.1	<2.0	<2.0	<2.0	<2.0
Nickel	NV	2.0	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nitrate (as N)	10	0.050	mg/L	0.082	<0.050	<0.050	1.2	1.2	<0.050	<0.050	0.067	1.1	<0.050	<0.050	0.059	1.3	<0.050	<0.050	<0.050
Nitrite (as N)	NV	0.010	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Phosphorus	NV	100	ug/L	<100	<100	<100	<100	110	<100	110	<100	<100	110	<100	<100	<100	<100	280	<100
Potassium	NV	100	ug/L	1300	1100	5400	630	680	280	1200	660	930	2300	<100	650	630	630	1200	<100
pH[4]	NV	N/A	pH	6.76	8.1	6.55	6.36	6.37	6.73	7.12	5.95	7.68	6.83	7.41	8.17	6.66	4.65	6.5	7.37
Selenium	10	1.0	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver	NV	0.10	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium (ug/L)	NV	100	ug/L	17000	9500	14000	6800	6700	7000	9900	15000	7700	5800	99000	31000	5800	5900	15000	57000
Strontium		2	ug/L	30	51	52	13	14	25	33	15	46	29	<2.0	98	44	45	24	<2.0
Sulphate	NV	2.0	mg/L	5.6	6.4	6.5	2.7	3	3.1	5.1	7	5.6	3.9	6.2	9.1	3.3	3.4	3.9	12
Thallium	NV	0.10	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin		2	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium		2	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total dissolved solids (TDS-Calculated)[5]	NV	1.0	mg/L	100	130	95	42	42	46	89	70	99	62	270	150	46	45	89	160
Turbidity	NV	0.10	NTU	0.5	0.34	3.1	0.26		0.28	1.2	13	0.37	0.19	1.2	0.82	<0.10	0.69	<0.10	<0.10
Uranium	20	0.10	ug/L	<0.10	0.25	<0.10	<0.10	<0.10	<0.10	0.11	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	1.2	<0.10
Vanadium		2	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Zinc (ug/L)	NV	5.0	ug/L	11	8	19	8.8	11	52	27	20	20	13	5.7	15	30	28	170	12
Anion Sum		N/A	me/L	1.79	2.47	1.64	0.610	0.610	0.740	1.54	1.07	1.66	1.07	4.78	0.750	1.21	0.660	0.670	2.69
Bicarb. Alkalinity (calc. as CaCO3)		1.0	mg/L	31	94	30	6.4	6.6	16	49	10	51	36	99	18	41	<1.0	<1.0	93
Calculated TDS		1.0	mg/L	100	130	95	42	42	46	89	70	99	62	270	65	100	45	45	160
Carb. Alkalinity (calc. as CaCO3)		1.0	mg/L	<1.0	1.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cation Sum		N/A	me/L	1.63	2.26	1.55	0.550	0.550	0.710	1.41	1.05	1.63	1.04	4.32	0.950	1.40	0.730	0.710	2.48
Hardness (CaCO3)		1.0	mg/L	44	91	39	12	12	20	47	14	64	38	<1.0	16	16	6.3	6.1	<1.0
Ion Balance (% Difference)		N/A	%	4.68	4.44	2.82	5.17	5.17	2.07	4.41	0.940	0.910	1.42	5.05	11.8	7.28	5.04	2.90	4.06
Langelier Index (@ 20C)			N/A	(2.06)	0.128	(2.28)	(3.79)	(3.76)	(2.57)	(1.36)	(4.02)	-0.696	(1.81)	NC	(3.03)	(2.49)	NC	NC	NC
Langelier Index (@ 4C)			N/A	(2.31)	-0.122	(2.53)	(4.04)	(4.01)	(2.82)	(1.61)	(4.27)	-0.947	(2.06)	NC	(3.28)	(2.74)	NC	NC	NC
Nitrate (N)		0.050	mg/L	0.082	<0.050	<0.050	1.2	1.2	<0.050	<0.050	0.067	1.1	<0.050	<0.050	<0.050	<0.050	<0.050	0.055	<0.050
Saturation pH (@ 20C)			N/A	8.82	7.97	8.83	10.1	10.1	9.30	8.48	9.97	8.37	8.64	NC	9.54	9.19	NC	NC	NC
Saturation pH (@ 4C)			N/A	9.07	8.22	9.08	10.4	10.4	9.55	8.73	10.2	8.62	8.89	NC	9.79	9.44	NC	NC	NC
Total Alkalinity (Total as CaCO3)		5.0	mg/L	31	95	30	6.4	6.6	17	49	10	52	36	100	18	41	<5.0	<5.0	93
Dissolved Chloride (Cl)		1.0	mg/L	37	15	32	12	12	12	16	25	15	9.8	94	11	13	22	22	21
Colour		5.0	TCU	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	210	62	350	320	<5.0
Nitrate + Nitrite		0.050	mg/L	0.082	<0.050	<0.050	1.2	1.2	<0.050	<0.050	0.067	1.1	<0.050	<0.050	<0.050	<0.050	<0.050	0.055	<0.050
Nitrite (N)		0.010	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrogen (Ammonia Nitrogen)		0.050	mg/L	<0.050	<0.050	0.053	<0.050	<0.050	<0.050	0.056	<0.050	<0.050	<0.050	<0.050	<0.050	0.15	<0.050	<0.050	<0.050
Total Organic Carbon (C)		0.50	mg/L	0.71	0.56	1.4	<0.50	<0.50	<0.50	0.60	1.4	0.64	1.2	0.95	10 (1)	5.2 (1)	17 (1)	14 (1)	0.79
Orthophosphate (P)		0.010	mg/L	<0.010	0.032	<0.010	0.025	0.027	<0.010	<0.010	<0.010	0.012	<0.010	0.040	0.065	0.14	0.011	0.011	0.015
pH		N/A	pH	6.76	8.10	6.55	6.36	6.37	6.73	7.12	5.95	7.68	6.83	7.41	6.51	6.70	4.65	4.66	7.37
Reactive Silica (SiO2)		0.50	mg/L	6.9	9.1	4.6	6.9	6.9	5.7	9.6	8.0	11	5.7	13	18	27	4.5	4.5	19
Dissolved Sulphate (SO4)		2.0	mg/L	5.6	6.4	6.5	2.7	2.6	3.1	5.1	7.0	5.6	3.9	6.2	2.9	<2.0	2.4	2.4	12
Turbidity		0.10	NTU	0.50	0.34	3.1	0.26	<0.10	0.28	1.2	13	0.37	0.19	1.2	19	37	0.69	0.64	<0.10
Conductivity		1.0	uS/cm	190	230	180	67	67	76	140	120	170	100	490	84	120	84	84	260

NOTES:
NV = no value
CDWQ = Canadian Drinking Water Quality Guidelines, Aug 2012
1. Duplicate Sample BPRWA005 2. Duplicate Sample BPRWA010
3. Aluminum Aesthetic Objective (CDWQ - AO): Conventional Treatment Plants = 0.1 mg/L (100 ug/L), Other Treatment Systems = 0.2 mg/L (200 ug/L)
4. pH Objective (CDWQ): 6.5 - 8.5
5. Calculated result only includes measured parameters. Actual TDS may be higher.
6. Sample results likely affected by water softner treatment system
BOLD RED: Exceeds guideline

Table A2: Granite Borehole Groundwater Quality Results
Black Point Quarry Hydrogeology Program

	Guideline (CDWQ)	Detection Limit	Units	BPBH5	BPBH07	BPBH08	BPBH09
				22-July-2014	23-July-2014	23-July-2014	23-July-2014
Aluminium (ug/L)[3]	NV	5.0	ug/L	2900	2700	3000	1200
Ammonia (total)	NV	0.050	mg/L	0.072	<0.050	<0.050	0.15
Antimony	6	1.0	ug/L	2.2	<1.0	<1.0	<1.0
Arsenic	10	1.0	ug/L	9.5	39	2.1	31
Barium	1000	1.0	ug/L	15	10	17	14
Beryllium		1	ug/L	<1.0	1.4	<1.0	<1.0
Bicarbonate	NV	1	mg/L	<1	18	29	41
Bismuth			ug/L	<2.0	2.1	<2.0	<2.0
Boron	5000	50	ug/L	<50	<50	<50	<50
Cadmium	5	0.010	ug/L	0.35	1.8	0.17	0.11
Calcium	NV	100	ug/L	740	3300	5800	3400
Chloride	NV	1.0	mg/L	9.3	11	10	13
Chromium (ug/L)	50	1.0	ug/L	18	4.2	9.4	5
Cobalt		0.4	ug/L	1.7	11	0.65	3.1
Colour	NV	5.0	TCU	110	210	<5.0	62
Copper (ug/L)	NV	2.0	ug/L	15	130	61	22
Iron (ug/L)	NV	50	ug/L	6100	2700	6600	8200
Lead (ug/L)	10	0.50	ug/L	7.3	5.7	48	2.6
Magnesium	NV	100	ug/L	660	1900	2300	1900
Manganese (ug/L)	NV	2.0	ug/L	150	400	240	1400
Molybdenum	NV	2.0	ug/L	3.9	13	3.6	7
Nickel	NV	2.0	ug/L	3	11	2.7	4.9
Nitrate (as N)	10	0.050	mg/L	0.11	<0.050	<0.050	<0.050
Nitrite (as N)	NV	0.010	mg/L	<0.010	<0.010	<0.010	<0.010
Phosphorus		100	ug/L	340	270	820	420
Potassium	NV	100	ug/L	1100	2700	2200	4600
pH[4]	NV	N/A	pH	5.05	6.51	6.48	6.7
Selenium	10	1.0	ug/L	<1.0	<1.0	<1.0	<1.0
Silver	NV	0.10	ug/L	73	75	17	4.5
Sodium (ug/L)	NV	100	ug/L	6700	11000	12000	15000
Strontium			ug/L	4.7	22	20	20
Sulphate	NV	2.0	mg/L	<2.0	2.9	2.8	<2.0
Thallium	NV	0.10	ug/L	<0.10	0.13	<0.10	<0.10
Tin			ug/L	<2.0	<2.0	<2.0	<2.0
Titanium			ug/L	35	59	24	22
Total dissolved solids (TDS-	NV	1.0	mg/L	35	65	83	100
Turbidity	NV	0.10	NTU	40	19	39	37
Uranium	20	0.10	ug/L	17	260	14	20
Vanadium			ug/L	2.5	<2.0	<2.0	<2.0
Zinc (ug/L)	NV	5.0	ug/L	390	1800	580	1500
Anion Sum		N/A	me/L	0.27	0.75	0.95	1.21
Bicarb. Alkalinity		1	mg/L	<1.0	18	29	41
Calculated TDS		1	mg/L	35	65	83	100
Carb. Alkalinity (calc. as CaCO3)		1	mg/L	<1.0	<1.0	<1.0	<1.0
Cation Sum		N/A	me/L	0.64	0.95	1.28	1.4
Hardness (CaCO3)		1	mg/L	4.6	16	24	16
Ion Balance (% Difference)		N/A	%	40.7	11.8	14.8	7.28
Langelier Index (@ 20C)			N/A	NC	-3.03	-2.62	-2.49
Langelier Index (@ 4C)			N/A	NC	-3.28	-2.87	-2.74
Nitrate (N)		0.05	mg/L	0.11	<0.050	<0.050	<0.050
Saturation pH (@ 20C)			N/A	NC	9.54	9.1	9.19
Saturation pH (@ 4C)			N/A	NC	9.79	9.35	9.44
Total Alkalinity (Total as CaCO3)		5	mg/L	<5.0	18	29	41
Dissolved Chloride (Cl)		1	mg/L	9.3	11	10	13

Colour		5	TCU	110	210	<5.0	62
Nitrate + Nitrite		0.05	mg/L	0.11	<0.050	<0.050	<0.050
Nitrite (N)		0.01	mg/L	<0.010	<0.010	<0.010	<0.010
Nitrogen (Ammonia Nitrogen)		0.05	mg/L	0.072	<0.050	<0.050	0.15
Total Organic Carbon (C)		0.5	mg/L	13 (1)	10 (1)	1.4	5.2 (1)
Orthophosphate (P)		0.01	mg/L	0.013	0.065	0.12	0.14
pH		N/A	pH	5.05	6.51	6.48	6.7
Reactive Silica (SiO2)		0.5	mg/L	9.6	18	23	27
Dissolved Sulphate (SO4)		2	mg/L	<2.0	2.9	2.8	<2.0
Turbidity		0.1	NTU	40	19	39	37
Conductivity		1	uS/cm	46	84	92	120

NOTES:

NV = no value

Canadian Drinking Water Quality CDWQ Guidelines: Aug 2012

3. Aluminum Aesthetic Objective (CDWQ - AO): Conventional Treatment Plants = 0.1 mg/L (100 ug/L), Other Treatment Systems = 0.2 mg/L (200 ug/L)
4. pH Objective (CDWQ): 6.5 - 8.5
5. Calculated result only includes measured parameters. Actual TDS may be higher.

BOLD RED Exceeds guideline

Table A3: Stream Water Quality Results
Black Point Quarry Hydrogeology Program

	(CWQG PAL Freshwater)	Detection Limit	Units	BPSTR09 31-07-2014	BPSTR12 31-07-2014	BPSTR08 24-07-2014	BPSTR06 24-07-2014	BPSTR10[1] 25-July-2014	BPSTR11[1] 25-July-2014
Aluminium (ug/L)[4]	5	5.0	ug/L	270	820	680	370	610	610
Ammonia (total)[5]	0	0.050	mg/L	0.084	<0.050	<0.050	0.086	<0.050	<0.050
Antimony	NV	1.0	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic	5	1.0	ug/L	<1.0	1.5	2	1.7	<1.0	<1.0
Barium	NV	1.0	ug/L	1.4	2.8	2.6	1.6	5.6	5.6
Beryllium		1	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bicarbonate Alkalinity	NV	1	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bismuth		2	ug/L			<2.0	<2.0	<2.0	<2.0
Boron	NV	50	ug/L	<50	<50	<50	<50	<50	<50
Cadmium	0.017	0.010	ug/L	0.016	0.019	0.018	0.021	0.032	0.026
Calcium	NV	100	ug/L	220	410	240	320	1000	920
Chloride[6]	120	1.0	mg/L	12	12	11	12	22	22
Chromium (ug/L)	NV	1.0	ug/L	<1.0	<1.0	<1.0	<1.0	1.1	<1.0
Cobalt		0.4	ug/L	<0.40	<0.40	<0.40	<0.40	0.7	0.69
Colour	NV	5.0	TCU	91	300	220	300	350	320
Copper		2	ug/L	<2.0	<2.0	390	760	1600	1500
Iron (ug/L)	300	50	ug/L	320	950	390	760	1600	1500
Lead (ug/L)[10]	1	0.50	ug/L	<0.50	1.2	0.86	0.96	1.2	1.2
Magnesium	NV	100	ug/L	570	620	450	550	930	920
Manganese (ug/L)	NV	2.0	ug/L	56	46	17	19	200	200
Molybdenum	73	2.0	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel[11]	25	2.0	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nitrate (as N)[12]	3	0.050	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.055
Nitrite (as N)	0.06	0.010	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Phosphorus		100	ug/L	<100	100	<100	110	110	<100
Potassium	NV	100	ug/L	280	290	370	360	750	720
pH[15]	6.5-9	N/A	pH	4.7	4.33	4.35	4.35	4.65	4.66
Selenium	1	1.0	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver	0.1	0.10	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium (ug/L)	NV	100	ug/L	6000	6400	6000	5600	12000	11000
Strontium			ug/L	2.8	4.2	2.8	4.2	7.5	7.4
Sulphate	NV	2.0	mg/L	<2.0	<2.0	<2.0	<2.0	2.4	2.4
Thallium	0.8	0.10	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin		2	ug/L	<0.10	<0.10	<2.0	<2.0	<2.0	<2.0
Titanium			ug/L	<2.0	<2.0	4.9	3.1	10	9.8
Total dissolved solids (TDS-Calculated)[19]	NV	1.0	mg/L	20	26	28	23	45	45
Turbidity	NV	0.10	NTU	0.93	1.6	1.2	1	0.69	0.64
Uranium	NV	0.10	ug/L	<0.10	0.41	0.49	0.14	<0.10	<0.10
Vanadium		2	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Zinc (ug/L)	30	5.0	ug/L	8.2	10	18	7.5	18	9
Anion Sum		N/A	me/L	0.34	0.33	0.310	0.350	0.660	0.670
Bicarb. Alkalinity (calc. as CaCO3)		1	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Calculated TDS		1	mg/L	20	26	28	23	45	45
Carb. Alkalinity (calc. as CaCO3)		1	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cation Sum		N/A	me/L	0.36	0.44	0.380	0.390	0.730	0.710
Hardness (CaCO3)		1	mg/L	2.9	3.6	2.4	3.0	6.3	6.1
Ion Balance (% Difference)		N/A	%	2.86	14.3	10.1	5.41	5.04	2.90
Langelier Index (@ 20C)			N/A	NC	NC	NC	NC	NC	NC
Langelier Index (@ 4C)			N/A	NC	NC	NC	NC	NC	NC
Saturation pH (@ 20C)			N/A	NC	NC	NC	NC	NC	NC
Saturation pH (@ 4C)			N/A	NC	NC	NC	NC	NC	NC
Total Alkalinity (Total as CaCO3)		5	mg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Dissolved Chloride (Cl)		1	mg/L	12	12	11	12	22	22
Colour		5	TCU	91	300	220	300	350	320
Nitrate + Nitrite		0.05	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.055
Nitrogen (Ammonia Nitrogen)		0.05	mg/L	0.084	<0.050	<0.050	0.086	<0.050	<0.050
Total Organic Carbon (C)		0.5	mg/L	7.3	24 (1)	13 (1)	11 (1)	17 (1)	14 (1)
Orthophosphate (P)		0.01	mg/L	<0.010	<0.010	0.019	0.032	0.011	0.011
Reactive Silica (SiO2)		0.5	mg/L	<0.50	5	9.7	2.3	4.5	4.5
Dissolved Sulphate (SO4)		2	mg/L	<2.0	<2.0	<2.0	<2.0	2.4	2.4
Conductivity		1	uS/cm	54	60	57	57	84	84

NV = no value

Canadian Water Quality Guidelines (CWQG) Protection for Aquatic Life (PAL) Freshwater Guidelines Update 7.0: Sep 2007

1. Duplicate sample is BPSTR011

4. Aluminum Guideline (CWQG Aquatic Life - Freshwater): if pH < 6.5 then 0.005 mg/L (5 ug/L), else if pH >= 6.5 then 0.1 mg/L (100 ug/L)

5. Ammonia (CWQG Aquatic Life - Freshwater) - guidelines vary with pH and temperature. See fact sheet for details

6. Chloride Guideline value is for long term exposure. Short term exposure value is 640 mg/L

7. Copper Guideline (CWQG Aquatic Life - Freshwater): if $CaCO_3$ < 120 mg/L then 0.002 mg/L, if CaCO3 = 120-180 mg/L then 0.003 mg/L, if CaCO3 > 180 mg/L then 0.004 mg/L

8. Dissolved Oxygen Guideline (CWQG A.L. - Freshwater): Warm-water biota early life stages 6000 ug/L, other life stages 5500 ug/L, Cold-water biota early life stages 9500 ug/L, other life stages 6500 ug/L

9. Dissolved Oxygen Guideline (CWQG Aquatic Life - Marinewater): > 8000 ug/L

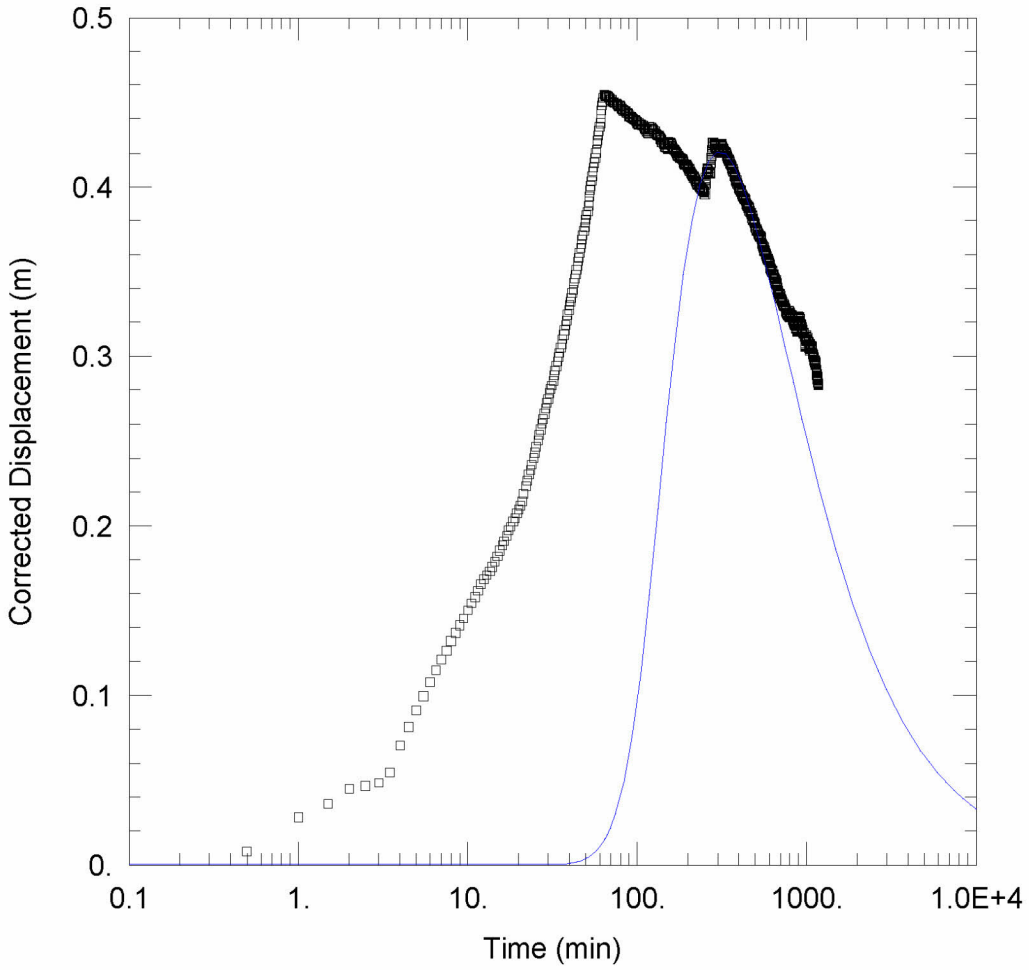
10. Pb Guideline (CWQG A.L.- Freshwater): if $CaCO_3$ < 60 mg/L then 0.001 mg/L, if CaCO3 = 60-120 mg/L then 0.002 mg/L, if CaCO3 = 120-180 mg/L then 0.004 mg/L, if CaCO3 > 180 mg/L then 0.007 mg/L,

11. Ni Guideline (CWQG A.L.-Freshwater): if $CaCO_3$ < 60 mg/L then 0.025 mg/L, if CaCO3 = 60-120 mg/L then 0.065 mg/L, if CaCO3 = 120-180 mg/L then 0.110 mg/L, if CaCO3 > 180 mg/L then 0.150 mg/L

12. Nitrate Canadian Water Quality Guidelines (CWQG) for Aquatic Life represents lower value for "Long Term Exposure". Short Term exposure values are 124 and 339 for Freshwater and Marine respectively

15. pH Guideline (CWQG Aquatic Life): Freshwater 6.5 - 9, Marine 7.0 - 8.7
16. Salinity Guideline (CWQG Aquatic Life - Marinewater): < 10% fluctuation.
17. Taste Aesthetic Objective (CDWQ): "Inoffensive"
18. Temperature Aesthetic Objective (CDWQ): <= 15°C
19. Calculated result only includes measured parameters. Actual TDS may be higher.

BOLD RED Exceeds guideline



WELL TEST ANALYSIS

Data Set: P:\...\RWA001 yield test.aqt
Date: 08/13/14 Time: 10:37:23

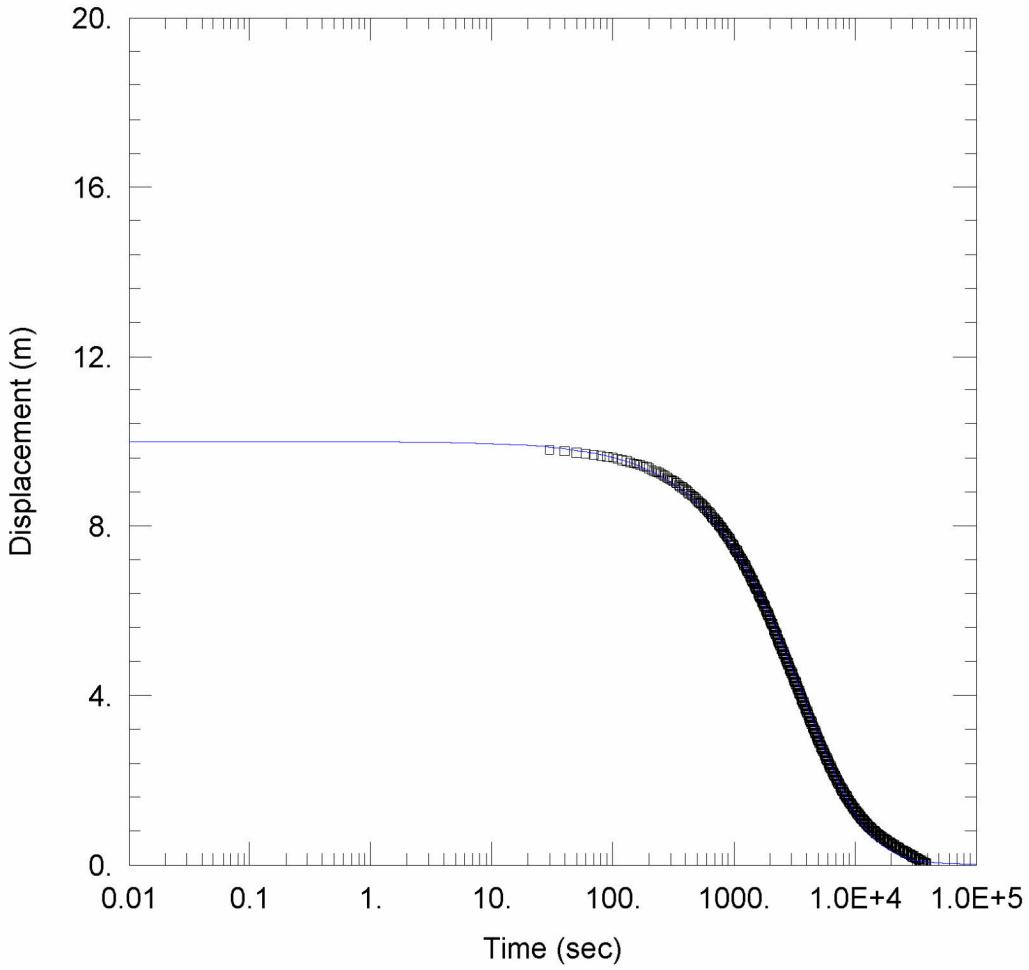
PROJECT INFORMATION

Company: AECOM
Client: Vulcan
Project: 60323234
Location: Black Point
Test Well: RWA001
Test Date: July 16, 2014

SOLUTION

Aquifer Model: Unconfined Solution Method: Theis

T = 2.545E-6 m^2/sec S = 0.7879
Kz/Kr = 1.0E-5 b = 3. m



WELL TEST ANALYSIS

PROJECT INFORMATION

Company: AECOM
Client: Vulcan
Project: 60323234
Location: Black Point
Test Well: RWA007
Test Date: July 17, 2014

AQUIFER DATA

Saturated Thickness: 73. m

WELL DATA (BPRWA007)

Initial Displacement: 10. m
Total Well Penetration Depth: 83. m
Casing Radius: 0.076 m
Static Water Column Height: 73. m
Screen Length: 80. m
Well Radius: 0.076 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 5.807E-8 m/sec
Kz/Kr = 1.
Ss = 1.402E-6 m^{-1}

Figure C1: Granite borehole long term monitoring data

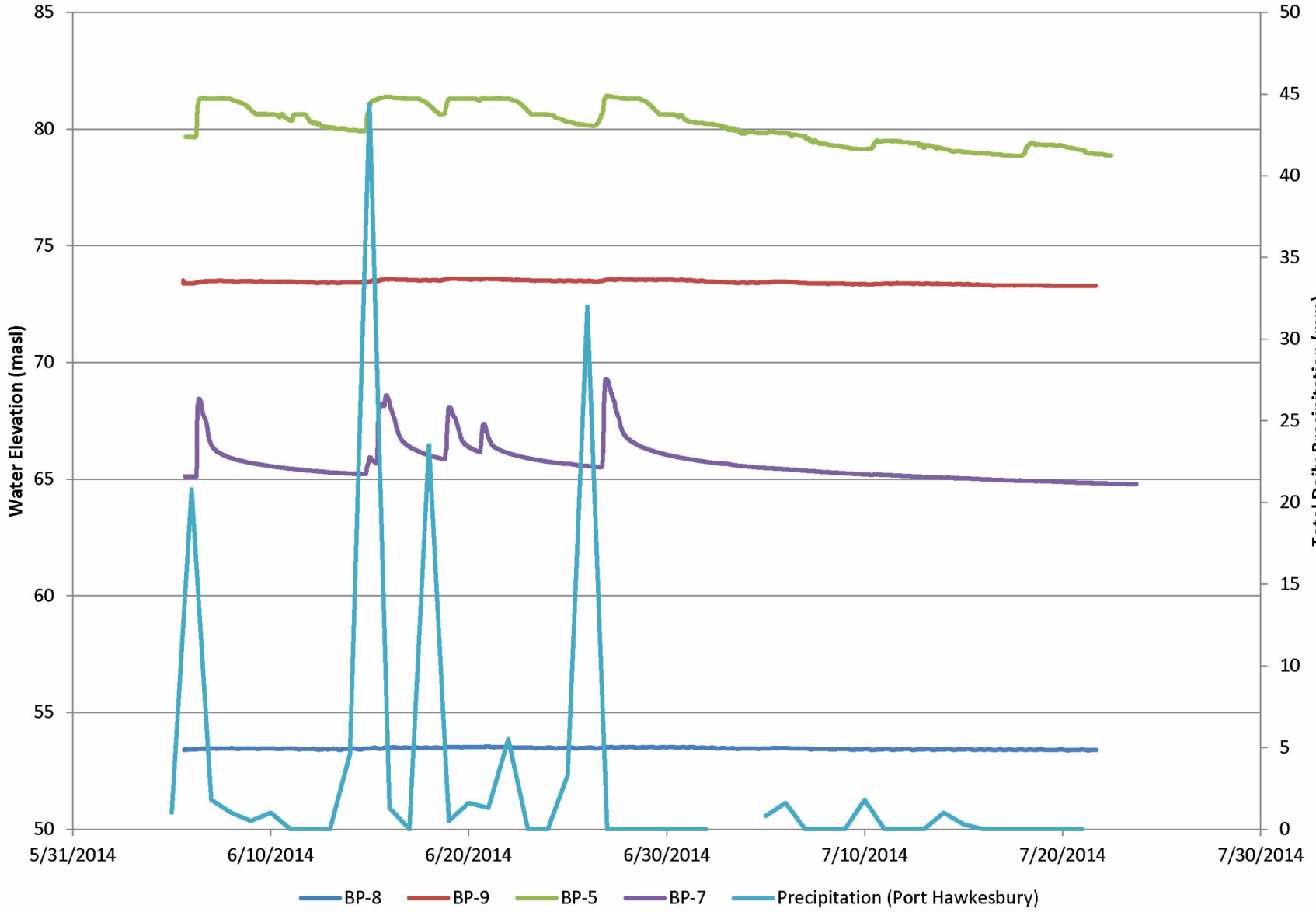


Figure C2: BP 8 long term monitoring data

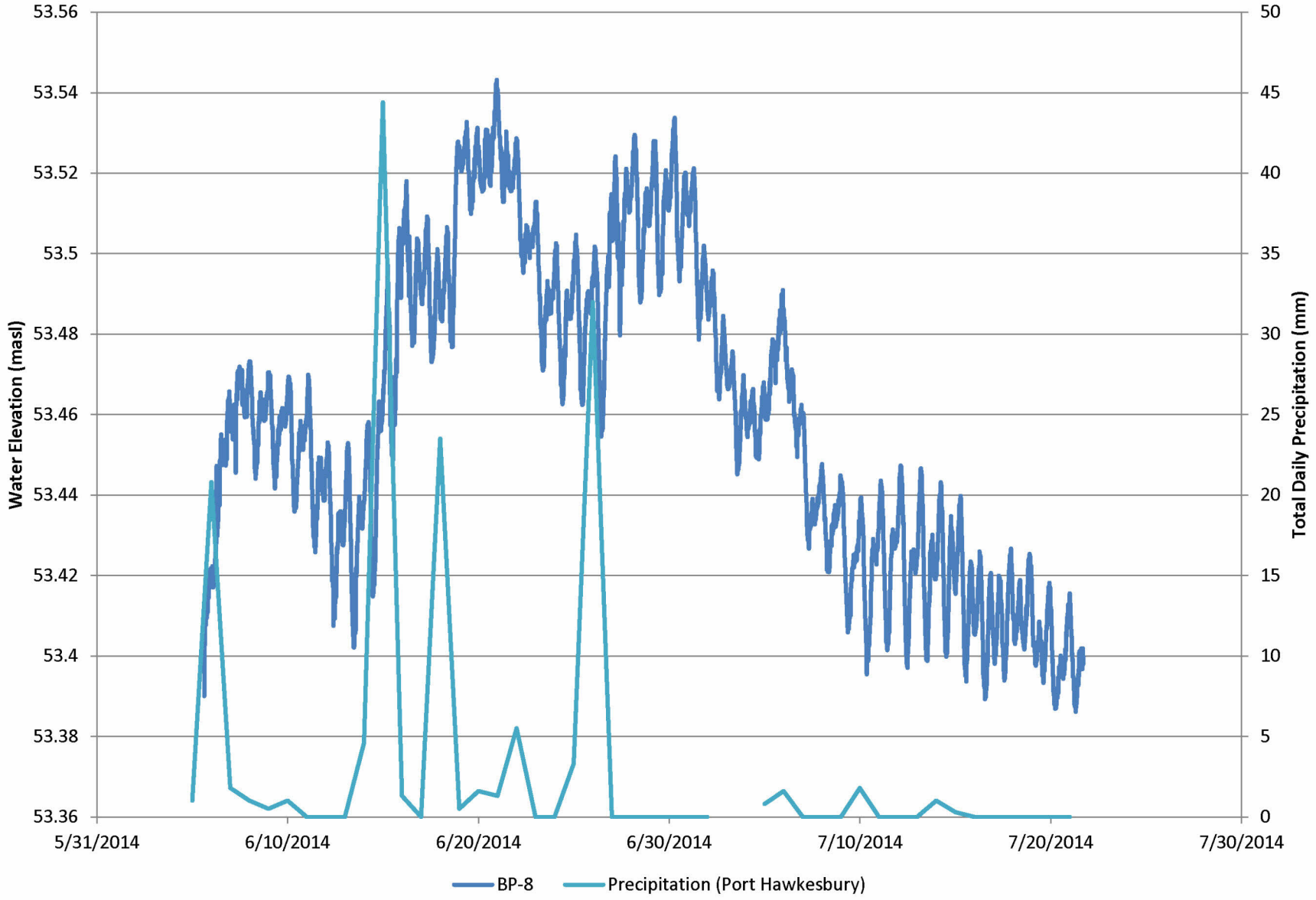
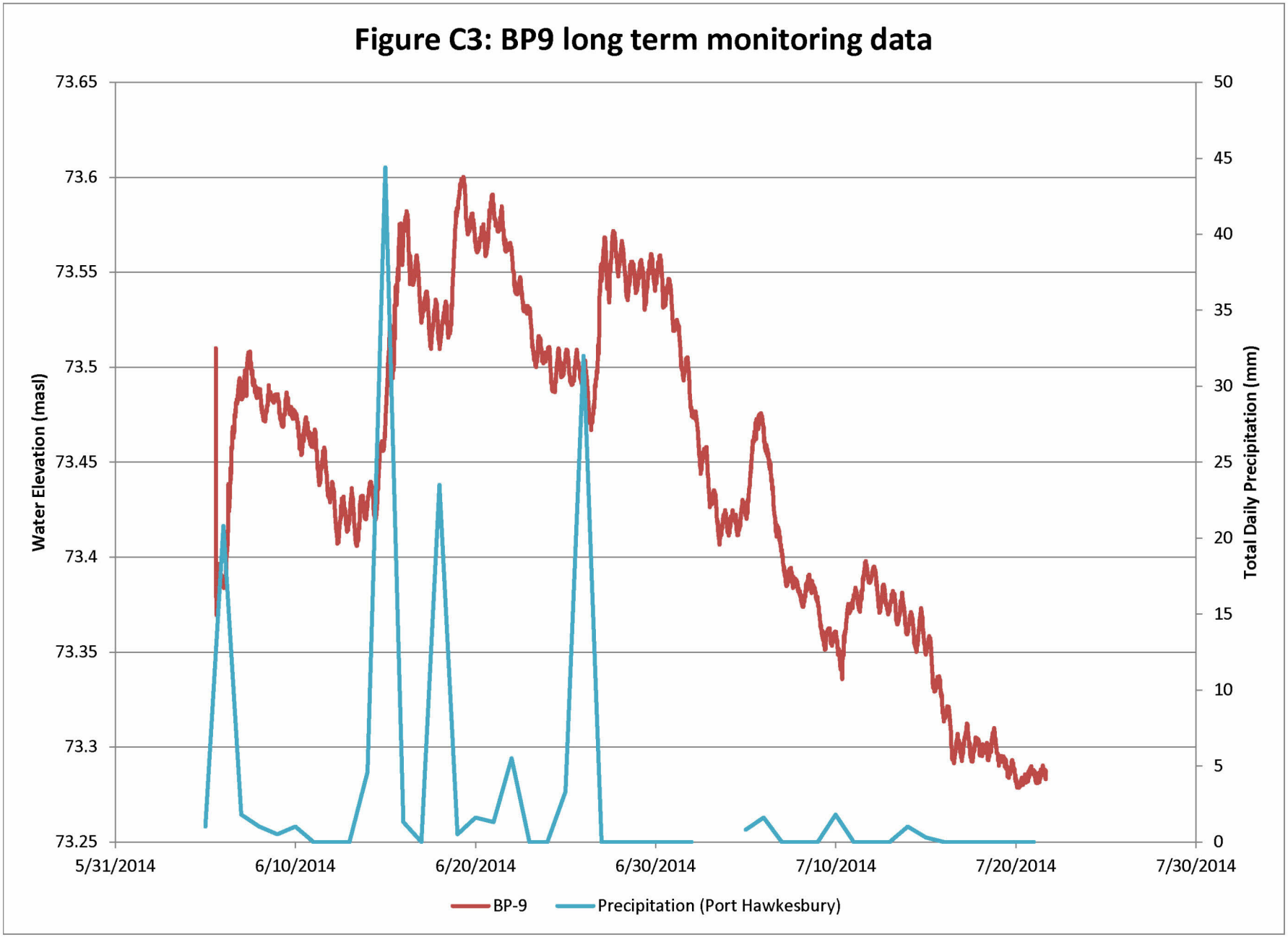
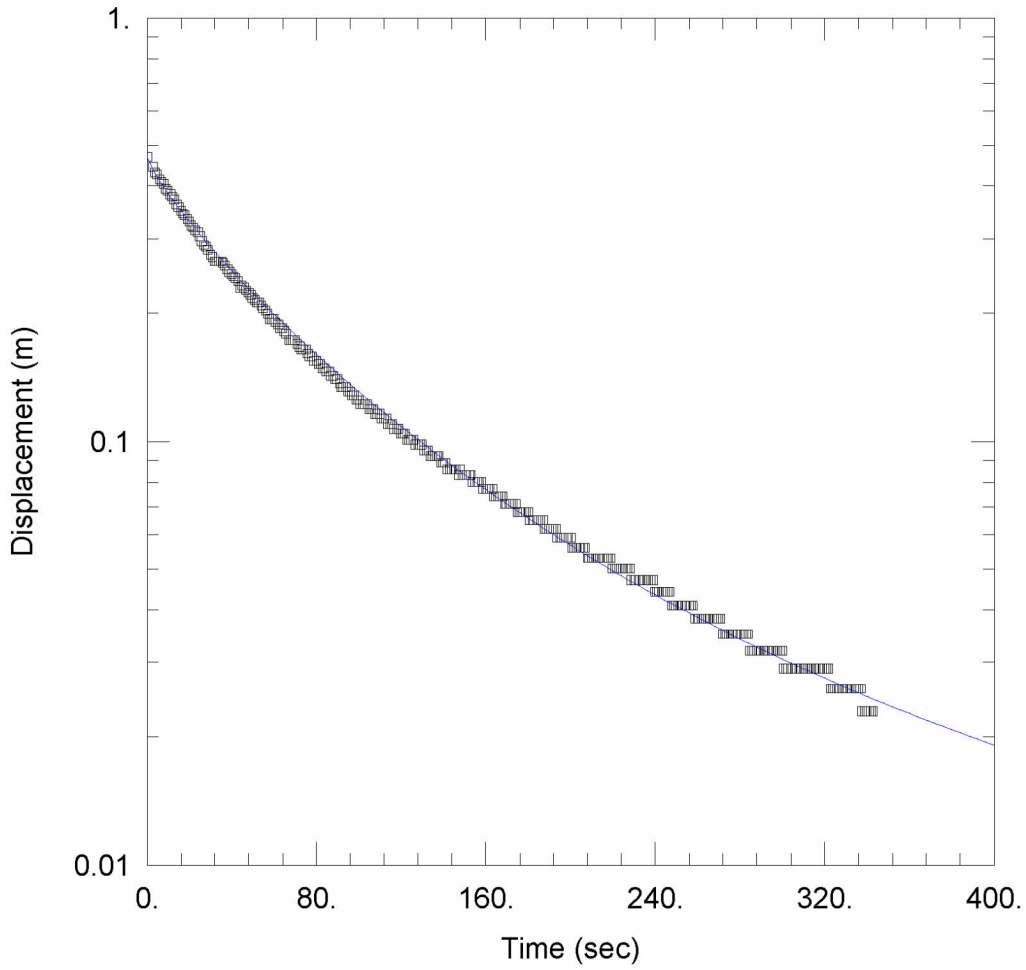


Figure C3: BP9 long term monitoring data





WELL TEST ANALYSIS

PROJECT INFORMATION

Company: AECOM
Client: Vulcan
Project: 60323234
Location: Black Point
Test Well: BP5
Test Date: July 22, 2014

AQUIFER DATA

Saturated Thickness: 86.67 m

WELL DATA (BP5)

Initial Displacement: 0.47 m
Total Well Penetration Depth: 89. m
Casing Radius: 0.03785 m

Static Water Column Height: 86.67 m
Screen Length: 89. m
Well Radius: 0.03785 m

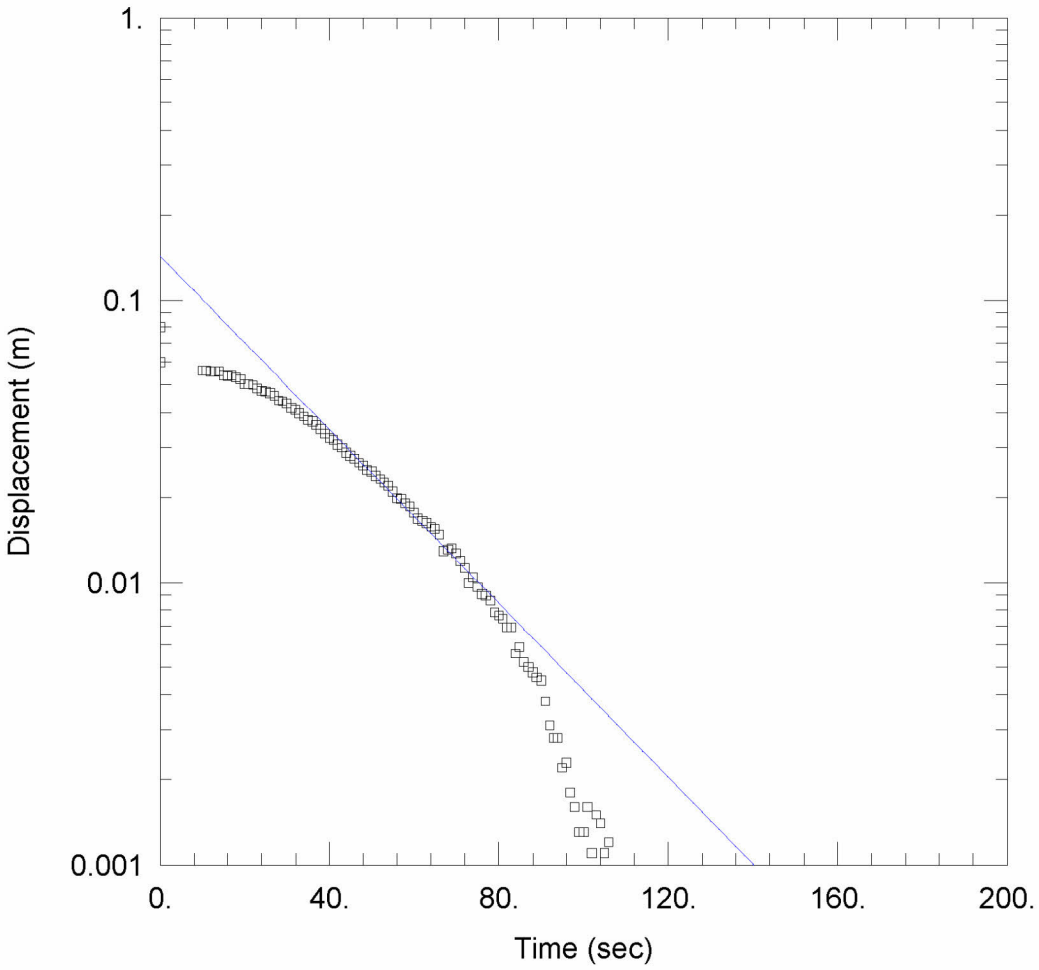
SOLUTION

Aquifer Model: Unconfined

Kr = 4.464E-7 m/sec
Kz/Kr = 1.

Solution Method: KGS Model

Ss = 1.791E-5 m^{-1}



WELL TEST ANALYSIS

PROJECT INFORMATION

Company: AECOM
Client: Vulcan
Project: 60323234
Location: Black Point
Test Well: BP7
Test Date: July 22, 2014

AQUIFER DATA

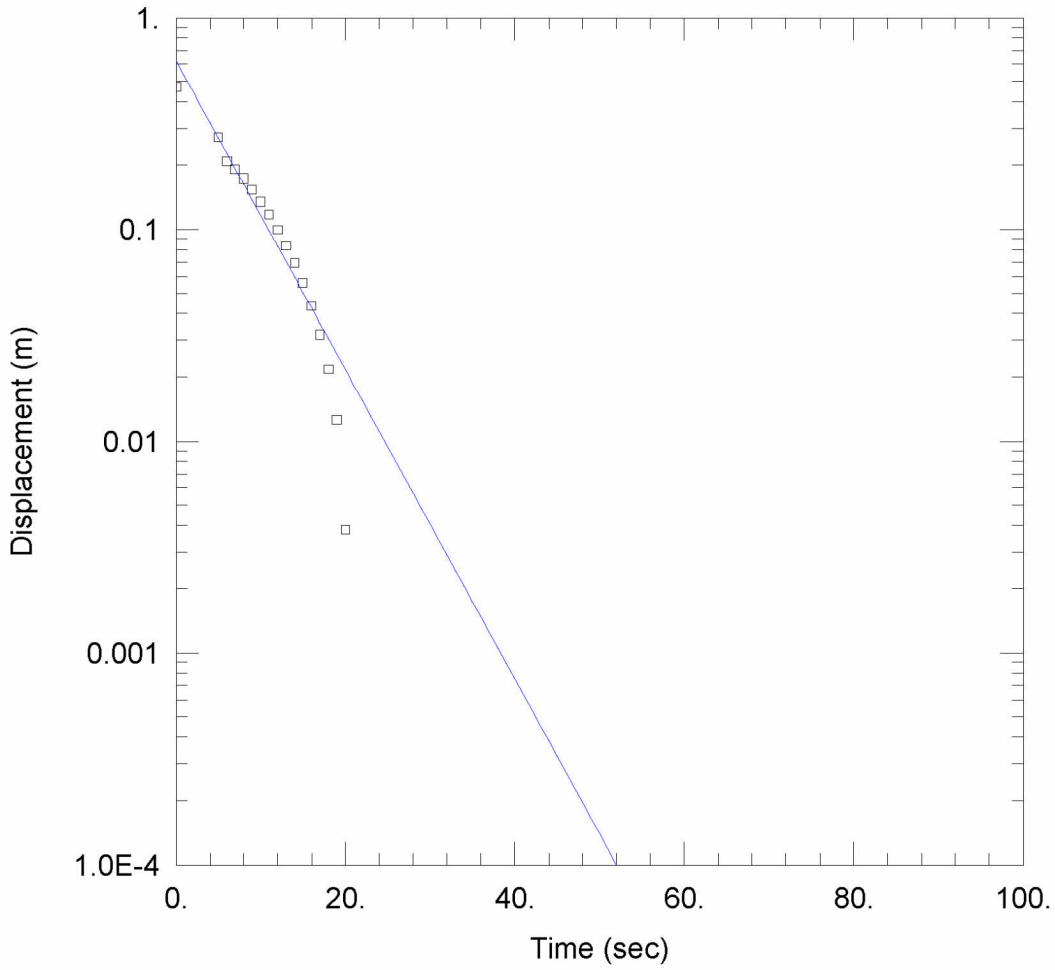
Saturated Thickness: 70.69 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BP7)

Initial Displacement: 0.08 m
Total Well Penetration Depth: 70.69 m
Casing Radius: 0.0378 m
Static Water Column Height: 70.69 m
Screen Length: 70.69 m
Well Radius: 0.0378 m

SOLUTION

Aquifer Model: Unconfined
K = 2.343E-6 m/sec
Solution Method: Bouwer-Rice
y0 = 0.1435 m



WELL TEST ANALYSIS

PROJECT INFORMATION

Company: AECOM
Client: Vulcan
Project: 60323234
Location: Black Point
Test Well: BP8
Test Date: July 22, 2014

AQUIFER DATA

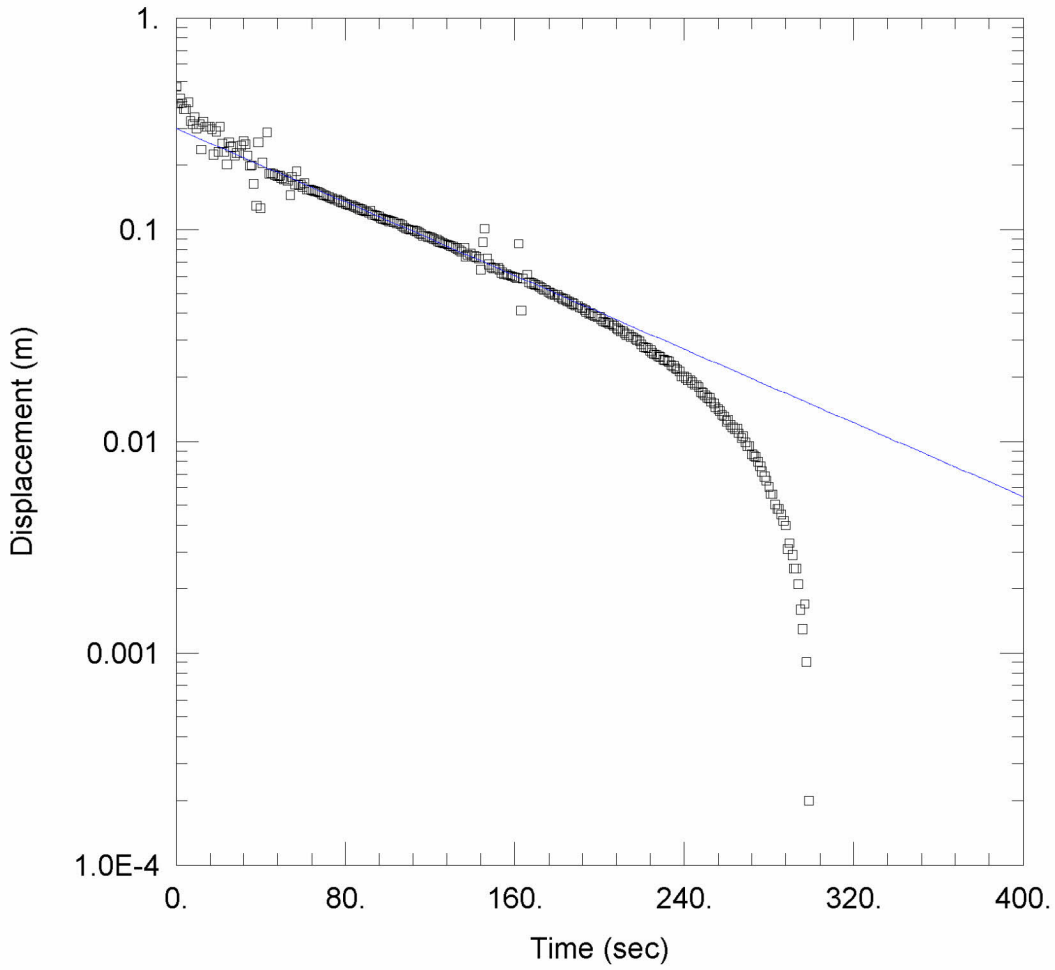
Saturated Thickness: 53. m
Anisotropy Ratio (Kz/Kr): 0.6607

WELL DATA (BP8)

Initial Displacement: 0.47 m
Total Well Penetration Depth: 53. m
Casing Radius: 0.03785 m
Static Water Column Height: 53. m
Screen Length: 53. m
Well Radius: 0.03785 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 1.412E-5 m/sec
y0 = 0.6262 m



WELL TEST ANALYSIS

PROJECT INFORMATION

Company: AECOM
Client: Vulcan
Project: 60323234
Location: Black Point
Test Well: BP9
Test Date: July 22, 2014

AQUIFER DATA

Saturated Thickness: 73. m
Anisotropy Ratio (Kz/Kr): 0.6607

WELL DATA (BP9)

Initial Displacement: 0.47 m
Total Well Penetration Depth: 73. m
Casing Radius: 0.03785 m
Static Water Column Height: 73. m
Screen Length: 73. m
Well Radius: 0.03785 m

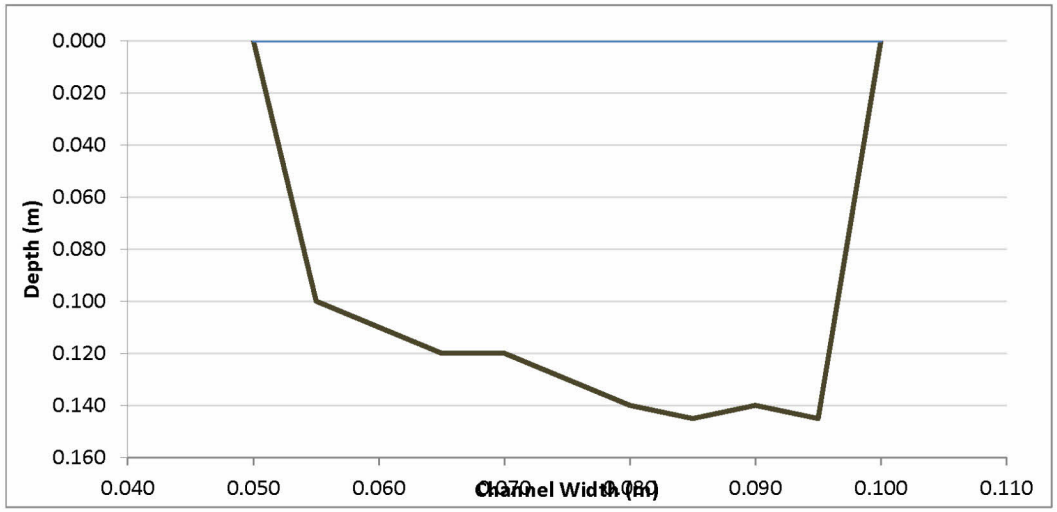
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 6.453E-7 m/sec
y0 = 0.2997 m

Location: BPSTR0P6
Date/Time: July 30, 2014 @ 9:00 am
Coordinates:
Description: Width = 50 cm. Well-defined channel by rock banks and gravel bed.
Metered By: Craig Hatt Recorded By: Tim Bachiu

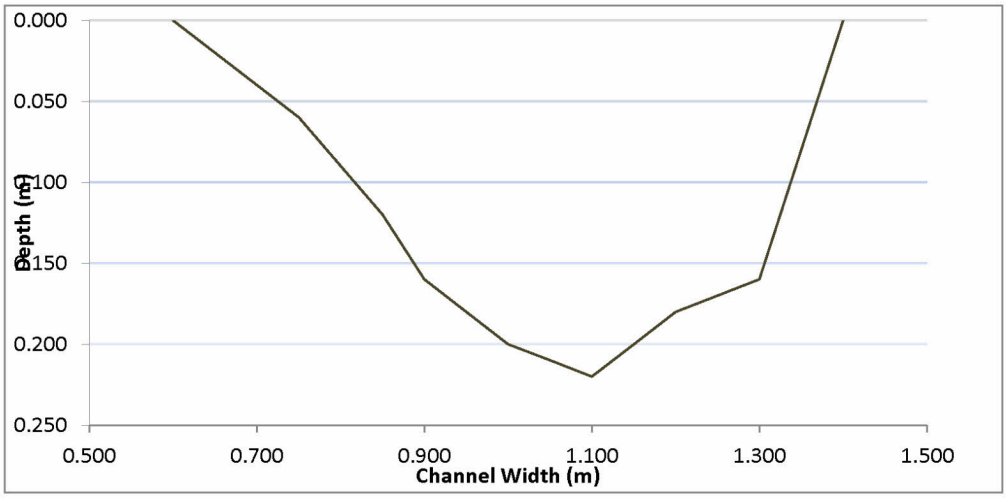
Station (m)	Depth (m)	Area (m^2)	Velocity (m/s)	Q (m^3/s)	Notes
0.050	0.000	0.0000000	0.00	0.00000000	LB (Looking Upstream)
0.055	0.100	0.0005000	-0.01	-0.00000500	
0.060	0.110	0.0005500	0.00	0.00000000	
0.065	0.120	0.0006000	0.00	0.00000000	
0.070	0.120	0.0006000	0.00	0.00000000	
0.075	0.130	0.0006500	0.00	0.00000000	
0.080	0.140	0.0007000	0.01	0.00000700	
0.085	0.145	0.0007250	0.01	0.00000725	
0.090	0.140	0.0007000	0.01	0.00000700	
0.095	0.145	0.0007250	0.02	0.00001450	
0.100	0.000	0.0000000	0.00	0.00000000	RB (Looking Upstream)

Total	0.000031	m^3/s
	0.031	L/s



Location: BPSTR09
Date/Time: July 31, 2014 @ 10:40 am
Coordinates:
Description:
Metered By: Craig Hatt Recorded By: Tim Bachiu

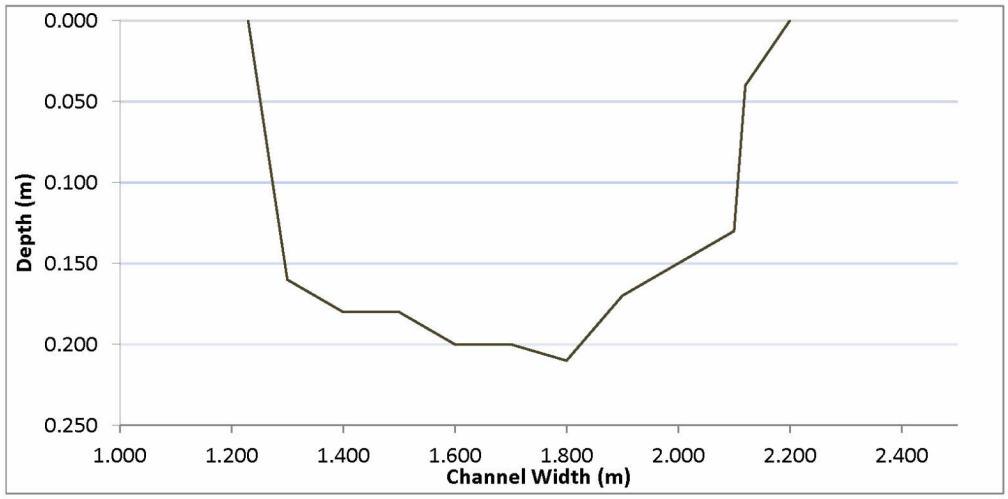
Station (m)	Depth (m)	Area (m^2)	Velocity (m/s)	Q (m^3/s)	Notes
0.600	0.000	0.0000000	0.00	0.00000000	LB (Looking Upstream)
0.750	0.060	0.0075000	-0.02	-0.00015000	
0.850	0.120	0.0090000	0.00	0.00000000	
0.900	0.160	0.0080000	0.01	0.00008000	
0.950	0.180	0.0090000	0.01	0.00009000	
1.000	0.200	0.0100000	0.01	0.00010000	
1.050	0.210	0.0105000	0.00	0.00000000	
1.100	0.220	0.0110000	0.01	0.00011000	
1.150	0.200	0.0100000	0.01	0.00010000	
1.200	0.180	0.0135000	0.00	0.00000000	
1.300	0.160	0.0160000	-0.01	-0.00016000	RB (Looking Upstream)
1.400	0.000	0.0000000	0.00	0.00000000	
					m^3/s
			Total	0.000170	L/s
				0.170	



Location: BPSTR12
Date/Time: July 31, 2014 @ 11:45 am
Coordinates: UTM: 645,841m, 5,022,319m
Description: Width = 50 cm. Well-defined channel by rock banks and gravel bed.
Metered By: Craig Hatt Recorded By: Tim Bachiu

Station (m)	Depth (m)	Area (m^2)	Velocity (m/s)	Q (m^3/s)	Notes
1.230	0.000	0.0000000	0.00	0.00000000	LB (Looking Upstream)
1.300	0.160	0.0136000	0.05	0.00068000	
1.400	0.180	0.0180000	0.05	0.00090000	
1.500	0.180	0.0180000	0.05	0.00090000	
1.600	0.200	0.0200000	0.06	0.00120000	
1.700	0.200	0.0200000	0.06	0.00120000	
1.800	0.210	0.0210000	0.05	0.00105000	
1.900	0.170	0.0170000	0.05	0.00085000	
2.000	0.150	0.0150000	0.04	0.00060000	
2.100	0.130	0.0078000	0.04	0.00031200	
2.120	0.040	0.0020000	0.02	0.00004000	
2.200	0.000	0.0000000	0.00	0.00000000	RB (Looking Upstream)

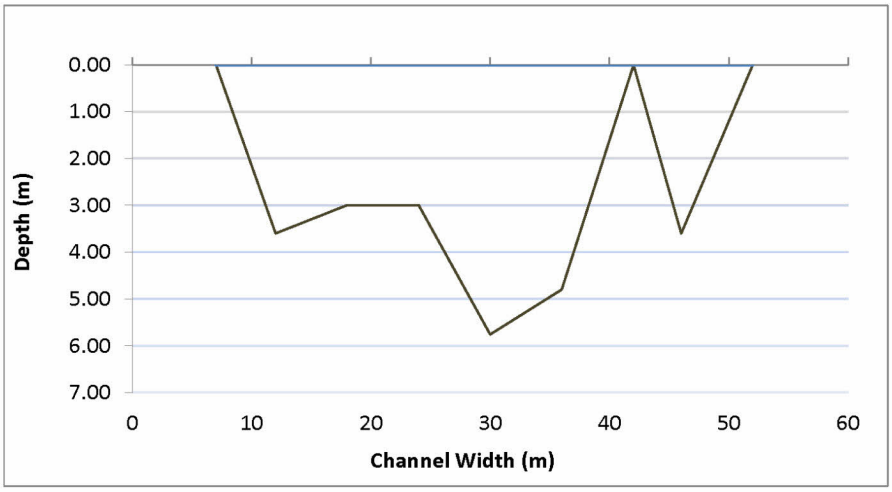
Total	0.00773	m^3/s
	7.73	L/s



Location: BPSTR10
Date/Time: July 25, 2014 @ 10 am
Coordinates:
Description:
Metered By: Mike McKenzie (SLR) Recorded By: Craig Hatt (AECOM)

Distance (in)	Depth (in)	Area (in^2)	Velocity (in/s)	Q (in^3/s)	Notes
7	0.00	0.00	0.00	0.0	LB (Looking Upstream)
12	3.60	19.80	0.12	2.4	
18	3.00	18.00	0.60	10.8	
24	3.00	18.00	6.48	116.6	
30	5.76	34.56	3.24	112.0	
36	4.80	28.80	0.96	27.6	
42	0.00	0.00	0.00	0.0	
46	3.60	18.00	-0.60	-10.8	
52	0.00	0.00	0.00	0.0	RB (Looking Upstream)

Total	259	in^3/s
	0.00424	m^3/s
	4.24	L/s



ATTACHMENT F
AECOM Technical Memo – August 2014 Fieldwork

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

AECOM
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902 428 2031 fax

Memorandum

To	Russell Dmytriw	Page	1
CC	Robert Till, Steve Usher		
Subject	Technical Memorandum: Black Point Hydrogeology August, 2014 Field Program		
From	Timothy Bachiu		
Date	September 23, 2014	Project Number	60323234

Field work in support of the hydrological and hydrogeological assessments of the proposed Black Point Quarry site was completed by AECOM and SLR Consulting (Canada) staff from August 25-29, 2014. This memo documents field activities and presents data compiled from field tests and measurements completed during the late August field event.

1. Mini-Piezometers

Mini-piezometers were installed at nine (9) locations as documented in the AECOM Technical Memorandum dated August 15, 2014. Water levels in each mini-piezometer (MP) were subsequently measured on August 26 and 27 (**Table 1**). The difference in water levels (DH) at each piezometer location is calculated by subtracting the water level (meters below ground surface – mbgs) in the deep MP from the water level in the shallow MP. Negative values indicate the water level in the deeper MP is lower than the shallow MP. The difference in the depth of the screened intervals (DL) is calculated as the difference between the deepest part of the screen in the shallow MP and depth of the upper limit of the screen in the deep MP. The vertical gradient is calculated by dividing the difference in the water levels by the DL (DH/DL). Negative values indicate a downward vertical gradient and positive values indicate an upward vertical gradient.

C 1340-913

Table 1: Water Levels

Mini piezometer ID	Bottom of perforated interval	Top of perforated interval	Vertical separation of screened intervals (DL)	Stick up	Water Level			Vertical gradient
	(mbgs)	(mbgs)	(m)	(m)	(m below top of pipe)	(mbgs)	Difference (shallow - deep)	
MP1 shallow	2.158	1.807	0.826	0.667	0.755	0.088	-0.111	-0.13
MP1 deep	3.334	2.984		0.72	0.919	0.199		
MP2 shallow	1.39	0.938	0.487	0.817	1.147	0.33	-0.257	-0.53
MP2 deep	2.227	1.877		1.815	2.402	0.587		
MP3 shallow	1.99	1.64	0.789	0.86	1.273	0.413	0.09	0.11
MP3 deep	3.132	2.779		0.915	1.238	0.323		
MP4 shallow	2.058	1.709	0.641	0.771	0.761	-0.01	0.043	0.07
MP4 deep	3.042	2.699		1.01	0.957	-0.053		
MP5 shallow	1.812	1.461	1.285	1.005	1.2	0.195	-0.17	-0.13
MP5 deep	3.447	3.097		0.605	0.97	0.365		
MP6 stream	0	n/a	0.985	0.897	0.764	-0.133	-0.6	-0.61
MP6 deep	1.335	0.985		0.897	1.364	0.467		
MP7 shallow	1.719	1.369	1.07	1.11	1.186	0.076	0.016	0.01
MP7 deep	3.14	2.789		0.904	0.964	0.06		
MP8 stream	0	n/a	0.44	0.796	0.736	-0.06	-0.146	-0.33
MP8 deep	0.79	0.44		0.796	0.882	0.086		
MP9 stream	0	n/a	1.003	1.46	1.335	-0.125	0.03	0.03
MP9 deep	1.353	1.003		1.46	1.305	-0.155		

Mini-piezometers at MP 2 (deep and shallow) and MP6 (deep and stream) contained data loggers installed during a previous site visit. Recorded data from these MPs are provided in the spreadsheet **Appendix A**.

2. Granite Boreholes

A water level survey of all granite boreholes was completed between August 25 and 28. Water level measurements collected in June, July and August 2014 are provided in Table 2. Data loggers were retrieved, downloaded and replaced. Barometrically compensated data and charts from each data logger are provided in the spreadsheet **Appendix B** in the files accompanying this memorandum.

Table 2: Water Levels

BH ID	Elevation (masl)[1]	Total depth (m)[1]	Stick up (m)[2]	WL (mTOC)	WL (mbgs)	WL elevation (masl)	WL (mTOC)	WL (mbgs)	WL elevation (masl)	WL (mTOC)	WL (mbgs)	WL elevation (masl)
				5-Jun-14			21-Jul-14			21-25 Aug 14		
BP-1A	73	100	-	-	-	-	-	-	-	-	-	-
BP-6A	73	56	n/a	n/a	3.73	**69.27**	n/a	4.01	**68.99**	n/a	4.64	**68.36**
BP-6B	69	70	n/a	-	-	**-**	-	-	**-**	-	-	**-**
BP-1B	74	80	-	-	-	**-**	-	-	**-**	-	-	**-**
BP-2	82	86	n/a	n/a	2.51	**79.49**	n/a	2.64	**79.36**	n/a	2.7	**79.30**
BP-3	74	60	n/a	n/a	3.12	**70.88**	n/a	3.27	**70.73**	n/a	3.39	**70.61**
BP-4	100	120	n/a	n/a	2.46	**97.54**	n/a	3.37	**96.63**	n/a	4.32	**95.68**
BP-5	82	89	n/a	n/a	2.33	**79.67**	n/a	2.33	**79.67**	n/a	3.54	**78.46**
BP-7	70	120	0.68	5.56	4.88	**65.12**	5.93	5.25	**64.75**	6.37	5.69	**64.31**
BP-8	58	108	0.7	5.31	4.61	**53.39**	5.36	4.66	**53.34**	5.51	4.81	**53.19**
BP-9	79	130	0.68	6.17	5.49	**73.51**	6.3	5.62	**73.38**	6.57	5.89	**73.11**

1 - Data from borehole logs

n/a - not applicable

'-' no information available

TOC - Top of Casing

WL – Water Level

mbgs - meters below ground surface

masl - meters above sea level

Short term pumping tests were completed and water quality samples were collected from granite boreholes BH5, BH7, BH8 and BH9. Prior to pump installation, a data logger with 30 m depth range was installed in the well at depth or approximately 2 m below the anticipated pump intake depth. The pump was installed and water was pumped from each borehole using a 12 Volt submersible pump powered by a 12 Volt marine battery.

The pumping test at BH5 was completed on August 28, 2014. Water was pumped from the borehole for approximately 135 minutes at a rate of 6.2 L/minute. Maximum drawdown approximately 3 m. After the pumping was completed, recovery was monitored until 85% of the drawdown had recovered.

The pumping test at BH7 was completed on August 28, 2014. Water was pumped from the borehole at two intervals of 15 minutes at a rate of 5.7 L/minute. The maximum drawdown observed was 1.4 m. Recovery was monitored for 25 minutes, during which 59% of displacement recovery was observed. During the second portion of the pumping, the pump was malfunctioning and did not operate consistently.

The pumping test at BH8 was completed on August 28, 2014. Water was pumped from the borehole for 135 minutes at a rate of 3.2 L/minute. The maximum drawdown observed was 1.05 m. Recovery was monitored for 12 minutes, during which 41 % of recovery was observed.

The pumping test at BH9 was completed on August 28, 2014. Water was pumped from the borehole for 99 minutes at a rate of 2.6 L/minute. The maximum drawdown observed was 1.63 m. Recovery was monitored for 44 minutes, during which 75% of recovery was observed.

Field parameters were measured at fifteen minute intervals during the pumping tests. The final field parameter measurements prior to sampling are in Table 3. Also included in Table 3 for comparison are the field parameters measured from residential wells and streams.

Table 3: Field Measured Parameters

Sample Location	Temperature	Electrical Conductivity	pH
	(°C)	(µS/cm)	
Granite Boreholes			
BP-5	9.2	38.7	5.56
BP-7	11.4	83.8	6.86
BP-8	9.5	80	6.4
BP-9	9.6	118.5	6.9
Residential Wells			
BPRWA001	12.8	140	6.57
BPRWA002	15.1	272	7.52
BPRWA003	15.7	398	6.15
BPRWA004	12.1	108	6.33
BPRWA006	17.3	251	6.67
BPRWA007	12.6	354	7.53
BPRWA008	19.7	n/a	6.79
BPRWA009	12.6	n/a	6.56
BPRWA011	14.3	104	6.28
BPRWA012	18.9	260	5.99
BPRWA013	16.4	240	6.72
BPRWA014	17	165	6.62
BPRWA015	n/a	n/a	n/a
BPRWA016	10.7	249	7.46
BPRWA017	14	197	7.68

Sample Location	Temperature	Electrical Conductivity	pH
Streams			
BPSTR06	18.3	56	4.05
BPSTR09	21.9	48	3.96
BPSTR10	21.8	53	3.36

Data logger recorded observations are provided and graphed in the excel spreadsheet **Appendix C** accompanying this memo.

3. Stream Flow Measurements

Stream flow observations and measurements were completed on August 26 and 27 (**Table 3**). The area-velocity method was used to determine stream discharge at BPSTR10. Discharge (Q) is calculated as the product of the mean stream velocity (V) and the cross-sectional area (A) of the channel; or Q=VA. Velocity measurements were taken at selected intervals across the channel cross-section. Stream velocity was measured using a Marsh McBirney Flo-Mate current meter. At each interval, the current meter operator measured water depth and mean velocity. Mean velocity measurements were taken at 0.6 of the depth and were observed for 40 seconds. The flow at BPSTR12 was minimal. A single flow measurement was made using the flow meter at a 5 cm by 5 cm notch where flow was observed. Observations and flow measurements are recorded in the excel spreadsheet **Appendix D** accompanying this memo.

Table 3: Flow

Stream ID	Discharge (L/s)	Date and Time	Stream Conditions
BPSTR06	N/A	Aug 27, 10:00	No measurable flow
BPSTR08	N/A	Aug 26, 16:00	No measurable flow
BPSTR09	N/A	Aug 27, 17:00	No measurable flow
BPSTR10 (Fox Island Main)	0.394	Aug 27, 11:30	Very low flow
BPSTR12	0.325	Aug 27, 15:20	Very low flow

4. Residential Wells

Work completed to assess residential wells included:

- Yield test and a second sampling event at 79 Fox Island Main Road.
- Collection of two water samples at 3421 Highway 16.
- Collection of one water sample at 2927 Highway 16.

The yield test at 79 Fox Island Main Road was completed on August 29, 2014. Two drilled wells, located side by side, are present at this location. A data logger was installed into the drilled well with the pump and water was discharged from the exterior tap for approximately 1 hour. Drawdown is observed to occur in steps which are interpreted to be a result of the pump switch on and off as governed by the in-house pressure tank. Total maximum drawdown was 1.7 m. Recovery was monitored for a period of 120 minutes and recharge of 0.19 m was observed before the data logger

was retrieved (**Figure 1**). Complete data of the yield test can be found in excel file **Appendix E** accompanying this memo.

One water quality sample (BPRWA016) was collected at the end of the yield test and submitted to Maxxam for analysis. Results are presented in **Appendix D**.

Two water quality samples (BPRWA007_A, BPRWA007_B) were collected from 3421 Highway 16 on August 28. Sample analyses were completed on one of the samples as unfiltered (BPRWA007_A), and one sampled after in-laboratory filtering (BPRWA007_B) and results are presented in **Appendix D**.

One water quality sample (BPRWA017) was collected from 2927 Highway 16. are presented in **Appendix D**

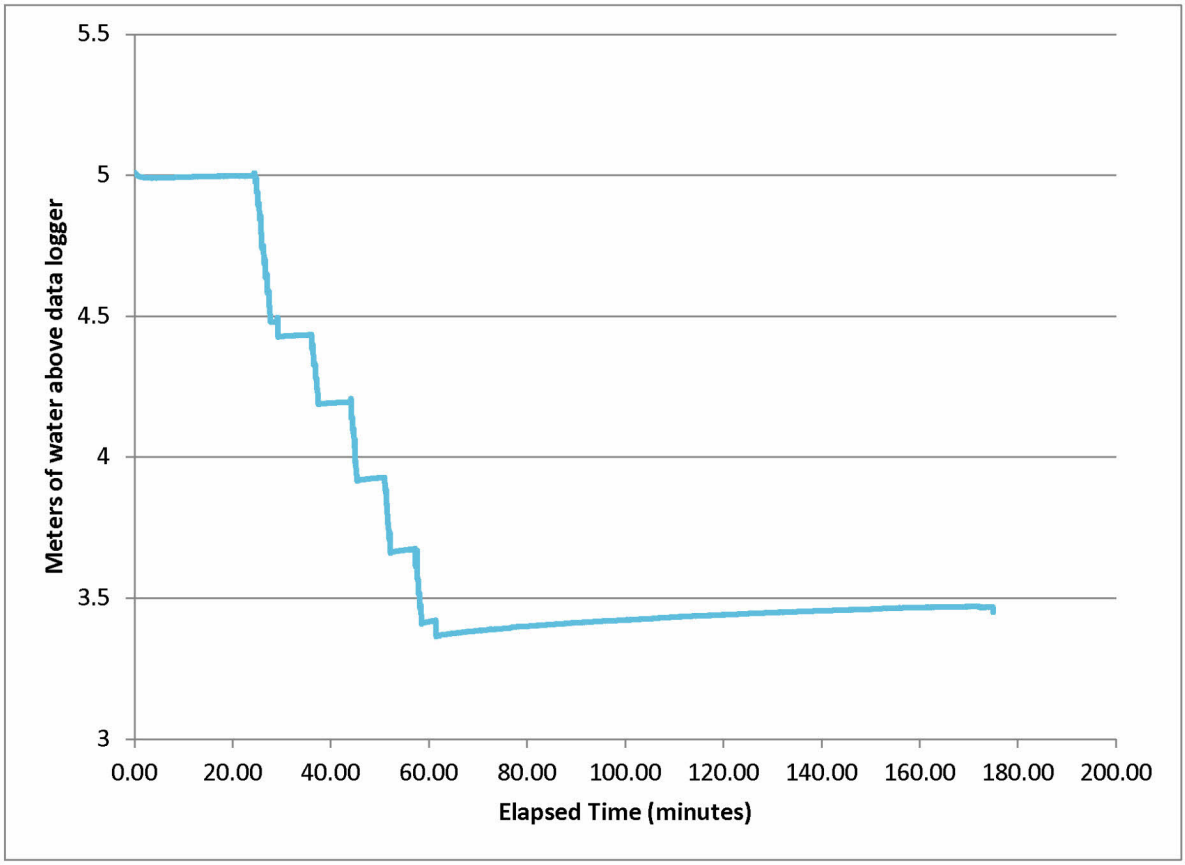


Figure 1: Water Level above the Datalogger during the Yield Test at 79 Fox Island Main Road

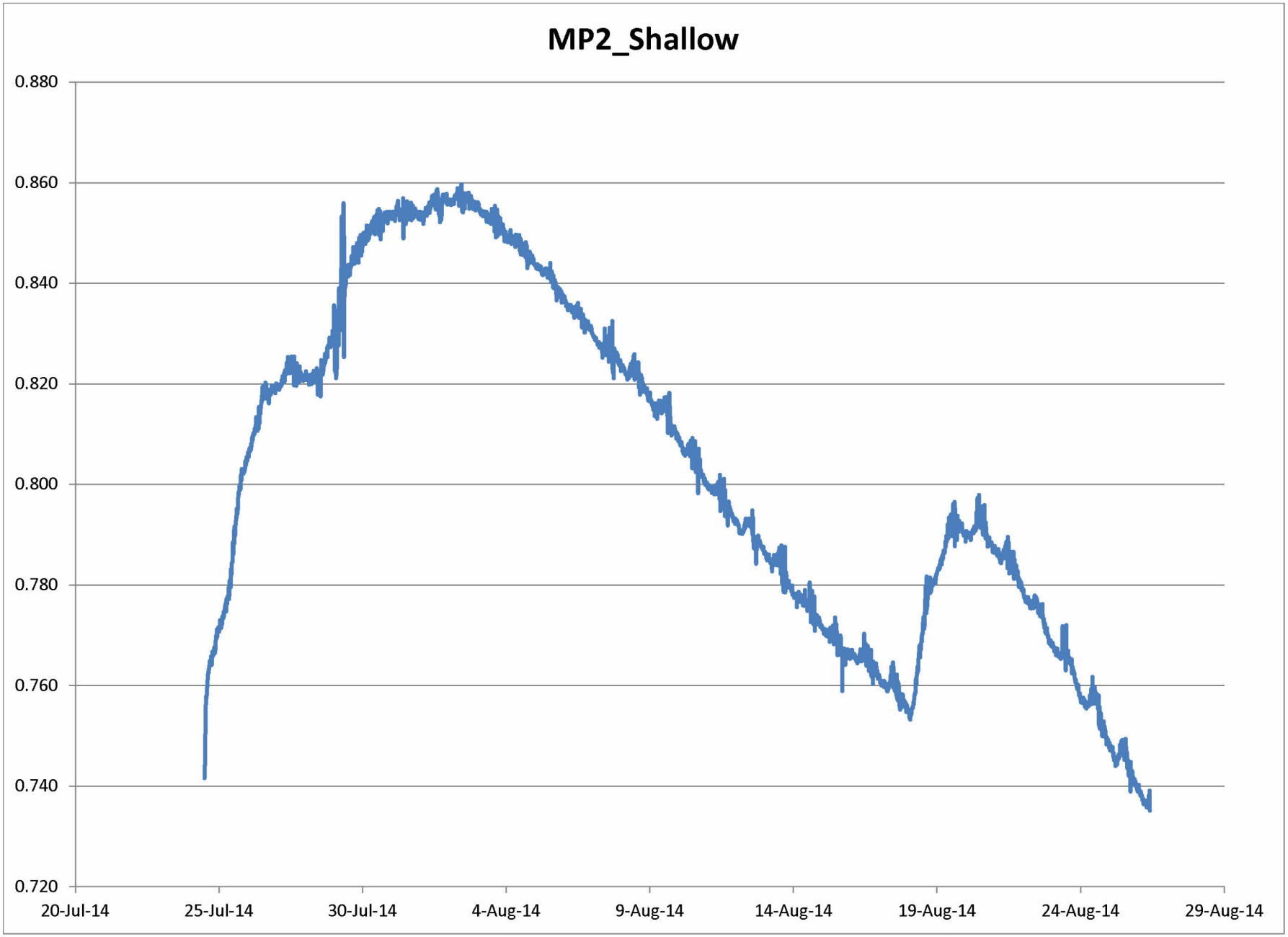
UTM coordinates of residential wells collected in August are summarized in Table 4.

Table 4: Residential Well Coordinates

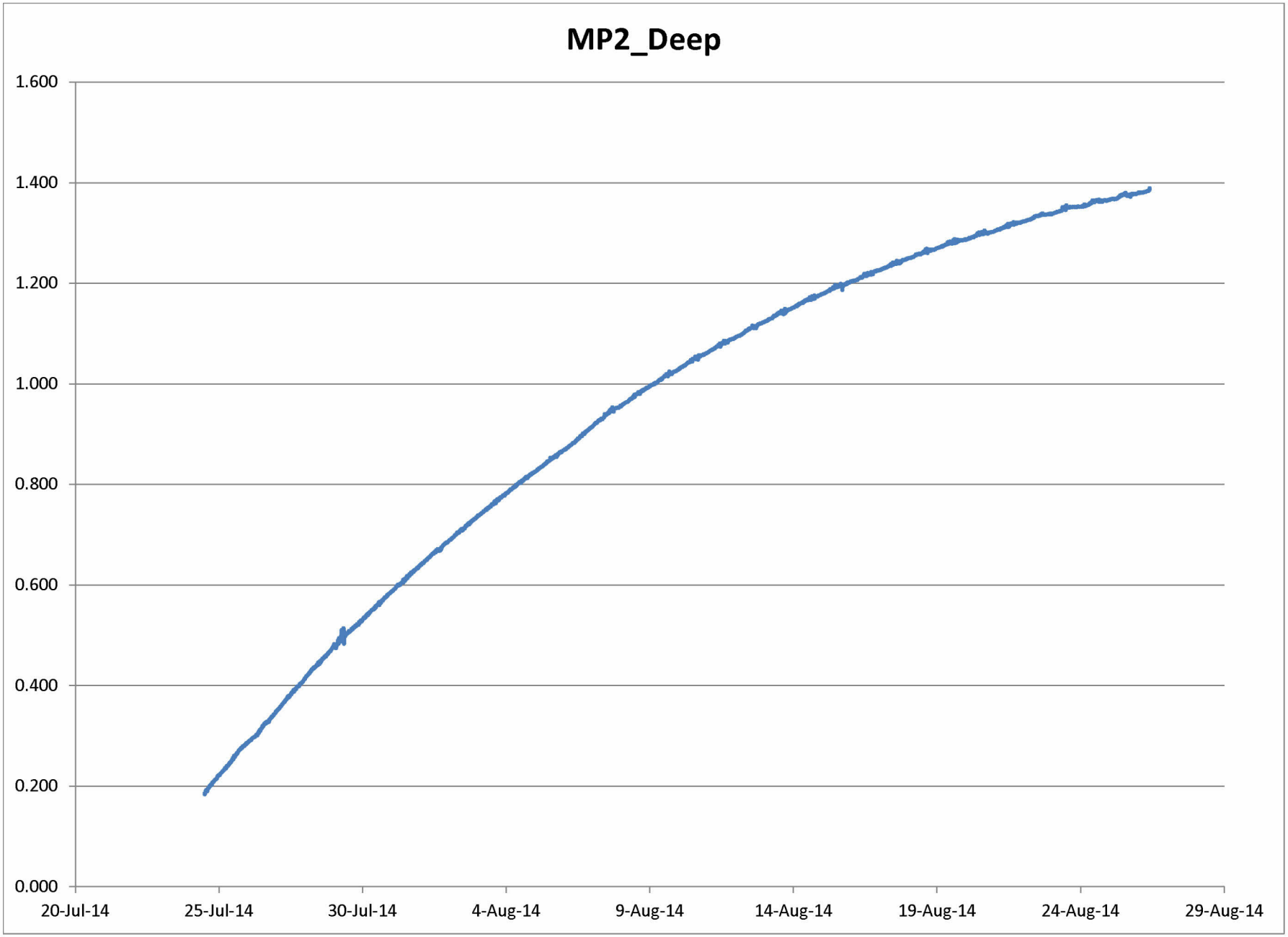
Address	Easting (m)	Northing (m)
212 Half Island Cove Rd	642025	5023336
215 Half Island Cove Rd	642030	5023399
246 Half Island Cove Rd	642106	5023396
48 Fox Island Main Rd	648704	5022390
75 Fox Island Main Rd	648724	5022566
130 Fox Island Main Rd	648782	5022762
149 Fox Island Main Rd	648776	5022879
169 Fox Island Main Rd	648805	5022958
2927 Hwy 16	646643	5021585
3581 Hwy 16	643696	5021694
2823 Upper Fox Island	647285	5021794

Supporting Excel Documents:

- **Appendix D** Black Point Flow and RWA: Summary of field measurements from stream flow measurements and samples collected from residential well assessments.
- **Appendix C** Master Borehole Drawdown Test Data: barometrically compensated data and charts showing drawdown and recovery data.
- **Appendix A** Master Piezometer Data: Barometrically compensated data from mini-piezometer data loggers and charts showing depth of water above data logger over time.
- **Appendix E** 79 Fox Island Main Road yield test: logger data and charts showing drawdown and recovery.
- **Appendix B** Master Borehole Data: barometrically compensated data from boreholes and charts.


MP2_Shallow
0.880
0.860
0.840
0.820
0.800
0.780
0.760
0.740
0.720
20-Jul-14
25-Jul-14
30-Jul-14
4-Aug-14
9-Aug-14
14-Aug-14
19-Aug-14
24-Aug-14
29-Aug-14

C 1340-920


MP2_Deep
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
20-Jul-14
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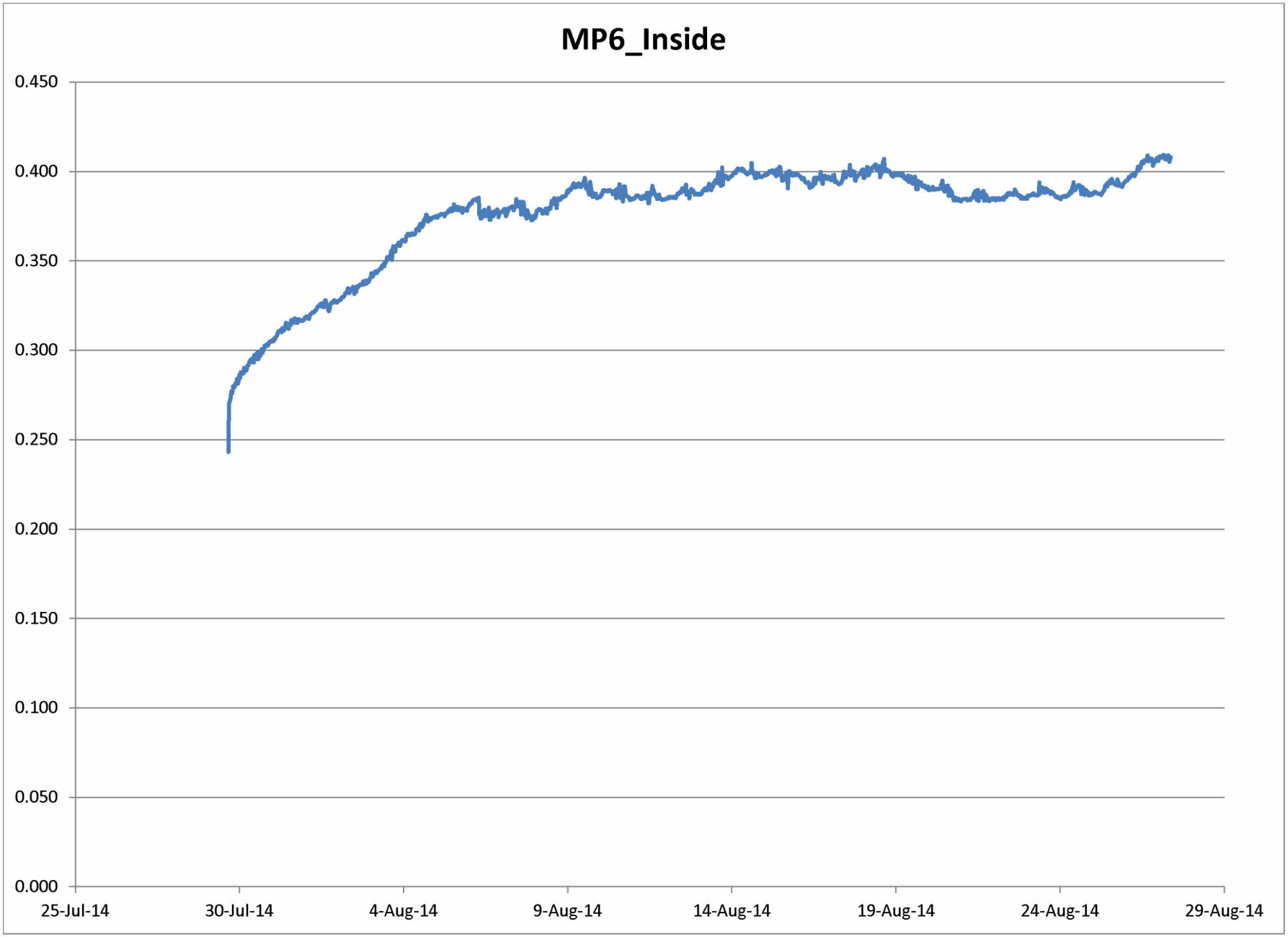
24-Aug-14
29-Aug-14


MP6_Inside
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
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30-Jul-14
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9-Aug-14
14-Aug-14
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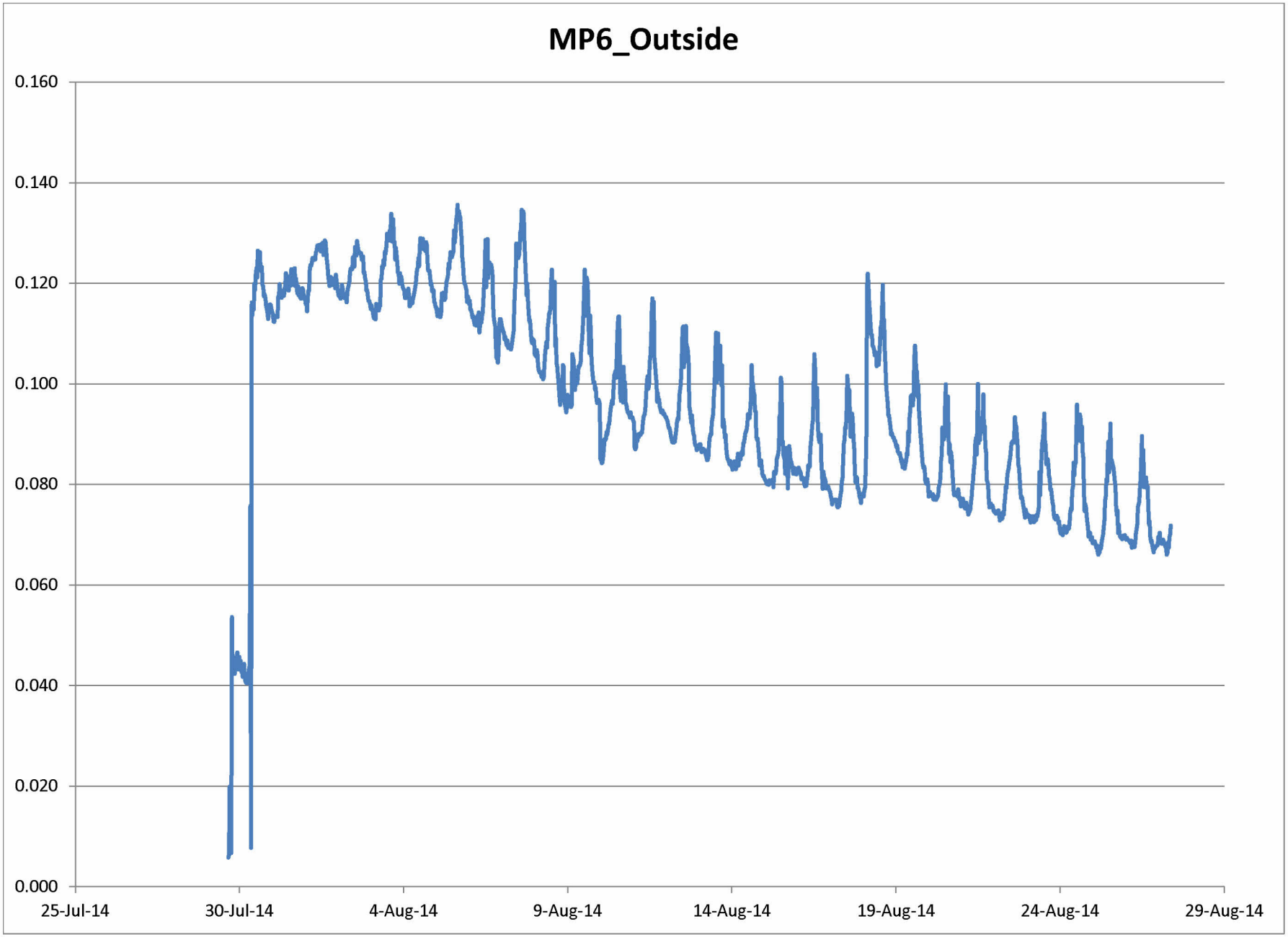
24-Aug-14
29-Aug-14


MP6_Outside
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0.140
0.120
0.100
0.080
0.060
0.040
0.020
0.000
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30-Jul-14
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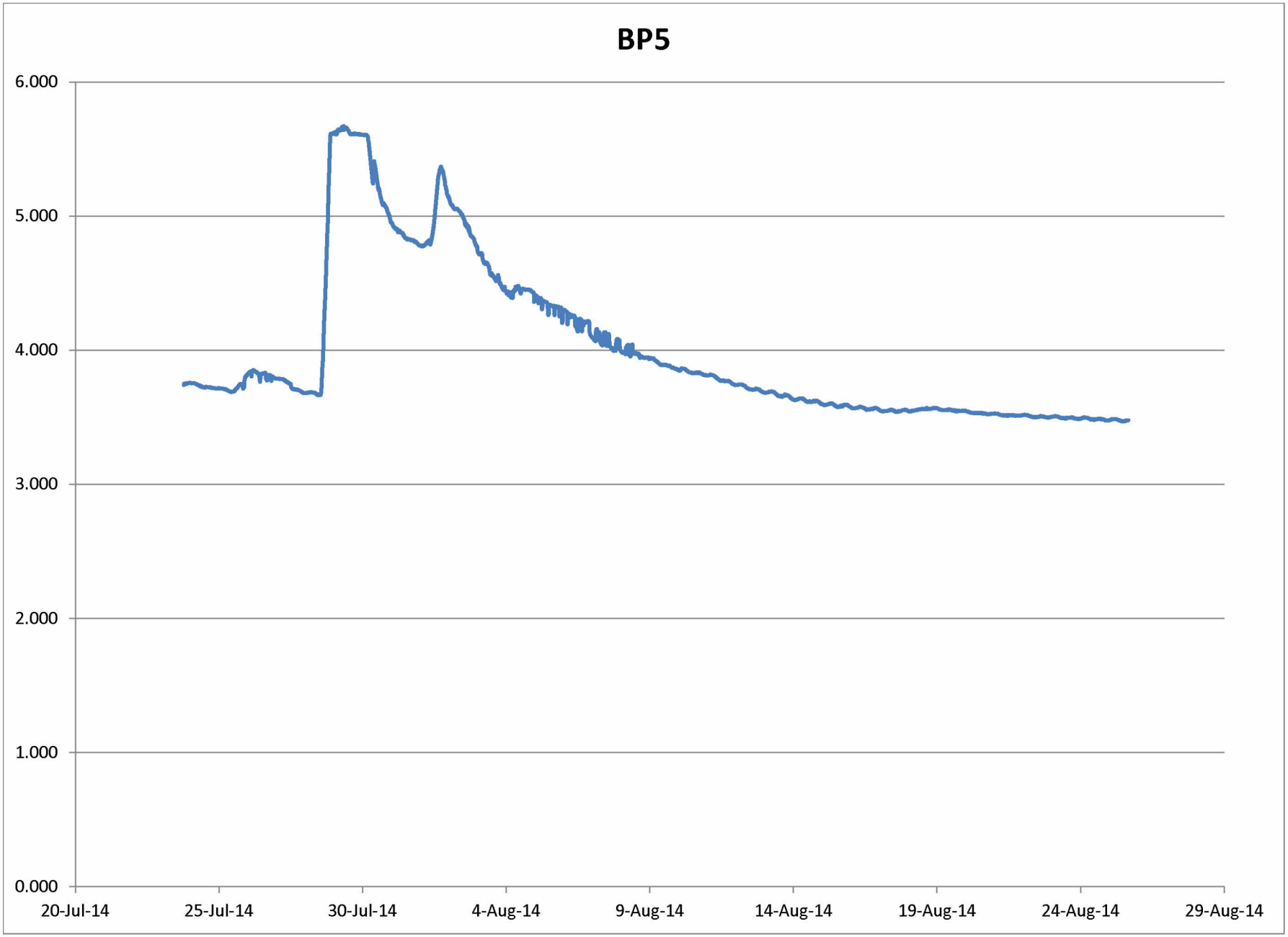
9-Aug-14
14-Aug-14
19-Aug-14
24-Aug-14
29-Aug-14


BP5
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4.000
3.000
2.000
1.000
0.000
20-Jul-14
25-Jul-14
30-Jul-14
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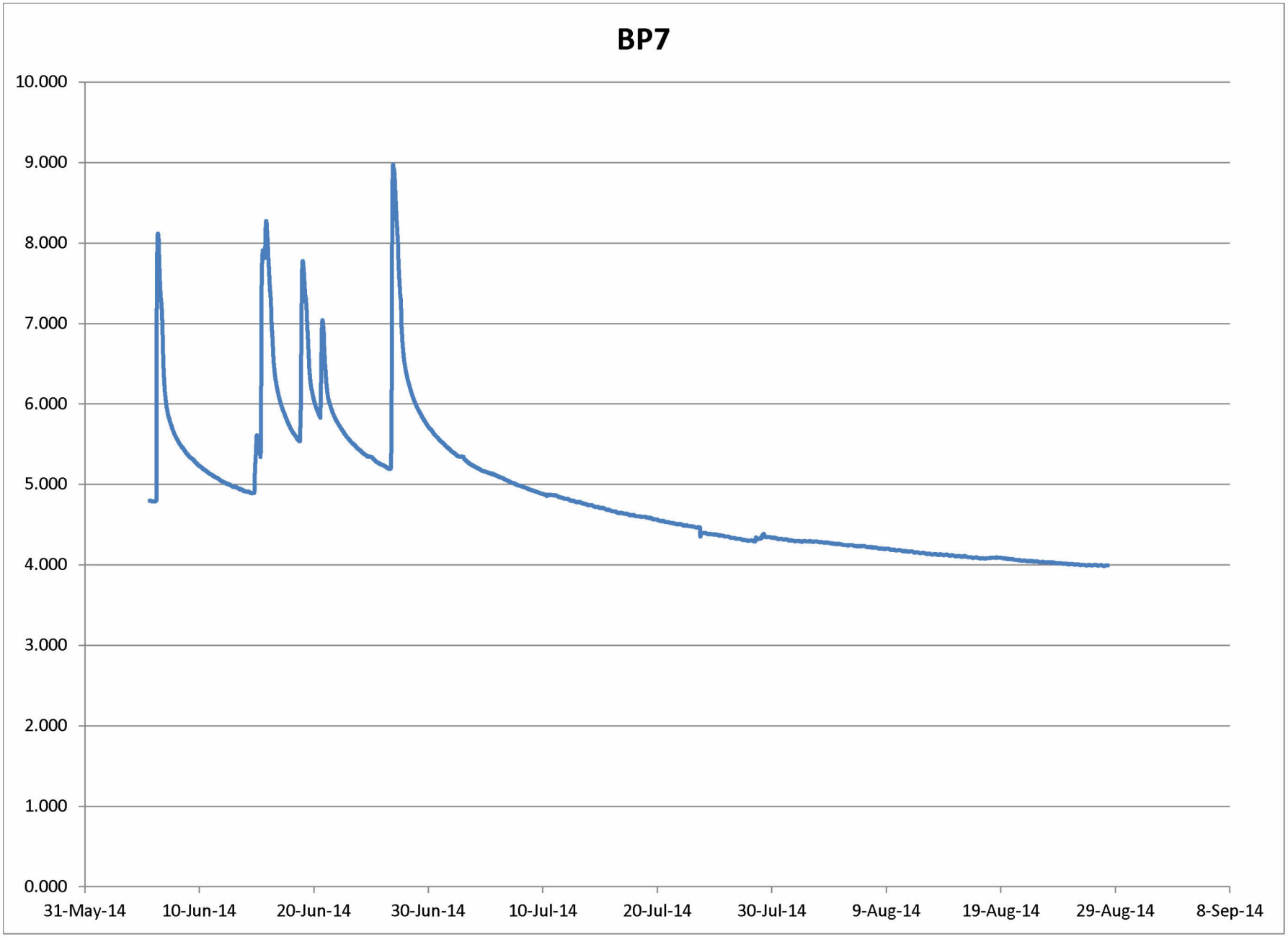
19-Aug-14
24-Aug-14
29-Aug-14


BP7
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8.000
7.000
6.000
5.000
4.000
3.000
2.000
1.000
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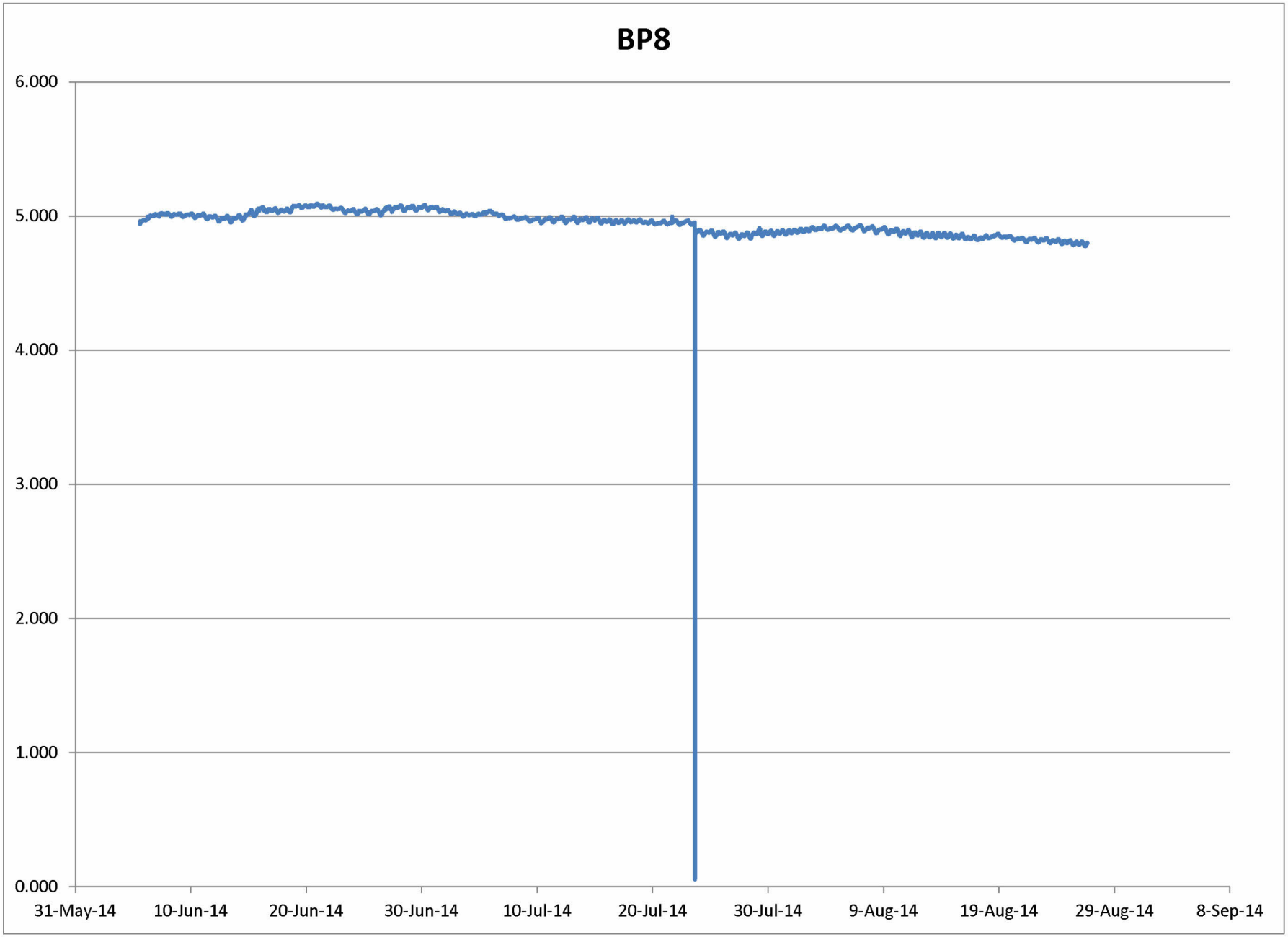
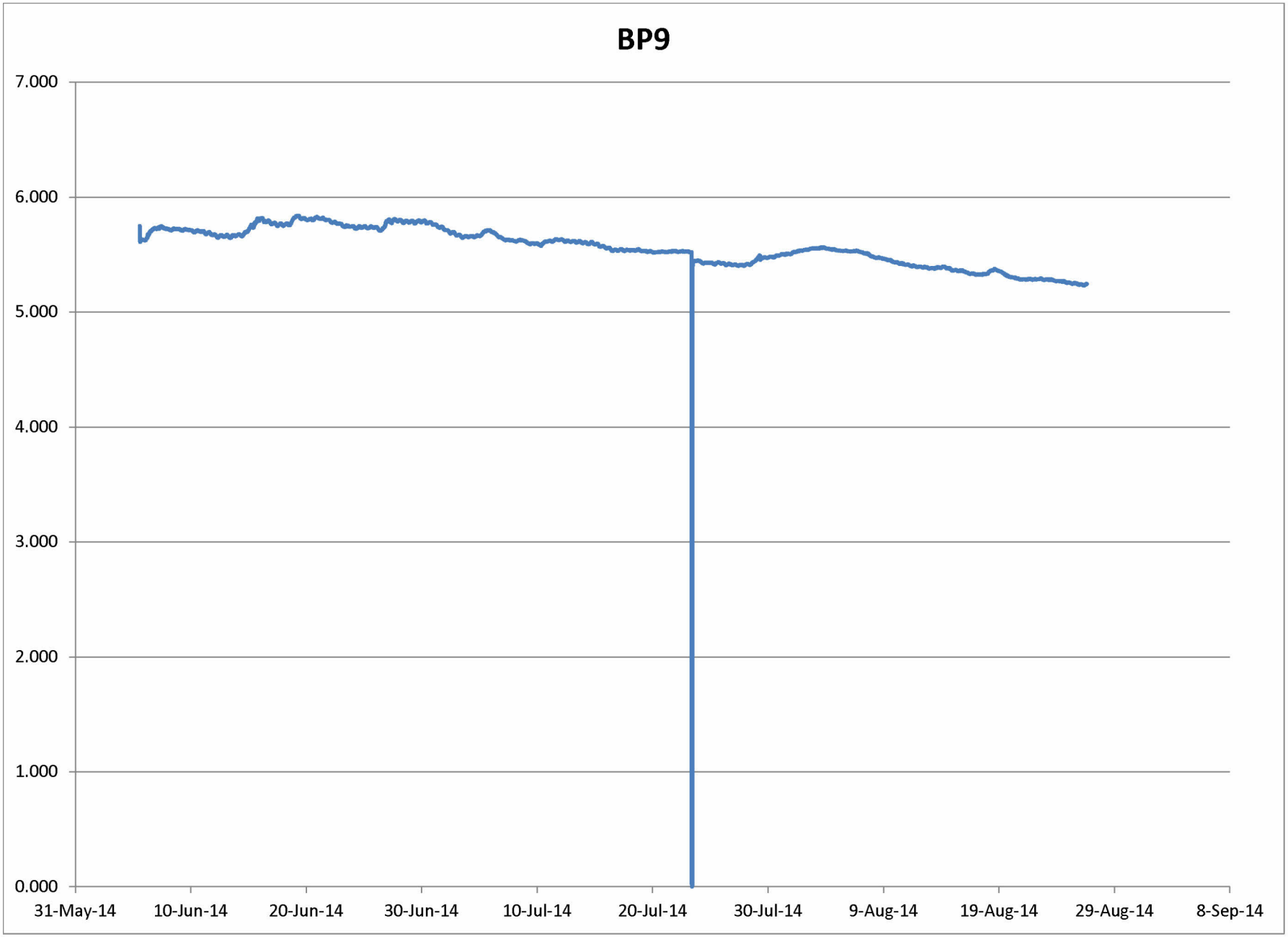
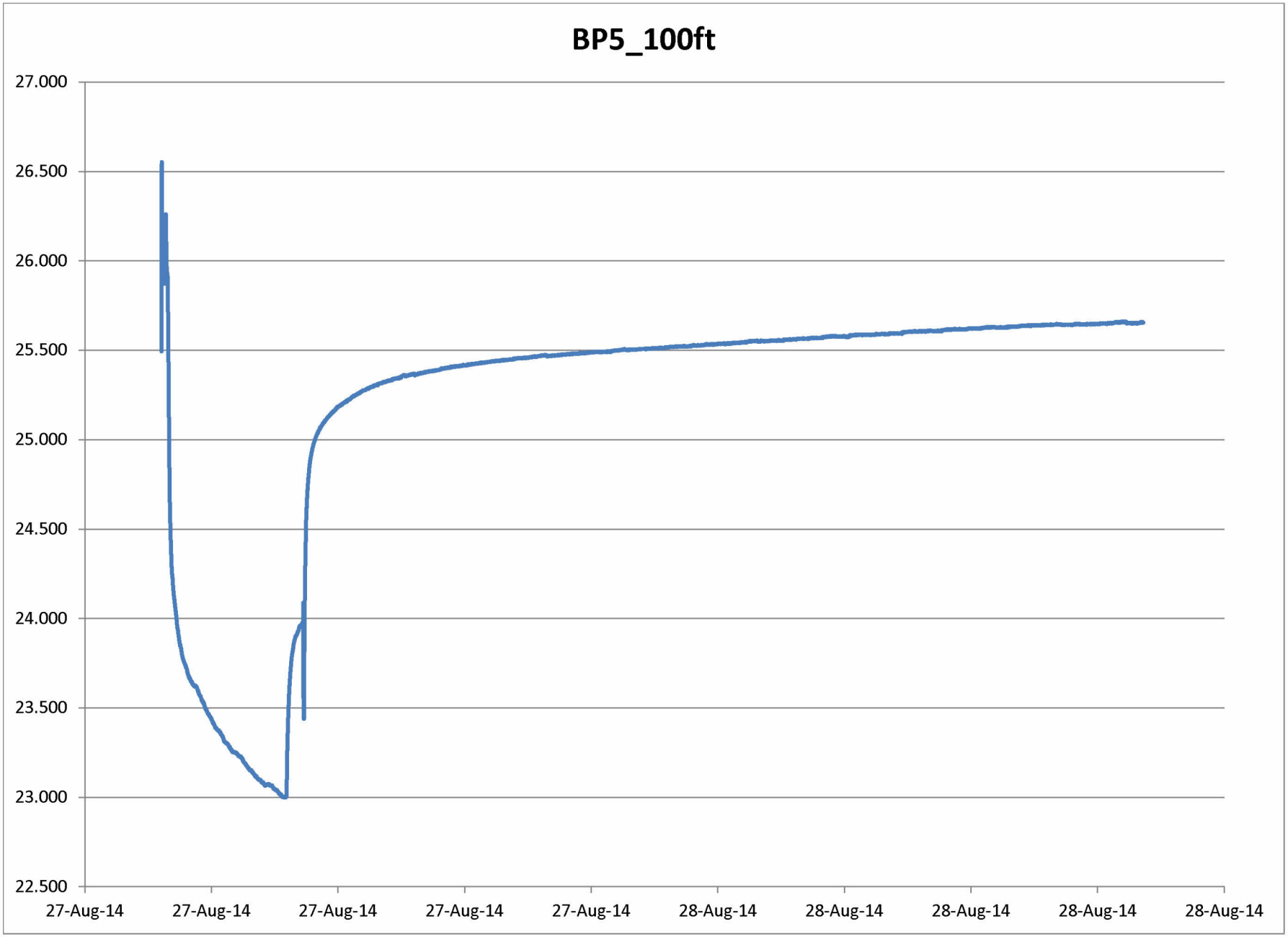
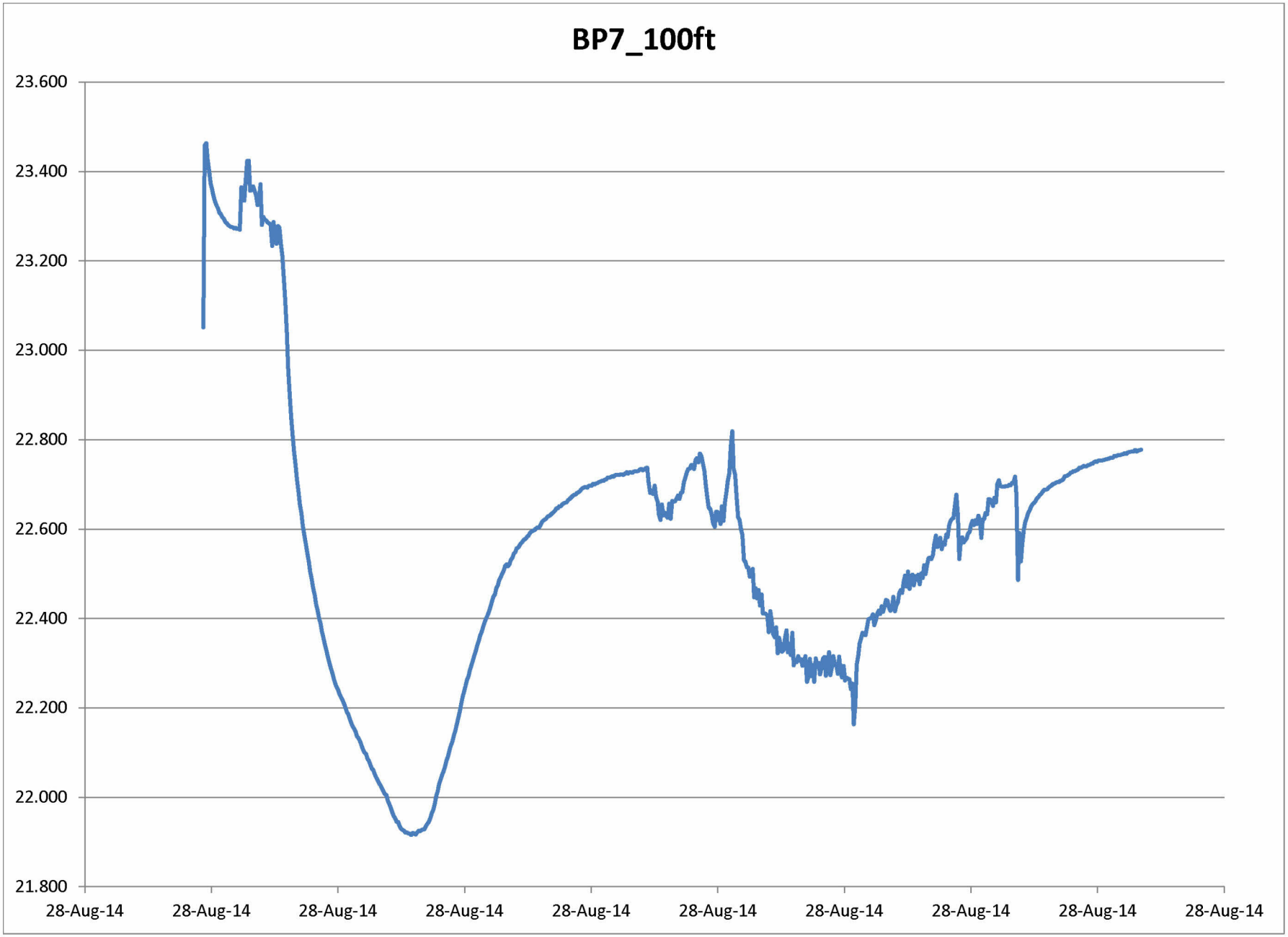
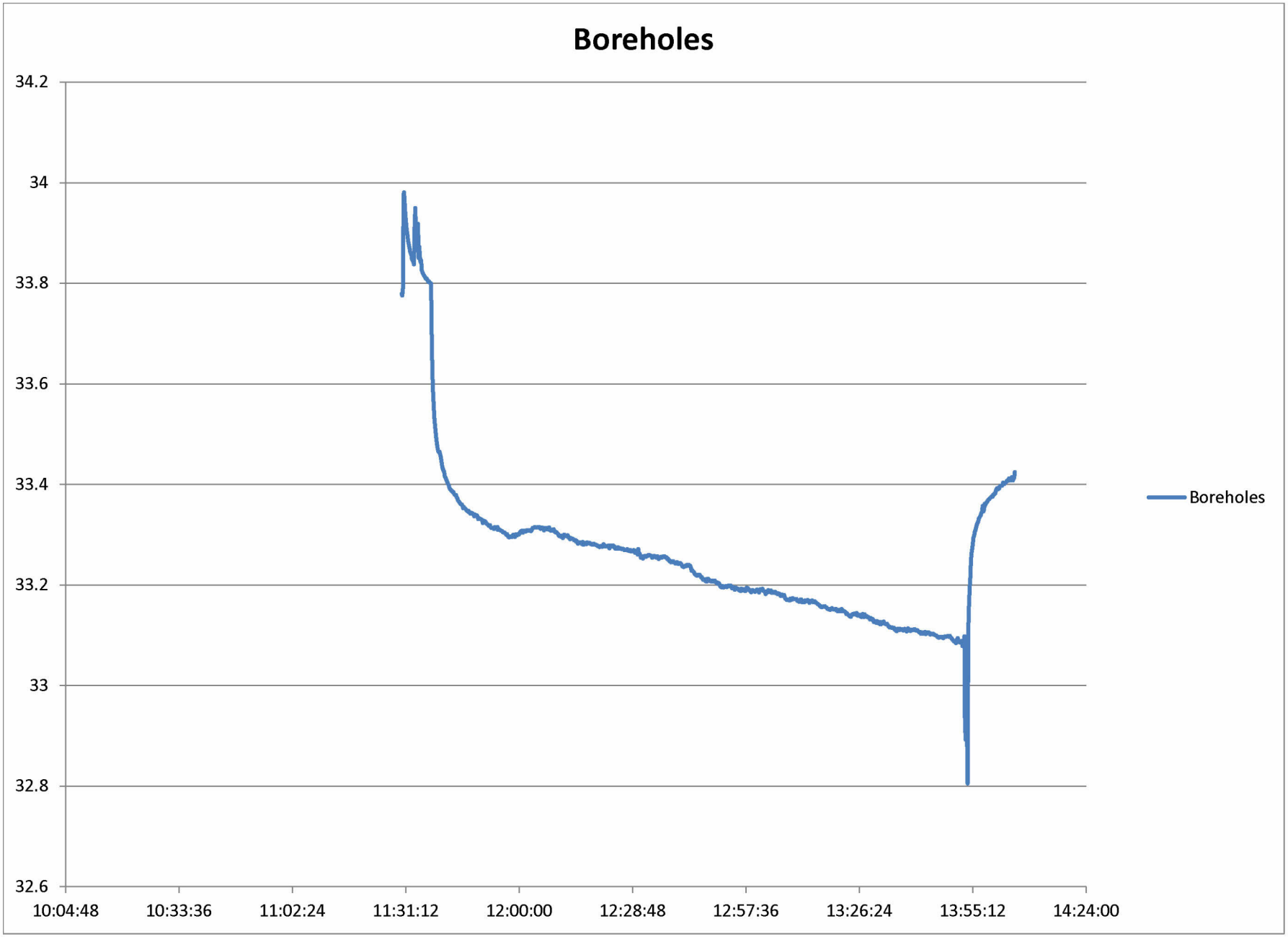
29-Aug-14
8-Sep-14


BP8
6.000
5.000
4.000
3.000
2.000
1.000
0.000
31-May-14
10-Jun-14
20-Jun-14
30-Jun-14
10-Jul-14
20-Jul-14
30-Jul-14
9-Aug-14
19-Aug-14
29-Aug-14
8-Sep-14

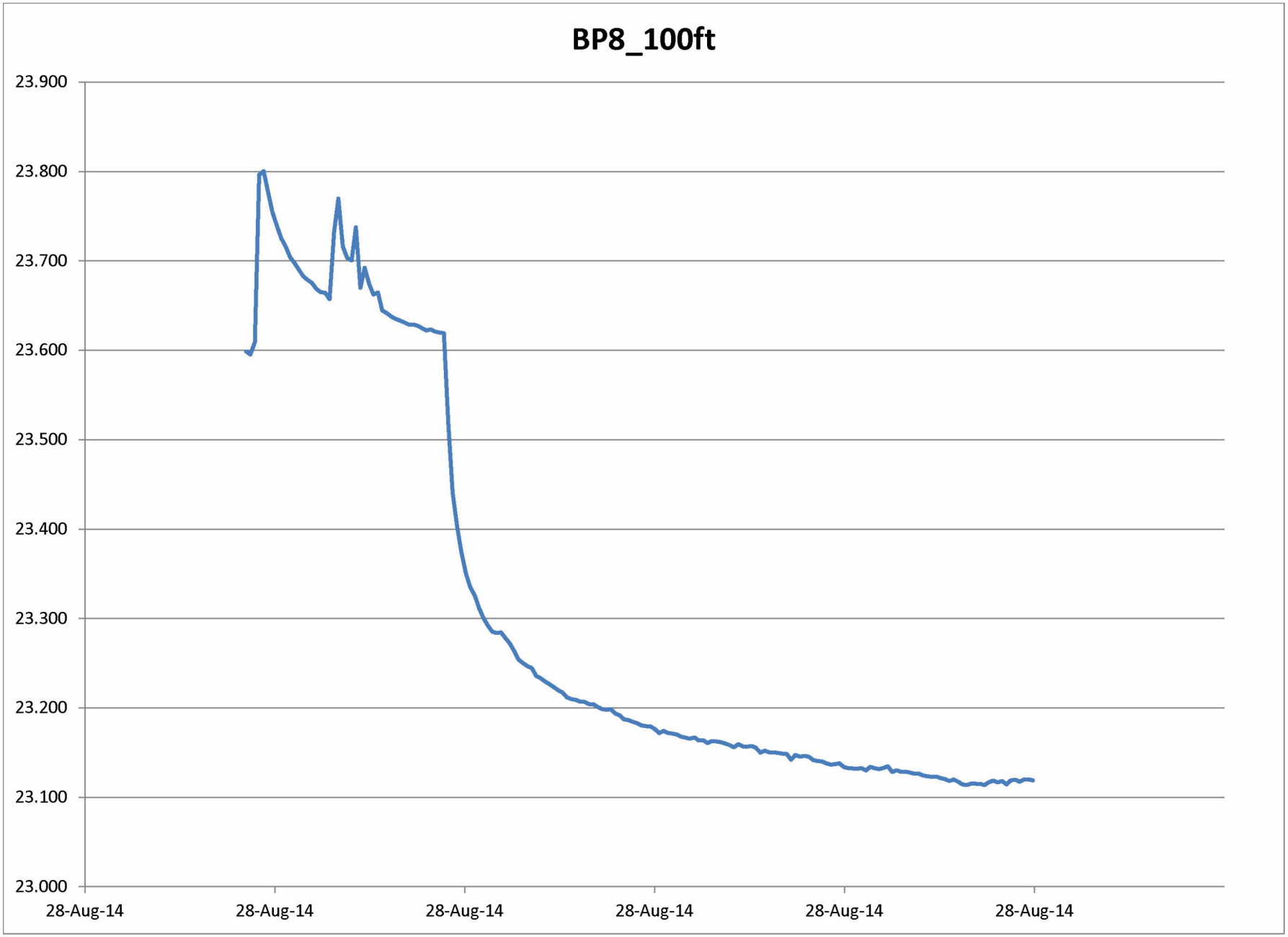

BP9
7.000
6.000
5.000
4.000
3.000
2.000
1.000
0.000
31-May-14
10-Jun-14
20-Jun-14
30-Jun-14
10-Jul-14
20-Jul-14
30-Jul-14
9-Aug-14
19-Aug-14
29-Aug-14
8-Sep-14

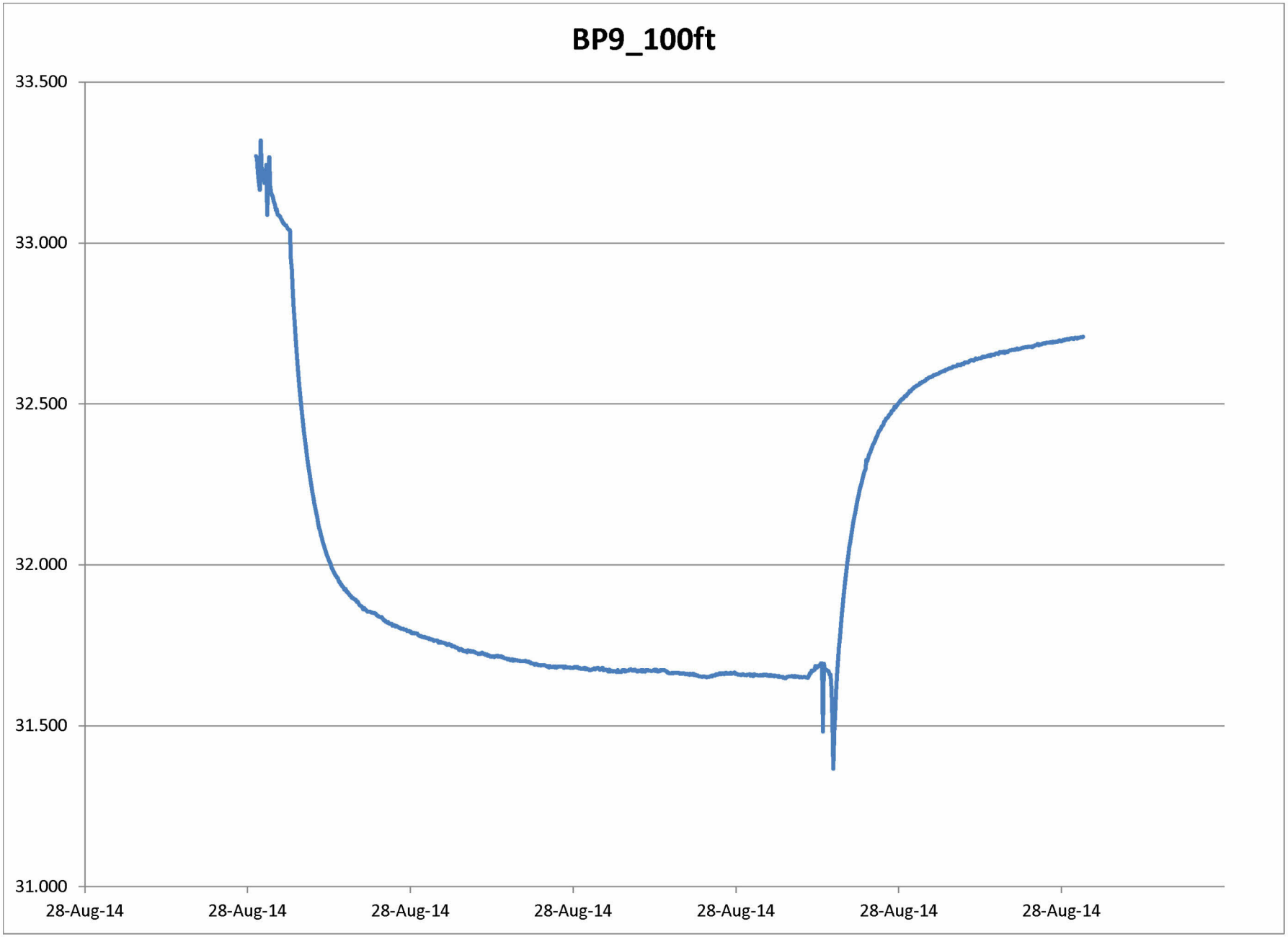

BP5_100ft
27.000
26.500
26.000
25.500
25.000
24.500
24.000
23.500
23.000
22.500
27-Aug-14
27-Aug-14
27-Aug-14
27-Aug-14
27-Aug-14
28-Aug-14
28-Aug-14
28-Aug-14
28-Aug-14
28-Aug-14


BP7_100ft
23.600
23.400
23.200
23.000
22.800
22.600
22.400
22.200
22.000
21.800
28-Aug-14
28-Aug-14
28-Aug-14
28-Aug-14
28-Aug-14
28-Aug-14
28-Aug-14
28-Aug-14
28-Aug-14
28-Aug-14


Boreholes
34.2
34
33.8
33.6
33.4
33.2
33
32.8
32.6
10:04:48
10:33:36
11:02:24
11:31:12
12:00:00
12:28:48
12:57:36
13:26:24
13:55:12
14:24:00
Boreholes

C 1340-930


BP8_100ft
23.900
23.800
23.700
23.600
23.500
23.400
23.300
23.200
23.100
23.000
28-Aug-14
28-Aug-14
28-Aug-14
28-Aug-14
28-Aug-14
28-Aug-14


BP9_100ft
33.500
33.000
32.500
32.000
31.500
31.000
28-Aug-14
28-Aug-14
28-Aug-14
28-Aug-14
28-Aug-14
28-Aug-14
28-Aug-14

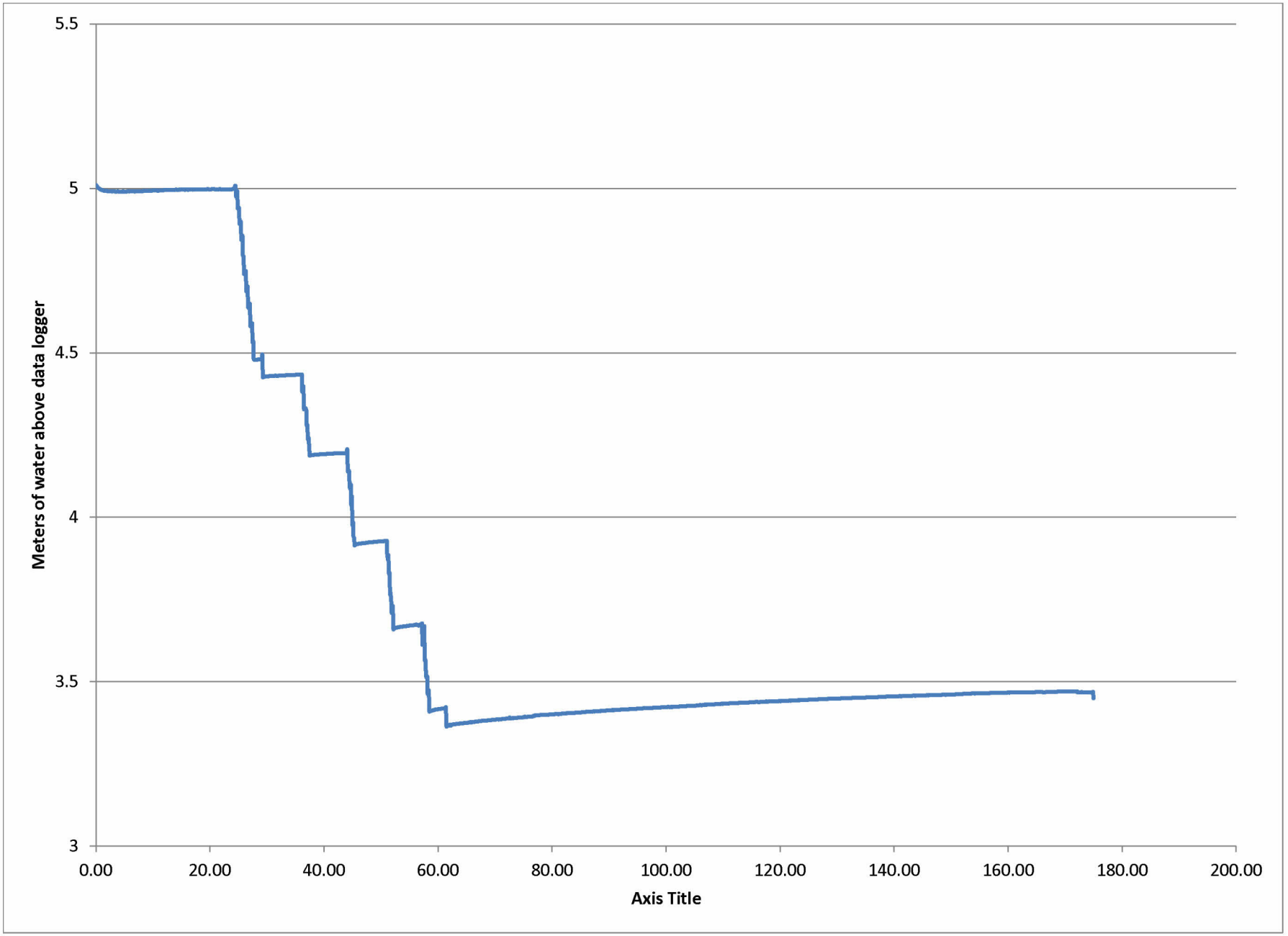
Stream ID	BPSTR10			
Location	Bridge crossing Starks Rd (off Fox Island Main Rd)			
Stream Conditions	Very low flow			
Distance (m)	Depth (m)	Velocity (m/s)	Flow (m^3/s)	Note
0.45	0.00	0.00	0.000000	Left Bank (looking upstream)
0.53	0.08	0.02	0.000104	
0.58	0.08	0.01	0.000040	
0.63	0.08	0.05	0.000200	
0.68	0.02	0.05	0.000050	
0.73	0.00	0.00	0.000000	Right Bank (looking upstream)
		Total Flow	0.000394	m^3/s
			0.394	L/s

Stream ID	BPSTR12			
Location	Stream Crossing at transmission lines			
Stream Conditions	Very low flow			
Distance (m)	Depth (m)	Velocity (m/s)	T. Flow (m^3/s)	Note
0.05	0.05	0.13	0.000325	Measurement Location: 5cm x 5cm knotch (opening) in a rock that captured all flow at that cross-section of the stream
			0.325	L/s

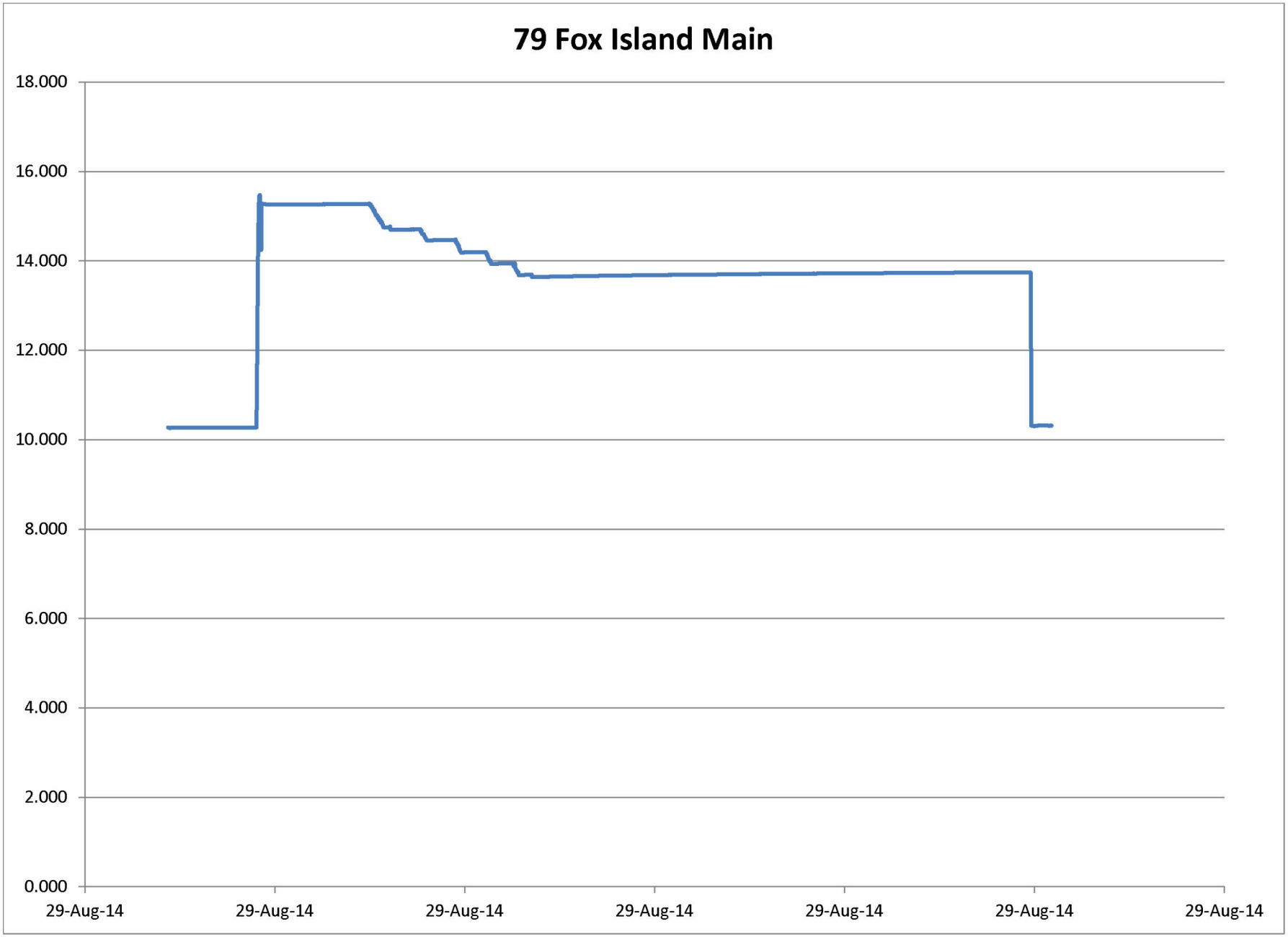
Well ID	BPRWA016	
Date	Aug-29	
Address	79 Fox Island Main Rd	
Resident's Family Name	Feltmate	
Well Inside Diameter (m)	0.157	
Stickup (m)	0.499	
Flow Rate (L/s)	0.156	
Initial Water Level (m)	3.597	_@ 9:27
Pump Start Time	9:35	
Final Water Level (m)	5.184	_@11:13
Max Drawdown (m)	1.587	

Water Level (m)	Time	EC (µS/cm)	Temp (˚C)	pH
3.595	9:45			
3.585	10:01			
4.107	10:18	243	11.2	7.18
4.154	10:30	257	11.3	7.12
4.395	10:44	253	10.7	7.54
4.669	10:55	248	10.6	7.48
4.925	11:05	249	10.7	7.46

Well ID	BPRWA017			
Date	Aug-29			
Water Level (m)	Time	EC (µS/cm)	Temp (˚C)	pH
2.69	12:57			
	13:48	196.9	14.0	7.68


5.5
5
4.5
4
3.5
3
Meters of water above data logger
0.00
20.00
40.00
60.00
80.00
100.00
120.00
140.00
160.00
180.00
200.00
Axis Title

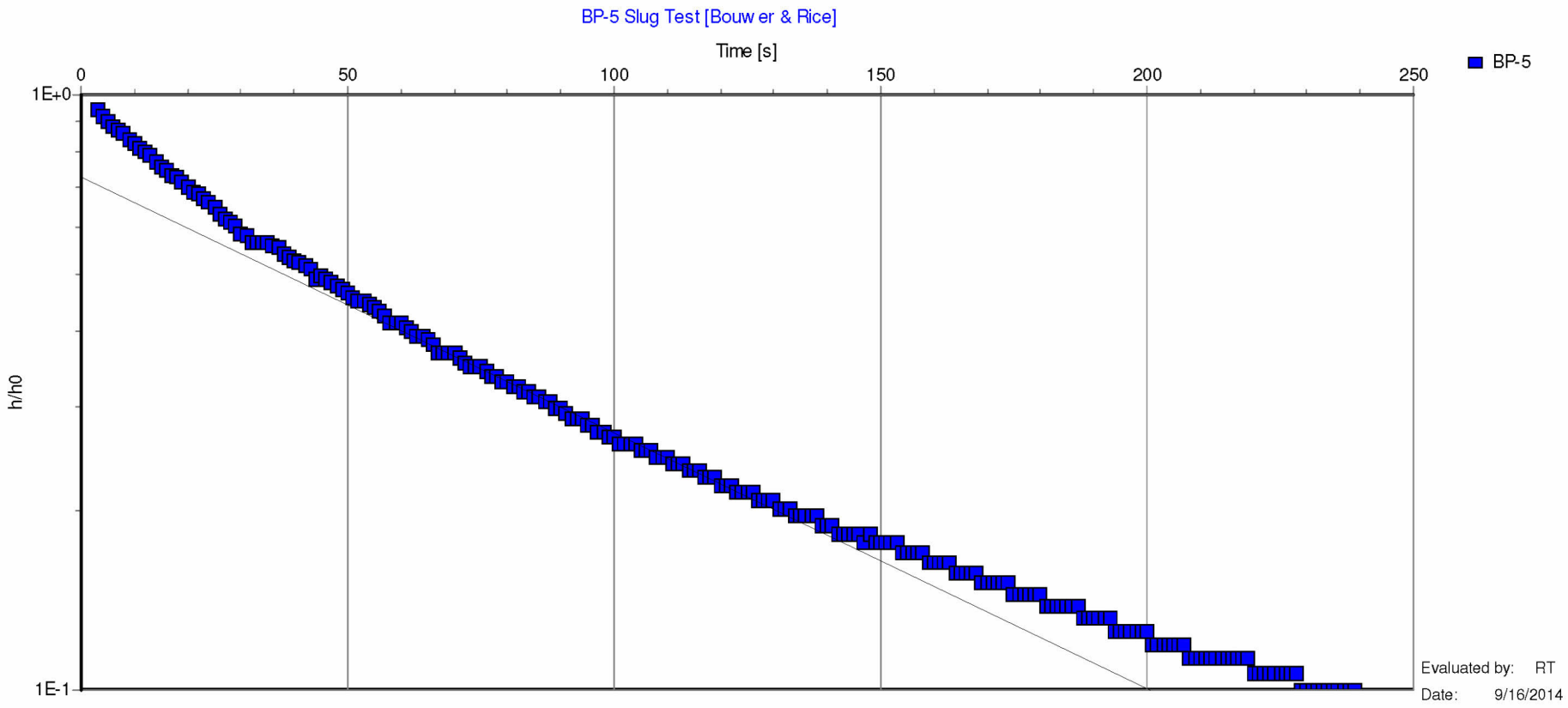
C 1340-935


79 Fox Island Main
18.000
16.000
14.000
12.000
10.000
8.000
6.000
4.000
2.000
0.000
29-Aug-14
29-Aug-14
29-Aug-14
29-Aug-14
29-Aug-14
29-Aug-14
29-Aug-14

ATTACHMENT G
Hydraulic Conductivity Test Analysis

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

SLR	**Analysis Report**	**Slug Test:** **BP-5 Slug Test**
	Project: Black Point Quarry	**Analysis Method:** **Bouwer & Rice**
	Number: 210.05913.00000	Comments:
	Client: Morien Resources Corp.	Saturated screen length = 86.7 [m] Max. Head Change = 0.47 [m] R (eff) not used in analysis

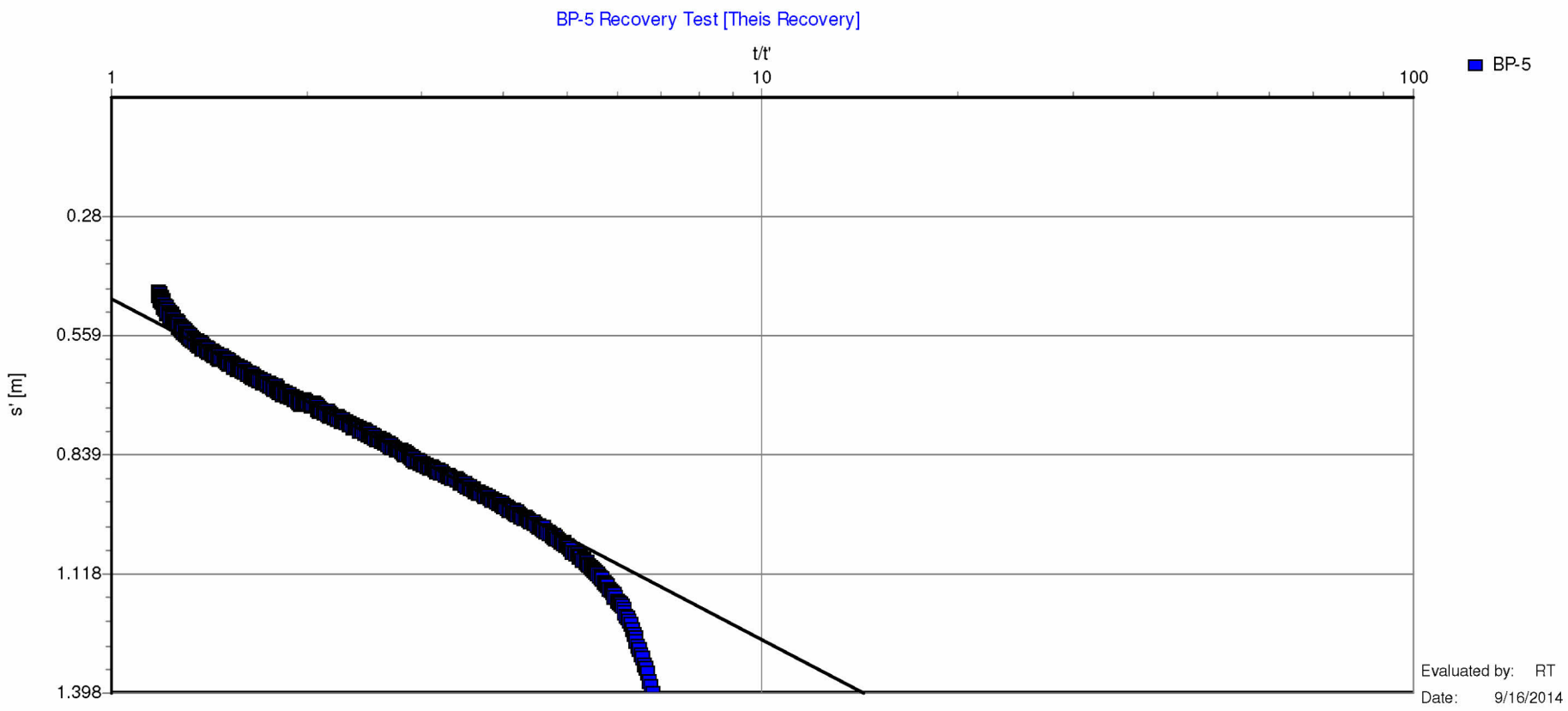


Analysis results: Conductivity: 6.06E-7 [m/s]

Test parameters:

Test Well:	BP-5	r(eff):	0.038 [m]
Screen radius:	0.03785 [m]	Aquifer thickness:	86.67 [m]
Screen length:	89 [m]	Boring radius:	0.03785 [m]

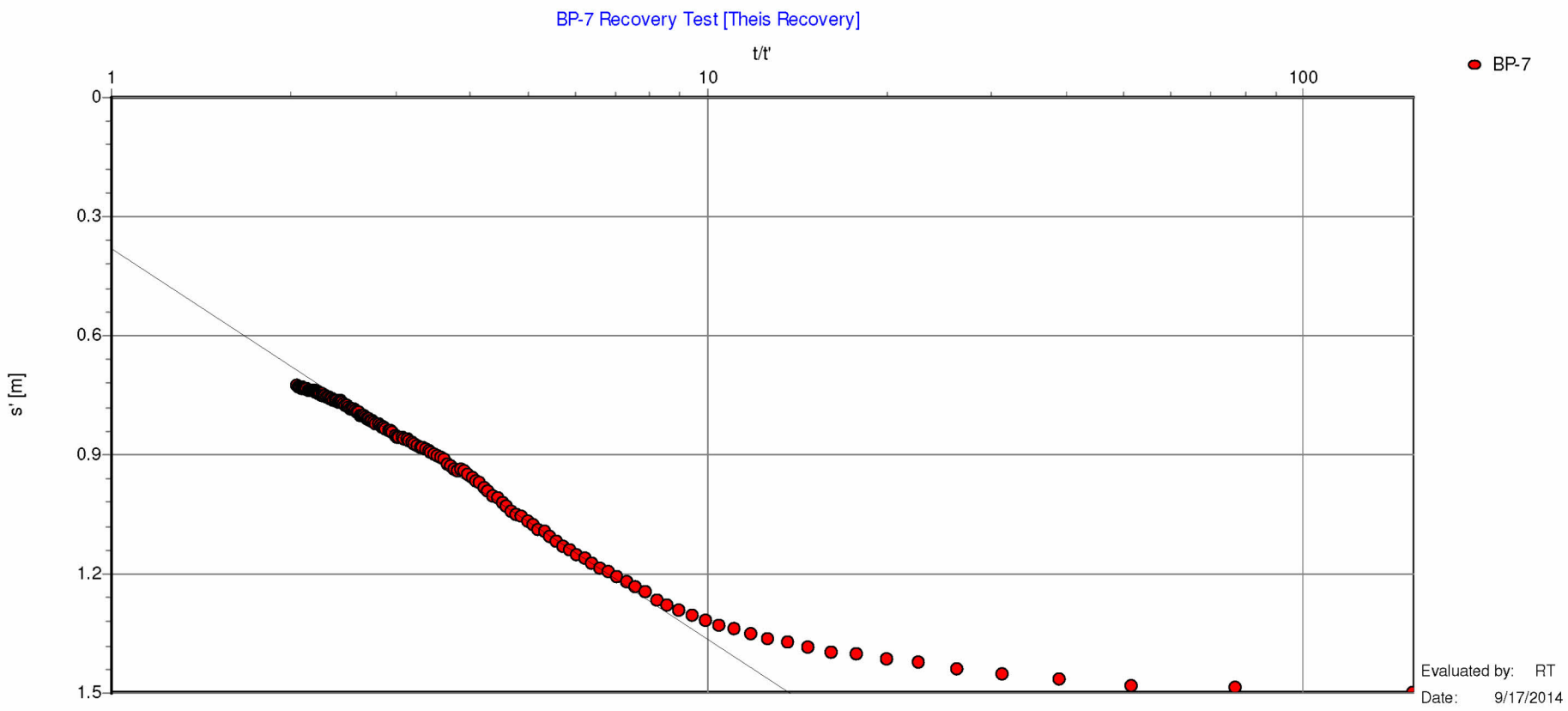
SLR	**Analysis Report**	**Pumping Test:** **BP-5 Recovery Test**
	Project: Black Point Quarry	**Analysis Method:** **Theis Recovery**
	Number: 210.05913.00000	Comments:
	Client: Morien Resources Corp.	Saturated screen length = 85.5 [m] Max. Head Change = 3.08 [m] R (eff) not used in analysis



Analysis results:	Transmissivity:	2.29E-5 [m²/s]	Conductivity:	2.68E-7 [m/s]

Test parameters:	Pumping Well:	BP-5	Pumping Time	8440 [s]
	Screen radius:	0.03785 [m]	Aquifer thickness:	85.46 [m]
	Screen length:	89 [m]	Boring radius:	0.03785 [m]
			Discharge Rate:	0.0001 [m³/s]

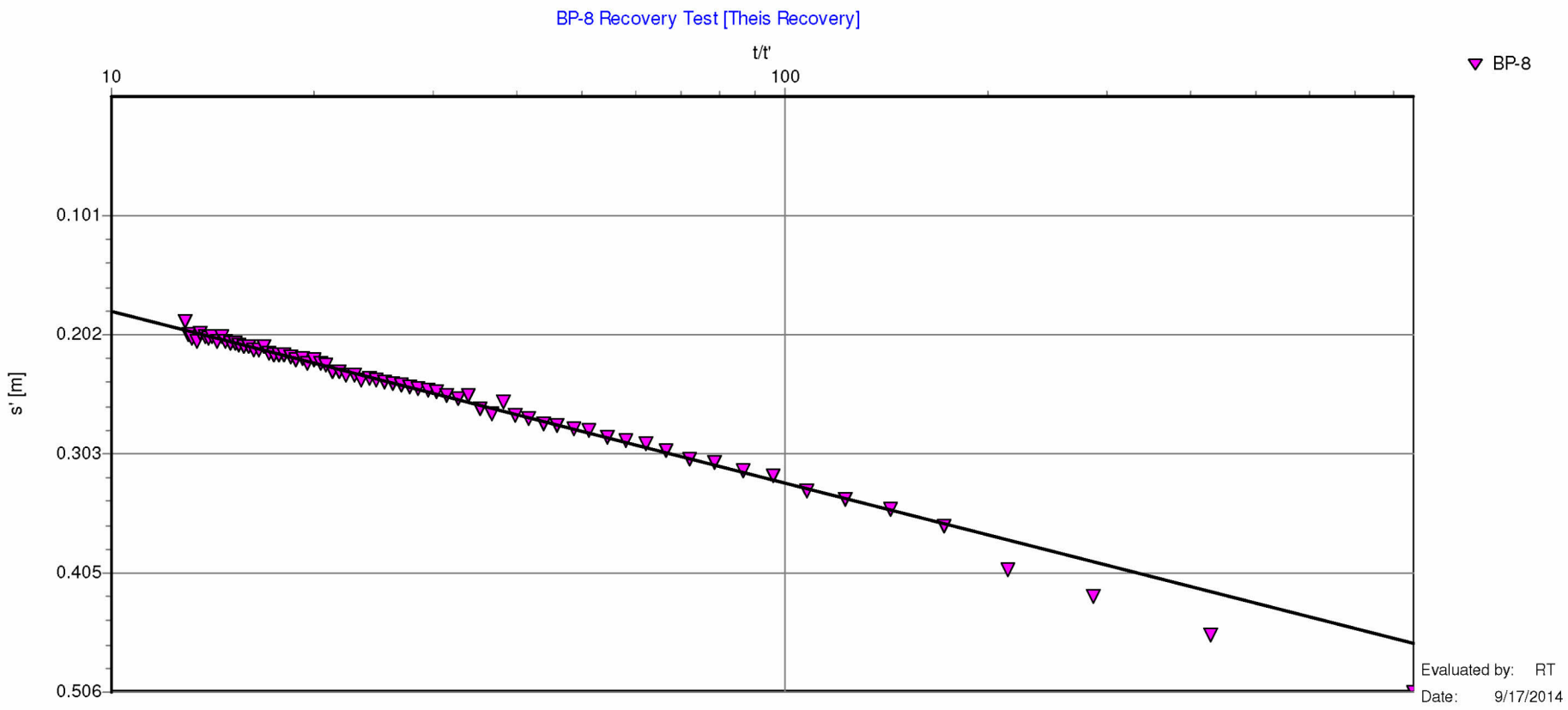
SLR	**Analysis Report**	**Pumping Test:** **BP-7 Recovery Test**
	Project: Black Point Quarry	**Analysis Method:** **Theis Recovery**
	Number: 210.05913.00000	Comments:
	Client: Morien Resources Corp.	Saturated screen length = 114.3 [m] Max. Head Change = 1.51 [m] R (eff) not used in analysis



Analysis results:	Transmissivity:	1.77E-5 [m²/s]	Conductivity:	1.55E-7 [m/s]

Test parameters:	Pumping Well:	BP-7	Pumping Time	1520 [s]
	Screen radius:	0.03785 [m]	Aquifer thickness:	114.31
	Screen length:	120 [m]	Boring radius:	0.03785 [m]
			Discharge Rate:	9.5E-5 [m³/s]

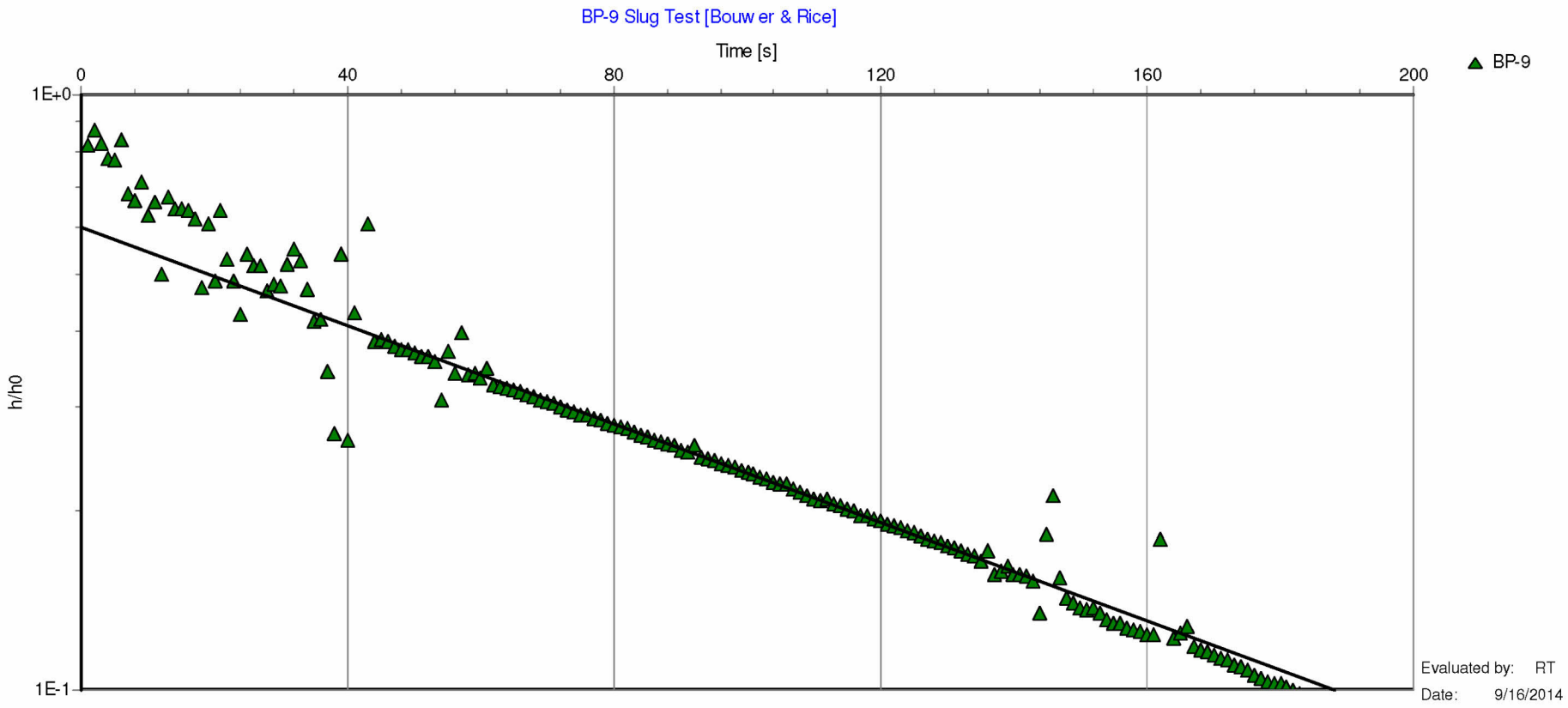
SLR	**Analysis Report**	**Pumping Test:** BP-8 Recovery Test
	Project: Black Point Quarry	**Analysis Method:** Theis Recovery
	Number: 210.05913.00000	Comments:
	Client: Morien Resources Corp.	Saturated screen length = 103.2 [m] Max. Head Change = 0.81 [m] R (eff) not used in analysis



Analysis results:	Transmissivity:	6.67E-5 [m²/s]	Conductivity:	6.47E-7 [m/s]

Test parameters:	Pumping Well:	BP-8	Pumping Time	8540 [s]
	Screen radius:	0.03785 [m]	Aquifer thickness:	103.19
	Screen length:	108 [m]	Boring radius:	0.03785 [m]
			Discharge Rate:	5.333E-5 [m³/s]

Analysis Report	Slug Test: BP-9 Slug Test
Project: Black Point Quarry	**Analysis Method: Bouwer & Rice**
Number: 210.05913.00000	Comments:
Client: Morien Resources Corp.	Saturated screen length = 124.4 [m] Max. Head Change = 0.48 [m] R (eff) not used in analysis



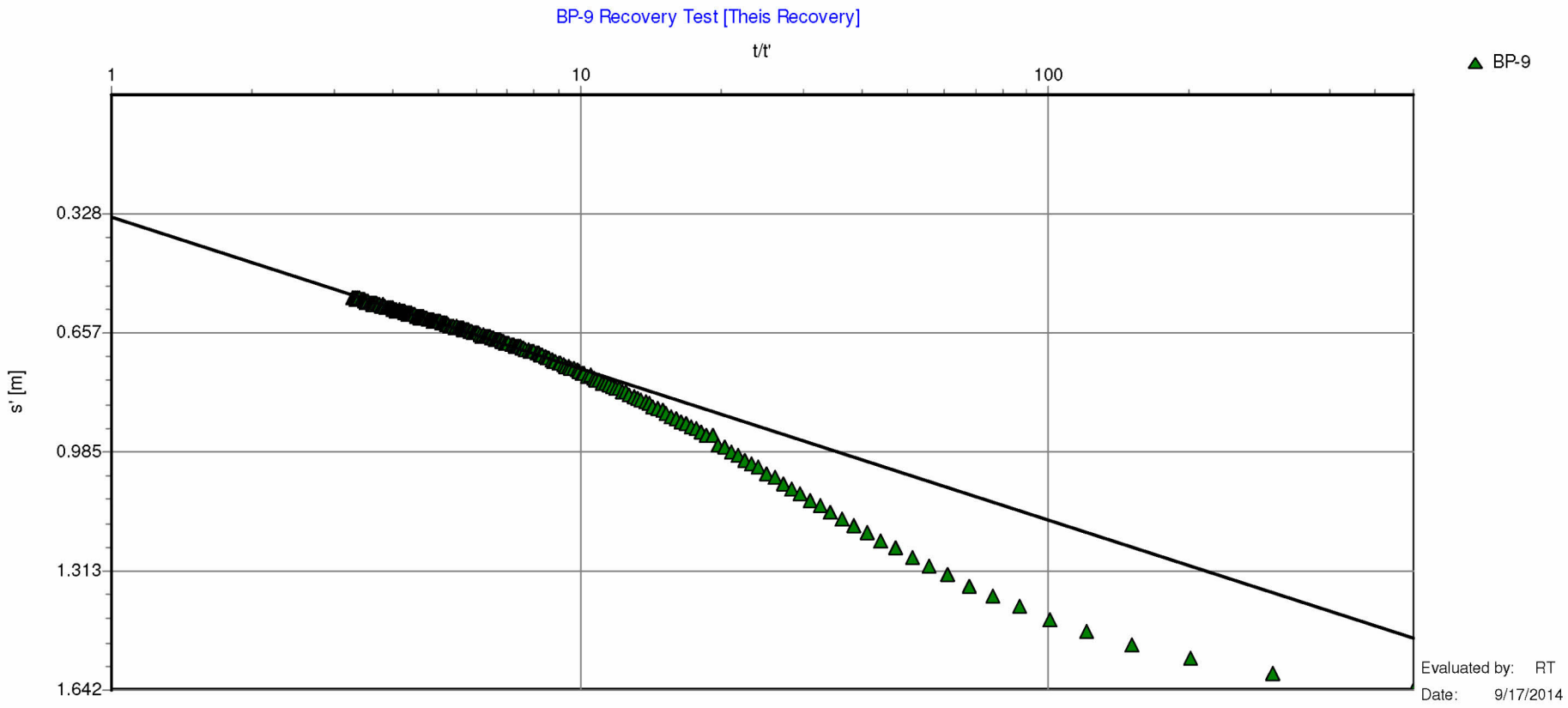
Analysis results:

Conductivity: 2.23E-6 [m/s]

Test parameters:

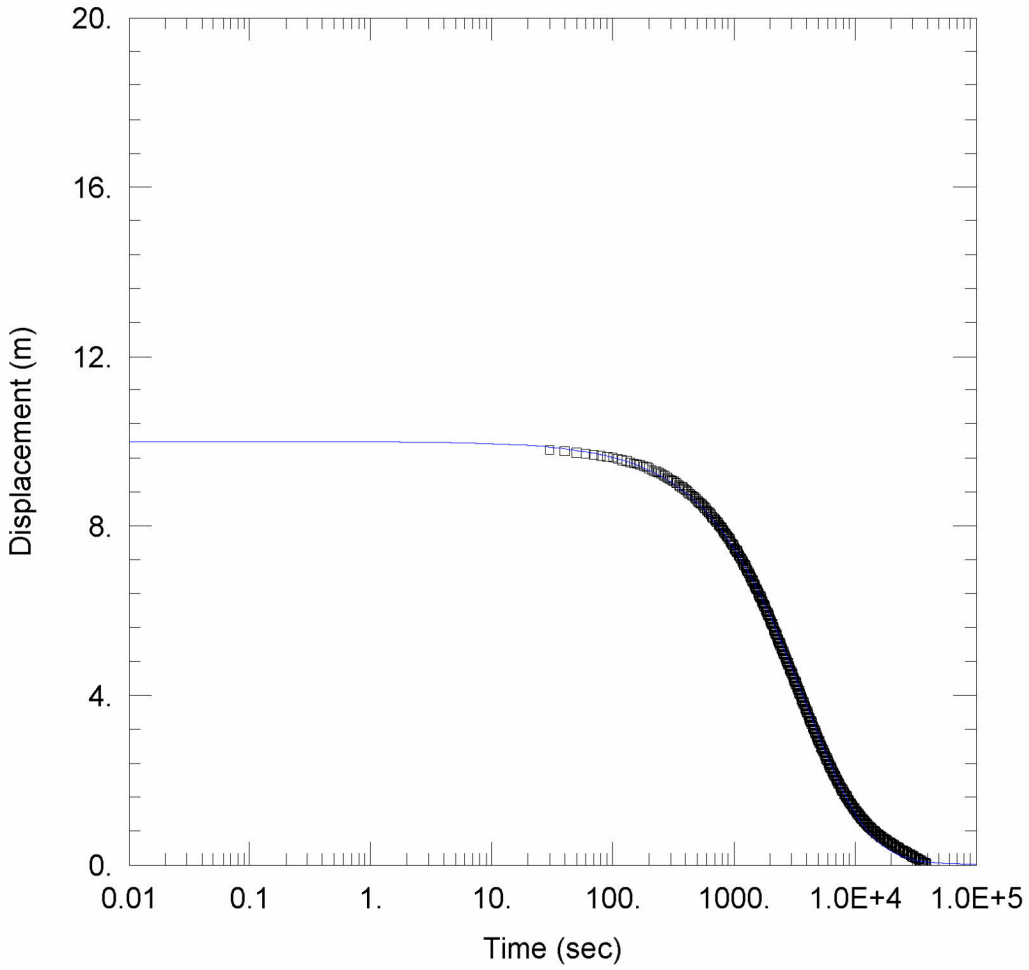
Test Well:	BP-9	r(eff):	0.038 [m]
Screen radius:	0.03785 [m]	Aquifer thickness:	124.38
Screen length:	130 [m]	Boring radius:	0.03785 [m]

SLR	**Analysis Report**	**Pumping Test:** **BP-9 Recovery Test**
	Project: Black Point Quarry	**Analysis Method:** **Theis Recovery**
	Number: 210.05913.00000	Comments:
	Client: Morien Resources Corp.	Saturated screen length = 124.1 [m] Max. Head Change = 1.72 [m] R (eff) not used in analysis



Analysis results:	Transmissivity:	1.90E-5 [m²/s]	Conductivity:	1.53E-7 [m/s]

Test parameters:	Pumping Well:	BP-9	Pumping Time	6010 [s]
	Screen radius:	0.03785 [m]	Aquifer thickness:	124.11
	Screen length:	130 [m]	Boring radius:	0.03785 [m]
			Discharge Rate:	4.333E-5 [m³/s]



WELL TEST ANALYSIS

PROJECT INFORMATION

Company: AECOM
Client: Vulcan
Project: 60323234
Location: Black Point
Test Well: RWA007
Test Date: July 17, 2014

AQUIFER DATA

Saturated Thickness: 73. m

WELL DATA (BPRWA007)

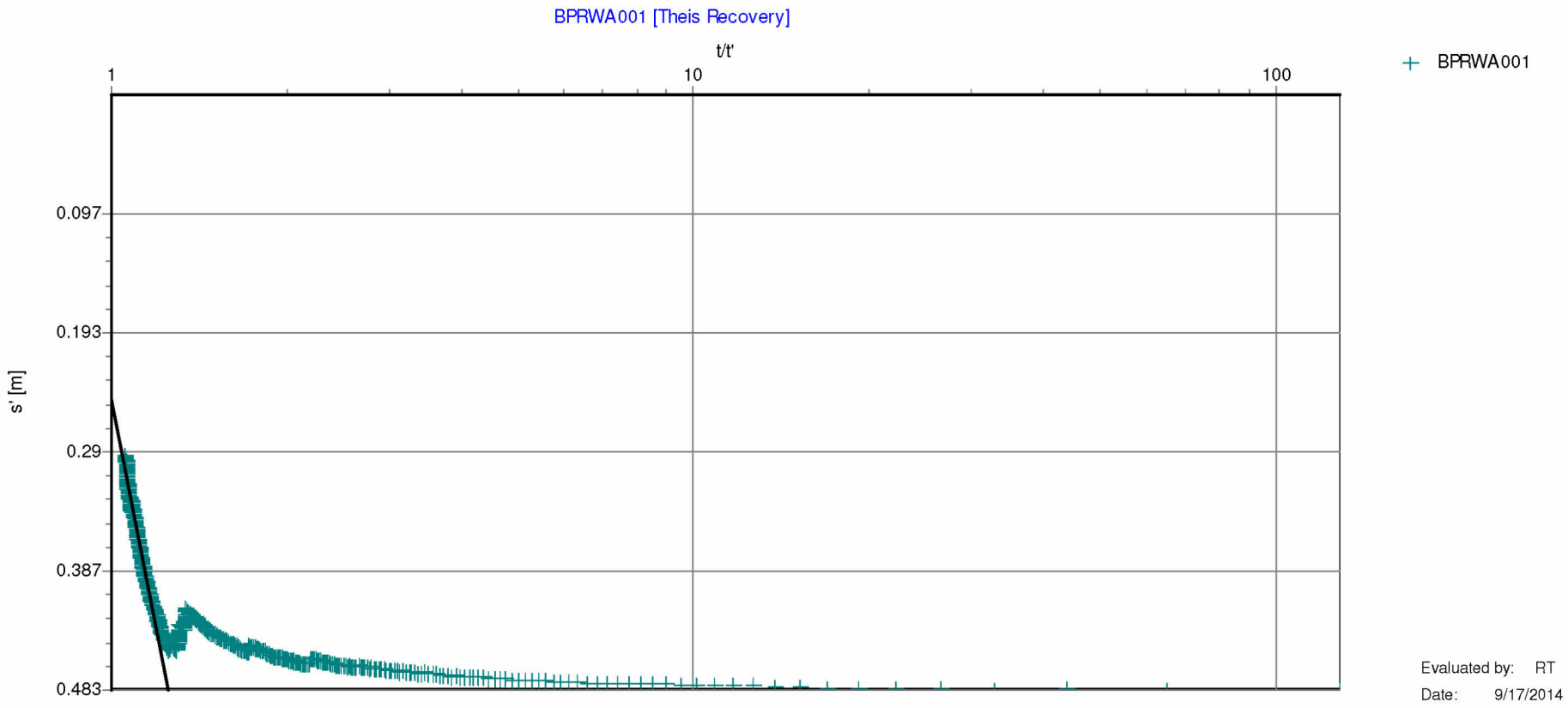
Initial Displacement: 10. m
Total Well Penetration Depth: 83. m
Casing Radius: 0.076 m
Static Water Column Height: 73. m
Screen Length: 80. m
Well Radius: 0.076 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 5.807E-8 m/sec
Kz/Kr = 1.
Ss = 1.402E-6 m^{-1}

SLR	**Analysis Report**	**Pumping Test:** BPRWA001
	Project: Black Point Quarry	**Analysis Method:** Theis Recovery
	Number: 210.05913.00000	Comments:
	Client: Morien Resources Corp.	Saturated screen length = 3.00 [m] Max. Head Change = 0.50 [m] R (eff) not used in analysis



Analysis results: Transmissivity: 2.15E-5 [m²/s] Conductivity: 2.15E-6 [m/s]

Test parameters:

Pumping Well:	BPRWA001	Pumping Time	3840 [s]
Screen radius:	0.451 [m]	Aquifer thickness:	10 [m]
Screen length:	5.3 [m]	Boring radius:	0.451 [m]
		Discharge Rate:	0.00028 [m³/s]

ATTACHMENT H
Groundwater Elevation Summary Tables and Hydrographs

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

Groundwater Level Tables

Project Site Granite Core Holes

Well	BP-1A	BP-2	BP-3	BP-4	BP-5	BP-6A	BP-7	BP-8	BP-9
Ground Elevation (mASL)	73	82	74	100	82	73	70	58	79
September 14, 2011	70.21	79.4	70.85	96.38	79.11	68.35			
June 15, 2014		79.49	70.88	97.54	79.67	69.27	65.12	53.39	73.51
August 26, 2014		79.3	70.61	95.68	78.46	68.36	64.31	53.19	73.11

Residential Water Wells

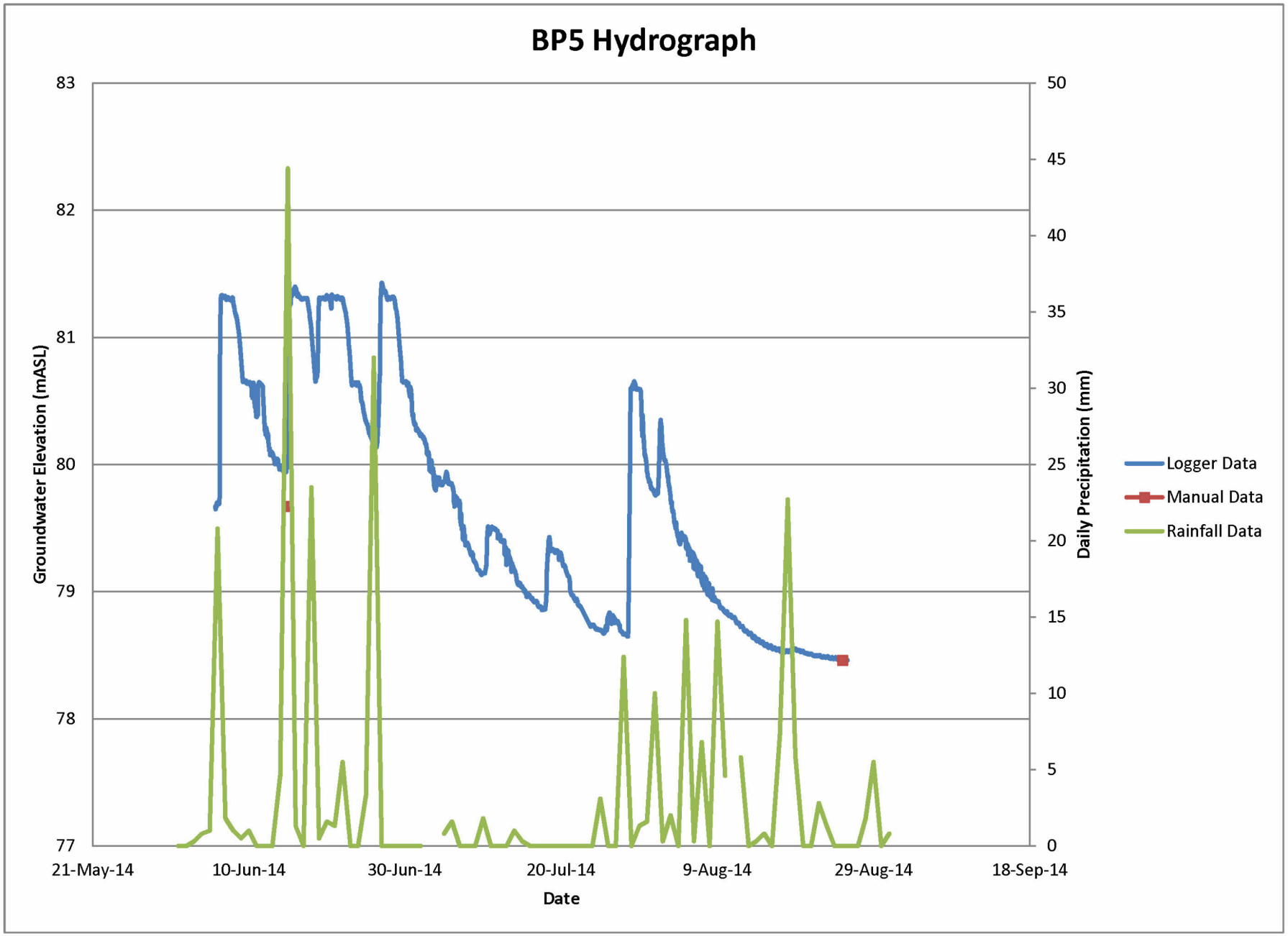
Well	BPRWA001	BPRWA002	BPRWA003	BPRWA004	BPRWA006	BPRWA007	BPRWA008	BPRWA012	BPRWA013	BPRWA014	BPRWA016
Ground Elevation (mASL)	21	21	12	35	32	42	48	5	50	41	17
July 16, 2014	18.71	19.54	10.88								
July 17, 2014				34.75	29.94	30.17	46.61				
July 18, 2014								2.73			
July 21, 2014											
July 22, 2014									46.9		
July 25, 2014										39.81	
August 29, 2014											13.403

Drive Point Piezometers

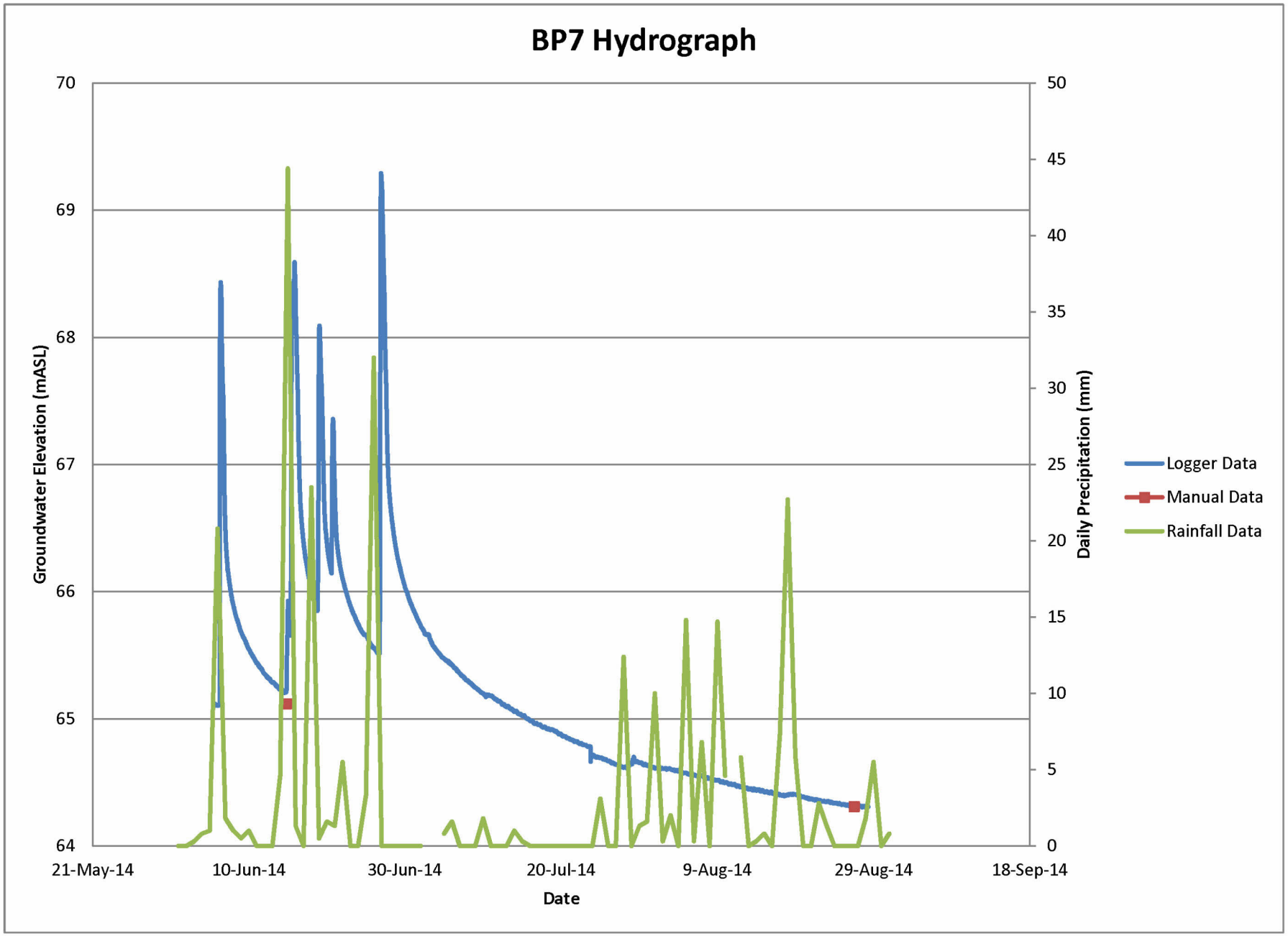
Mini piezometer ID	Ground Elevation	Bottom of perforated interval	Top of perforated interval	Vertical separation of screened intervals (DL)	Stick up	Water Level (26 August 2014)			Vertical gradient
	(mASL)	(mbgs)	(mbgs)	(m)	(m)	(m below top of pipe)	(mbgs)	Difference (shallow - deep)	
MP1 shallow	76	2.158	1.807	0.826	0.667	0.755	0.088	-0.111	-0.13
MP1 deep		3.334	2.984		0.72	0.919	0.199		
MP2 shallow	75	1.39	0.938	0.487	0.817	1.147	0.33	-0.257	-0.53
MP2 deep		2.227	1.877		1.815	2.402	0.587		
MP3 shallow	75	1.99	1.64	0.789	0.86	1.273	0.413	0.09	0.11
MP3 deep		3.132	2.779		0.915	1.238	0.323		
MP4 shallow	53	2.058	1.709	0.641	0.771	0.761	-0.01	0.043	0.07
MP4 deep		3.042	2.699		1.01	0.957	-0.053		
MP5 shallow	47	1.812	1.461	1.285	1.005	1.2	0.195	-0.17	-0.13
MP5 deep		3.447	3.097		0.605	0.97	0.365		
MP6 stream	74	0	n/a	0.985	0.897	0.764	-0.133	-0.6	-0.61
MP6 deep		1.335	0.985		0.897	1.364	0.467		
MP7 shallow	72	1.719	1.369	1.07	1.11	1.186	0.076	0.016	0.01
MP7 deep		3.14	2.789		0.904	0.964	0.06		
MP8 stream	49	0	n/a	0.44	0.796	0.736	-0.06	-0.146	-0.33
MP8 deep		0.79	0.44		0.796	0.882	0.086		
MP9 stream	45	0	n/a	1.003	1.46	1.335	-0.125	0.03	0.03
MP9 deep		1.353	1.003		1.46	1.305	-0.155		

Positive value indicates upward gradient i.e. Groundwater discharge zone

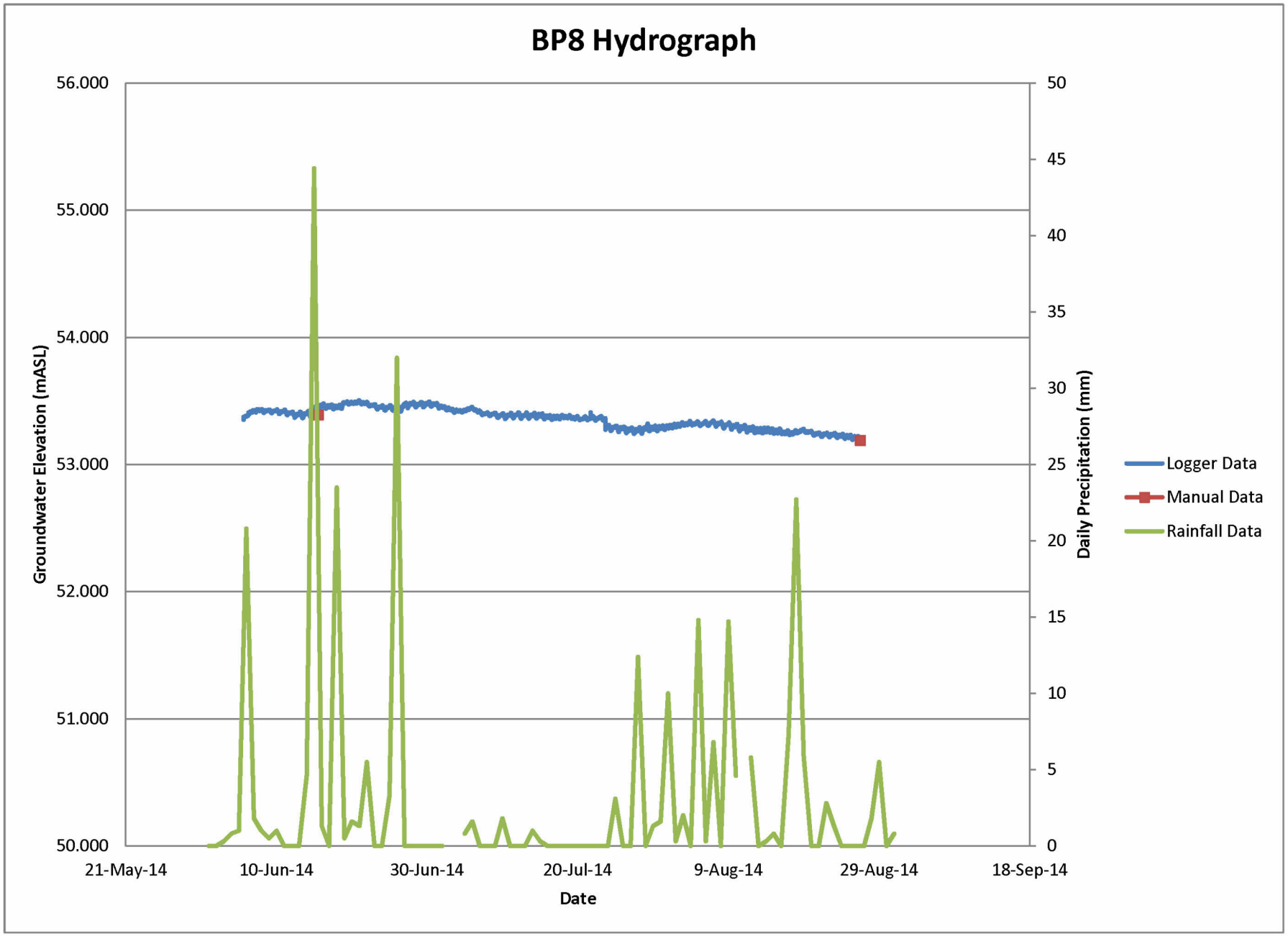
Negative Value indicates downward gradient i.e. Groundwater recharge zone


BP5 Hydrograph
Groundwater Elevation (mASL)
83
82
81
80
79
78
77
Daily Precipitation (mm)
50
45
40
35
30
25
20
15
10
5
0
21-May-14
10-Jun-14
30-Jun-14
20-Jul-14
9-Aug-14
29-Aug-14
18-Sep-14
Date
Logger Data
Manual Data
Rainfall Data

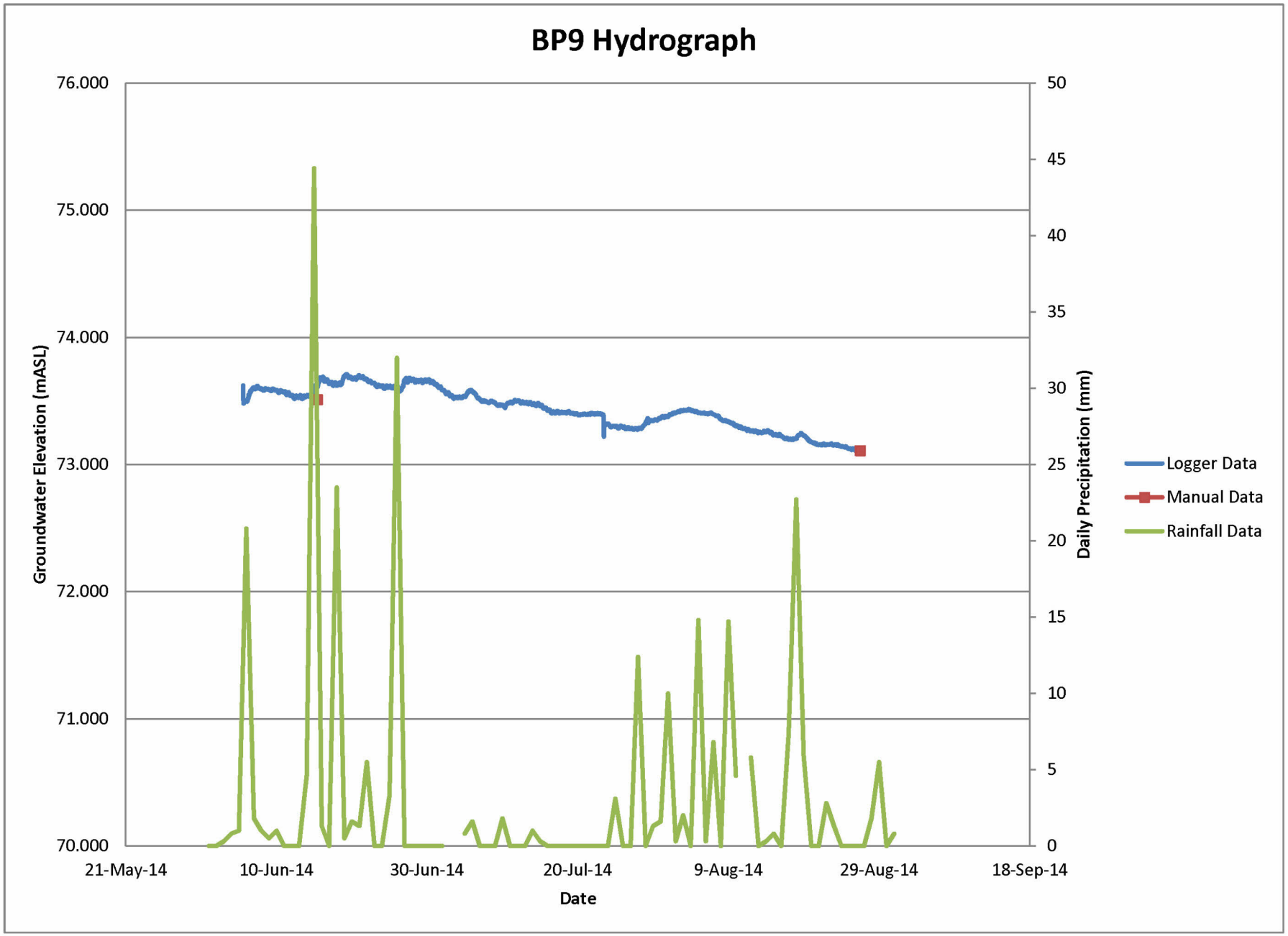
C 1340-948


BP7 Hydrograph
Groundwater Elevation (mASL)
70
69
68
67
66
65
64
Daily Precipitation (mm)
50
45
40
35
30
25
20
15
10
5
0
21-May-14
10-Jun-14
30-Jun-14
20-Jul-14
9-Aug-14
29-Aug-14
18-Sep-14
Date
Logger Data
Manual Data
Rainfall Data

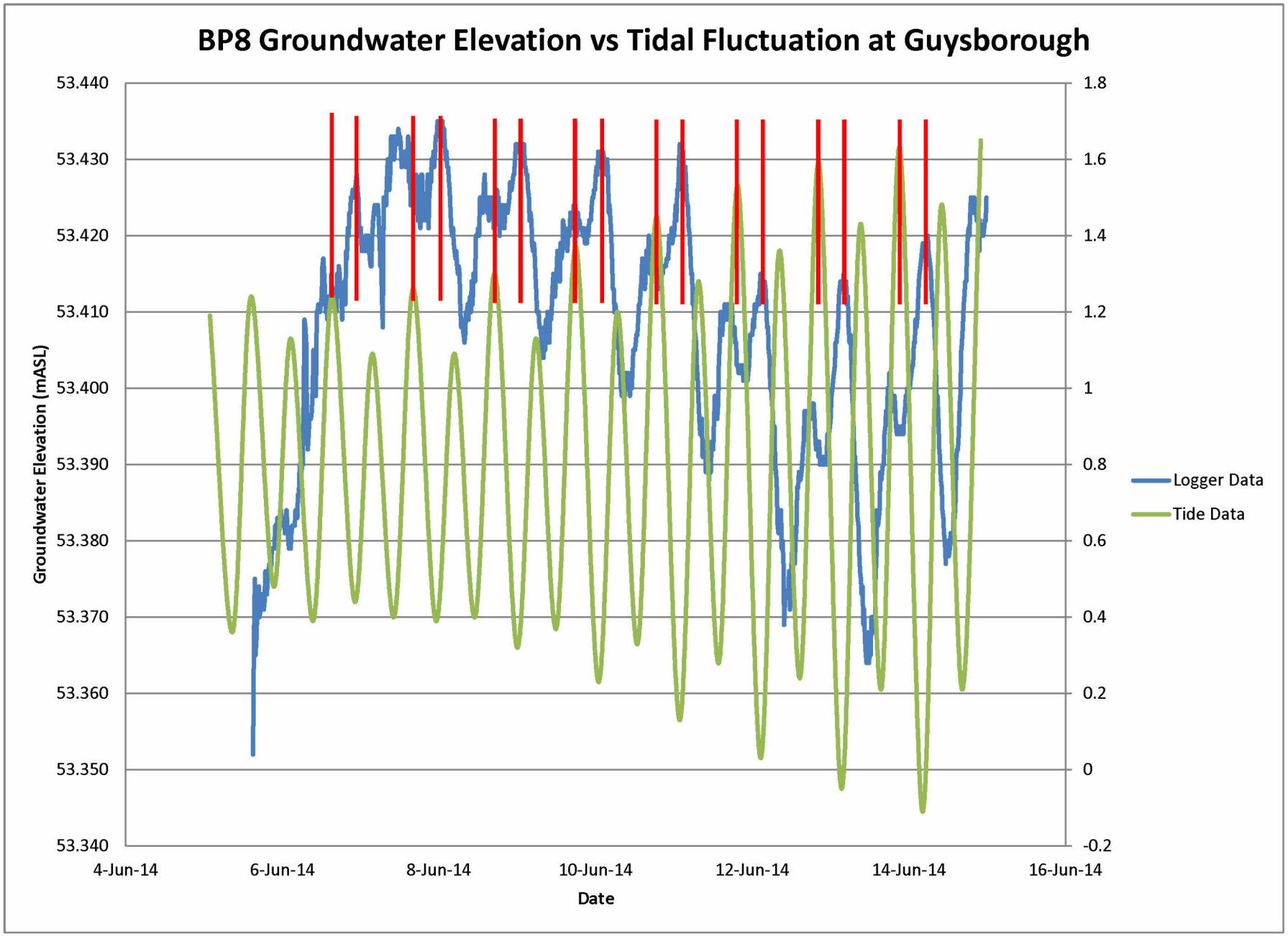
C 1340-949


BP8 Hydrograph
56.000
55.000
54.000
53.000
52.000
51.000
50.000
Groundwater Elevation (mASL)
50
45
40
35
30
25
20
15
10
5
0
Daily Precipitation (mm)
21-May-14
10-Jun-14
30-Jun-14
20-Jul-14
9-Aug-14
29-Aug-14
18-Sep-14
Date
Logger Data
Manual Data
Rainfall Data

C 1340-950


BP9 Hydrograph
76.000
75.000
74.000
73.000
72.000
71.000
70.000
Groundwater Elevation (mASL)
50
45
40
35
30
25
20
15
10
5
0
Daily Precipitation (mm)
21-May-14
10-Jun-14
30-Jun-14
20-Jul-14
9-Aug-14
29-Aug-14
18-Sep-14
Date
Logger Data
Manual Data
Rainfall Data

C 1340-951


BP8 Groundwater Elevation vs Tidal Fluctuation at Guysborough
Groundwater Elevation (mASL)
53.440
53.430
53.420
53.410
53.400
53.390
53.380
53.370
53.360
53.350
53.340
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
4-Jun-14
6-Jun-14
8-Jun-14
10-Jun-14
12-Jun-14
14-Jun-14
16-Jun-14
Date
Logger Data
Tide Data

C 1340-952

SLR

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APPENDIX B
Acid Rock Drainage Potential Report (2011)

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

Field Report

November 15, 2011

Submitted By: Peter Dalton

Purpose

To determine the potential for Acid Rock Drainage (ARD) related to the bedrock underlying the processing area at the proposed Black Point Aggregate project site.

Introduction

Erdene Resource Development's Black Point aggregate project is located approximately 10km west of Canso along the southern coast of the Chedabucto Bay, Guysborough County, Nova Scotia.

On October 27, 2011 Erdene geologists Mark Davies and Peter Dalton completed a one day geologic mapping and sampling program focused over the industrial footprint of the project site proposed for aggregate processing and marine load out facilities. Six representative rock samples were collected from both outcrop and subcrop located over the area of interest. All samples were submitted for sulphide concentration and acid producing potential analysis. Of the six samples collected only one sample (BP-ARD-5) exhibited intense sulphide (pyrite) mineralization suggesting the potential for acid production.

Geology

The central portion of the Black Point project area is dominated by a Devonian aged monzogranite pluton which intruded Ordovician aged metasedimentary units of both the Halifax and Goldenville Formations which comprise the Meguma Group (see Figure 1). The granite is the rock intended to be mined as construction aggregate. Most infrastructure related to aggregate processing would be constructed on the coastal platform comprised of the Halifax and Goldenville Formations in the northern portion of the project area.

Granite- Medium grained, equigranular, micaceous monzogranite

Halifax Formation- Highly foliated metawacke and slates. Commonly sulphide (pyrite) bearing.

Goldenville Formation- Silicified quartzites, minor interbeds of highly foliated shales and metawacke.

Discussion

A representative suite of six rock samples were collected over the proposed processing facility area at Black Point. An attempt to collect all samples from outcrop was not possible based upon the heavy surficial cover.

Samples from the Goldenville formation was exclusively collected from outcrop locations. The silicified weather resistive nature of the quartzite provide outcrops of prominent ridges and topographic highs.

Sampling related to the Halifax Formation was not sourced from outcrop but rather cobble sized material interpreted to be subcrop collected from within a small stream bed near the bottom of the prominent slope that rises in elevation towards the granite to the south.

Goldenville Formation

All samples related to the Goldenville Formation remained consistent in regards to lithology. Samples consisted of silicifed, very fine grained to aphanititc, well indurated quartzite. Variations observed included weak manganese staining and trace concentrations of oxidized pyrite.

Halifax Formation

The representative sample of the Halifax Formation consisted of a highly foliated slate with moderate intensity iron oxide staining on the weathered surface. The fresh surface exhibited ≤5% pyrite mineralization occurring as clumps along cleavage planes.

The most up to date geology map of the Black Point area is associated with the GSC Bulletin 383 by J.D. Hill, 1991. Mapping completed by Erdene geologists of the Goldenville and Halifax Formations at Black Point suggests a slight discrepancy when compared to the geology map indicated by J.D. Hill. Where Hill has mapped a geologic boundary between the Goldenville and the Halifax Formations Erdene geologist found evidence to suggest that the Goldenville quartzites extend further south (see Figure 2). This evidence is based on outcropping quartzite located at BP-ARD-4 clearly located within what was previously mapped as Halifax Formation metawacke.

Methodology and Laboratory Testing

All samples were either directly collected from outcrop or subcrop using a 2-5kg sample volume. Samples were cleared of any obvious organic debris to minimized contamination.

All samples were submitted to the Dalhousie University Minerals Engineering Center Laboratory in Halifax, Nova Scotia. Sample Analysis consists of the **BC Research Initial Test Method** which consists of:

Total Sulphur- weight %

*Total Sulphide-weight % (BP-ARD-1 and BP-ARD-5)

Acid Producing Potential- kg/tonne H_2SO_4

Acid Consuming Ability- kg/tonne H_2SO_4

pH

*Total Sulphide analysis was completed for sample BP-ARD-1 which represented the Goldenville quartzite sample with the highest total sulphur value and BP-ARD-5 which represents the Halifax pyritic slate.

Complete results of the ARD sampling are located in Appendix 1

Conclusion

A suite of six rock samples were collected from the proposed processing and marine load out area at the Black Point project location in Guysborough County, Nova Scotia to determine their acid producing potential. The samples collected represent both the Goldenville Formation quartzite and Halifax Formation slate which underlie the area of interest. Of these six samples collected only one sample (BP-ARD-5) collected from the Halifax Formation feature increased sulphur/sulphide concentrations in hand specimen. These samples were submitted to Dalhousie

University's Minerals Engineering Laboratory for sulphur and sulphide analysis by BC Research Initial Test method.

Geology	S (Total wt%) Ave.	S (Sulphide)wt%	Acid Prod. Potential Ave. kg/t H_2SO_4	Acid Cons. Ability Ave.	pH Ave.
Goldenville Quartzite	0.0114	0.009	0.29	4.012	8.06
Halifax Slate/Metawacke	1.0	0.935	28.60	4.61	7.4

Results indicate that the Goldenville quartzite pose no risk of acid production under meteoric conditions. The Halifax Formation slate and metawacke contains abundant concentrations of sulphide (pyrite) which elevates the acid producing potential of the rock to 28.60 kg/t H_2SO_4. It is interesting to note that although sample BP-ARD-5 contained abundant sulphide concentrations the overall pH of the sample was neutral to basic at 7.4.

Based upon these findings future steps of mitigation may be necessary in order to minimize acid rock drainage related of the Halifax Formation slates should the local bedrock become disturbed during infrastructure development.

References

Hill J.D. (1991) Petrology, tectonic Setting, and Economic Potential of Devonian Peraluminous Granitoid Plutons in the Canso and Forest Hill Areas, Eastern Meguma terrane, Nova Scotia. Geological Survey of Canada, Bulletin 383

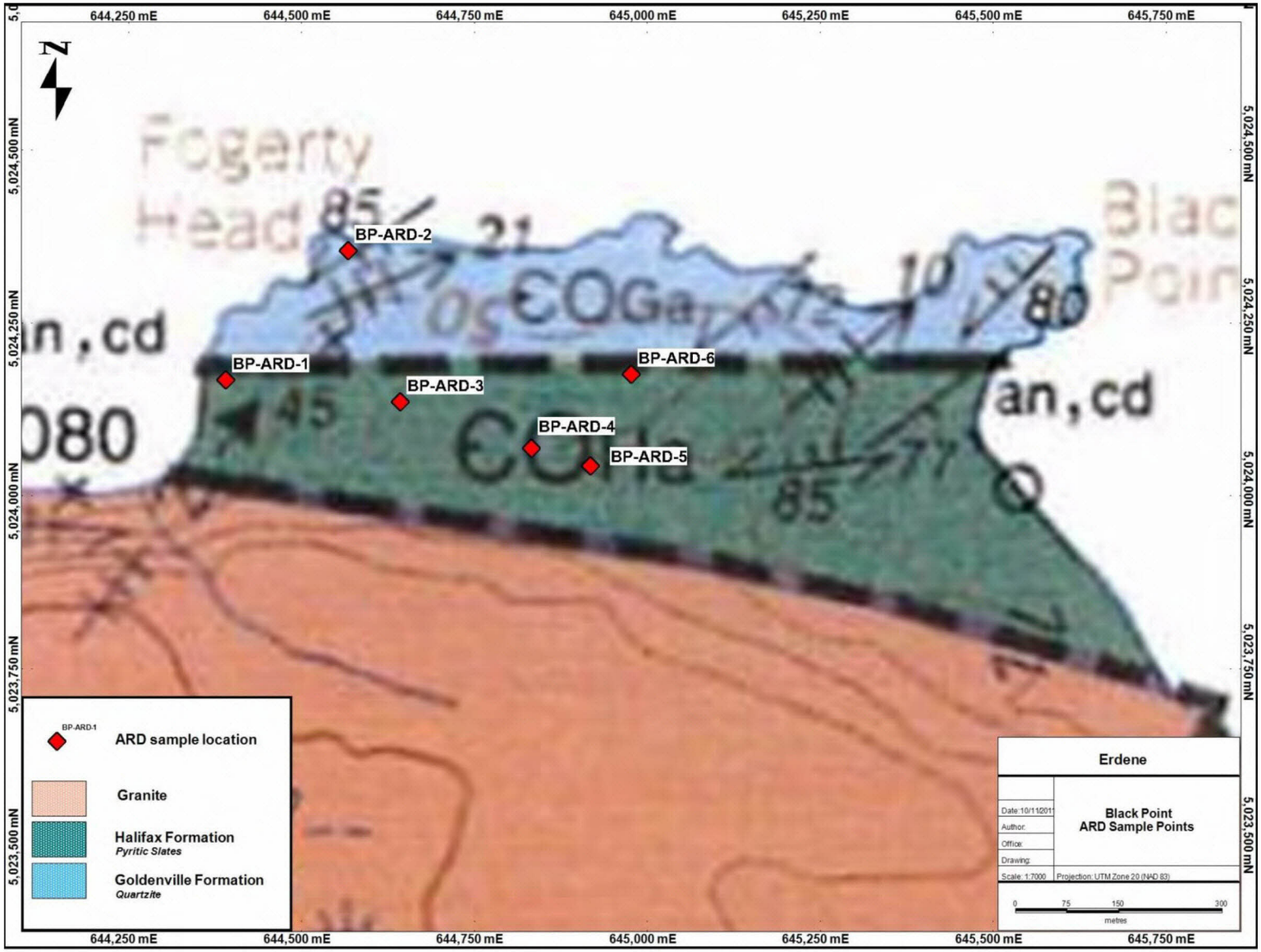

Figure 1 Black Point ARD sampling locations based on J.D. Hill 1991 Geology.

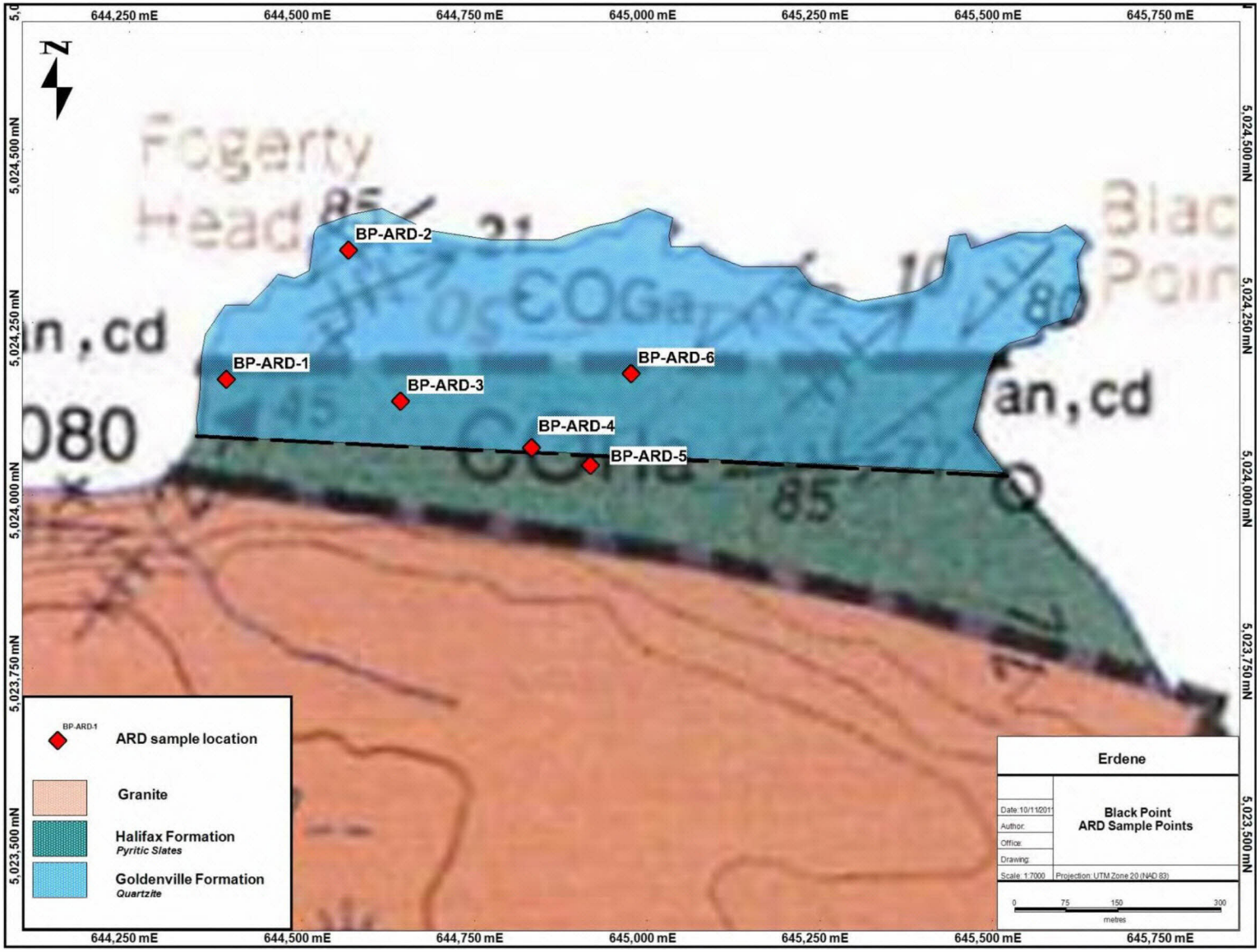

Figure 2 Black Point ARD sample locations with modification to Goldenville Quartzite based on field observations.

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Inspiring Minds

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14-Nov-11

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Attention: Peter J. Dalton

Re: Results of analysis on submitted samples.
Acid producing potential based on total sulphur unless sulphide sulphur analysis results are indicated.

	Wt. %		kg/t H2SO4		
Sample	S(Total)	S(Sulphide)	Acid Prod. Potential	Acid Cons. Ability	pH
BP-ARD-1	0.019	0.009	0.28	3.33	7.6
BP-ARD-2	0.008		0.23	3.43	8.9
BP-ARD-3	0.003		0.11	4.41	7.9
BP-ARD-4	0.013		0.40	4.37	7.8
BP-ARD-5	1.000	0.935	28.60	4.61	7.4
BP-ARD-6	0.014		0.43	4.52	8.1

Refer.	Wt. %
Sample	S (Total)
NBM-1	0.29
Recomd. Value	0.28

Digitally signed by Daniel Chevalier
Date: 2011.11.14 12:35:21 -04'00'

Daniel Chevalier, MASc
Manager, Minerals Engineering Centre

Appendix 1. ARD sample results by BC Research Initial Test Method

APPENDIX C
Surface Water Assessment Technical Report (2015)

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

global environmental solutions

Surface Water Assessment
Black Point Quarry, Nova Scotia

SLR Project No.: 7CA.19025.00003

January 2015

Vulcan Materials Group and Morien Resources Corp

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DOCUMENT INFORMATION

Title	Surface Water Assessment
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Reviewer	Russell Dmytriw
Client	Morien Resources Corp
Date last printed	2015/02/04 08:49:00 AM
Date last saved	2015/02/04 08:49:00 AM
Comments	
Keywords	Insert keywords
Project Number	7CA.19025.00003
Report Number	
Revision Number	
Status	FINAL
Issue Date	January 2015

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SURFACE WATER ASSESSMENT

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SURFACE WATER ASSESSMENT

1 INTRODUCTION

1.1 BACKGROUND

SLR Consulting was retained by Vulcan Materials Group and Morien Resources Corporation (the Proponent) to conduct a hydrologic assessment of a proposed Black Point aggregate quarry in Guysborough County, Nova Scotia. The assessment and description of hydrologic conditions within the vicinity of the site is a requirement outlined in the *Guide to Preparing an EA Registration Document for Pit and Quarry Developments in Nova Scotia* (NSE 2009).

1.2 SITE DESCRIPTION

The proposed Black Point Quarry Project is located on a 354.5 ha property along the south shore of Chedabucto Bay, approximately 4.0 km east of Fox Island in Guysborough County, Nova Scotia.

The proposed quarry land is currently zoned by the MODG as Industrial Heavy (I-2).

The site is greenfield (undeveloped) and covered by thin soils, which sustain tall shrub and some coniferous forest. The site features several wetlands and a lake (Fogherty Lake). Topography on the site slopes in all directions away from a granite hill, located within the southern central part of the site.

1.3 PROPOSED DEVELOPMENT

The proposed quarry is located on the abovementioned hill which has minimal overburden on top of the granite. The base of the quarry will be at approximately 30 m below mean seal level (<130 m deep) and will occupy a footprint of 180 ha. Processing including secondary crushing, screening, and washing will be undertaken on a 28 ha “lower platform” situated between the quarry and the coastline. The aggregate will be exported by ship via a marine terminal and load-out facility, north of the processing platform.

1.4 OBJECTIVES

The objectives of this hydrologic assessment are based on Section 6.1.2 of the *Nova Scotia Pit and Quarry Guidelines*:

1. Provide a general description of the hydrologic conditions and water quantity and quality for all surface waters in the vicinity of the proposed quarry;

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2. Discuss and quantify the predicted effects the quarry activity may have on existing surface water quantity, both on-site and downstream of the quarry area;
3. Estimate the total change in surface water runoff amounts for the existing and proposed quarry development;
4. Estimate the total required capacity of the detention/siltation facilities (i.e. detention ponds) for the existing and proposed conditions (i.e. full quarry expansion) in order to meet acceptable liquid effluent discharge concentrations as defined in the *Guidelines*; and
5. Assess any potential impacts of the proposed quarry expansion on downstream surface water components with respect to water quantity and quality and propose mitigation measures to minimize any potential effects.

2 BASELINE HYDROLOGY

The following section provides a description of baseline hydrological conditions of the site including rainfall, evaporation, storm intensities, catchments and watercourse network.

2.1 CLIMATE

Climate data including historical average total monthly precipitation and average monthly temperature were obtained from Government of Canada Climate website[1]. Deming Station, located approximately 15 km south of the proposed quarry, was chosen due to the large amounts of continuously recorded data dating between 1954 and 2011. This station (station 8201410) is located at coordinates 45.22N, -61.18W. Average climate conditions for the site were calculated using 30 year averages for data from 1975 to 2005. Data for years subsequent to 2005 were incomplete and not used in the calculation. A summary of climate norms is presented in Table 2-1.

As common on the eastern coast of Canada, the region's climate is influenced by the Atlantic Ocean and is characterised by mild winters and cool summers. Average monthly temperatures range from -0.5°C to -4.4°C from December to the end of March and from 11.1°C to 17.3°C from June through September.

The Deming, NS Climate Station recorded an average annual total precipitation of 1426.17 mm over a thirty year period consisting of 1311.8 mm of rain and 114.3 cm of snow.

[1] http://climate.weather.gc.ca/climate_normals/index_e.html

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TABLE 2-1: SUMMARY OF CANADA CLIMATE NORMS FOR STATION 8201410, DEMING, NS (1975-2005)

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave.
Mean Temp (°C)	-4	-4.4	-1.4	2.5	6.6	11.1	14.7	17.3	15	10	4.9	-0.5	6.0
Mean Max Temp (°C)	-0.5	-1.1	1.4	5.3	9.7	14.3	17.4	20.2	18	12.7	7.6	2.7	9.0
Mean Min Temp (°C)	-7.5	-7.6	-4.3	-0.3	3.5	7.8	11.8	14.5	12	7.2	2.1	-3.7	3.0
Extreme Max Temp (°C)	10.5	10	11	20	24	31.1	30	28.5	26	20.5	18.5	12	20.2
Extreme Min Temp (°C)	-25	-23	-19	-11	-3.5	1	4.5	7	2	-2.2	-12	-23.5	-8.7

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Average Total Rain (mm)	90.4	66.5	97.1	121.9	112.9	99.8	103.2	93.3	115.5	149.5	140.9	120.7	1311.7
Average Total Snow (cm)	29.1	27.7	21.2	9.4	0.6	0	0	0	0	0	4.6	21.7	114.3
Average Total Precipitation(mm)	119.5	94.2	118.3	131.3	113.5	99.8	103.2	93.3	115.5	149.5	145.6	142.4	1426.1

Table 2-2 presents Depth Duration Frequency (DDF) rainfall data for the site, which is taken as the average of Sable Island and Shearwater stations abstracted from the Government of Canada Climate DDFv2 dataset[2]. These weather stations were selected from the database because of the long records used for estimation of the DDF data. The 1:100 year 24 hour rainfall depth averaged from Sable Island and Shearwater stations was compared against the average 1:100 year 24 hour depths for the three stations nearest to the site, which had over 40 years of data as provided by Environment Canada[3], which gave a similar result (<0.5% difference).

TABLE 2-2: DEPTH DURATION FREQUENCY (DDF) RAINFALL – PROJECT SITE

Duration	Rainfall Depth (mm) and Frequency					
	1:2 years	1:5 years	1:10 years	1:25 years	1:50 years	1:100 years
5 minutes	6.3	8.3	9.6	11.3	12.6	13.8
10 minutes	9.2	11.8	13.6	15.8	17.5	19.1
15 minutes	11.5	14.6	16.7	19.4	21.3	23.2
30 minutes	16.1	20.5	23.3	27.0	29.7	32.3
1 hour	22.2	28.1	32.1	37.1	40.8	44.5
2 hour	30.3	39.2	45.2	52.7	58.2	63.7
6 hour	49.8	62.9	71.7	82.7	90.8	98.9
12 hour	60.9	77.5	88.5	102.5	112.8	123.1
24 hour	68.7	89.6	103.4	120.9	133.8	146.7
2 Day	79.5	108.0	127.0	150.9	168.6	186.3
5 Day	98.6	127.9	147.4	171.9	190.1	208.2

[2] http://climate.weather.gc.ca/prods_servs/engineering_e.html and ftp://ftp.tor.ec.gc.ca/Climate_Services/

[3] Email from climate.atlantic@ec.gc.ca dated 26 January 2015

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10 Day	127.2	163.8	188.1	218.8	241.5	264.1
15 Day	154.5	194.5	221.0	254.5	279.3	303.9
30 Day	221.0	270.0	302.5	343.5	373.9	404.1

Storm intensities are predicted to increase in this region due to the effects of climate change (Richards and Daigle 2001) as follows:

- 1980s – 0% (1980 is the base decade against which increases are compared).
- 2020s – 5% above 1980s values.
- 2050s – 9% above 1980s values.
- 2080s – 16% above 1980s values.

2.2 EVAPOTRANSPIRATION

Evapotranspiration has been calculated at 549 mm/year calculated using the Thornthwaite equation requiring mean monthly temperature and latitude. Mean temperature and a factor for latitude combine to reflect the amount of energy available to contribute to potential evapotransporation (PET).

2.3 TOPOGRAPHY

The topography of the site and surroundings is presented on Figure 2-1 which shows that site topography slopes in all directions away from a granite hill, located within the southern central part of the site. The granite hill has a maximum elevation of approximately 97 m above mean sea level (amsl).

There is a marked break in slopes between the headland containing both Black Point and Fogerty Head, which forms a level plateau, and the rest of the site which raises sharply from 20-30 m amsl to 60 – 80 m amsl within just over 100 m. With the exception of this steep slope, the rest of the site is gently undulating.

2.4 WATER FEATURES AND CATCHMENTS

As presented on Figure 2-1 the site features numerous wetlands and a lake (Fogherty Lake), suggesting that relatively low infiltration rates are typical. This is supported by considering the elevation of Fogherty Lake, in which water levels are sustained at approximately 80m amsl and in relatively close proximity to the coast line.

Fogherty Lake is a shallow waterbody surrounded by trees, barrens and exposed rock. The water is clear but darkly tea-coloured, and visibility is nil at approximately one metre depth. The lake substrate is exposed bedrock and large boulders. There is some woody organic debris on the lake bed, which has a strong sulfurous smell. Lake water is to be very acidic (pH in field=2.94) (AMEC 2011).

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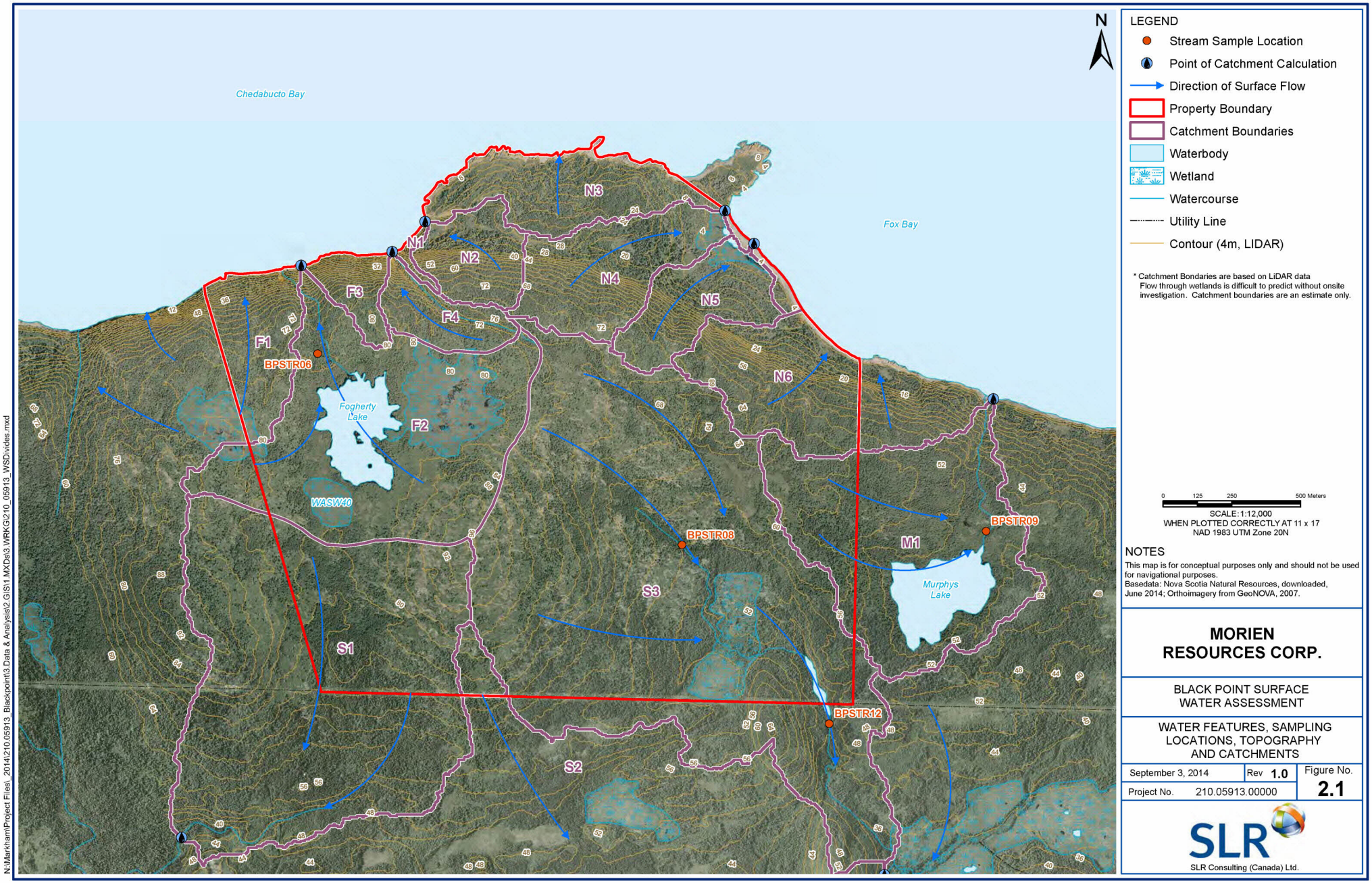
N
Chedabucto Bay
Fox Bay
N1
N2
N3
N4
N5
N6
F1
F2
F3
F4
S1
S2
S3
M1
BPSTR06
BPSTR08
BPSTR09
BPSTR12
Fogherty Lake
WASW40
Murphys Lake
LEGEND
Stream Sample Location
Point of Catchment Calculation
Direction of Surface Flow
Property Boundary
Catchment Boundaries
Waterbody
Wetland
Watercourse
Utility Line
Contour (4m, LIDAR)
* Catchment Bondaries are based on LiDAR data
Flow through wetlands is difficult to predict without onsite investigation. Catchment boundaries are an estimate only.
0 125 250 500 Meters
SCALE:1:12,000
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N
NOTES
This map is for conceptual purposes only and should not be used for navigational purposes.
Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.
MORIEN RESOURCES CORP.
BLACK POINT SURFACE WATER ASSESSMENT
WATER FEATURES, SAMPLING LOCATIONS, TOPOGRAPHY AND CATCHMENTS
September 3, 2014
Rev 1.0
Figure No. 2.1
Project No. 210.05913.00000
SLR
SLR Consulting (Canada) Ltd.
N:\Markham\Project Files_2014\210.05913_Blackpoint\3.Data & Analysis\2.GIS\1.MXDs\3.WRK\3210_05913_WSDivides.mxd

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Three watercourses are identified within the site boundary and are described in full in AMEC's report (AMEC 2011), a summary of which is as follows:

- Watercourse 1 – flows from Fogherty Lake northwards into Chedabucto Bay. A beaver dam is located near the upstream end of the watercourse. Upstream of the dam, the channel is deep and wide and the substrate largely fines; downstream, the channel is a relatively narrow and shallow run with one area of natural deadwater. The northernmost 150m of this watercourse was not surveyed, as it flows down a steep dropoff; however, the dimensions and substrate of the downstream reaches appeared to be similar to the run portions of the channel (AMEC 2011). Flow was measured and water quality monitored approximately 10 m downstream from the discharge of Fogherty Lake at location BPSTR06. The channel varied from approximately 0.50 to 1.0 m wide and had a moderate slope. The stream bed consisted of gravel and varied sized boulders scattered throughout.
- Watercourse 2 – flows within a steep valley from the centre of the site in a north-westerly direction into Chedabucto Bay. There was a great deal of deadfall in the channel valley. The upstream reaches were dry at the time of the 2011 survey, and further downstream the stream was very shallow; this watercourse is probably ephemeral. The stream was dry in July and August, 2014. The last 220 m of this watercourse was inaccessible, as it flows down a steep slope to the ocean, as does Watercourse 1. However, the dimensions and substrate of the downstream reaches appeared to be similar to the rest of the channel (AMEC 2011).
- Watercourse 3 – flows south from the wetlands in the southeast part of the site, across the transmission line cut and towards another wetland system southeast of the site. This in turn is the headwaters of Reynolds Brook, which drains in a south-westerly direction, eventually discharging through Hendsbee and Cooeycoff Lakes into Tor Bay. The downstream portion of the assessed section is a large pool resulting from a beaver dam on the watercourse just south of the Site property line. Flows were measured and water quality monitored at two locations; BPSTR12 which is downstream of wetland 17, and BPSTR08 which is upstream of wetland 17. The discharge measurement at BPSTR12, also on Watercourse 3, was measured at the outflow of Wetland 1. The channel is 2.0 to 10.0 m wide with low, gradual banks, and moderate slope. The stream bed consisted primarily of a mix of small and large boulders. The discharge measurement was located at a narrow, well-contained section 1.0 m wide with large boulders on each side, and consistent flow throughout the section.

In addition to the abovementioned watercourses, the following significant off-site surface water resources are noted in close proximity to the site:

- South-West (off-site) Watercourse – runoff from the south-west of the site drains towards a watercourse (Reynolds Brook) which flows to the south-west into Hendsbee Lake, approximately 1.3km form the site.

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- Murphys Lake (Sample ID BPSTR09) - runoff from the east of the site drains towards Murphys Lake which is located approximately 100 m east of the site. Murphys Lake drains to the north into Chedabucto Bay. The discharge measurement at BPSTR09 was measured approximately 20 m downstream from the discharge from Murphys Lake. The typical channel width was 1.0 m or less and had a moderate slope. The stream bed was muddy with fine gravel. The discharge measurement section was 0.80 m wide, had well-defined banks on each side, and had consistent flow throughout the entire section.
- Fox Island Main Creek (Sample ID BPRST10) - Fox Island Main creek drains a large wetland southeast of the Property and discharges north to Indian Cove approximately located 2.0 km east of the Property boundary. Water samples and discharge measurements were taken approximately 10 m upstream from the bridge crossing at Starks Road, Fox Island Main. The typical full-bank channel width is approximately 3.0 m wide, with high banks and a moderate slope. The stream was in low-flow conditions at the time of July and August, 2014 measurements. The stream bed consisted of a mix of gravel and small boulders. The discharge measurement section was 1.1 m wide, well-defined with boulders at each bank, with flow concentrated primarily in middle of the cross-section and negligible at the banks.

As presented in Figure 2-1 the site can be split into 13 catchments which drain to the above mentioned receptors or directly to the ocean.

As presented in Table 2-3, flow measurements were taken in five watercourses at the end of July 2014 and end of August 2-14 (AECOM 2014). The July flows were considered representative of dry (baseflow) conditions (no precipitation for the three days prior to measurements), showed flow out of Fogherty Lake in Watercourse 1 to be 0.03 L/s and flow out of the southeast wetland in Watercourse 3 to be 7.7 L/s. The August flows were also considered representative of low flow conditions and measured flows were consistently lower than during the July round of measurements.

For comparison, estimates of mean annual runoff for these locations suggest higher flows would be more common at other, wetter, times of the year, in the order of 15 L/s in Watercourse 1 and 31 L/s in Watercourse 3.

Table 2-3: Stream discharge summary

Sample ID	Location Description	Discharge (L/s)	Dates Measured (2014)
BPSTR06	Fogherty Lake Outflow Watercourse 1	0.031 / 0	July 30 / Aug 27
None	Watercourse 2	0 / 0	July 30 / Aug 26
BPSTR08	Wetland 17 Inflow Watercourse 3 Upstream	0 / 0	July 30 / Aug 26
BPSTR09	Murphys Lake Outflow	0.170 / 0	July 31 / Aug 27
BPSTR12	Wetland 1 Outflow (Watercourse 3 downstream)	7.73 / 0.325	July 31 / Aug 27

2.5 MEAN ANNUAL RUNOFF

Rain falling onto a catchment either evaporates, infiltrates to groundwater, or runs off as storm water. Undertaking a basic water balance allows the mean annual runoff from the site to be estimated as detailed below:

- Mean Annual Precipitation – 1426 mm (as presented in section 2.1).
- Mean Annual Evapotranspiration – 549 mm (as presented in section 2.2).
- Mean Annual Infiltration – adopting factors to account for the slope, soils types, and vegetation cover (OMOE 2003), allows an infiltration factor to be estimated:
    - Topography is classified as rolling to hilly, with an infiltration factor of 0.15.
    - Soils are shallow and peaty, with an infiltration factor of 0.1.
    - Vegetation is thicket and shrub, with an infiltration factor of 0.15.
- From the above, an infiltration factor of 0.4 is estimated (the sum of each of the above components). When this factor is multiplied by the net precipitation (calculated as precipitation – evapotranspiration), an annual infiltration of 351 mm is derived.
- Mean Annual Runoff – calculated to be 526 mm based on the net precipitation (877 mm) minus infiltration (351 mm). When applied to the entire 354.5 ha site, this gives an annual runoff of 1 865 592 m^3 which equates to an average flow of 59 L/s leaving the site.

2.6 PEAK FLOW RATES AND FLOOD VOLUMES

The peak flows and flood volumes generated by the site during baseline and developed conditions were estimated using the SCS Method within the HydroCAD software package. The following parameters were used:

- Rainfall – 24 hour storm depths were adopted based on the DDF storm data presented in Table 2-2, and a Type II storm profile was adopted which is considered applicable for most parts of Canada (LSRCA 2013).

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- Catchment Area – the total site area of 354.5 ha is used.
- Curve Number – taking into account the shallow soils over much of the site, which readily generate runoff, and the shrub vegetation coverage, a curve number of 82 is used.
- Time of Concentration – estimated from longest flow pathway (approximately 1,000 m) and average gradient (0.03) to be 44.5 minutes for the pre-development site.

The peak flows and flood volumes for the site are presented in Table 2-4.

TABLE 2-4: PEAK FLOWS RATES AND FLOOD VOLUMES

Flood Hydrograph	1:25 years	1:100 years
Peak Flow (m^3/s)	47	62
Flood Volume (m^3)	258 000	341 000

2.7 WATER QUALITY

Water quality monitoring was undertaken at 5 locations on 31st July 2014 and is described in detail in Section 6.2 and Appendix A of the Main Report; a summary of the key findings are presented below. The analytical results were compared against Canadian Water Quality Guidelines (CWQG) for the Protection for Aquatic Life (PAL) Freshwater Guideline Update 7.0 (CCME 2007). The results indicate:

- pH was low (4.33 – 4.70) in all 5 samples and is outside of the acceptable CWQG PAL guideline range (6.5-9.0).
- Lead slightly exceeded the CWQG PAL guidelines at two locations.
- Iron was elevated (320 – 1600 ug/L) in all 5 samples and exceeded the CWQG PAL guidelines (300 ug/L).
- Cadmium was above the CWQG PAL guidelines at one location (0.09 ug/L).
- Ammonia was elevated (0.08 – 0.086 mg/L) in 2 samples and exceeded the CWQG PAL guidelines.
- Aluminium was elevated (270 – 820 ug/L) in all 5 samples and exceeded the CWQG PAL guidelines (5 ug/L).

The pH of surface water features is low and colour of water is typically dark brown, both characteristics are thought to be attributable to the peaty soils which are common across the site. The high pH is likely to be the cause of the elevated concentrations of dissolved metals within the samples.

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2.8 SOILS AND GEOLOGY

The regional geology consists of Ordovician-age metamorphosed sedimentary rocks of the Halifax and Goldenville formations that were intruded by Devonian-age granite (Stea and Dickie 1977). The granite will be quarried to produce crushed-stone aggregate.

Based on information collected from 11 boreholes completed within the granite, this unit is fractured to approximately 15 m below ground level (bgl) and groundwater levels are shallow, generally found between 2 and 4.5 m bgl.

Soils in this area belong to the Rockland series and are described as having "excessive to poor" drainage and characterised as having "extreme shallowness" (Hilchey 1964).

2.9 VEGETATION

Most of the area is covered by a mosaic of barren vegetation, tall shrub barren, and some coniferous forest. There are also patches of mixed forest, and wetlands such as treed bog, open bog, fen, and swamp scattered throughout the site. A number of other habitat types are also present, including beaches, coastal barren headlands, coastal cliffs, regenerating forests, and lakes.

3 POTENTIAL POST DEVELOPMENT CHANGES

The quarry development has the potential to affect the baseline hydrology in the following ways:

- Mean Annual Runoff – alteration of topography / drainage routes, removal of topsoil / vegetation, and use of water for processing requirements may impact the volumes of runoff discharged from the site thereby affecting flow dependent receptors within the downstream environment.
- Peak Flow – alteration of topography / drainage routes and removal of topsoil / vegetation may increase the peak flow of runoff discharged from the site thereby increasing the risk of flooding within the downstream environment.
- Water Quality – the use of chemicals, fuels, lubricants and explosives at the site and disturbance of soils, and rock has the potential to detrimentally impact upon the quality of water discharged from the site thereby affecting downstream environmental receptors.

These points are described in more detail below.

3.1 EFFECT ON MEAN ANNUAL RUNOFF

Following full development (50+ years) and without accounting for re-vegetation that will occur during progressive rehabilitation, the quarry and much of the lower platform will not retain any soils or vegetation, reducing the infiltration factor from 0.4 to 0.3 across approximately 57% of the total site. This reduction in infiltration will increase the runoff by 17% in these areas (208 ha), which equates to a 10% increase from the entire 354.5ha site to a mean annual runoff of 2 043 906m^3 following development.

As discussed further in Section 4.1, measures are recommended to convey runoff from operational areas to one of two stormwater retention ponds, from where runoff will either be re-used on site or discharged to Chedabucto Bay, meaning that post development the mean annual runoff of several catchments will be reduced whilst runoff from N2, N3 and N4 will be substantially increased. The impact of full development on the mean annual runoff from the site is presented in Table 3-1.

TABLE 3-1: IMPACT OF DEVELOPMENT ON MEAN ANNUAL RUNOFF

Catchment	Baseline Scenario (Pre Development)		Post Development Scenario		% of Baseline Runoff
	Area (ha)	Mean Annual Runoff (m^3)	Area (ha)	Mean Annual Runoff (m^3)	
F1	14.4	75 573	14.4	75 573	100%
F2	61.5	323 504	36.8	193 743	60%
F3	5.8	30 387	5.8	30 387	100%
F4	8.7	45 767	3.9	20 621	45%
M1	13.2	69 481	4.6	24 237	35%
N1	1.0	5 401	1.0	5 238	97%
N2	11.0	57 684	27.8	169 414	294%
N3*	19.9	104 481	8.4	44 296	42%
N4*	21.5	113 040	91.3	557 914	494%
N5	14.4	75 632	93.8	571 322	755%
N6	22.4	118 041	5.7	30 193	26%
S1	31.9	168 101	17.4	91 373	54%
S2	2.9	15 100	1.5	8 053	53%
S3	126.1	663 399	42.1	221 542	33%
Total	**354.5**	**1 865 592**	**354.5**	**2 043 906**	**110%**

**Stormwater Discharge Point*

It should be noted that this estimated impact on mean annual runoff discharged from the site does not take account of any collection and re-use of runoff for processing requirements at the site. However, since the processing water will be recycled and given the relatively low evaporation rates at the site, losses of processing water and consequent impact upon mean annual runoff will be minimal.

The estimated mean annual runoff from the quarry and lower platform areas which will drain into the stormwater ponds and will be available for re-use is likely to be 1 248 202 m^3, which equates to an average flow of 40 L/s during the fully developed site. However, volumes of runoff are likely to be

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much lower during the initial stages of site development and prior to excavation of the quarry, the mean annual runoff from the lower platform only is likely to be 161 467 m^3 (5 L/s).

3.2 EFFECT ON PEAK FLOW RATES AND FLOOD VOLUMES

Of the total site area, the development will feature approximately 180 ha of quarry while the processing plant and stockpiles will occupy the 28 ha lower platform. Most of the vegetation and soils in these areas are likely to be removed and stockpiled, leaving bare rock surfaces. This tends to increase runoff volume and runoff velocity, which is represented as follows:

- Curve Number – for 208 ha of the site, an increased curve number of 91 is used.
- Time of Concentration – a reduced time of concentration of 37.4 minutes is used.

The hydrographs for the site during 1:25 year and 1:100 year events for pre-development and post development scenarios are presented in Figure 3-1 and Figure 3-2. The post-development hydrographs do not take into account the retention ponds discussed in Section 4.1 and are therefore representative of an un-mitigated scenario.

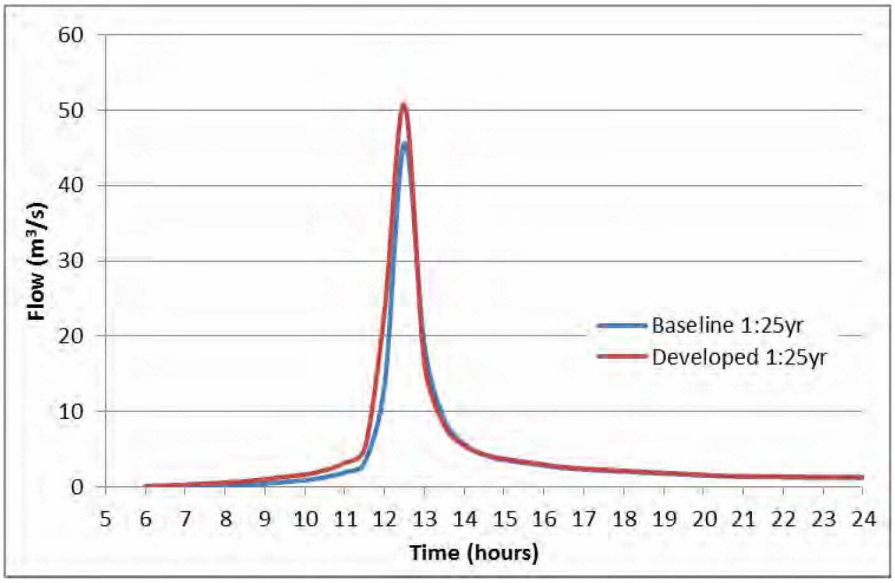

FIGURE 3-1: HYDROGRAPHS FOR BASELINE AND DEVELOPED SITE DURING A 1:25 YEAR EVENT

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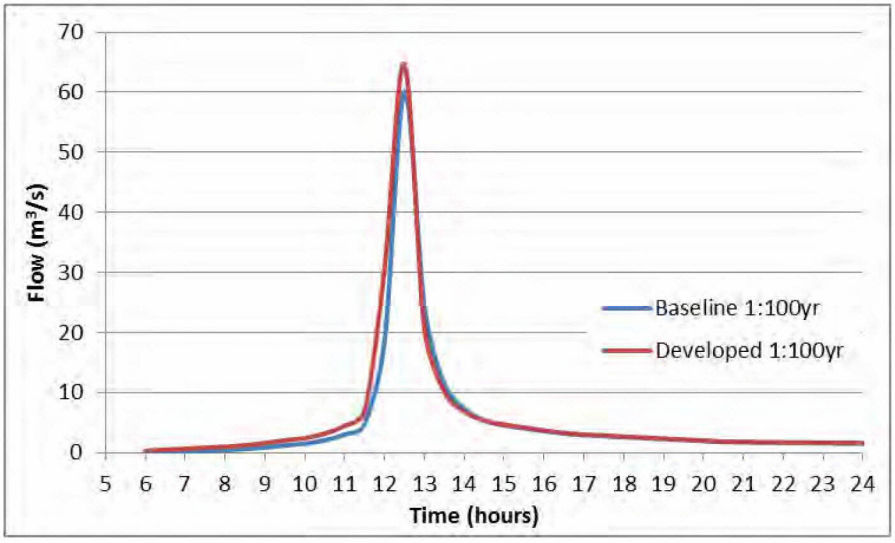

FIGURE 3-2: HYDROGRAPHS FOR BASELINE AND DEVELOPED SITE DURING A 1:100 YEAR EVENT

As can be observed in the un-mitigated post-development scenario, peak flows will increase by 11% for a 1:25 year event and 8% for a 1:100 year event while the volume of runoff generated post development will be increased by 17% for a 1:25 year event and 13% for a 1:100 year event.

It is considered that the increase in peak flow and flood volumes attributable to the development are relatively minor and given that there are no downstream receptors susceptible to flooding, these increases are not considered significant. Therefore, it is not considered necessary to attenuate peak flows on-site to ensure that the pre-development discharge rates are not exceeded.

3.3 EFFECT ON WATER QUALITY

It is not possible to quantitatively assess the un-mitigated impact of the development upon the baseline water quality conditions. Nonetheless qualitatively the impacts could be as follows:

- Geochemistry – quarrying activities may expose elements naturally occurring within soils and geology to rainfall and oxidation, potentially mobilising these elements into discharge from the site. From the water quality monitoring it can be seen that pH is low and aluminum, iron and lead are already found at elevated levels within the surface water environment.
- Ammonia and Nitrate - the use of Ammonium Nitrate-Fuel Oil (ANFO) blasting agents (consisting of inorganic nitrates and petroleum-based fuels) may leave explosives residues, high in ammonia and nitrate, within areas where blasting has occurred. These residues may be mobilised by runoff. From the water quality monitoring it can be seen that ammonia is already found at elevated levels within the surface water environment.

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- Suspended Solids – quarrying activities will include stripping of vegetation and soils, as well as washing of crushed aggregate. These activities have the potential to increase the concentrations of suspended solids and silts within runoff discharges from the site.

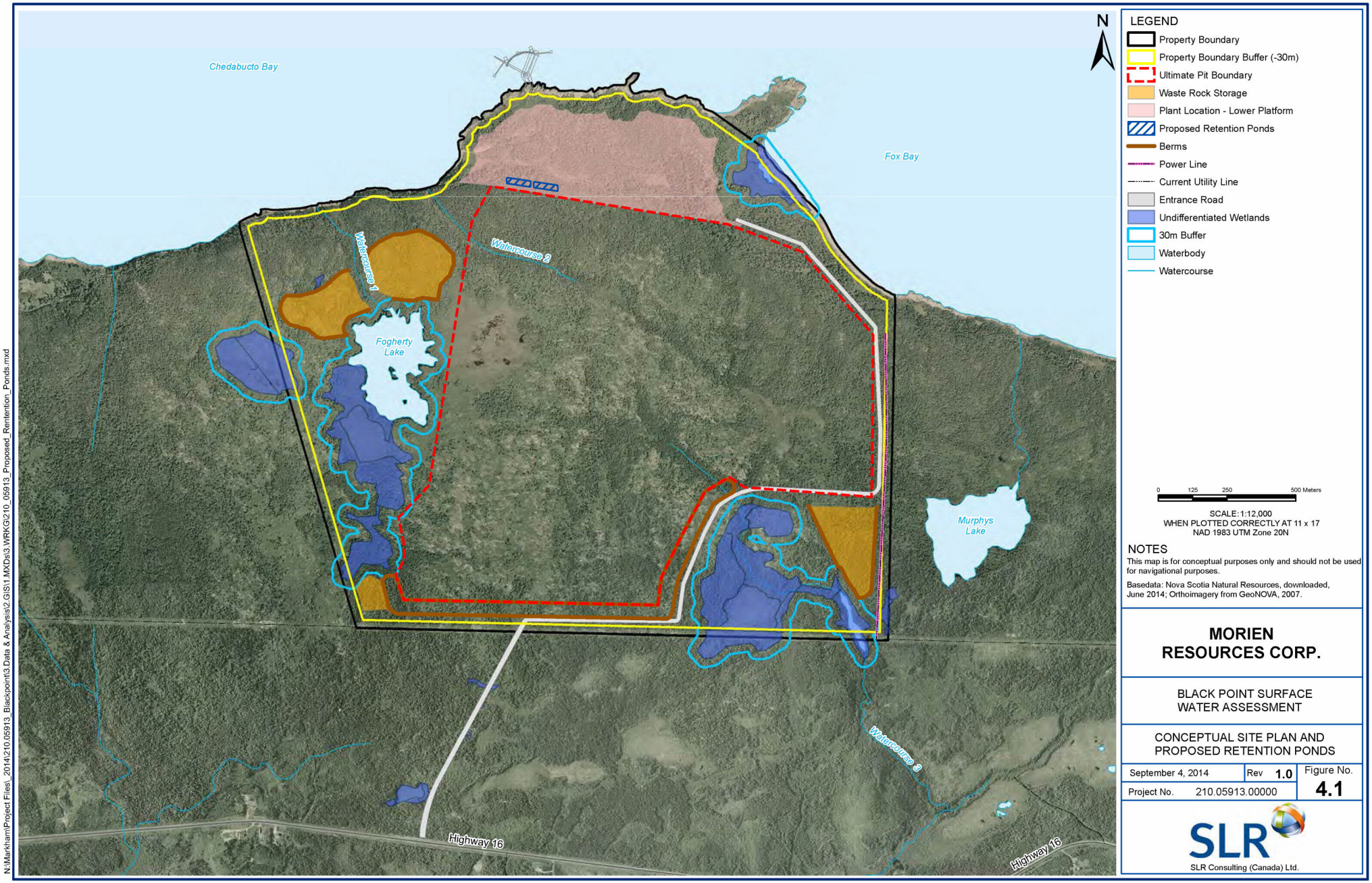
4 MITIGATION MEASURES

In order to reduce the potential impacts of the development on the baseline surface water environment as identified in Section 2, the following is recommended:

- Stormwater Retention Ponds;
- Fuel and Chemical Storage; and
- Discharge Monitoring.

4.1 STORMWATER RETENTION PONDS

Runoff from the working areas of the quarry and associated infrastructure will be conveyed to flow stormwater retention ponds as shown in Figure 4-1. These ponds should be constructed upstream of the final discharge point to improve the quality of water discharged from the site.


N
Chedabucto Bay
Fox Bay
Watercourse 1
Watercourse 2
Watercourse 3
Fogherty Lake
Murphys Lake
Highway 16
Highway 16
LEGEND
Property Boundary
Property Boundary Buffer (-30m)
Ultimate Pit Boundary
Waste Rock Storage
Plant Location - Lower Platform
Proposed Retention Ponds
Berms
Power Line
Current Utility Line
Entrance Road
Undifferentiated Wetlands
30m Buffer
Waterbody
Watercourse
0 125 250 500 Meters
SCALE:1:12,000
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N
NOTES
This map is for conceptual purposes only and should not be used for navigational purposes.
Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.
MORIEN RESOURCES CORP.
BLACK POINT SURFACE WATER ASSESSMENT
CONCEPTUAL SITE PLAN AND PROPOSED RETENTION PONDS
September 4, 2014
Rev 1.0
Figure No. 4.1
Project No. 210.05913.00000
SLR
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It is recommended that retention ponds are designed in accordance with Nova Scotia Department of the Environment Guidelines (NSE 1988) to intercept sediment laden runoff and allow sediment to settle out, thereby reducing the amount of sediment leaving the disturbed area, and protecting local watercourses from excessive sedimentation.

The recommended design features are as follows:

- Permanent Pool – a permanent volume of water is to be retained within the pond at all times to ensure treatment of all stormwater discharged from the site. It is recommended the permanent pool is sized to contain at least 190 m^3 per ha of catchment (NSE 1988). Based on the mean annual runoff, this equates to 11 days of residence time within the pond prior to discharge.
- Flood Conveyance – flood events up to and including a 1:100 year event + 16 % for climate change should be conveyed through the pond and discharged via a spillway.

The following stormwater retention ponds are proposed:

- Process Water Ponds – during construction of the lower platform and access road, a series of process water ponds will be constructed to store runoff from the entire lower platform area. Once complete the entire lower platform will drain to these ponds and will be re-used for processing where required or discharged to Chedabucto Bay.
- In-Pit Drainage Sump – during the initial stages of quarrying a drainage sump will be created to intercept runoff generated within the footprint of the quarry in addition to any groundwater inflows to the pit, and water will either be used for processing where required or discharged to Chedabucto Bay.

The catchment areas, recommended retention pond sizes, and outflow controls are presented in Table 4-1 below:

TABLE 4-1: RECOMMENDED RETENTION POND DETAILS

Parameters	Process Water Ponds	In-Pit Drainage Sump
Catchment Area is (ha)	28	180
Mean Annual Runoff (L/s)	5.5	35.0
Permanent Pool Volume (m^3)	5 320	34 200*
Flood Conveyance – 1:100yr + 16% (m^3/s	7.5	33.0

*Theoretical design volume; the actual sump will have a smaller volume since any overflow would be contained within quarry limits

At this stage of the project, the above measures and design detail are considered indicative and as such, it is recommended that the drainage strategy be revisited during further design of the site.

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4.2 Fuel and Chemical Storage

All fuels and chemicals stored or used on site should be contained within fit-for-purpose containers and stored within designated storage areas. In order to prevent pollution of the surrounding environment during an accidental spillage, the designated storage areas should be situated on an impermeable surface and should feature a perimeter bund and a drainage sump. The volume of the bund and sump should be sized to contain at least 110% of the total volume of the fuel and chemicals being stored within the designated storage area. The storage areas should feature a roof to prevent inflow of rainwater, which would require the sump to be emptied frequently.

4.3 Discharge Monitoring

It is recommended that water quality monitoring is undertaken on the discharge from the retention ponds on a monthly basis and results compared against the baseline conditions.

Where guideline values and baseline are exceeded, it is recommended that a review of site activities should be undertaken to identify the source of pollution and remedial measures should be implemented to ensure that the quality of the discharge is improved.

5 CONCLUSIONS AND RECOMMENDATIONS

The site is 354.5 ha in area features 3 watercourses, numerous wetlands and a lake. The existing topography divides the site into 13 catchments. The mean annual runoff for the site is 1 865 592 m^3 and the peak flows leaving the site are 34 m^3/s for a 1:25 year event and 42 m^3/s for a 1:100 year event. The baseline water quality shows low pH, elevated iron and aluminium concentration across all sampling locations.

Unless appropriately mitigated, the proposed quarry development has the potential to impact upon the baseline surface water quantity and quality.

It is proposed that runoff is from the site is conveyed to stormwater retention ponds, to improve the quality of water discharged from the site and allow for settlement of suspended solids prior to discharge to the receiving environment. This will significantly reduce the mean annual runoff in some of the catchments identified at site and increase mean annual runoff at the discharge points.

The proposed development will increase peak flows by up to 16% during a 1:100 year event however, it is not considered necessary to attenuate peak flows on-site as no receptors susceptible to flooding because of the slightly increased peak flows were identified.

The following monitoring and maintenance is recommended during construction and operational phases of the site:

- Water Quality Monitoring – discharge from the retention ponds should be monitored to demonstrate compliance with the Nova Scotia Pit and Quarry Guidelines (NSEL 1999).
- Maintenance Retention Ponds – in order to maintain the function of the ponds as outlined above, it is recommended that silt is removed and the outflow controls are routinely checked for any potential blockages.

It should be noted that the above strategy is indicative only and should be revisited to take account of more detailed information which may be forthcoming during later stages of design or during the operational phases of the site, as detailed below:

- Site Development Phasing – as the site develops, catchment areas and drainage pathways will need to be considered and additional berms or ponds maybe required to prevent direct discharge of runoff from working areas to any surrounding receptors.
- Site Water Requirements – water will be required for operational and processing activities at the site. It is recommended that this is considered through an operational water balance for the site, to confirm whether the operation is water positive and excess water needs to be discharged, or whether the operation is water negative and further makeup water will need to be abstracted.
- Groundwater Inflow – in addition to runoff collecting within the pit, it is anticipated that groundwater seepage into the pit may need to be managed. Given the close proximity to the coastline and the deep nature of the quarry, it may be that seawater seeps into the pit, which may impact upon the natural salinity of surface water receptors if pumped out alongside runoff.
- Settlement Velocities – during initial phases of construction, samples of the runoff entering the stormwater ponds should be taken during storm events. Samples should be left to stand and the settlement velocity should be observed to confirm the design of the retention ponds.

6 REFERENCES

AMEC (2011). Black Point Baseline Ecological Surveys Summary Report. Prepared for Erdene Resource Development Corporation. 43 pp. + Appendices. (This report presented in the Main Report, Appendix E.

AECOM (2014). Memorandum to Russell Dmytriw, SLR: Black Point Hydrogeology Field Program 2014. Project Number 60323234. Date: August 15, 2014. (This memo is presented in the Main Report, Appendix A).

CCME: Canadian Council of Ministers for the Environment. 2007. Canadian Water Quality Guidelines for the Protection for Aquatic Life. Freshwater Guidelines, Update 7, September 2007.

Hilchey, J. D. 1964. Soil Survey of Guysborough County, Nova Scotia. Report No. 14. Nova Scotia Soil Survey. Incl. Soil Map of Guysborough County, NS - East Sheet (Soil Research Institute, Canada Department of Agriculture, 1963).

LSRCA: Lake Simcoe Region Conservation Authority 2013. LSRCA Technical Guidelines for Stormwater Management Submissions. April 26, 2013. 71 pp. http://www.lsrca.on.ca/pdf/swm_guidelines.pdf

OMOE: Ontario Ministry of the Environment. 2003. Stormwater Management Planning and Design Manual (March 2003). 379 pp.

NSE: Nova Scotia Environment. 1988. Erosion and Sedimentation Control – Handbook for Construction Sites Nova Scotia Department of the Environment, Environmental Assessment Division. 102 pp.

NSEL: Nova Scotia Environment and Labour. 1999. Pit and Quarry Guidelines.

NSE: Nova Scotia Environment. 2009. Guide to Preparing an EA Registration Document for Pit and Quarry Developments in Nova Scotia. Revised September 2009. 36 pp.

Richards, W and Daigle, R. 2011. Scenarios and Guidance for Adaption to Climate Change and Sea Level Rise – NS and PEI Municipalities. Atlantic Climate Adaptation Solutions Association. 90 pp.

Stea. R.R. amd Dickie, J. R. 1977. Pleistocene Geology – Eastern Shore Region, Nova Scotia – Sheet 1. Nova Scotia Department of Mines. Bedrock Geology adapted from “Geological Map of the Province of Nova Scotia, Department of Mines, Nova Scotia 1965.

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APPENDIX D
Noise and Vibration Technical Report

ATTACHMENT A – Acoustic Terminology

ATTACHMENT B – Noise Monitoring Data

ATTACHMENT C – Equipment and Site Layouts

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

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global environmental solutions

Black Point Quarry
Nova Scotia

Noise and Vibration Impact Assessment

February 2015
SLR Project No.: 210.05913.00000

C 1340-990

NOISE AND VIBRATION IMPACT ASSESSMENT

BLACK POINT QUARRY

NOVA SCOTIA

SLR Project No.: 210.05913.00000

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EXECUTIVE SUMMARY

This report describes the potential noise and vibration impacts of the Black Point Quarry Project, as part of the Environmental Impact Assessment in accordance with the requirements of the Canadian Environmental Assessment Agency and Nova Scotia Environment. The objective of this report is to identify the existing ambient noise and vibration levels within the local area and provide information on typical existing sound sources, and their geographic extent and temporal variations. Existing ambient noise levels were previously measured in a baseline ambient noise survey. The noise and vibration impacts of the Project have also been identified, and recommendations made for mitigation of noise impacts during future aggregate production.

The assessment of Project noise and vibration has considered the following potential areas of impact:

- Construction noise and vibration, both terrestrial and underwater
- Noise from aggregate production and shiploading operations
- Noise and vibration from blasting, including impacts on people and structures and the potential for underwater impacts on wildlife.

This report also discusses the potential *perceived* noise and vibration impacts of the project, since impacts on people may exist even if compliance with numerical noise and vibration criteria is achieved.

Existing Noise and Vibration Environment

The existing noise environment has been determined by measurement at two representative geographic locations (one inland, and one nearer the coast). These locations are the residential receptors located nearest to the Property boundary. As is expected for a remote rural environment, existing background noise levels (L_{90}) are very low, below 30 dBA in all time periods at both locations. At each location, little temporal variation was observed in background noise levels throughout the daytime, evening and night-time. The location near the coast had slightly higher background noise levels than the inland location. However, the average noise levels (L_{eq}), which include the contribution of short-term noise events, were higher at the inland location, probably due to the influence of road traffic noise.

At the measurement location west of the project site near the coast, the dominant noise sources noted were natural, including waves, birds, and the movement of leaves. At the location further inland traffic noise from the road was observed, in addition to natural noise sources.

Ambient vibration levels in the study area have not been measured. Since this is a rural/remote location with no existing anthropogenic vibration sources nearby, existing ambient ground and seabed vibration levels are expected to be low, below the thresholds of human perception and below levels that would affect marine fauna.

Ambient underwater noise levels in the study area have also not been measured. While there are no existing fixed anthropogenic sources of underwater noise and vibration, underwater noise can propagate over very large distances. For this reason, both natural and anthropogenic sources may contribute to the existing underwater noise environment in the project area. Natural underwater noise sources include wind, waves, precipitation, sea ice, marine fauna, and seismic background activity. Anthropogenic noise sources include commercial fishing and

shipping traffic, seismic exploration activity, sonar equipment, construction and industrial activity, and distant explosive detonations. Whether natural or anthropogenic sources dominate at any particular time and location depends on changing natural conditions, and the proximity and level of the human activities.

Project Construction Noise and Vibration Impacts

The site development and initial rock processing that will occur during the construction phase of the Black Point operation will involve activities similar to the activities that will occur during full facility operation. The equipment used for the construction will be similar to that used for site operation. The noise generated from the construction activities is anticipated to be similar to the noise generated from facility operations.

The construction of the marine terminal has the potential to impact on the underwater noise and vibration environment, however these impacts would be temporary and localised to the immediate construction area. It is estimated that the underwater noise criteria for lethal impacts on fish (including shellfish and crustaceans) may be exceeded during piling, in an area around the pile location extending up to 10 m. Behavioural modification may occur at greater distances, for the duration of the piling activity.

Project Operational Noise Impacts

The Black Point operation will generate noise from the operation of mobile equipment, the operation of the processing plant, blasting, and product loadout at the marine terminal. The Pit and Quarry Guidelines require that noise levels at the boundaries of the project site are not to exceed the following levels:

- $L_{eq} \leq 65$ dBA between 0700 to 1900 hours (daytime)
- $L_{eq} \leq 60$ dBA between 1900 to 2300 hours (evening)
- $L_{eq} \leq 55$ dBA between 2300 to 0700 hours (night-time, Sunday and statutory holidays)

The assessment of unmitigated worst case noise emissions for the future (fully developed) quarry indicates there is potential for future exceedance of the noise criteria at the site boundary. These impacts can be mitigated by a combination of reasonable and feasible measures such as having the majority of mobile equipment operating in the pit below ground surface, retaining natural barriers such as hillsides to the extent possible, locating product stockpiles to block noise transmission, and by specifying best practice quiet equipment during procurement. A combination of these measures will ensure that the site complies with the Pit and Quarry Guidelines established for operational sound levels.

The nearest sensitive residential receivers are set back from the property boundary, and the predicted noise levels at all residential locations are expected to comply with the applicable operational noise criteria. While compliance with the numeric noise limits at residences is expected, the noise of the quarry will be noticeable, particularly during otherwise quiet periods. Quarry production noise is generally characterised by low-frequency “rumbling” noise that does not vary much with time.

At the levels predicted in this assessment, it is anticipated that future noise from the quarry will dominate the background noise environment in the local area during the daytime and evening periods, and will be audible at “moderate to quiet” levels in nearby residential areas. Noise from

night-time shiploading will also contribute to the background noise environment and be audible at a "quiet" level in nearby residential areas. The night-time noise level would not be expected to disturb the sleep of most people.

Blasting Noise and Vibration Impacts

Blasting will occur anywhere from 30 to 120 days per year, depending on aggregate sales demand. The NSE *Pit and Quarry Guidelines* define acceptable limits for blast overpressure (noise) and vibration, and also require a minimum distance from blasting to the nearest off-site structure greater than 800 m. Minimum blasting distances are respected in all directions from the Property boundary.

The assessment indicates that exceedance of the airblast overpressure limit and vibration limit at sensitive receivers is unlikely throughout the life of the quarry. As required by the NSE *Pit and Quarry Guidelines*, all blasts would be monitored to establish overpressure and vibration levels. This monitoring would be used to develop site-specific propagation constants, to enable refinement of the blast overpressure and vibration predictions as the quarry develops. In this manner, blast designs can be adopted that comply with the overpressure and vibration limits at sensitive receivers throughout the life of the quarry.

While underwater blasting is not anticipated to be required by the Project, the location of the quarry adjacent to the ocean means that there is potential for quarry blasting noise and vibration to impact on the underwater environment and marine fauna. This assessment identifies indicative offset distances between a blast and the ocean to meet the underwater noise and vibration limits defined in *Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters*. It is recommended that these indicative setback distances be refined following monitoring of initial test blasts at the site. Depending on their proximity to ocean habitats, these initial blasts may need to take place outside of any identified spawning periods for marine fauna. These initial blasts would identify the site-specific vibration transmission characteristics, to enable design of blasts to comply with the underwater noise and vibration limits.

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1.0 INTRODUCTION

Morien Resources Corporation and Vulcan Materials Company (the Proponent) proposes the construction, operation, decommissioning, and abandonment of a granite quarry at Black Point in Guysborough County, Nova Scotia, and the construction and operation of a marine terminal and load-out facility, adjacent to the quarry, in Chedabucto Bay. The quarry is expected to have a production capacity of up to 7.5 million tonnes of granite per year, over a mine life of approximately 50 years.

This report describes the potential noise and vibration impacts of the Project, as part of the Environmental Impact Statement (EIS) in accordance with the requirements of the Canadian Environmental Assessment Agency (CEA Agency) and Nova Scotia Environment (NSE). The objective of this report is to describe the existing acoustic environment, to predict the noise and vibration impacts of the Project, and to assess the predicted noise levels against relevant criteria. This report also discusses the potential noise and vibration impacts of the project, since impacts on people and wildlife may exist even if compliance with numerical noise and vibration criteria is achieved.

1.1 Project Area

The Project is located in a rural setting with little industrial, commercial or residential development. The local region is generally a rural forested area with an existing noise environment dominated by natural sounds. There is occasional noise associated with forest resources harvesting, some recreational activity (all-terrain vehicle and snowmobile use, hunting), and noise associated with residential land use and traffic along Highway 16 and residential access roads.

A desktop survey of the Project area using topographic maps indicates there are no residences within 500 m of the Property boundary, one residence at 690 m, two within 750 m, seven residences within 875 m, 11 within 1.0 km, and fewer than 45 within 2.0 km. The Project study area for noise and vibration impacts is shown in Figure 1.

1.2 Relevant Guidelines

The following guideline documents are relevant to the assessment of noise and vibration impacts of the Project:

- Canadian Environmental Assessment Agency *Guidelines for the preparation of an Environmental Impact Statement pursuant to the Canadian Environmental Assessment Act, 2012 and Nova Scotia Registration Document pursuant to the Nova Scotia Environment Act Black Point Quarry Project, Morien Resources Corp*. June 9, 2014 (the CEAA EIS guideline)
- Nova Scotia Environment and Labour *Guidelines for Environmental Noise Measurement and Assessment*. April 1990, amended May 18 2005.
- Nova Scotia Environment *Guide to Preparing an EA Registration Document for Pit and Quarry Developments in Nova Scotia*. Revised September 2009.
- Nova Scotia Environment *Pit and Quarry Guidelines*. Revised May 1999.
- Fisheries and Oceans Canada *Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters.* Canadian Technical Report of Fisheries and Aquatic Sciences 2107. D.G. Wright and G.E. Hopky, 1998.

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1.3 Terminology

Specific acoustic terminology is used in this report. An explanation of common acoustic terms is provided in Appendix A.

This report is considers noise and vibration impacts on land and also underwater. If the type of impact is not specifically indicated, it is a land-based impact. Underwater noise and underwater vibration impacts are described as such.

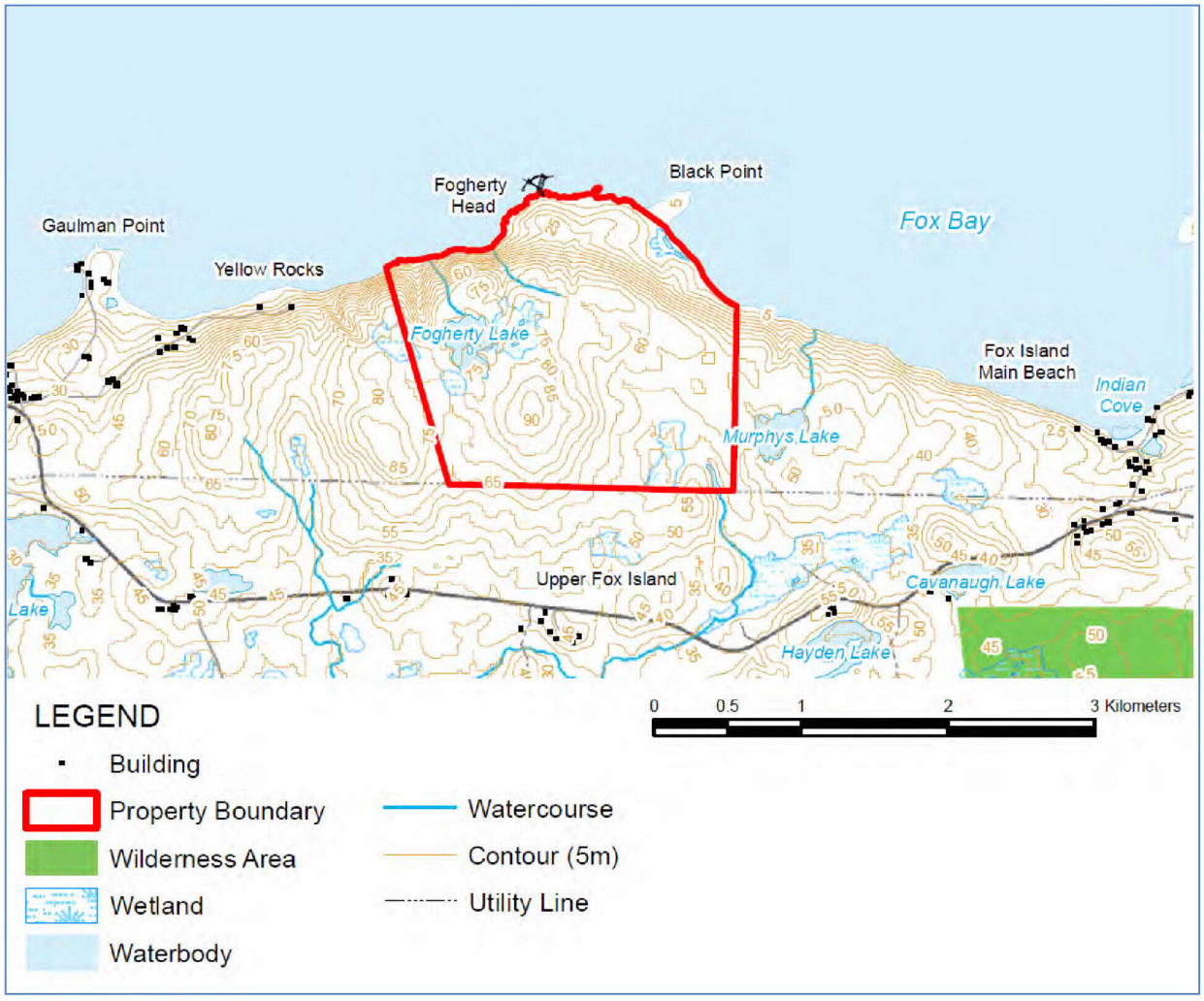

Figure 1
Project Study Area

2.0 CRITERIA

2.1 Noise Criteria

In 1990, the then Nova Scotia Department of Environment and Labour (NSEL, now the NSE) developed environmental guidelines to allow the evaluation of noise pollution in the environment (*Guidelines for Environmental Noise Measurement and Assessment*). Industrial operations which require an Environmental Approval come under the jurisdiction of this Guideline. The noise criteria defined by this guideline are A-weighted average sound pressure (L_{eq}) limits applicable at locations where people normally live, work, or take part in recreation. The criteria are as follows:

- $L_{eq} \leq 65$ dBA between 0700 to 1900 hours (daytime)
- $L_{eq} \leq 60$ dBA between 1900 to 2300 hours (evening)
- $L_{eq} \leq 55$ dBA between 2300 to 0700 hours (night-time, Sunday and statutory holidays)

The NSE *Pit and Quarry Guidelines* also define noise limits identical to the daytime, evening and night-time limits listed above. Although the magnitude of the noise limits is the same in both guidelines, the *Pit and Quarry Guidelines* require that the limits be observed at the property boundaries of the pit or quarry. This is more stringent than the requirements of the *Guidelines for Environmental Noise Measurement and Assessment*, since residences are set back from the quarry property boundary. Therefore, this study predicts the noise impacts at the quarry property boundary for assessment against the noise criteria.

Quarry noise levels at the nearest residential properties are also described, to enable a discussion of the predicted effects on residents in accordance with the guidance contained in the NSE *Guide to Preparing an EA Registration Document for Pit and Quarry Developments in Nova Scotia*. This guide also recommends a discussion of the effect of increased noise levels on wildlife.

2.2 Vibration Criteria

The NSE *Pit and Quarry Guidelines* do not define vibration criteria, with the exception of specific limits for blasting (see Section 2.3). Instead, separation distances are defined for pit and quarry operations. These separation distances require that the excavation working face of a pit be located no less than 90 m from the foundation or base of a structure located off site. The Project will comply with these separation distances. Adverse vibration impacts from excavation activities and general operation of the site are not anticipated and are not considered further in this assessment; with the exception of blasting vibration impacts (see Section 8.2).

2.3 Noise and Vibration Criteria Specific to Blasting Activities

The NSE *Pit and Quarry Guidelines* require a separation distance for blasting of 800 m, measured from the point of blast to a structure off site. In addition to this separation distance, this guideline defines noise and vibration criteria and control measures specific to blasting activities (NSE *Pit and Quarry Guidelines* Section VIII. Blasting). These criteria and control measures are reproduced as follows:

(1)(a) No person responsible for the operation of a quarry shall permit any blasting on site to exceed the following limits:

Concussion (Air Blast) 128 dBA	*Within 7 m of the nearest structure not located on the property where the blasting operations occur, or other locations as directed by the Minister or Administrator.*
Ground Vibration 0.5 in./sec. (12.5 mm/s) Peak Particle Velocity	*Measured below grade or less than 1 m above grade in any part of the nearest structure not located on the property where blasting occurs, or other locations as directed by the Minister or Administrator.*

(1)(b) No person shall fail to monitor all blasts for the parameters outlined in VIII(1)(a).

(2) Monitoring results shall be forwarded to the Department on a monthly basis unless otherwise indicated.

(3) No blasting shall occur on Sunday, on a statutory holiday prescribed by the Province, or on any day between the hours of 1800 hours and 0800 hours.

(4) Every person responsible for the operation of a quarry shall have a technical blast design prepared by a qualified person which ensures the ground vibration and air concussion outlined in VIII (1) can be achieved.

(5) Every person responsible for the operation of a quarry shall conduct a preblast survey of all structures within 800 m of the point of blast. This survey should be conducted with Nova Scotia Environment and Labour's "Procedure For Conducting a Pre-Blast Survey".

(6) No blasting is to take place if a thermal inversion is anticipated at the time of the proposed blast.

2.4 Underwater Noise and Vibration Criteria

In addition to the blasting noise and vibration criteria relevant to the assessment of impacts on people and structures, the CEA Agency EIS Guideline also requires that the potential for blasting vibration impacts on fish behaviour such as spawning or migrations be considered. The *Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters* provides information to proponents on the conservation and protection of fish, marine mammals and their habitat from the impacts of explosive use in or near water. Note that in this guideline, the term "fish" is defined to include *"shellfish, crustaceans, marine animals and the eggs, sperm, spawn, spat and juvenile stages of fish, shellfish, crustaceans and marine animals".*

The recommended underwater noise and vibration limits are as follows:

"No explosive is to be detonated in or near fish habitat that produces, or is likely to produce, an instantaneous pressure change (i.e., overpressure) greater than 100 kPa (14.5 psi) in the swimbladder of a fish."

and

"No explosive is to be detonated that produces, or is likely to produce, a peak particle velocity greater than 13 mm•s^{-1} in a spawning bed during the period of egg incubation."

In decibels, the 100 kPa underwater noise overpressure limit corresponds to 220 dB re 1 µPa.

The guideline provides indicative setback distances from the land-water interface for explosive use to comply with the target levels. In addition, no explosive is to be knowingly detonated within 500 m of any marine mammal.

3.0 NOISE AND VIBRATION PROPAGATION

3.1 Outdoor noise propagation

Outdoor sound propagation between a sound source and a receptor is affected by several sound attenuation and propagation mechanisms. These include dissipation with distance, ground attenuation, atmospheric attenuation, barrier attenuation (such as shielding by buildings or terrain), as well as meteorological effects such as wind and temperature gradients.

Ground cover in the study area is mainly forested. At the quarry site, open areas with exposed rock and crushed rock would become more predominant over the life of the quarry. The ground attenuation properties of forested areas are relatively sound-absorptive. The ground attenuation properties of areas of exposed rock and crushed rock are predominantly sound-reflective.

Wind effects on outdoor sound propagation can cause variations in the sound level of a distant facility. Similar effects are caused by temperature gradients in the atmosphere. The sound level variations caused by wind and temperature gradients are most pronounced for large source/receptor distances. Sound from a distant facility which propagates in a downwind direction (and/or during atmospheric inversion conditions) results in higher sound levels at a receptor than for calm conditions and a neutral atmosphere. This effect is caused by the downward refraction (or bending) of sound rays as they propagate through the atmosphere. Conversely, sound propagating in an upwind direction (and/or during lapse conditions in the atmosphere) is refracted upwards, which results in lower sound levels at the receptor. Sound propagating in a crosswind direction does not exhibit refraction effects and is essentially the same as sound propagation during calm conditions and a neutral atmosphere. This noise assessment assumes atmospheric conditions which produce moderate downward refraction of sound. This condition results in relatively efficient outdoor sound propagation between a source and receptor, and is representative of adverse noise impact effects associated with meteorological factors.

3.2 Underwater Noise Propagation

Underwater noise propagation is also affected by various attenuation and propagation mechanisms. The resulting level at any particular location removed from the source is the result of geometric spreading of the signal, combined with any losses or attenuations. Losses can be due to volume attenuation, to the conversion of acoustic energy to heat, to scattering, as well as losses due to interactions with the seafloor and surface (although a water surface is typically a very efficient reflector of sound, especially when the surface is smooth). Sound propagation underwater is also highly dependent on the speed of sound, which varies as a function of water temperature, ocean salinity and depth.

If all losses due to factors other than geometric spreading are neglected, then the transmission loss (TL) at a distance R from the noise source would be wholly due to spherical spreading (in deep water) or cylindrical spreading (in the case of shallow water, bounded above and below).

Spherical spreading means underwater noise would attenuate by 6 dB with each doubling of distance. Cylindrical spreading means an attenuation of 3 dB with each doubling of distance.

In terms of underwater noise, bodies of water up to 200 m deep are considered to be "shallow". In shallow water, noise propagation is highly dependent on the properties of the bottom and the surface as well as the properties of the fluid. The following points are relevant to the prediction of noise propagation in shallow water[1]:

- The properties of the water are reasonably constant with depth. In particular, the speed of sound may be assumed to be constant (although it may vary seasonally with water temperature).
- Sources of transmission loss other than cylindrical spreading are dominated by bottom interaction effects (absorption) at lower frequencies (< 1 kHz) and by scattering losses at high frequencies.
- There is a low-frequency cut-off, below which energy is transferred directly into the sea floor.
- There is an optimum transmission frequency which is dependent on the water depth.
- Parameters such as depth and the bottom properties can vary with range.

3.3 Vibration Propagation

Vibration (both on land and underwater) propagates through the ground mass and to a large extent is unaffected by external factors such as topography and weather or water conditions. Key factors in the propagation and attenuation of ground vibration are the distance from the source (for example the blast point or excavation equipment), and site-specific elements such as rock or seabed type, geology and thickness of ground layers.

4.0 EXISTING NOISE AND VIBRATION LEVELS

4.1 Baseline Noise Monitoring Survey

Baseline sound monitoring surveys were completed by AECOM over 48 hours in November 2011 at the two residential dwellings nearest the property boundary:

- Location 1: 950 km west of the Project property boundary and 1.65 km west of the proposed quarry. The monitoring station was installed near the house trailer (currently uninhabited) at the eastern extremity of Half Island Cove Road; and
- Location 2: 870 m south of the property boundary and 920 m south of the proposed quarry. The station was installed at the entrance to Eagle Valley Road, just off Route 16.

The equipment used for the ambient noise surveys was two 2900 integrating/logging sound level meters (unit version 02.4, serial numbers CDF060006 and CDE020012). The meters were

[1] Jensen, F.B., W.A. Kuperman, M.B. Porter, H.Schmidt (2000). Computational Ocean Acoustics Springer-Verlag, New York.

calibrated prior to the study commencing. The monitoring took place over 48 hours in total with a logging interval of one hour.

At Location 1 to the west of the project site near the coast, the dominant noise sources noted were waves, birds, and the movement of leaves. At Location 2 the predominant noise source noted was traffic passing along the road.

The noise readings were recorded in A-weighted decibels (dBA) and reported in three categories (see Appendix A for definitions of noise parameters):

1. as equivalent continuous noise level (L_{eq}),
2. as the noise level exceeded for 10% of the time (L_{10}), which is used to give an indication of the upper limit of fluctuating noise, such as that from road traffic; and
3. as the noise level exceeded 90% of the time (L_{90}). This last parameter is generally taken to be the ambient or background noise level.

At both stations, measurements were collected over 1-hour intervals. This data has been collated to report results over each of the three time periods designated in the Guidelines: daytime (7am to 7pm), evening (7pm to11pm), and night-time (11pm to 7am). Time periods corresponding to wind speeds greater than 20 km/h or periods of precipitation have not been included in the summary analysis. The results are summarised in Table 4-1. The measurement data is also attached as Appendix B.

Table 4-1
Measured Ambient Noise Levels

Location	Time Period	Sound Level (dBA)		
		L_{eq}	L_{90}	L_{10}
Location #1 Half Island Cove Road	Daytime (7am to 7pm)	38.3	27.1	43.2
	Evening (7pm to 11pm)	31.7	28.9	34.4
	Night-time (11pm to 7am)	33.1	28.2	37.0
Location #2 Eagle Valley Road	Daytime (7am to 7pm)	51.0	24.2	56.3
	Evening (7pm to 11pm)	48.9	25.8	53.9
	Night-time (11pm to 7am)	42.1	24.3	35.8

The monitoring survey results in Table 4-1 indicate a noise environment with very low existing background noise levels, as is expected for a remote rural environment. The L_{90} background levels are lower at Location 2 (which is inland) than at Location 1 (nearer the coast). However the L_{eq} (or average) noise levels were typically higher at Location 2, probably due to the influence of road traffic noise at this location.

The background noise levels at both locations are similar during the daytime, evening and night-time periods.

4.2 Comments on Baseline Vibration

Ambient vibration levels in the study area have not been measured. Since this is a rural/remote location with no existing anthropogenic vibration sources nearby, existing ambient ground vibration levels are expected to be low, below the thresholds of human perception.

4.3 Comments on Baseline Underwater Noise and Vibration

Ambient underwater noise and vibration levels in the study area have not been measured. While there are no existing localised anthropogenic sources of underwater noise and vibration, underwater noise can propagate over very large distances. For this reason, both natural and anthropogenic sources may contribute to the existing environment in the project area.

Natural underwater noise sources include wind, waves, precipitation, sea ice, marine fauna, and seismic background activity. Anthropogenic noise sources include shipping, seismic exploration activity, sonar equipment, construction and industrial activity, and explosive detonations. Whether natural or anthropogenic sources dominate at any particular time and location depends on changing natural conditions, and the proximity and level of the human activities. This assessment focuses on the identification of the underwater noise and vibration impacts of the Project, and does not consider the varying influence of the ambient environment on overall underwater noise or vibration levels.

5.0 CONSTRUCTION NOISE AND VIBRATION

The relevant guidelines do not include specific requirements for the assessment of noise and vibration during construction. Since construction activities would occur predominantly within the quarry operation and processing areas, and the construction activities are anticipated to generate noise at levels similar to or less than noise from quarry operations, it is assumed that the noise and vibration impacts during construction would generally be similar to or less than impacts during operation.

One possible exception to this is that the number of heavy vehicles accessing the quarry site by road may be higher during some periods of construction than during operations. It is anticipated that trucks would be used for the final stage of transport of equipment onto the site. Increased heavy vehicle noise on local roads may be noticeable at times during construction.

Where possible, heavy vehicles would be scheduled to arrive and depart the construction site during daytime hours to minimise potential noise impacts at locations near the site road access.

6.0 UNDERWATER CONSTRUCTION NOISE AND VIBRATION

6.1 Overview of Marine Terminal Construction

The preferred construction method for the marine terminal employs a fill and rock technique along the shore. The fill and rock material will be sourced from the site. Blasting in the terrestrial near shore area for construction of the laydown area and approach to the wharf may also be required. Underwater blasting is not expected to be required.

Construction of the marine terminal will also require construction of caissons, piers/dolphins, a rubble approach and finally the slewing rail and shiploader.

The direct underwater construction noise and vibration impacts would be temporary and restricted to the immediate construction area. The activity with the greatest potential for underwater impacts is piling to support the piers and dolphins. These piles will be installed to anchor in the bedrock, from a barge using pile driving hammers and churn drills. Any piles required for the loadout conveyor in the nearshore area will be installed from land and at low tide.

6.2 Piling Underwater Noise Source Levels

Piling activities may give a wide range of possible noise source levels depending on the equipment used. Typically, pile driving sounds underwater are characterised by multiple rapid increases and decreases in sound pressure over time lasting approximately 300 to 500 ms. Most pile driving acoustic energy is relatively low frequency (< 2000 Hz).

SLR Consulting has conducted underwater noise measurements during pile driving for the construction of ship berths for previous projects. On the basis of these measurements, an indicative peak source noise level for piling of 230 dB re. 1 μPa at 1m is assumed for this assessment.

6.3 Piling Underwater Noise Impacts

The *Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters* recommend a peak underwater overpressure of 100 kPa. While this limit is defined to manage blasting impacts, it may also be used as an indication of the extent of impacts due to piling. The overpressure limit of 100 kPa corresponds to 220 dB re 1 μPa, and represents a theoretical lethal level. In practice, the susceptibility of different types and sizes of fish to injury due to underwater noise can vary considerably. For this reason, this assessment is intended only to give an order of magnitude indication of the potential range of impacts.

On the basis of the assumed piling source noise level, it is estimated that the 100 kPa overpressure level may be exceeded in an area around the pile location extending up to 10m from the pile (conservatively assuming cylindrical spreading, and neglecting all other losses).

It is concluded that the direct impacts of piling on fish (including shellfish and crustaceans) are likely to be restricted to an area with indicative radius up to 10 m around each pile. Behavioural modification would be expected to occur at greater distances, during underwater piling activities.

7.0 OPERATIONAL NOISE IMPACT ASSESSMENT

7.1 Operational Noise Modelling Overview

The quarry will remove material from the pit which will increase in size throughout the life of the quarry, as illustrated in Figure 2. This assessment considers the future operation of the quarry, in a scenario when all equipment is operating at the maximum anticipated capacity and the pit is expanded to its maximum size. This situation represents a “worst-case” scenario for noise impacts.

The quarry would be operational 24 hours a day in the future scenario, with a production schedule of 16 hours and a maintenance schedule of 8 hours. Shipping of material produced could occur at any time of the day or night. It is assumed for the purpose of this assessment that all potential production and shipping noise sources are operational during the daytime and evening time periods, i.e. from 7:00 am to 11:00 pm. During the night-time, it is assumed that the majority of noise sources would shut down, with the exception of conveyors from stockpiles out to the ship-loading equipment, and some mobile plant in the maintenance area.

While shiploading may take place at any time, it is estimated that that approximately 100 ships will be loaded per year once the plant reaches peak production. Since it will take approximately

18 to 24 hours to load the largest ships, noise impacts due to shiploading at night-time would be expected on less than a third of all nights.

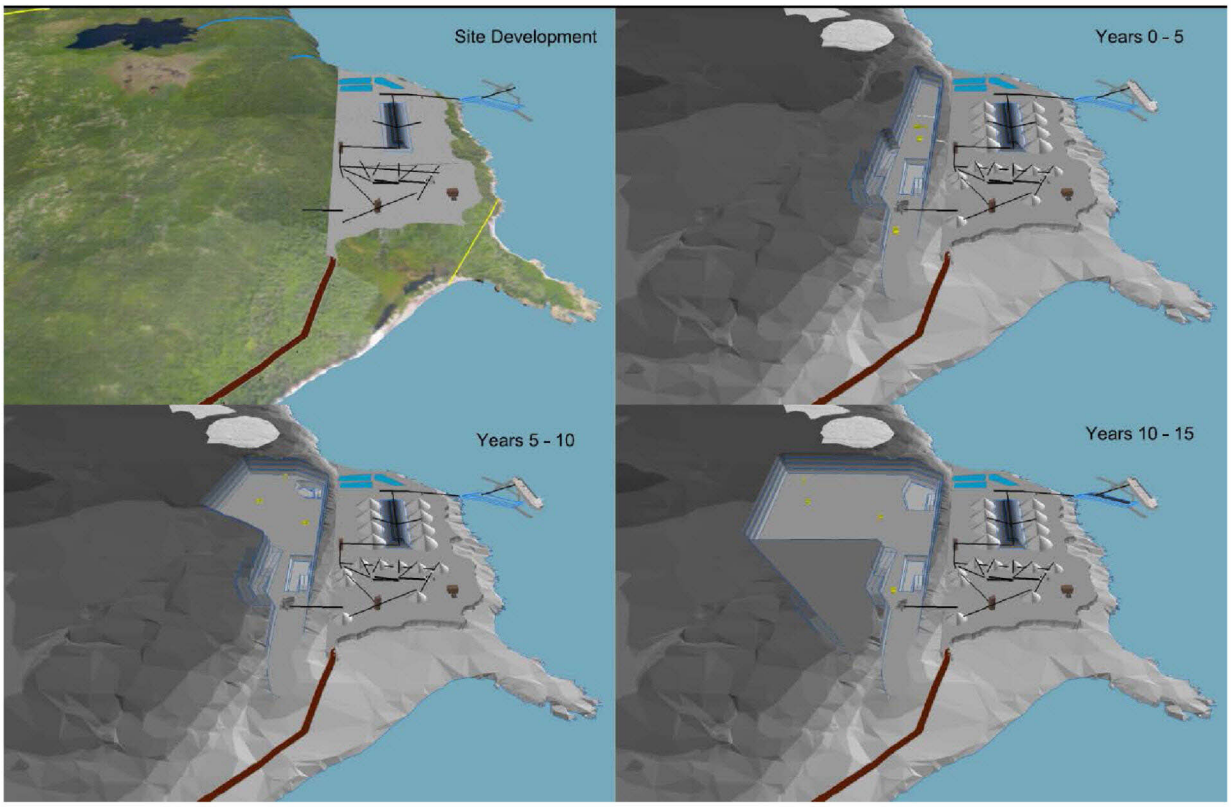

Figure 2
Simplified quarry development over time

7.2 Noise Modelling Procedure

In order to calculate the noise emission levels at the site boundary and at residential receiver locations, a SoundPLAN (Version 7.2) environmental computer model was developed. SoundPLAN is a software package which enables compilation of a sophisticated computer model comprising a digitised ground map (containing ground contours and buildings), the location and acoustic sound power levels of potentially critical noise sources on site and the location of receivers for assessment purposes.

The computer model can generate noise emission levels taking into account such factors as the source sound power levels and locations, distance attenuation, ground absorption, air absorption and shielding attenuation, as well as meteorological conditions, including wind effects.

The computer noise models utilize the ISO 9613-1[2] calculation method for absorption of sound by the atmosphere, and the CONCAWE[3] calculation method for outdoor sound propagation from industrial facilities.

Meteorological parameters and ground attenuation values typical of summer seasonal conditions are used in the noise model calculations. Predicted sound levels were calculated for a temperature of 10°C, a relative humidity of 70%, and downwind sound propagation from source to receptor based on a wind speed of 7.5 km/hr. Hard ground was assumed across the Project site and over the ocean, with soft ground elsewhere. The computer model calculations also take into account the topography of the study area, which was imported into the modelling software in the form of digital elevation data.

The noise model results presented in this report include only the effects of industrial noise in the study area; they do not include the effects of non-industrial ambient noise, such as road traffic, or natural sounds.

7.3 Quarry Noise Sources

Table 7-1 summarises the equipment that is expected to be operating on the site in the future scenario, along with the source sound power levels assumed for this study. The layout of the equipment including elevations is shown in Appendix C.

Equipment sound power levels have been derived from SLR Consulting's experience of the unmitigated noise emissions of equipment in similar applications. The source levels assumed are therefore considered to be conservative. There is potential to mitigate the noise emissions of equipment during the detail design of the Project to minimise noise impacts.

Table 7-1
Equipment List and Sound Power Levels

Equipment	Quantity	Sound Power Level (dBA)	Notes
Mobile Plant			
CAT 772G Off-Highway Truck	2	115	One only at night
CAT 966M Medium Wheel Loader	2	110	One only at night
CAT 988K Large Wheel Loader	2	109	One only at night
CAT 990K Large Wheel Loader	2	113	One only at night
MD5050 Track Drill	1	119	Daytime / evening only
Ship-board noise sources	1	110	Daytime and night-time
Screen Towers			
Scalping Screen	1	128	Daytime / evening only
Sizing Screen	2	119	Daytime / evening only
Sizing Screen	4	116	Daytime / evening only

[2] International Standards Organization (ISO). 1993. *ISO 9613-1, Acoustics - Attenuation of sound during propagation outdoors - Part 1: Calculation of the absorption of sound by the atmosphere*, Geneva, 1993.

[3] Conservation of Clean Air and Water – Europe (CONCAWE), 1981. *The propagation of noise from petroleum and petrochemical complexes to neighbouring communities.* Report No. 4/81, May 1981.

Equipment	Quantity	Sound Power Level (dBA)	Notes
Sizing Screen	4	110	Daytime / evening only
Sizing Screen	2	110	Daytime / evening only
Wash Screen	2	114	Daytime / evening only
Crushers			
Gyratory	1	130	Daytime / evening only
Secondary Standard	1	127	Daytime / evening only
Tertiary Short Head	2	124	Daytime / evening only
Tertiary Short Head	4	124	Daytime / evening only
Conveyors			
Primary Crusher to Transfer 1	1	110/100m	Daytime / evening only
Transfer 1 to Primary Surge	1	110/100m	Daytime / evening only
Primary Reclaim to Scalping Tower	1	110/100m	Daytime / evening only
Scalping Tower to Secondary Surge	1	110/100m	Daytime / evening only
Base Stacker	1	110/100m	Daytime / evening only
Secondary Surge Reclaim	1	110/100m	Daytime / evening only
Tower 2 to CNV008 Stacker, 1 1/2x1	1	110/100m	Daytime / evening only
Stacker, 1 1/2x1	1	110/100m	Daytime / evening only
Tertiary Discharge Belt to Transfer 1	2	110/100m	Daytime / evening only
Transfer 1 to Tower 3	4	110/100m	Daytime / evening only
Tower 3 to H6800 Crushers	4	110/100m	Daytime / evening only
Tower 3 to 1x3/4 Pile	2	110/100m	Daytime / evening only
Tower 3 to 3/4x1/2 Pile	2	110/100m	Daytime / evening only
Tower 3 to Tower 4	10	110/100m	Daytime / evening only
Tower 4 to CNV020 to 1/2x3/8 Pile	2	110/100m	Daytime / evening only
Tower 4 to CNV022 to 3/8x#8 Pile	2	110/100m	Daytime / evening only
Tower 4 to CNV011A&B	2	110/100m	Daytime / evening only
Tower 4 to Screenings Pile	2	110/100m	Daytime / evening only
Base/Screenings Reclaim	1	110/100m	Daytime / evening only
Fraction Reclaim	1	110/100m	Daytime / evening only
Fraction Reclaim to Wash Tower	3	110/100m	Daytime / evening only
Sand Screws to Reclaim	1	110/100m	Daytime / evening only
Wash Tower Bypass Belt	1	110/100m	Daytime / evening only
Wash Tower to Tripper	1	110/100m	Daytime / evening only
Tripper and Stackers	3	110/100m	Daytime / evening only
Reclaim to Ship Loader	3	110/100m	Daytime and night-time
Ship Loader	2	110/100m	Daytime and night-time

7.4 Predicted Operational Noise Levels

The predicted worst-case noise impacts in the future operational scenario are summarised in Table 7-2 at locations around the site boundary and in Table 7-3 at residential receiver locations.

Table 7-2
Predicted Worst Case Project Noise Levels – Site Boundary

Location	Leq Sound Level (dBA)	
	Daytime and Evening (7am to 11pm)	Night-time (11pm to 7am)
Western Boundary	66-67	47-57
Southern Boundary	47-64	29-39
Eastern Boundary	56-73	34-58

Table 7-3
Predicted Worst Case Project Noise Levels – Residential Receivers

Location	Leq Sound Level (dBA)	
	Daytime and Evening (7am to 11pm)	Night-time (11pm to 7am)
272 Half Island Cove Road	51	40
267 Half Island Cove Road	53	41
257 Half Island Cove Road	52	40
246 Half Island Cove Road	52	40
230 Half Island Cove Road	51	39
215 Half Island Cove Road	52	40
212 Half Island Cove Road	51	39
155 Half Island Cove Road	50	38
3595 Highway 16	47	25
3596 Highway 16	48	25
3581 Highway 16	45	26
3421 Highway 16	55	26
2927 Highway 16	54	30
2823 Upper Fox Island	52	35
2574 Highway 16	48	34
48 Fox Island Main Road	48	33
59 Fox Island Main, Canso	49	34
79 Fox Island Main Road	49	34
75 Fox Island Main Road	49	34
130 Fox Island Main Road	49	34
149 Fox Island Main Road	49	35
169 Fox Island Main Road	50	35
235 Fox Island Main Rd	48	34
RR 1 Canso	50	35

7.5 Discussion of Operational Noise Impacts

The predicted worst case daytime operational noise impacts at residential receivers (Table 7-3) indicate that the Project is expected to comply with of the *Guidelines for Environmental Noise Measurement and Assessment*. This guideline defines noise limits being:

- $L_{eq} \leq 65$ dBA between 0700 to 1900 hours (daytime)

- $L_{eq} \leq 60$ dBA between 1900 to 2300 hours (evening)
- $L_{eq} \leq 55$ dBA between 2300 to 0700 hours (night-time, Sunday and statutory holidays)

The *NSE Pit and Quarry Guidelines* also define noise limits identical to the daytime, evening and night-time limits above, but require that the limits be observed at the property boundaries of the pit or quarry. The predicted worst case noise impacts at the site boundary (see Table 7-2) indicate that the Project has the potential to exceed the noise limits at the property boundary in an unmitigated future operating scenario. Industry standard mitigation measures are described in Section 7.6.

7.5.1 Daytime and Evening Noise Impacts on Residences

For the purpose of this assessment, the daytime and evening noise emissions are assumed to be the same. The predicted noise levels at the nearest residential receivers during the daytime and evening range from 47 dBA to 55 dBA, complying with the most stringent noise limit of 55 dBA. These predicted noise impacts represent a worst-case scenario, once the quarry is fully developed, and with no noise mitigation measures included in the detailed design. At the commencement of quarry construction and operation, noise levels would be expected to be considerably less than indicated in this assessment.

The dominant noise sources during daytime operations would be the crushers and screen towers.

While compliance with the numeric noise limits at residences is expected, the noise of the quarry will be noticeable at residences during the daytime and evening, particularly during otherwise quiet periods. Quarry production noise is generally characterised by low-frequency "rumbling" noise that does not vary much with time. At the levels predicted in this assessment, it is anticipated that in future noise from the quarry would dominate the background noise environment in the local area during the daytime and evening periods, and will be audible at a "moderate to quiet" level in nearby residential areas (see Appendix A for more information on perception of noise levels).

7.5.2 Night-time Noise Impacts on Residences

The predicted noise levels at the nearest residential receivers during night-time shiploading and site maintenance activities range from 25 dBA to 41 dBA, complying with the night-time limit of 55 dBA. These predicted noise impacts represent a worst-case scenario on nights when ship-loading takes place, and with no noise mitigation measures included in the detailed design. Shiploading is expected to occur on around 100 nights per year once operations reach full capacity.

The dominant noise sources during night-time shiploading and maintenance operations would be the conveyors leading out to the ship.

While compliance with the numeric night-time noise limits at residences is expected, the noise impact of night-time shiploading will be noticeable at residences. At the levels predicted in this assessment, it is anticipated that in future noise from night-time shiploading would contribute to the background noise environment in the local area, and will be audible at a "quiet" level in nearby residential areas (see Appendix A for more information on perception of noise levels). The character of night-time noise would be a steady low-frequency "rumbling" noise. The night-time noise level would not be expected to disturb the sleep of most people.

7.5.3 Noise Impacts at Project Boundary

The predicted noise levels around the project boundary indicate there is potential for exceedances of the noise goals at the project boundary both during daytime operations and during night-time shiploading and site maintenance activities. These predicted noise impacts represent a worst-case scenario with no noise mitigation measures included in the detailed design. The highest noise levels are predicted at the boundary on the coast both to the east and to the west of the site – this is because these project boundaries are closest to the dominant production equipment noise sources, and do not benefit from as much shielding by the terrain as the areas south of the site.

7.6 Operational Noise Mitigation

There is opportunity to reduce the noise impacts below the levels identified in this report by design and implementation of noise mitigation measures. Design-related mitigation measures included in the model are having the majority of mobile equipment operating in the pit below ground surface, and retaining natural barriers such as hillsides to the extent possible. Product stockpiles would also be located to block noise transmission – this benefit has not been modelled since the height of stockpiles would be variable. Additional reasonable and feasible mitigation options include the specification of best practice equipment noise emissions during the procurement stage, and/or the incorporation of equipment enclosures or other noise shielding such as localised walls or earth mounds for noisy equipment items. For example, for conveyor systems it is anticipated that noise emissions 5-10 dB lower than assumed in this assessment could be achieved by specification of low noise conveyor systems[4].

The staged development of the quarry means that there is scope to monitor noise emissions as the quarry develops, and to include additional noise mitigation in the later stages if required to comply with the noise limits at the site boundary.

8.0 BLASTING NOISE AND VIBRATION IMPACT ASSESSMENT

Blasting will occur anywhere from 30 to 200 days per year, depending on aggregate sales demand. Blasting locations will be based on pit geometry and will vary over the the life of the quarry. Face heights will range from 13 m to 20 m with an average height of approximately 15 m. The average number of holes in an individual blast will be approximately 60 but this number would vary in a range from 20 to 100. Shot patterns will be staggered or square and typically placed in no more than four rows. Holes would be spaced approximately 3 m to 5 m apart. Typical charge weights (kg per delay) per hole will be approximately 270 kg but may range from less than 25 kg (during plant construction) to 400 kg.

The minimum distance to nearest off-site structure will be greater than 800 m, complying with the NSE *Pit and Quarry Guidelines* minimum distance. Initial blasts at the commencement of quarrying operations would take place at much greater offset distances, with the nearest sensitive receivers more than 1500 m from the blast location.

[4] Brown, S.C. *Conveyor Noise Specification and Control*. Proceedings of Acoustics 2004, Gold Coast, Australia, pp269-275.

On the basis of this nominated indicative blast design, the level of blast noise (overpressure) and vibration emissions can be predicted using standard formulae and assuming blasting in average rock.

8.1 Blasting Overpressure

The relevant formula for airblast overpressure is:

$$P = K_a \left(\frac{R}{Q^{1/3}} \right)^A$$

Equation 1

Where,

P = pressure (kPa)
K_a, A = constants related to site specific propagation
R = distance between charge and receiver (m)
Q = Charge mass per delay (kg)

For the purpose of this assessment, the site exponent A is assumed to be -1.45, which corresponds to an attenuation rate of 8.6 dB with doubling of distance. For confined blasthole charges, the site constant K_a is commonly in the range 10 to 100. The resulting estimates of blasting overpressure levels for the maximum anticipated charge mass per delay are presented in Table 8-1.

Table 8-1
Estimated Blasting Overpressure Levels at Maximum Charge Mass per Delay

Receiver Distance (m)	Overpressure Level (dB)	
	Q=550 kg, K_a=10	Q=550 kg, K_a=100
900	115	135
1000	113	133
1500	108	128
2000	105	125

Equation 1 is a generic equation, and in practice the site specific constants may vary considerably, as indicated by the 20 dB range of estimated overpressure levels in Table 8-1 for the range of likely values of K_a. Factors that affect the site specific propagation include the pit geometry, the blast location relative to the receiver, the amount of shielding provided by terrain and meteorological conditions. In unfavourable meteorological conditions, it is common for airblast levels to be increased by up to 20 dB due to the combined effects of temperature inversions and/or wind velocity. Alternatively, airblast levels would be reduced from the levels estimated in Table 8-1 at blast locations where shielding is provided by the pit geometry or surrounding terrain.

Table 8-1 indicates that compliance with the airblast overpressure limit of 128 dB is expected at sensitive receiver locations at the commencement of quarry operations, for the potential range of site propagation constants considered in this assessment (including the most conservative assumptions).

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At the minimum blast distances anticipated to occur as the pit expands, it is possible the airblast overpressure limit of 128 dB may be exceeded, depending on blast location relative to the receiver, site specific propagation factors and meteorological conditions. However, the layout of the Project site and indicative pit geometry indicates that the potentially affected receivers would benefit from shielding due to pit geometry. For this reason, it is considered that exceedance of the airblast overpressure limit at sensitive receivers is unlikely throughout the life of the quarry. Furthermore, there is scope to mitigate the potential impacts further if required by adjusting the individual blast designs and considering meteorological conditions.

As required by the NSE *Pit and Quarry Guidelines*, all blasts would be monitored to establish overpressure levels. This monitoring would be used to develop site-specific propagation constants, to enable refinement of the blast overpressure predictions as the quarry develops. In this manner, blast designs can be adopted that comply with the overpressure limits at sensitive receivers throughout the life of the quarry.

8.2 Blasting Vibration

The relevant formula for the prediction of blasting ground vibration is:

$$V = K_b \left(\frac{R}{Q^{1/2}} \right)^{-B}$$

Equation 2

Where,

V = ground vibration as vector peak particle velocity (mm/s)
K_b, B = constants related to site and rock properties for estimation purposes
R = distance between charge and receiver (m)
Q = Charge mass per delay (kg)

As many site factors will affect the transmission of vibration through the ground, the following levels are considered to be estimates, based on blasting in average rock to a free face under average field conditions. The estimates are of mean vibration level (50% exceedance level). The corresponding assumed site constants are K_b of 1140, and B of 1.6. The resulting mean estimated ground vibration levels are shown in Table 8-2. In practice, due to variations in ground conditions and other factors, the resulting ground vibration levels can vary from two-fifths to four times that estimated in Table 8-2.

Table 8-2
Estimated Mean Blasting Ground Vibration at Maximum Charge Mass per Delay

Receiver Distance (m)	Vibration (mm/s)
900	3.3
1000	2.8
1500	1.5
2000	0.9

Table 8-2 indicates that compliance with the vibration limit of 12.5 mm/s is likely at all sensitive receiver locations both at the commencement of quarry operations and throughout the life of the quarry.

As required by the NSE *Pit and Quarry Guidelines*, all blasts would be monitored to establish vibration levels. This monitoring would be used to develop site-specific propagation constants, to enable refinement of the blast vibration predictions as the quarry develops. In this manner, blast designs can be refined as required to comply with the vibration limits at sensitive receivers throughout the life of the quarry.

8.3 Blasting Noise and Vibration Mitigation Measures

The NSE Pit and Quarry Guidelines Section VIII. Blasting describes control measures for blasting noise and vibration. These measures are reproduced as follows:

(1)(b) No person shall fail to monitor all blasts for the parameters outlined in VIII(1)(a).

(2) Monitoring results shall be forwarded to the Department on a monthly basis unless otherwise indicated.

(3) No blasting shall occur on Sunday, on a statutory holiday prescribed by the Province, or on any day between the hours of 1800 hours and 0800 hours.

(4) Every person responsible for the operation of a quarry shall have a technical blast design prepared by a qualified person which ensures the ground vibration and air concussion outlined in VIII (1) can be achieved.

(5) Every person responsible for the operation of a quarry shall conduct a preblast survey of all structures within 800 m of the point of blast. This survey should be conducted with Nova Scotia Environment and Labour's "Procedure For Conducting a Pre-Blast Survey".

(6) No blasting is to take place if a thermal inversion is anticipated at the time of the proposed blast.

9.0 BLASTING NOISE AND VIBRATION UNDERWATER IMPACT ASSESSMENT

While underwater blasting is not anticipated to be required by the Project, the location of the quarry adjacent to the ocean means that there is potential for quarry blasting noise and vibration to impact on the underwater environment and marine fauna.

Indicative offset distances between a blast and the ocean to meet the 13 mm/s underwater vibration limit in a spawning bed may be estimated using the same formula applied to terrestrial vibration impacts in Section 8.2 (Equation 2). The *Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters* indicates that the offset distance required to meet the underwater noise overpressure guideline level of 100 kPa is typically one third of the distance required to meet the vibration limit in spawning beds, for blasting in rock.

As with the terrestrial vibration assessment, the underwater vibration predictions are based on mean vibration levels. In practice, variations in ground conditions and other factors mean that vibration and the resulting underwater noise level can vary considerably. For the purpose of this assessment, the recommended offset distances between a blast point and ocean habitats are

presented as a range. The range presented in Table 9-1 corresponds to the estimated mean or typical offset distance, and the estimated maximum offset distance (assuming a maximum vibration level four times higher than the mean or typical value). This factor of four has been included in the estimates because ground vibration levels in practice can vary from two-fifths to four times the estimated mean value (Angel 2006).

Table 9-1
Approximate Blasting Setback Distances to Ocean Habitats by Charge Mass

	Charge Mass per delay (kg)				
	50kg	100kg	200 kg	300 kg	400 kg
Setback distance for vibration impacts to spawning beds (m)	120-280	170-390	240-560	290-680	330-780
Setback distance for underwater noise impacts to fish (m)	40-90	60-130	80-190	100-230	110-260

It is recommended that these setback distances be refined following monitoring of initial test blasts at the site (using small charge weights). Depending on their proximity to ocean habitats, these initial blasts may need to take place outside of any identified spawning periods for marine fauna. These initial blasts would identify the site-specific vibration transmission characteristics, to enable design of blasts to comply with the underwater noise and vibration limits.

10.0CONCLUSION

The potential noise and vibration impacts of the Project have been assessed in accordance with the requirements of the Canadian Environmental Assessment Agency (CEA Agency) and Nova Scotia Environment (NSE). As required by the relevant guidelines for the EIS, the assessment identifies the current ambient noise and vibration levels within the local area, summarises the results of a baseline ambient noise survey, and provides information on typical sound sources, geographic extent and temporal variations. The noise and vibration impacts of the Project have also been identified, and recommendations made for mitigation of noise impacts during future aggregate production.

References

Angel, H.G. 2006. Australian Standard for Explosives 2187-2006.

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11.0STATEMENT OF LIMITATIONS

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ATTACHMENT A
Acoustic Terminology

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

1 Sound Level or Noise Level

The terms "sound" and "noise" are almost interchangeable, except that in common usage "noise" is often used to refer to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure capable of evoking the sense of hearing. The human ear responds to changes in sound pressure over a very wide range. The loudest sound pressure to which the human ear responds is ten million times greater than the softest. The decibel (abbreviated as dB) scale reduces this ratio to a more manageable size by the use of logarithms.

The symbols SPL, L or L_P are commonly used to represent Sound Pressure Level. The symbol L_A represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is 2×10^{-5} Pa.

2 "A" Weighted Sound Pressure Level

The overall level of a sound is usually expressed in terms of dBA, which is measured using a sound level meter with an "A-weighting" filter. This is an electronic filter having a frequency response corresponding approximately to that of human hearing.

People's hearing is most sensitive to sounds at mid frequencies (500 Hz to 4000 Hz), and less sensitive at lower and higher frequencies. Thus, the level of a sound in dBA is a good measure of the loudness of that sound. Different sources having the same dBA level generally sound about equally loud.

A change of 1 dBA or 2 dBA in the level of a sound is difficult for most people to detect, whilst a 3 dBA to 5 dBA change corresponds to a small but noticeable change in loudness. A 10 dBA change corresponds to an approximate doubling or halving in loudness. The table below lists examples of typical noise levels.

Sound Pressure Level (dBA)	Typical Source	Subjective Evaluation
130	Threshold of pain	Intolerable
120	Heavy rock concert	Extremely noisy
110	Grinding on steel	
100	Loud car horn at 3 m	Very noisy
90	Construction site with pneumatic hammering	
80	Kerbside of busy street	Loud
70	Loud radio or television	
60	Department store	Moderate to quiet
50	General Office	
40	Inside private office	Quiet to very quiet
30	Inside bedroom	
20	Recording studio	Almost silent

Other weightings (eg B, C and D) are less commonly used than A-weighting. Sound Levels measured without any weighting are referred to as "linear", and the units are expressed as dB(lin) or dB.

3 Sound Power Level

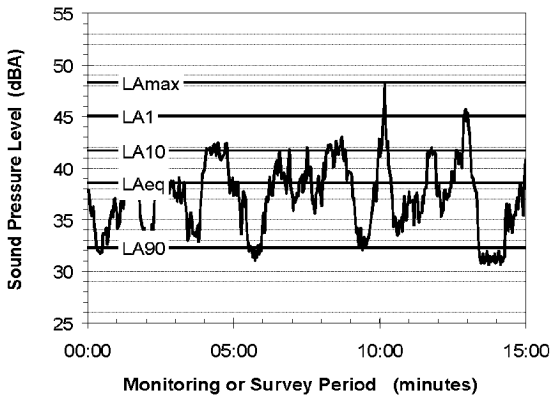
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or Lw, or by the reference unit 10^{-12} W.

The relationship between Sound Power and Sound Pressure may be likened to an electric radiator, which is characterised by a power rating, but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

4 Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels L_{AN}, where L_{AN} is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the L_{A1} is the noise level exceeded for 1% of the time, L_{A10} the noise exceeded for 10% of the time, and so on.

The following figure presents a hypothetical 15 minute noise survey, illustrating various common statistical indices of interest.



Of particular relevance, are:

L_{A1} The noise level exceeded for 1% of the 15 minute interval.

L_{A10} The noise level exceed for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.

L_{A90} The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

L_{Aeq} The A-weighted equivalent noise level (basically the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

When dealing with long term statistical noise data, it is sometimes necessary to define the typical noise levels at a given monitoring location for a particular time of day. A standardised method is available for determining these representative levels.

This method produces a level representing the "repeatable minimum" L_{A90} noise level over the daytime, evening and night-time measurement periods. In addition the method produces mean or "average" levels representative of the other descriptors (L_{Aeq}, L_{A10}, etc).

5 Tonality

Tonal noise contains one or more prominent tones (ie distinct frequency components), and is normally regarded as more offensive than "broad band" noise.

6 Impulsiveness

An impulsive noise is characterised by one or more short sharp peaks in the time domain, such as occurs during hammering.

7 Frequency Analysis

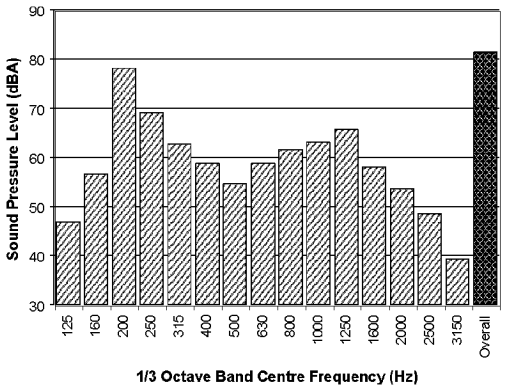
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal. This analysis was traditionally carried out using analogue electronic filters, but is now normally carried out using Fast Fourier Transform (FFT) analysers.

The units for frequency are Hertz (Hz), which represent the number of cycles per second.

Frequency analysis can be in:

- Octave bands (where the centre frequency and width of each band is double the previous band)
- 1/3 octave bands (3 bands in each octave band)
- Narrow band (where the spectrum is divided into 400 or more bands of equal width)

The following figure shows a 1/3 octave band frequency analysis where the noise is dominated by the 200 Hz band. Note that the indicated level of each individual band is less than the overall level, which is the logarithmic sum of the bands.



8 Vibration

Vibration may be defined as cyclic or transient motion. This motion can be measured in terms of its displacement, velocity or acceleration. Most assessments of human response to vibration or the risk of damage to buildings use measurements of vibration velocity. These may be expressed in terms of "peak" velocity or "rms" velocity.

The former is the maximum instantaneous velocity, without any averaging, and is sometimes referred to as "peak particle velocity", or PPV. The latter incorporates "root mean squared" averaging over some defined time period.

Vibration measurements may be carried out in a single axis or alternatively as triaxial measurements. Where triaxial measurements are used, the axes are commonly designated vertical, longitudinal (aligned toward the source) and transverse.

The common units for velocity are millimetres per second (mm/s). As with noise, decibel units can also be used, in which case the reference level should always be stated. A vibration level V, expressed in mm/s can be converted to decibels by the formula 20 log (V/V_o), where V_o is the reference level (10^{-9} m/s). Care is required in this regard, as other reference levels may be used by some organizations.

9 Human Perception of Vibration

People are able to "feel" vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building (even though they may not be disturbed by the motion). An individual's perception of motion or response to vibration depends very strongly on previous experience and expectations, and on other connotations associated with the perceived source of the vibration. For example, the vibration that a person responds to as "normal" in a car, bus or train is considerably higher than what is perceived as "normal" in a shop, office or dwelling.

10 Over-Pressure

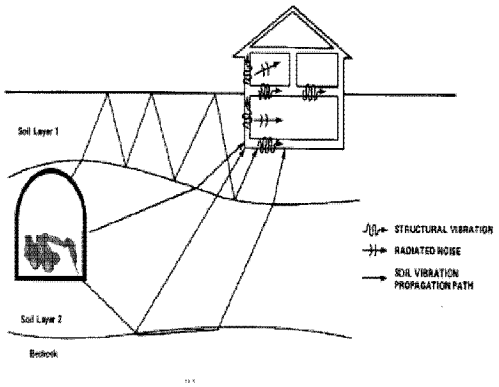
The term "over-pressure" is used to describe the air pressure pulse emitted during blasting or similar events. The peak level of an event is normally measured using a microphone in the same manner as linear noise (ie unweighted), at frequencies both in and below the audible range.

11 Ground-borne Noise, Structure-borne Noise and Regenerated Noise

Noise that propagates through a structure as vibration and is radiated by vibrating wall and floor surfaces is termed "structure-borne noise", "ground-borne noise" or "regenerated noise". This noise originates as vibration and propagates between the source and receiver through the ground and/or building structural elements, rather than through the air.

Typical sources of ground-borne or structure-borne noise include tunnelling works, underground railways, excavation plant (eg rockbreakers), and building services plant (eg fans, compressors and generators).

The following figure presents the various paths by which vibration and ground-borne noise may be transmitted between a source and receiver for construction activities occurring within a tunnel.



The term "regenerated noise" is also used in other instances where energy is converted to noise away from the primary source. One example would be a fan blowing air through a discharge grill. The fan is the energy source and primary noise source. Additional noise may be created by the aerodynamic effect of the discharge grill in the airstream. This secondary noise is referred to as regenerated noise.

ATTACHMENT B
Noise Monitoring Data

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

Location 1 Half Island Cove Rd							
Weather Station Name		HART ISLAND (AUT)					
Province		NOVA SCOTIA					
Latitude		45.35					
Longitude		-60.98					
Elevation		8.2					
Climate Identifier		8202318					
WMO Identifier		71419					
TC Identifier		WRN					
All times are specified in Local Standard Time (LST).							
A-Weighted Noise Levels							
Date	Time	Leq	Lmax	Lpk	L10	L90	Wind speed km/h
8-Nov-11	9:32:22	59.5	80.3	103.7	61.3	42.2	26
8-Nov-11	10:32:22	45.9	64	82.8	45.8	40.4	30
8-Nov-11	11:32:22	39.4	57.8	80	41.3	35.3	28
8-Nov-11	12:32:22	36.1	46.8	76.7	37.7	34	20
8-Nov-11	13:32:22	41.3	62.3	82.5	42.6	38.6	15
8-Nov-11	14:32:22	45.2	52	81.9	47.3	41.2	17
8-Nov-11	15:32:22	44	54.3	81.4	45.9	41.7	13
8-Nov-11	16:32:22	41.2	56.3	79.2	43.4	37	15
8-Nov-11	17:32:22	36.5	52.5	69.2	36.8	34.7	19
8-Nov-11	18:32:22	34	38.8	69.3	35.7	32.5	19
8-Nov-11	19:32:22	32.1	35.8	69.2	33.3	30.5	9
8-Nov-11	20:32:22	29.8	36.4	70.1	30.8	28.8	13
8-Nov-11	21:32:24	30	37.9	72.3	30.8	29	11
8-Nov-11	22:32:24	34	46.1	76.3	35.8	29.7	4
8-Nov-11	23:32:24	35.1	39.1	75.3	36.4	33.8	13
9-Nov-11	0:32:24	35.7	40.3	77.7	37.1	33.6	11
9-Nov-11	1:32:24	34.5	38.7	74.7	36.1	32.7	9
9-Nov-11	2:32:24	34.8	39.3	74.5	36.8	32.2	6
9-Nov-11	3:32:24	34.7	39.2	75	35.9	33.4	6
9-Nov-11	4:32:24	32.8	36.7	73.4	34.3	31.1	6
9-Nov-11	5:32:24	36.2	41.8	74.2	37.4	34.2	6
9-Nov-11	6:32:24	36	47	76.6	36.7	35.1	15
9-Nov-11	7:32:24	37.4	62.1	80.4	37.5	33.4	11
9-Nov-11	8:32:24	37.3	54.9	75.8	37.9	33.8	7
9-Nov-11	9:32:26	40.3	69.8	88.9	37.5	32.6	6
9-Nov-11	10:32:26	35.8	60.2	77.5	35.9	30.7	11
9-Nov-11	11:32:26	36.7	59.9	79.1	35.3	31.3	13
9-Nov-11	12:32:26	36.8	63.7	82.7	34.8	30.9	4
9-Nov-11	13:32:26	31.6	59.3	76.4	30.7	26.7	9
9-Nov-11	14:32:26	37.9	68.6	84.9	36.1	26.9	13
9-Nov-11	15:32:26	34.4	57.5	73.8	31.7	27.6	13
9-Nov-11	16:32:26	35.1	58.5	76.2	34.9	29.3	13
9-Nov-11	17:32:26	33.5	54.9	74	34.1	30.6	7
9-Nov-11	18:32:26	31.9	38.1	72.8	33.2	30.7	11
9-Nov-11	19:32:26	30.4	34.9	72.2	31.1	29.7	9
9-Nov-11	20:32:26	32.6	39.3	72.8	33.8	30.7	4
9-Nov-11	21:32:27	31.8	47.3	71.6	32.7	30.7	2
9-Nov-11	22:32:27	30.9	44.9	69.7	31.3	29.5	7
9-Nov-11	23:32:27	30.6	43	75.7	31.3	29.3	0
10-Nov-11	0:32:27	30.3	32.9	70.2	31.3	29.3	2
10-Nov-11	1:32:27	29.7	40.6	76.9	30.6	28.7	4
10-Nov-11	2:32:27	29.1	32.4	69.2	30.1	28.3	7
10-Nov-11	3:32:27	28.4	31.3	63.8	29.1	28	2
10-Nov-11	4:32:27	28.3	39.1	61.5	28.5	28	6
10-Nov-11	5:32:27	28.8	32.6	73.8	29.3	28.3	7
10-Nov-11	6:32:27	29.6	40.5	70.4	31	28.5	7
10-Nov-11	7:32:27	32.2	55.5	72.9	31.8	28.6	11
10-Nov-11	8:32:27	34.8	58.9	76.5	31.7	28.1	11
10-Nov-11	9:32:29	32.1	58.6	75.3	30.5	27.6	15
10-Nov-11	10:32:29	34	63.6	81.6	29.7	27	17

Location 2 Eagle Valley Rd							
Weather Station Name		HART ISLAND (AUT)					
Province		NOVA SCOTIA					
Latitude		45.35					
Longitude		-60.98					
Elevation		8.2					
Climate Identifier		8202318					
WMO Identifier		71419					
TC Identifier		WRN					
All times are specified in Local Standard Time (LST).							
A-Weighted Noise Levels							
Date	Time	Leq	Lmax	Lpk	L10	L90	Wind speed km/h
8-Nov-11	10:34:57	54.8	78.3	102.9	58.2	31.9	30
8-Nov-11	11:34:57	50.4	67.3	94	54.5	30.1	28
8-Nov-11	12:34:57	51	68.9	89.4	55.1	31.3	20
8-Nov-11	13:34:57	49.9	67.3	97	53.8	33.6	15
8-Nov-11	14:34:57	50.5	70.9	98.4	54.2	35.1	17
8-Nov-11	15:34:57	51.2	69.3	94.8	55.9	29.3	13
8-Nov-11	16:34:57	51.7	70	87.4	55.8	27.9	15
8-Nov-11	17:34:57	52.5	69.7	82.9	56.9	24.3	19
8-Nov-11	18:34:57	49.9	69	84.2	51.9	25.1	19
8-Nov-11	19:34:57	48.9	66.6	83.1	51.1	25.9	9
8-Nov-11	20:34:57	48.6	68.6	83	49.2	26.5	13
8-Nov-11	21:34:57	48.5	68.3	82.3	46.9	27.1	11
8-Nov-11	22:34:59	42.4	65	79.2	30.9	27.8	4
8-Nov-11	23:34:59	36.1	64	79.4	28.8	26.9	13
9-Nov-11	0:34:59	31.4	34.1	63.4	32.4	29.2	11
9-Nov-11	1:34:59	30.7	34.2	62.6	32.6	28.5	9
9-Nov-11	2:34:59	30.9	32.6	62.8	32	29.8	6
9-Nov-11	3:34:59	38.5	65	78.7	30.4	28.5	6
9-Nov-11	4:34:59	46.7	68.5	83	37.1	28.3	6
9-Nov-11	5:34:59	46	69.3	83.7	33.3	26	6
9-Nov-11	6:34:59	45.6	66.4	80.1	38.9	25.5	15
9-Nov-11	7:34:59	53.1	71.2	86.7	55.9	24.7	11
9-Nov-11	8:34:59	54.5	71.3	87.5	59.5	26.1	7
9-Nov-11	9:34:59	50.9	66.9	86.1	55.5	28.9	6
9-Nov-11	10:35:01	48.6	67.5	85.4	50.6	24.1	11
9-Nov-11	11:35:01	49.7	67.5	89	53.9	24.1	13
9-Nov-11	12:35:01	49.8	70.2	86.6	53.4	24.2	4
9-Nov-11	13:35:01	49.1	71.4	89.2	52	24.5	9
9-Nov-11	14:35:01	49.2	66.2	85.1	53.9	24.9	13
9-Nov-11	15:35:01	48.2	66.1	85	50.9	24.7	13
9-Nov-11	16:35:01	50.5	68	82.4	54.6	26.7	13
9-Nov-11	17:35:01	51.9	69.8	89.6	56.3	26.4	7
9-Nov-11	18:35:01	52.2	70.7	92.7	55.8	27.4	11
9-Nov-11	19:35:01	52.2	67.3	80	55.8	26.9	9
9-Nov-11	20:35:01	51.1	69.6	84.7	53.1	27.2	4
9-Nov-11	21:35:01	45.6	68.6	82.7	33.4	26.3	2
9-Nov-11	22:35:03	46.9	68.1	83.1	41.8	25.6	7
9-Nov-11	23:35:03	38.3	62.1	76.6	27.5	25.2	0
10-Nov-11	0:35:03	39.1	64.1	77	26.9	25.5	2
10-Nov-11	1:35:03	37.9	65	81.8	26	24.7	4
10-Nov-11	2:35:03	24.5	29.6	61	24.7	24.3	7
10-Nov-11	3:35:03	24.5	26.5	65.4	24.9	24.2	2
10-Nov-11	4:35:03	43.7	66.3	80.4	31.6	24.1	6
10-Nov-11	5:35:03	46.5	69	82.9	30.3	24.4	7
10-Nov-11	6:35:03	44.9	67.5	82.4	34.5	25.1	7
10-Nov-11	7:35:03	49.6	68.9	84.7	49.2	24.2	11
10-Nov-11	8:35:03	50.5	67.2	84.6	55	24.4	11
10-Nov-11	9:35:03	51.2	67.2	83.4	56.1	25.9	15

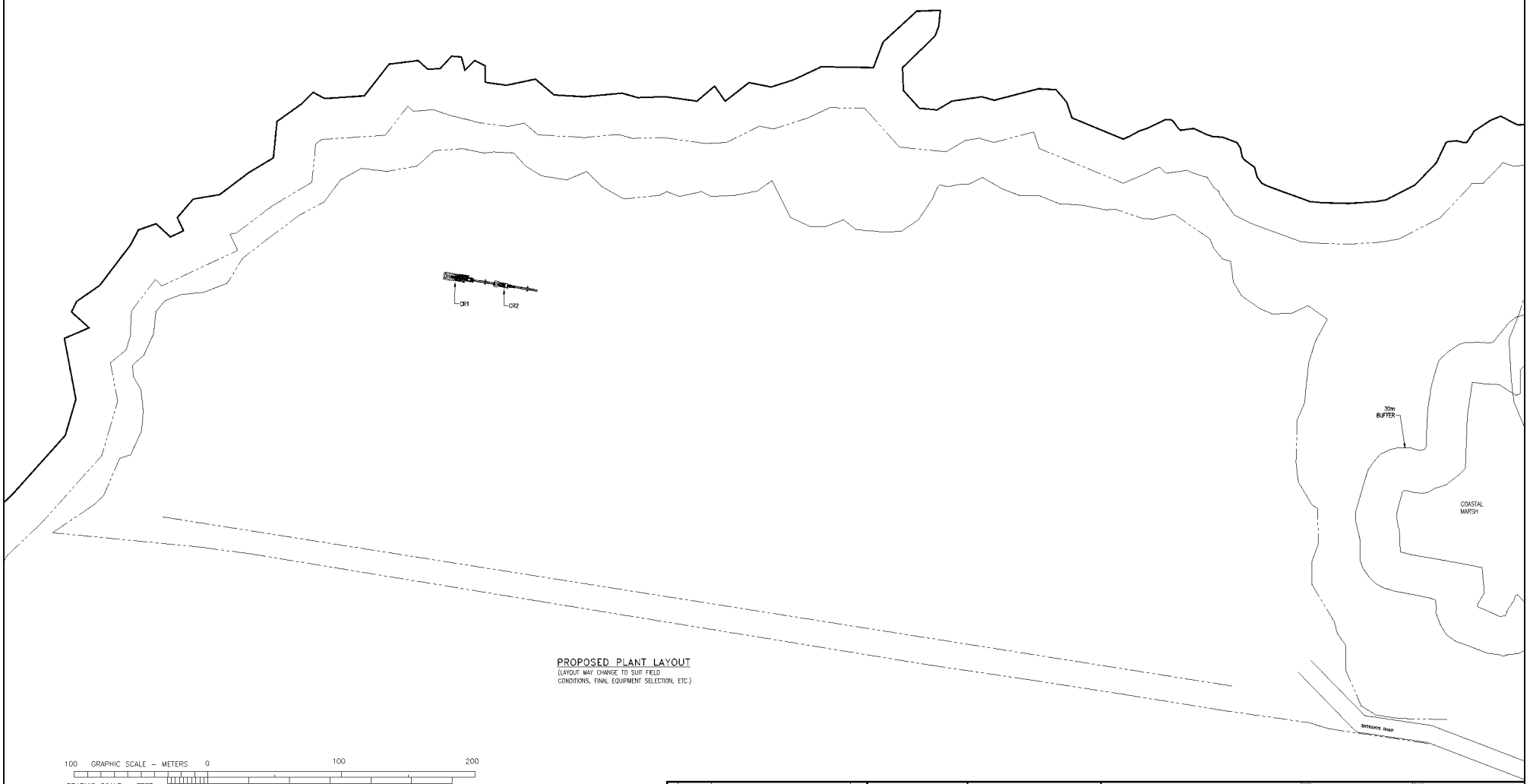
ATTACHMENT C
Equipment and Site Layouts

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

PRELIMINARY EQUIPMENT LIST

Crusher Plant	Model Number	Description	Crusher Model	Power
CR1	LT160	Track Mounted Crushing Plant	C160	Diesel
CR2	LT120	Track Mounted Crushing Plant	C120	Diesel

Conveyors	
Conveyor Number	Description
C1	CR1 to CR2
C2	Product Stacker



PROPOSED PLANT LAYOUT
(LAYOUT MAY CHANGE TO SUIT FIELD CONDITIONS, FINAL EQUIPMENT SELECTION, ETC.)

100 GRAPHIC SCALE – METERS 0 100 200

GRAPHIC SCALE – FEET 100 0 100 200 300 400 500 600

D			
C			
B			
A			
–		INITIAL RELEASE	
	DATE	REVISION	BY

TOLERANCES–UNLESS NOTED
FRACTIONAL: ± 1/16"
DECIMAL: ± 0.010"
ANGLE: ± 0.1°

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Vulcan Materials Company

PLANT LAYOUT
PHASE #1

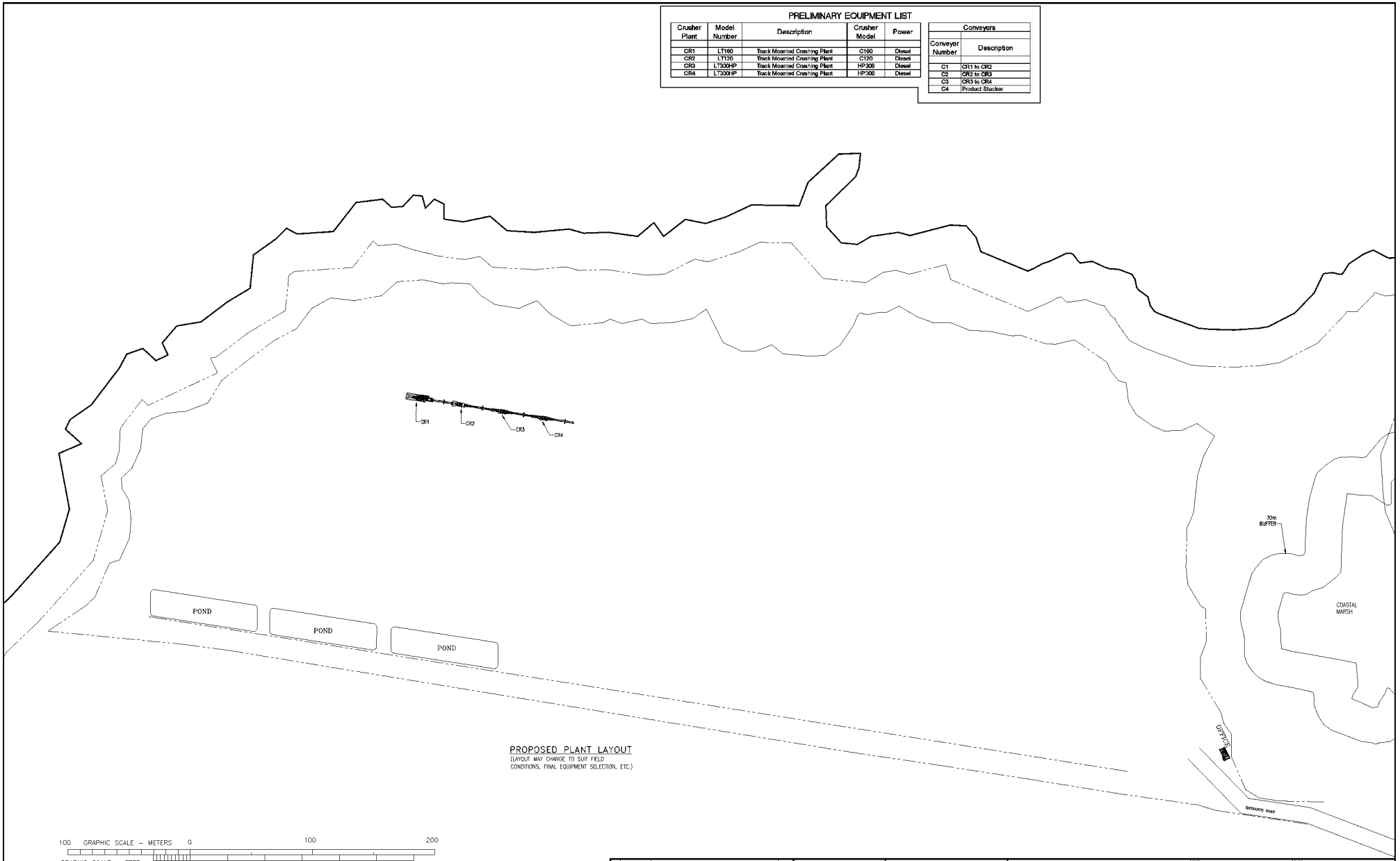
STATE: NOVA SCOTIA
PLANT: BLACK POINT
BY: CB
DATE: 8/15/14
SCALE: 1 : 33 1/3
SHEET 1 OF 1
DWG. NO.: 100–PLT–0001
REV.

C 1340-1027

PRELIMINARY EQUIPMENT LIST

Crusher Plant	Model Number	Description	Crusher Model	Power
CR1	LT160	Track Mounted Crushing Plant	C160	Diesel
CR2	LT120	Track Mounted Crushing Plant	C120	Diesel
CR3	LT300HP	Track Mounted Crushing Plant	HP300	Diesel
CR4	LT300HP	Track Mounted Crushing Plant	HP300	Diesel

Conveyors	
Conveyor Number	Description
C1	CR1 to CR2
C2	CR2 to CR3
C3	CR3 to CR4
C4	Product Stacker



PROPOSED PLANT LAYOUT
(LAYOUT MAY CHANGE TO SUIT FIELD CONDITIONS, FINAL EQUIPMENT SELECTION, ETC.)

100 GRAPHIC SCALE – METERS 0 100 200

GRAPHIC SCALE – FEET 100 0 100 200 300 400 500 600

	DATE	REVISION	BY
D			
C			
B			
A			
–		INITIAL RELEASE	

TOLERANCES–UNLESS NOTED
FRACTIONAL: ± 1/16"
DECIMAL: ± 0.010"
ANGLE: ± 0.1°

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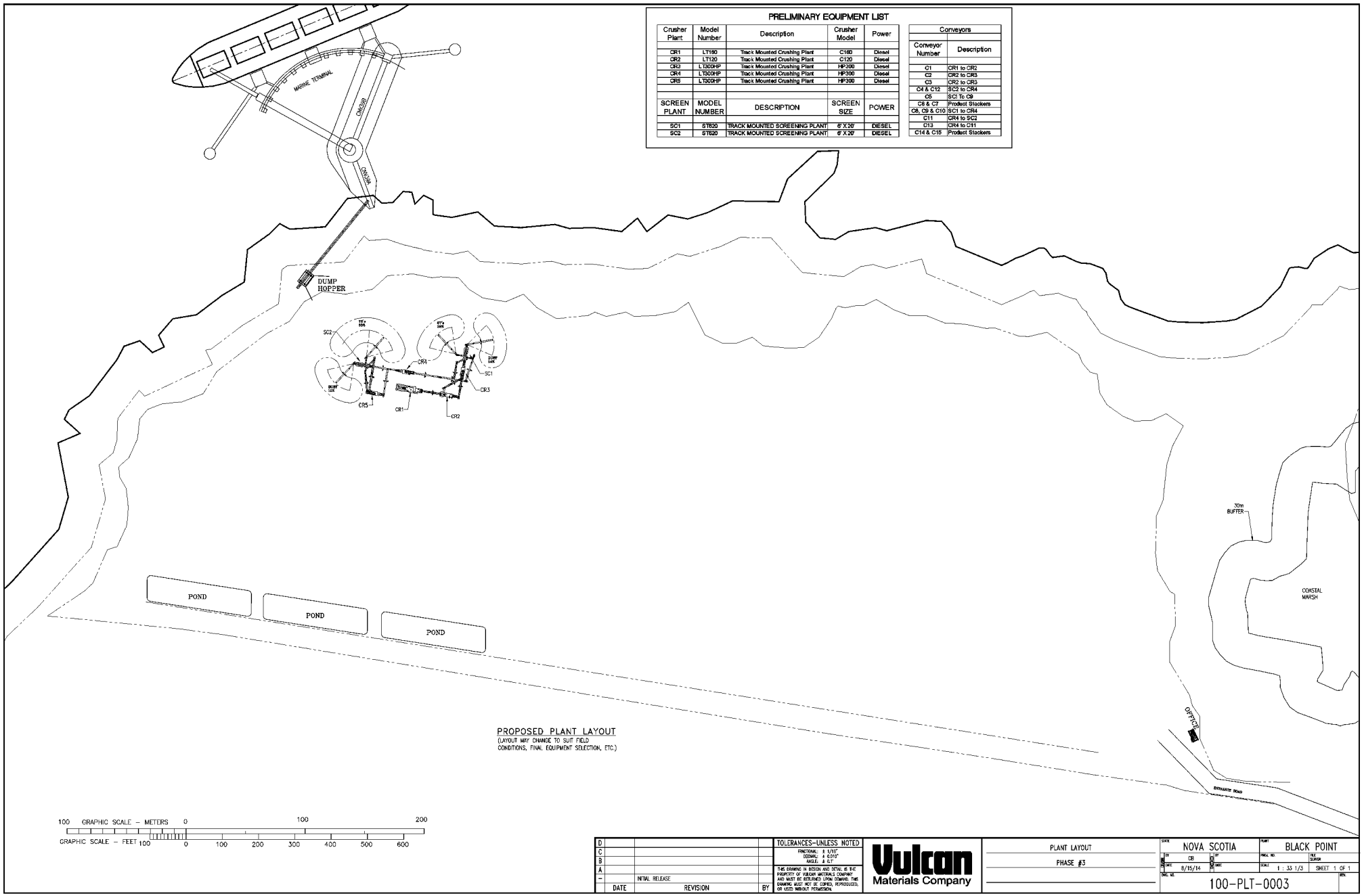
Vulcan Materials Company

PLANT LAYOUT
PHASE #2

STATE: NOVA SCOTIA
PLANT: BLACK POINT
BY: CB
DATE: 8/15/14
SCALE: 1 : 33 1/3
SHEET 1 OF 1
DWG. NO.: 100–PLT–0002
REV.



PRELIMINARY EQUIPMENT LIST

Crusher Plant	Model Number	Description	Crusher Model	Power
CR1	LT160	Track Mounted Crushing Plant	C160	Diesel
CR2	LT120	Track Mounted Crushing Plant	C120	Diesel
CR3	LT300HP	Track Mounted Crushing Plant	HP300	Diesel
CR4	LT300HP	Track Mounted Crushing Plant	HP300	Diesel
CR5	LT300HP	Track Mounted Crushing Plant	HP300	Diesel
SCREEN PLANT	MODEL NUMBER	DESCRIPTION	SCREEN SIZE	POWER
SC1	ST620	TRACK MOUNTED SCREENING PLANT	6' X 20'	DIESEL
SC2	ST620	TRACK MOUNTED SCREENING PLANT	6' X 20'	DIESEL

Conveyors	
Conveyor Number	Description
C1	CR1 to CR2
C2	CR2 to CR3
C3	CR2 to CR3
C4 & C12	SC2 to CR4
C5	SC1 To C9
C6 & C7	Product Stackers
C8, C9 & C10	SC1 to CR4
C11	CR4 to SC2
C13	CR4 to C11
C14 & C15	Product Stackers

PROPOSED PLANT LAYOUT
(LAYOUT MAY CHANGE TO SUIT FIELD CONDITIONS, FINAL EQUIPMENT SELECTION, ETC.)

100 GRAPHIC SCALE – METERS 0 100 200

GRAPHIC SCALE – FEET 100 0 100 200 300 400 500 600

D			TOLERANCES–UNLESS NOTED
C			FRACTIONAL: ± 1/16"
B			DECIMAL: ± 0.010"
A			ANGLE: ± 0.1°
–	INITIAL RELEASE		THIS DRAWING IN DESIGN AND DETAIL IS THE PROPERTY OF VULCAN MATERIALS COMPANY AND MUST BE RETURNED UPON DEMAND. THIS DRAWING MUST NOT BE COPIED, REPRODUCED, OR USED WITHOUT PERMISSION.
	DATE REVISION	BY	

Vulcan Materials Company

PLANT LAYOUT
PHASE #3

STATE: NOVA SCOTIA
PLANT: BLACK POINT
DRN: CB
APP:
DATE: 8/15/14
SCALE: 1 : 33 1/3
SHEET 1 OF 1
ENG. NO.: 100-PLT-0003
REV.

C 1340-1029

PRELIMINARY EQUIPMENT LIST

Screen Towers

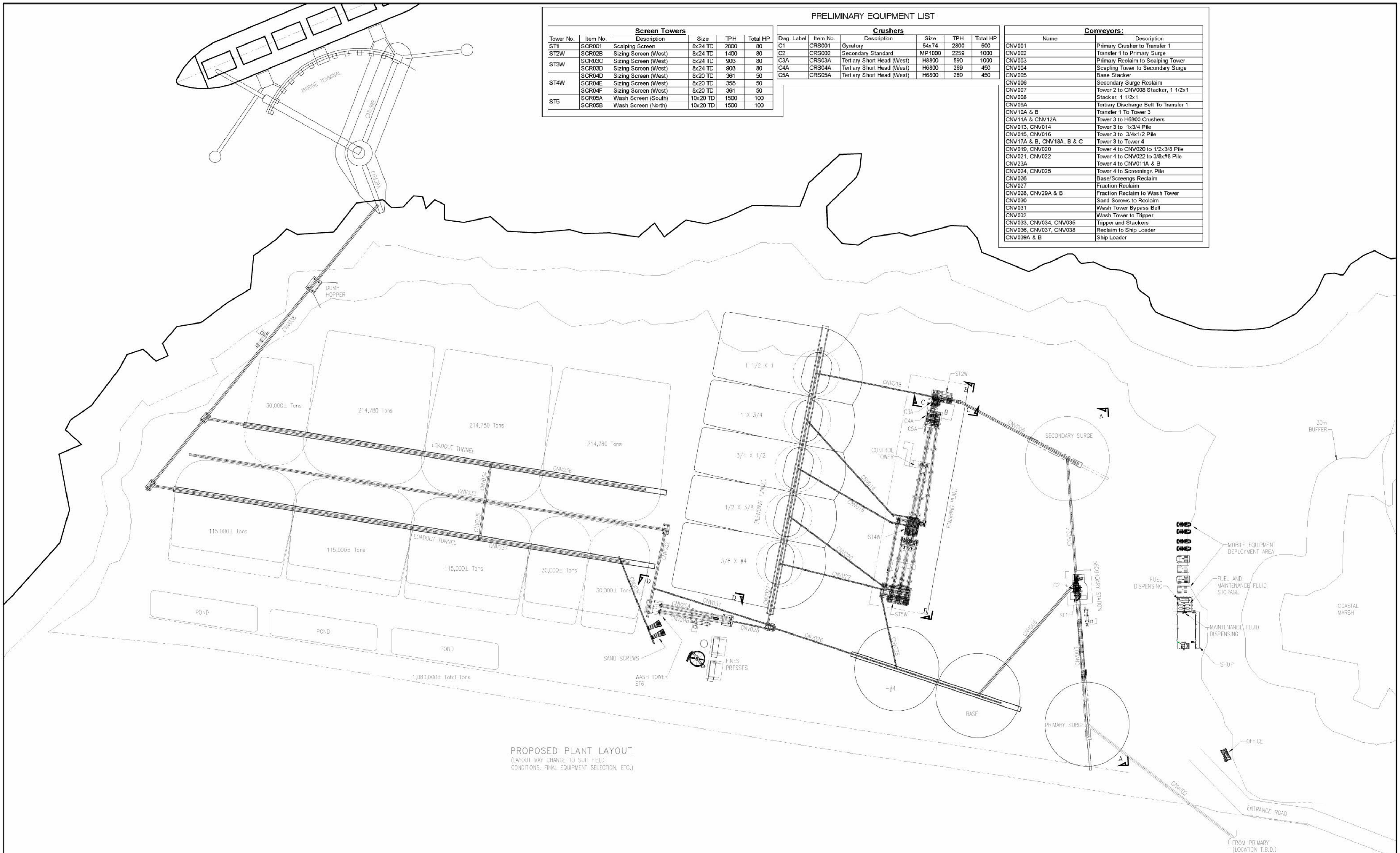
Tower No.	Item No.	Description	Size	TPH	Total HP
ST1	SCR001	Scalping Screen	8x24 TD	2800	80
ST2W	SCR02B	Sizing Screen (West)	8x24 TD	1400	80
ST3W	SCR03C	Sizing Screen (West)	8x24 TD	903	80
	SCR03D	Sizing Screen (West)	8x24 TD	903	80
ST4W	SCR04D	Sizing Screen (West)	8x20 TD	361	50
	SCR04E	Sizing Screen (West)	8x20 TD	355	50
	SCR04F	Sizing Screen (West)	8x20 TD	361	50
ST5	SCR05A	Wash Screen (South)	10x20 TD	1500	100
	SCR05B	Wash Screen (North)	10x20 TD	1500	100

Crushers

Dwg. Label	Item No.	Description	Size	TPH	Total HP
C1	CRS001	Gyratory	54x74	2800	500
C2	CRS002	Secondary Standard	MP1000	2259	1000
C3A	CRS03A	Tertiary Short Head (West)	H8800	590	1000
C4A	CRS04A	Tertiary Short Head (West)	H6800	269	450
C5A	CRS05A	Tertiary Short Head (West)	H6800	269	450

Conveyors:

Name	Description
CNV001	Primary Crusher to Transfer 1
CNV002	Transfer 1 to Primary Surge
CNV003	Primary Reclaim to Scalping Tower
CNV004	Scapling Tower to Secondary Surge
CNV005	Base Stacker
CNV006	Secondary Surge Reclaim
CNV007	Tower 2 to CNV008 Stacker, 1 1/2x1
CNV008	Stacker, 1 1/2x1
CNV09A	Tertiary Discharge Belt To Transfer 1
CNV10A & B	Transfer 1 To Tower 3
CNV11A & CNV12A	Tower 3 to H6800 Crushers
CNV013, CNV014	Tower 3 to 1x3/4 Pile
CNV015, CNV016	Tower 3 to 3/4x1/2 Pile
CNV17A & B, CNV18A, B & C	Tower 3 to Tower 4
CNV019, CNV020	Tower 4 to CNV020 to 1/2x3/8 Pile
CNV021, CNV022	Tower 4 to CNV022 to 3/8x#8 Pile
CNV23A	Tower 4 to CNV011A & B
CNV024, CNV025	Tower 4 to Screenings Pile
CNV026	Base/Screengs Reclaim
CNV027	Fraction Reclaim
CNV028, CNV29A & B	Fraction Reclaim to Wash Tower
CNV030	Sand Screws to Reclaim
CNV031	Wash Tower Bypass Belt
CNV032	Wash Tower to Tripper
CNV033, CNV034, CNV035	Tripper and Stackers
CNV036, CNV037, CNV038	Reclaim to Ship Loader
CNV039A & B	Ship Loader



D			
C			
B			
A			
–		INITIAL RELEASE	
	DATE	REVISION	BY

TOLERANCES–UNLESS NOTED
FRACTIONAL: ± 1/16"
DECIMAL: ± 0.010"
ANGLE: ± 0.1°

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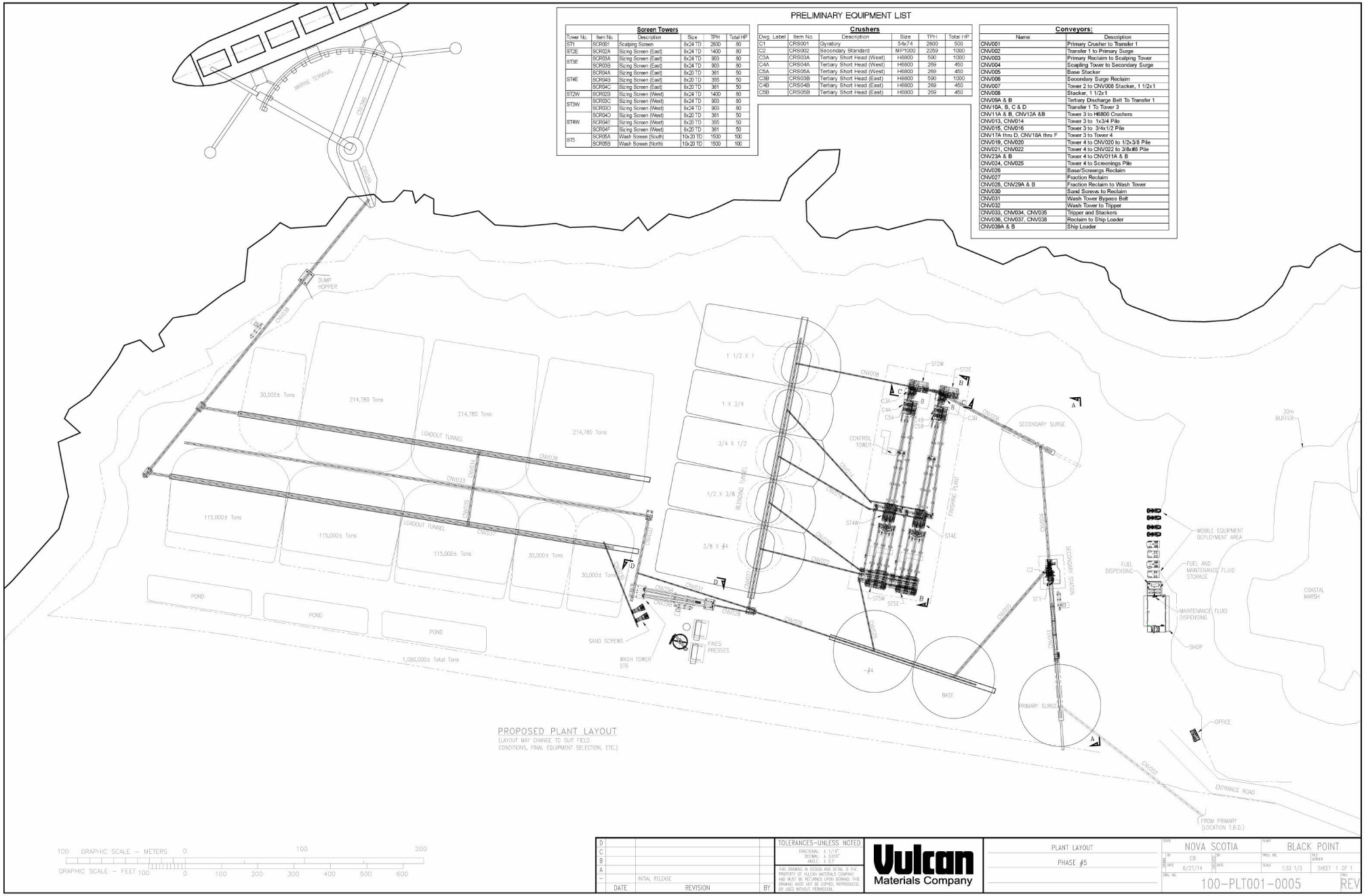
Vulcan Materials Company

PLANT LAYOUT
PHASE #4

STATE: NOVA SCOTIA
PLANT: BLACK POINT
DRAWN BY: CB
DATE: 6/27/14
CHECKED BY:
DATE:
PROJ. NO.
FILE SERVER
SCALE: 1:33 1/3
SHEET 1 OF 1
DWG. NO. 100–PLT001–0004
REV.



PRELIMINARY EQUIPMENT LIST

Screen Towers

Tower No.	Item No.	Description	Size	TPH	Total HP
ST1	SCR001	Scalping Screen	8x24 TD	2800	80
ST2E	SCR02A	Sizing Screen (East)	8x24 TD	1400	80
	SCR03A	Sizing Screen (East)	8x24 TD	903	80
ST3E	SCR03B	Sizing Screen (East)	8x24 TD	903	80
ST4E	SCR04A	Sizing Screen (East)	8x20 TD	361	50
	SCR04B	Sizing Screen (East)	8x20 TD	355	50
	SCR04C	Sizing Screen (East)	8x20 TD	361	50
ST2W	SCR02B	Sizing Screen (West)	8x24 TD	1400	80
ST3W	SCR03C	Sizing Screen (West)	8x24 TD	903	80
	SCR03D	Sizing Screen (West)	8x24 TD	903	80
ST4W	SCR04D	Sizing Screen (West)	8x20 TD	361	50
	SCR04E	Sizing Screen (West)	8x20 TD	355	50
	SCR04F	Sizing Screen (West)	8x20 TD	361	50
ST5	SCR05A	Wash Screen (South)	10x20 TD	1500	100
	SCR05B	Wash Screen (North)	10x20 TD	1500	100

Crushers

Dwg. Label	Item No.	Description	Size	TPH	Total HP
C1	CRS001	Gyratory	54x74	2800	500
C2	CRS002	Secondary Standard	MP1000	2259	1000
C3A	CRS03A	Tertiary Short Head (West)	H6800	590	1000
C4A	CRS04A	Tertiary Short Head (West)	H6800	269	450
C5A	CRS05A	Tertiary Short Head (West)	H6800	269	450
C3B	CRS03B	Tertiary Short Head (East)	H6800	590	1000
C4B	CRS04B	Tertiary Short Head (East)	H6800	269	450
C5B	CRS05B	Tertiary Short Head (East)	H6800	269	450

Conveyors:

Name	Description
CNV001	Primary Crusher to Transfer 1
CNV002	Transfer 1 to Primary Surge
CNV003	Primary Reclaim to Scalping Tower
CNV004	Scalping Tower to Secondary Surge
CNV005	Base Stacker
CNV006	Secondary Surge Reclaim
CNV007	Tower 2 to CNV008 Stacker, 1 1/2x1
CNV008	Stacker, 1 1/2x1
CNV09A & B	Tertiary Discharge Belt To Transfer 1
CNV10A, B, C & D	Transfer 1 To Tower 3
CNV11A & B, CNV12A &B	Tower 3 to H6800 Crushers
CNV013, CNV014	Tower 3 to 1x3/4 Pile
CNV015, CNV016	Tower 3 to 3/4x1/2 Pile
CNV17A thru D, CNV18A thru F	Tower 3 to Tower 4
CNV019, CNV020	Tower 4 to CNV020 to 1/2x3/8 Pile
CNV021, CNV022	Tower 4 to CNV022 to 3/8x#8 Pile
CNV23A & B	Tower 4 to CNV011A & B
CNV024, CNV025	Tower 4 to Screenings Pile
CNV026	Base/Screengs Reclaim
CNV027	Fraction Reclaim
CNV028, CNV29A & B	Fraction Reclaim to Wash Tower
CNV030	Sand Screws to Reclaim
CNV031	Wash Tower Bypass Belt
CNV032	Wash Tower to Tripper
CNV033, CNV034, CNV035	Tripper and Stackers
CNV036, CNV037, CNV038	Reclaim to Ship Loader
CNV039A & B	Ship Loader

PROPOSED PLANT LAYOUT

(LAYOUT MAY CHANGE TO SUIT FIELD CONDITIONS, FINAL EQUIPMENT SELECTION, ETC.)

100 GRAPHIC SCALE – METERS 0 100 200

GRAPHIC SCALE – FEET 100 0 100 200 300 400 500 600

D			
C			
B			
A			
–	INITIAL RELEASE		
	DATE	REVISION	BY

TOLERANCES–UNLESS NOTED
FRACTIONAL: ± 1/16"
DECIMAL: ± 0.010"
ANGLE: ± 0.5°

THIS DRAWING IN DESIGN AND DETAIL IS THE PROPERTY OF VULCAN MATERIALS COMPANY AND MUST BE RETURNED UPON DEMAND. THIS DRAWING MUST NOT BE COPIED, REPRODUCED, OR USED WITHOUT PERMISSION.

Vulcan Materials Company

PLANT LAYOUT

PHASE #5

STATE	NOVA SCOTIA	PLANT	BLACK POINT
BY	CB	PROJ. NO.	REF. DRAWER
DATE	6/27/14	SCALE	1:33 1/3 SHEET 1 OF 1
DWG. NO.	100–PLT001–0005		REV.

C 1340-1031

APPENDIX E
AMEC 2010 and 2014 Ecological Surveys

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

BLACK POINT
BASELINE ECOLOGICAL SURVEYS
SUMMARY REPORT
(2010 Surveys with Updates from 2014)

Prepared for:

Morien Resources Corp. (Morien)
Metropolitan Place
Suite 1480, 99 Wyse Road
Dartmouth, Nova Scotia,
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Submitted by:
AMEC Earth & Environmental
a Division of AMEC Americas Ltd.
50 Troop Ave., Unit 300
Dartmouth, NS B3B 1Z1

September 2014

Project No.: TV144003

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1.0 INTRODUCTION AND BACKGROUND

Vulcan Materials Company and Morien Resources Corp. (the Proponent) proposes the development, operation, decommissioning and abandonment of a granite quarry and marine terminal at Black Point in Guysborough County, Nova Scotia. The Black Point Quarry Project consists of aggregate production (drilling, blasting, processing and stockpiling) on a 354.5 ha property, along with the construction and operation of a 200 m long marine terminal adjacent to the quarry in Chedabucto Bay. The aggregate will be loaded into bulk carriers up to 70,000 DWT and transported to ports along the US eastern and Gulf coasts and potentially to markets in Canada and the Caribbean.

The Black Point Quarry Project (the Project) is located on the south shore of Chedabucto Bay in the District of Guysborough, Nova Scotia. The proposed Project Site is approximately 2 and 2.5 km from the communities of Half Island Cove in the west, and Fox Island Main in the east, respectively. The Project is situated between Highway 16 and the Atlantic coast in an area dominated by coniferous forests, coastal barrens, as well as various types of wetlands, including bog, fen, swamp and marsh. A power transmission line corridor runs along the south end of the property and with the exception of a few ATV trails, skidder tracks and property cut lines, the area is relatively undisturbed. The Project Site is depicted in Figure 1-1.

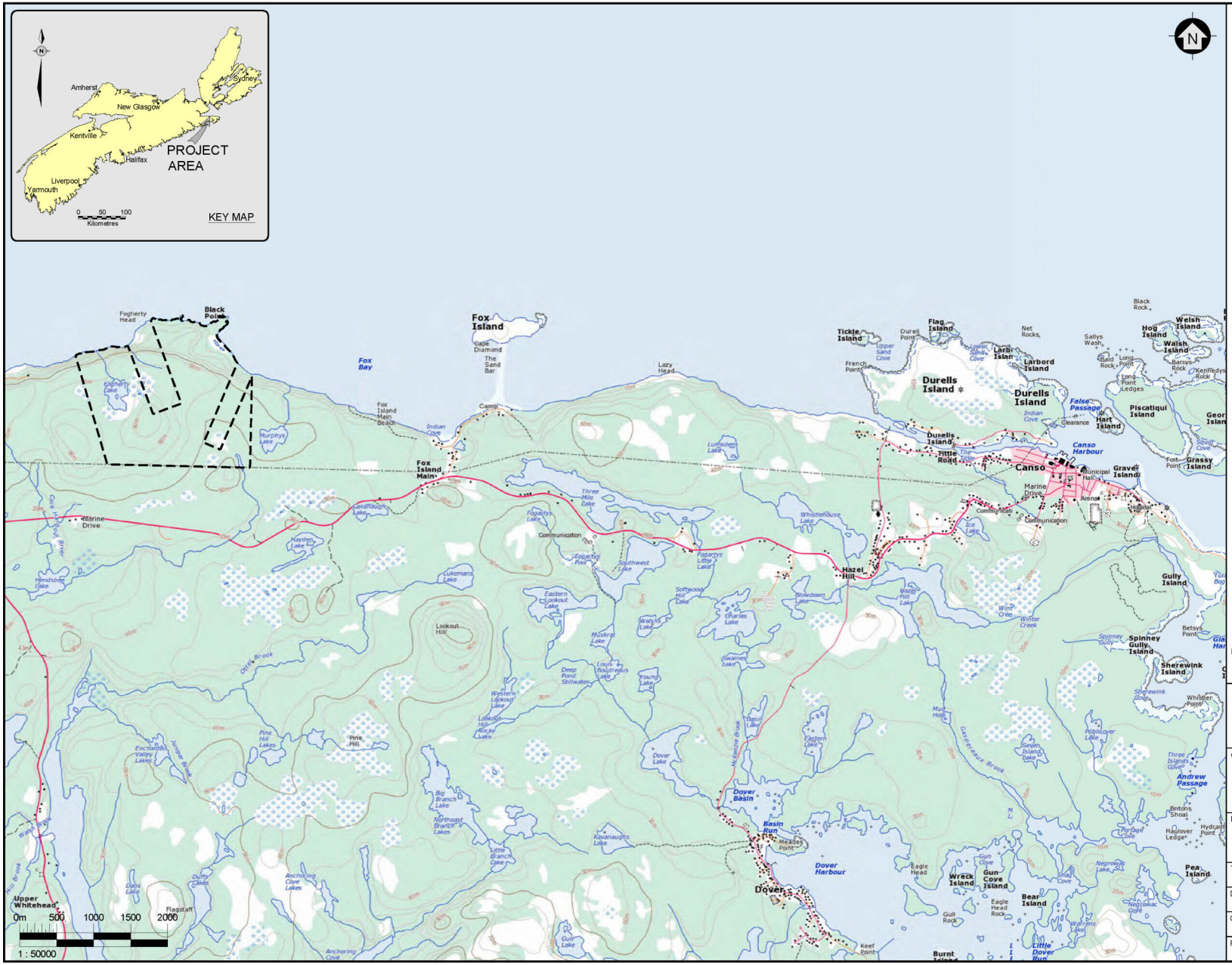
This summary report presents the results of ecological field survey conducted in 2010 and in 2014. The 2010 surveys were completed by AMEC Earth & Environmental (AMEC) and presented in report format in February 2011 (Black Point Baseline Ecological Surveys Summary Report). The AMEC work was conducted for Erdene Resource Development Corp. (Erdene), the initial proponent of the Project. Subsequently, the Project was taken over by Vulcan Materials Company and Morien Resources Corp. who retained AMEC to update the ecological information through field surveys in 2014. This report builds on the 2011 Summary Report in that additional and new field information is simply added or inserted where applicable. The updated information is identified as 2014 survey results. It is of note that the status information provided for species recorded in 2010 and reported in 2011 has not been updated.

The results presented in this report derive from on-site surveys for:

- Vascular Plants;
- Cyanolichens;
- Birds, including
    - Owls and early breeders;
    - Migrating and early breeding passerines
    - Breeding passerines;
    - Shorebirds and coastal birds;
- Mammals;
- Herpetiles (reptiles and amphibians);

- Odonates (dragonflies and damselflies);
- Wetlands;
- Freshwater habitat and fish communities;
- Marine habitat and benthic invertebrate communities.

The full wetland delineations were beyond the scope of the AMEC surveys conducted in 2010. They were conducted in the 2011 and 2014, following the finalization of the Project design, and are reported in a separate document.



LEGEND:
Site Boundary

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CLIENT
Erdene Resource Development Corp.
Metropolitan Place
99 Wyse Road, Suite 1480
Dartmouth, NS B3A 4S5

PROJECT
Black Point Quarry Project

TITLE
Study Area with Project Site

DWN BY: DS	PROJECTION: UTM Zone 20	DATE: February 2011
CHK'D BY: BC	DATUM: NAD83	PROJECT NO: TV01017
REV. NO.: N/A	SCALE: 1:50,000	FIGURE No. 1-1

C 1340-1042

2.0 FLORA

2.1 VASCULAR PLANTS

Field surveys were carried out in order to describe the existing plant communities and habitats within the Project Site, identify wetlands, and to confirm presence or absence of rare plants. These surveys were also supplemented during the 2014 wetland and vegetation surveys.

2.1.1 Approach and Methodology

In preparation for the vascular plant field surveys, maps of existing habitat were assembled, indicating streams, wetlands and habitats including forest types. Map sources included available mapping from provincial and federal governments, such as aerial photography, the NSDNR Wetlands Database (NSDNR 2000), Forest Inventory Mapping (NSDNR 2010), and 1:50,000 topographic maps (11F/06) (NRCan 1998).

A priority species list was prepared prior to conducting field work in order to help guide the plant surveys by identifying plant species at risk /conservation concern potentially present on the site. In order to prepare this priority list an ACCDC data search was obtained in April 2010 (ACCDC 2010) to identify any plant species at risk/conservation concern previously identified within 100 km radius of the site.

For the purpose of the vascular plant surveys, the survey area consisted of all land encompassed within the property boundary provided by Erdene (Figure 1-1). Surveys within the Project Site focused on habitats suitable for potential vascular plant species at risk. Habitats with high potential for species at risk include freshwater and marine wetlands, as well as floodplains of streams and rivers. Forest habitats, except forests in flood plains, are estimated to have medium to low potential for rare vascular plants. Surveys for rare vascular plants were timed to cover both early and late phenology. Field surveys in the Project Area were carried out between June 22 and June 25, 2010 (early summer); and between August 31 and September 8, 2010 (late summer). A third round of surveys was conducted between August 18 and August 22, 2014 to update and supplement the 2010 surveys.

The surveys were carried out by senior botanist Dr. Marion Sensen and biologist Scott Burley. All habitat types in the Project Site were surveyed. Streams visible on the topographic maps as well as streams identified during the field surveys were investigated. Floodplains and aquatic flora of streams and lakes were also surveyed. All wetlands within the Project Area were investigated, including any wetlands which were field identified during the surveys, but which are not included in the provincial Wetlands Inventory Database (NSDNR 2000).

An inventory of plant species present on the Project Site was established in order to describe the existing habitat. Samples of species which were difficult to identify in the field were collected and later identified in the laboratory using a microscope and applicable identification guides. Photographs were taken of all major habitat types encountered during the survey.

2.1.2 Baseline Inventory

Five main habitat types were encountered within the Project Site. Most of the Project Site is covered by a mosaic of barren vegetation and coniferous forest. There are also patches of mixed forest, and wetlands such as treed bog, open bog, fen, and swamp scattered throughout the Project Area.

Coniferous Forest

Patches of coniferous forest dominated by balsam fir (*Abies balsamea*), and black spruce (*Picea mariana*) are present throughout the Project Site. The understory of this habitat type varies in dominant species but can include lambkill (*Kalmia angustifolia*), late low blueberry (*Vaccinium angustifolium*), twinflower (*Linnaea borealis*), bunchberry (*Cornus canadensis*), starflower (*Trientalis borealis*), and wild sarsaparilla (*Aralia nudicaulis*).

Photo 2-1. Coniferous Forest Patch

Photo 2-2. Balsam Fir Dominated Coniferous Forest

Barren

Much of the Project Site is dominated by low barren vegetation. This habitat type can either be dominated by shrub species such as huckleberry (*Gaylussacia baccata*), late low blueberry and common juniper (*Juniperus communis*) growing to heights of less than one metre. Other forms of this habitat type are dominated by black crowberry mats growing over rocks. This type of barren is typically located closer to the coast (on headlands), but can occur inland over bedrock outcrops.

Photo 2-3. Low Barren/Shrub Barren Transition Area

Photo 2-4. Coastal Headland Barren

Photo 2-5. Low Barren

Tall Shrub Barren

A number of tall shrub barren vegetation patches are located throughout the Project Site. Dominant vegetation in these areas include Pin Cherry (*Prunus pensylvanica*), Alder (*Alnus incana*), and Mountain Holly (*Nemopanthes mucronatus*). In many instances, this habitat type acts as a transition zone between coniferous forest and barren habitat (described above).

Photo 2-6. Tall Shrub Barren

Mixed Forest

Mixed forest patches are scattered throughout the Project Site. These areas are dominated by canopy species such as red maple (*Acer rubrum*), heart-leaved paper birch (*Betula papyrifera var. cordifolia*), balsam fir, and understorey species including lambkill, late low blueberry, twinflower, bunchberry, starflower and wild sarsaparilla (*Aralia nudicaulis*). This habitat type is generally located in the southern end of the Project Site but does occur in patches closer to the coast.

Photo 2-7. Mixed Forest along Stream

Wetlands

A number of wetlands were identified within the Project Site. Wetland types encountered within the Project Site include open/treed bogs, fens, and treed/shrub swamps. Wetlands surveyed within the Project Area are described in more detail below in Section 4 and in the 2014 Wetland Baseline Survey Report.

Other habitat types

A number of other habitat types were also encountered within the Project Site including beaches, coastal barren headlands, coastal cliffs, regenerating forests, and lakes. Three mapped streams, as well as a number of intermittent/seasonal drainage channels, are also located on the property. Freshwater habitats on the site are discussed in Section 5.

A complete inventory of the vascular plant species observed during the surveys is provided in Table A.1-1 in Appendix A.1.

Photo 2-8. Beach at Northeast End of Property

2.1.3 Species of Conservation Concern

One vascular plant species of conservation concern was detected on the Project Site during the June 2010 surveys. Southern twayblade (*Listera australis)* has an ACCDC rarity rank of S2. This species was encountered along two streams located within the Project Area. Figure 2-1 illustrates the locations where this species was encountered. One location contained over 40 individuals within a relatively small area whereas only one individual was found at the second location. This species is shown in Photo 2-9, while its habitat is depicted in Photo 2-10.

An additional plant species of conservation concern, Northern Comandra (*Geocaulon lividum* – ACCDC rank S3) was detected during the August 2014 field survey. This species was noted in Wetland 18 (WL18) in the open bog portion of this wetland. Numerous individuals were reported throughout this wetland. Figure 2-1 illustrates the locations where this species was encountered. This species is shown in 11, while its habitat is depicted in Photo 2-101.

LEGEND:

- Site Boundary

Lichens:

- *Peltigera leucophlebia*
- *Ramalina thrausta*
- *Cladonia stygia*
- *Nephroma bellum*
- *Usnea flammea*

Vasular Plants:

- *Listera australis*
- *Geocaulon lividum*

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Dartmouth, NS B3A 4S5

PROJECT
Black Point Quarry Project

TITLE
Rare Vascular Plants and Lichens

DWN BY: DS	PROJECTION: UTM Zone 20	DATE: September 2014
CHK'D BY: SB	DATUM: NAD83	PROJECT NO: TV144003
REV. NO.: N/A	SCALE: N.T.S.	FIGURE No. 2-1

C 1340-1050

Photo 2-9. *Listera australis* in *Sphagnum* moss along stream

Photo 2-10. *Listera australis* habitat

Photo 2-11. *Geocaulon lividum* in open bog

Photo 2-12. *Geocaulon lividum* habitat

No plant species at risk listed by *SARA*/COSEWIC or in the *Nova Scotia Endangered Species Act* (*NSESA*) were identified in the field during the two vegetation surveys (June 2010 and August/September 2010).

2.2 LICHENS

2.2.1 Approach and Methodology

Field survey for lichens focused on cyanolichens. These lichens contain a blue-green algae (cyanobacterium) instead of (or in addition to) a green alga, as the photosynthetic component. Cyanolichens are very sensitive to air quality (Richardson, 1988), and are the only group of lichens which have been given status rankings by the Nova Scotia Department of Natural Resources (NSDNR General Status Ranks of Wild Species, 2010). Field surveys for cyanolichens were conducted by traversing through and around the proposed Project Site, visiting all habitat types. An AMEC lichenologist examined all potential substrates, such as tree trunks, branches, soil, and rock and recorded all cyanolichen species observed. Particular attention was paid to potential suitable habitat for cyanolichen species of concern, such as shaded, humid locations and mature red maples (*Acer rubrum*) growing in and around wetlands.

Mature balsam fir (*Abies balsamea*) trees on north-facing slopes were also examined, as such trees may support the boreal felt lichen (*Erioderma pedicellatum*). This species is an epiphytic cyanolichen listed as endangered under both the *SARA* and the *NSESA*. It is red-listed by NSDNR. The boreal felt lichen predictive habitat mapping maintained by Nova Scotia

Environment (Robert Cameron, NSE, pers. comm. April, 2010) was consulted to determine if there was any potential boreal felt lichen habitat on the site which would warrant further investigation. The mapping indicated there are no areas of potential habitat for this species on the site.

Examples of additional lichen (non-cyanolichen) species detected during field surveys for other taxa in 2010 were also recorded.

2.2.2 Baseline Inventory

A total of 9 species of cyanolichen were detected during the field survey. Table 2.1 lists the cyanolichen species observed on the Project Site during field surveys in 2010.

Table 2.1 Cyanolichen Species Identified on the Proposed Black Point Project Site in 2010

Binomial	Common Name	ACCDC Subnational Rank	NSDNR General Status
Lobaria pulmonaria	--	S4S5	Green
Lobaria quercizans	--	*S4S5*	Green
Lobaria scrobiculata	--	S4S5	Green
Peltigera canina	Dog Lichen	S4S5	Green
Peltigera leucophlebia	Dog's Tooth Lichen	S4S5	Yellow
Pseudocyphellaria perpetua	---	S4S5	Green
Collema sp.	--	--	--
Leptogium sp.	--	--	--
Nephroma sp.	--	--	--

Several additional non-cyanolichen species were observed during the cyanolichen and other taxa surveys in 2010, these are listed in Table 2.2 None of these species have been assigned status ranks by NSDNR.

Table 2.2. Other Lichen Species Identified on the Proposed Black Point Project Site in 2010.

Binomial	Common Name	ACCDC Subnational Rank
Cladonia arbuscula	Bering Reindeer Lichen	S4S5
Cladonia multiformis	--	S4S5
Cladonia rangiferina	Reindeer Lichen	S4S5
Cladonia maxima	Reindeer Lichen	S4S5
Cladonia sp.	---	--
Arctoparmelia centrifuga	Concentric-ring Lichen	S4S5
Parmelia squarrosa	--	S4S5
Ramalina thrausta	--	S2S3
Platismatia glauca	--	S4S5
Xanthoria parietina	Maritime sunburst lichen	S4S5
Usnea spp. *	Old Man's Beard Lichen	-

*Note that *Usnea* species are notoriously difficult to identify to species, often requiring the use of thin-layer chromatography.

2.2.3 Species of Conservation Concern

A single cyanolichen species of concern was detected on the Site during the surveys in 2010. A specimen of *Peltigera leucophlebia* was detected at the location depicted on Figure 2-1. This

species was yellow-listed by NSDNR, indicating it is vulnerable to natural or anthropogenic events. ACCDC ranks this species as S4S5. According to the updated General Status ranks (2010), this species is now ranked as 4 and is no longer considered rare.

No boreal felt lichen was detected on the Site, nor was any habitat deemed to be particularly suitable.

A second uncommon lichen (though not a cyanolichen), *Ramalina thrausta*, was found on the Site. The approximate location is depicted on Figure 2-1. ACCDC ranks this species as S2S3.

2.2.4 Species of Conservation Concern (2014)

Due to changes in species ranks and legislative requirements, an additional round of rare lichen surveys was carried out in August 2014. During these field surveys three additional lichen species of conservation concern were recorded on the Site. *Ramalina thrausta (*Angelhair Ramalina Lichen), detected in 2010, is still considered a species of conservation concern, with General Status rank 3. Table 2.3 provides a summary of the additional lichen species of conservation concern recorded in the Black Point Study Area. It should be noted that in weltands with suitable habitat, *Cladonia stygia* occurred frequently enough that only examples of *C. stygia* patches were marked with GPS locations.

Table 2.3. Lichen SOCC Identified on the Proposed Black Point Project Site in 2014.

Binomial	Common Name	ACCDC Rank	General Status Rank*	Location	Habitat
Cladonia stygia	Black-footed Reindeer Lichen	S2S3	3	WL 9, WL11, WL18, WL19, WL20	Open Bog
Nephroma bellum	Naked Kidney Lichen	S3?	3	WL10, WL17	Forested Wetland
Usnea flammea	Coastal Bushy Beard Lichen	S2S3	3	WL8, WL12, WL17	

*General Status Ranks accurate as of 22 September, 2014

3.0 FAUNA

3.1 BIRDS

3.1.1 Approach and Methodology

Bird surveys were carried out at those times of the year when birds make the most intensive use of the area. Survey times were chosen based on known breeding and migration periods, and all habitats used by the targeted birds were surveyed at appropriate times of the year to maximize the quality and quantity of data obtained. Surveys were conducted at the time of day with the highest likelihood of detecting the target species (e.g., early morning for breeding passerines, and during the appropriate parts of the tidal cycle for shorebirds), and in favourable conditions to maximize detection probability (low winds, no precipitation).
Survey dates and primary targets were as follows:

April 14th, 2010: year-round residents and early breeders, including owls;

May 18th and 19th, 2010: main passerine migration and early breeders;

June 22nd and 23rd, 2010: main passerine breeding;

August 25th, 2010: early shorebird migration; and

September 23rd, 2010: late shorebird migration.

Bird species, abundance and geographical location were recorded during each of the site visits. The location of each survey point was recorded using a handheld GPS unit. The early breeding bird survey in April included a night-time survey for owls which used the playback method employed by the Atlantic Canada Nocturnal Owl Survey (BSC, 2011). At each survey location, a series of owl calls interspersed with listening periods was played, for a total listening time of 15 minutes. Locations are depicted on Figure 3-1. For the day-time surveys in April, formal point counts were not conducted (as most birds were not yet present and/or vocalizing); instead, a list of observed species was recorded as the surveyors traversed the Project Site.

For the May and June surveys, ten-minute Maritimes Breeding Bird Atlas (MBBA)-style point counts were conducted at 29 fixed locations within the Project Site including each of the available habitat types on the Site. Points were selected in a systematic manner, with point counts spaced approximately 300 m apart in an effort to cover the entire project footprint; after the habitat classification had been completed, point count locations were plotted on a habitat figure (Figure 3-1) to ensure that all habitat types were represented in the surveys.

Surveys began at approximately 0600 hrs, and although efforts were made to complete the point counts by 1000 hrs, i.e., within four hours of dawn, because of time constraints the surveys often continued until late morning or very early afternoon in order to obtain data from each of the point count locations. It is very important to note that the point counts conducted after 1000 hrs are likely to miss many species that are present in the area but that do not tend to sing beyond the early morning hours; for that reason, the data from the late morning/early afternoon point counts are presented separately in the summary tables and are considered qualified. The point count surveys employed silent listening only; no playback was used. During each point count, species were identified visually or by their characteristic songs and call

notes, and the observer recorded numbers of each species observed as well as breeding evidence using Bird Studies Canada and Maritimes Breeding Bird Atlas criteria. Surveys were conducted only during suitable weather conditions, with no precipitation or winds that would interfere with listening conditions.

In addition to the point counts, Fogherty Lake was viewed from the bank (near PC-03 and PC-04) to look for shorebirds and waterfowl, and the waters off the coast were scanned for the presence of marine-associated bird species (seabirds, waterfowl and shorebirds). Any incidental observations of birds or other fauna made while traversing the site between point count locations were noted.

Shorebird data were collected in August and September according to the Atlantic Canada Shorebird Survey protocol (CWS, 2003). Surveyors walked back and forth along suitable areas of coastline within the Project Site (Figure 3-1) several times throughout the tidal cycle, recording numbers and species of shorebirds seen on each pass. In addition, a list of observed species was recorded as the surveyors traversed the Project Site, and the waters off the coast were scanned for the presence of seabirds and waterfowl.

LEGEND

2010 Bird Survey Locations

- Early Morning Point Count
- Late Morning/Mid Afternoon Point Count
- Owl Survey
- Shorebird Survey Area
- 400m Buffer (2010 Bird Survey Locations)

Terrestrial Habitats

- Wetland
- Coniferous Forest
- Open Coniferous Forest
- Open Mixed Forest
- Regenerating Coniferous Forest
- Regenerating Forest
- Bog
- Coastal Barren
- Open Barren
- Shrub Barren
- Sand Gravel Beach
- Powerline Transmission Corridor

DRAFT

0 125 250 500 Meters

SCALE: 1:10,000
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

MORIEN RESOURCES CORP.

BLACK POINT QUARRY
ENVIRONMENTAL ASSESSMENT

2010 BIRD SURVEY LOCATIONS

September 23, 2014	Rev 1.0	Figure No. 3.1
Project No. 210.05913.00000		

SLR Consulting (Canada) Ltd.

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3.1.2 Baseline Inventory

Owls and Early Migrants

During the nocturnal survey on April 14, 2010, three owl survey locations were established (Figure 3-1). At Survey Location PC03, near the southwest corner of the Site, two owls were heard: Northern Saw-whet Owl (*Aegolius acadicus*) and Barred Owl (*Strix varia*). No owls were heard at the other two owl survey locations.

A total of nineteen species were encountered during the day-time bird surveys in April. Table 3.1 lists these species, along with their NSDNR status and ACCDC ranks, respectively.

Table 3.1. Bird Species Identified During Daytime Surveys on Black Point Project Site, April 2010.

Common Name	Binomial	NSDNR Status	ACCDC rank
American Black Duck	*Anas rubripes*	Green	S5
American Crow	*Corvus brachyrhynchos*	Green	S5
Bald Eagle	*Haliaeetus leucocephalus*	Green	S4
Black-capped Chickadee	*Poecile atricapilla*	Green	S5
Boreal Chickadee	*Poecile hudsonica*	Yellow	S3
Brown Creeper	*Certhia americana*	Green	S5
Common Loon	*Gavia immer*	Yellow	S3B,S4N
Common Raven	*Corvus corax*	Green	S5
Dark-eyed Junco	*Junco hyemalis*	Green	S4S5
Golden-crowned Kinglet	*Regulus satrapa*	Green	S4
Great Black-backed Gull	*Larus marinus*	Green	S4
Hairy Woodpecker	*Picoides villosus*	Green	S5
Herring Gull	*Larus argentatus*	Green	S4S5
Merlin	*Falco columbarius*	Green	S5B
Northern Flicker	*Colaptes auratus*	Green	S5B
Pileated Woodpecker	*Dryocopus pileatus*	Green	S5
Red-breasted Merganser	*Mergus serrator*	Green	S3B,S5N
Ruffed Grouse	*Bonasa umbellus*	Green	S4S5
Song Sparrow	*Melospiza melodia*	Green	S5B

May and June Point Count Surveys

Twenty-nine point counts were conducted during the May and June surveys using the methodology described in Section 3.1.1; of those, 22 were surveyed in the early morning (between dawn and 1000 hrs), while seven were conducted after 1000 hrs. The locations of the point count surveys are depicted on Figure 3-1, and the habitat type(s) within an approximately 100m radius of each point count are described in Table 3.2. Tables B.1-1 and B.1-2 (Appendix B) summarize the observations at each point count location. The seven point counts conducted after 1000 hrs, in both May and June, had a lower number of species detected per point count than did the early morning point counts, with a notable drop in numbers of many early morning singers (e.g. most sparrow and warbler species), and an overrepresentation of species that are frequently observed and/or vocal throughout the day (e.g. Black-capped and Boreal

Chickadees, Ruby-crowned Kinglet, Blue-headed Vireo, Winter Wren). It is of note that **all habitat types were surveyed with at least one point count before 10:00 am** (Table 3-2).

Table 3.2. Habitat Types of Point Count Locations on Black Point Project Site, May and June 2010.

Habitat Type(s)	Point Count ID(s)[1]
Coniferous Forest	5,7,13,14,19,20,21,23,26
Barrens	9,11,12
Wetland (bog, fen, treed swamp)	3,29
Regenerating Forest	1,24
Mixed (Barrens and Wetland)	18,2
Mixed (Coniferous Forest and Barrens)	8,10,15,16,17,22,25,27,28
Mixed (Coniferous Forest and Regenerating Forest)	6

Note: Point counts 12, 13, 14, 26, 27, 28 and 29 were surveyed after 1000 hrs

May Migrant and Early Breeding Bird Survey

Point counts were conducted over two days (May 18 and 19) by AMEC ornithologists. A total of 407 birds, representing forty-one species were observed or heard during the May migration and early breeding surveys (Table B.1-1 in Appendix B). An average of 15.1 ± 4.0 (standard deviation) individual birds were recorded per point count, excluding the counts conducted after 1000 hrs; in the late morning/early afternoon point counts, 10.7 ± 3.9 individuals were recorded. Bird species of concern are discussed in Section 3.1.2.

June Breeding Birds

On June 22 and 23 2010, point count surveys were conducted by AMEC ornithologists at the same twenty-nine locations as in May (Figure 3-1). A total of 240 birds, representing forty-six species, were detected during the June breeding bird surveys (Table B.1-2 in Appendix B). An average of 13.4 ± 3.9 individual birds were recorded per point count, excluding the counts conducted after 1000 hrs; in the late morning/early afternoon point counts, 10.3 ± 4.9 individuals were recorded. Bird species of concern are discussed in Section 3.1.2.

Shorebirds

During the August 25 and September 23 surveys, five shorebird species were observed in small numbers feeding on the shores of the study area (Table 3.3).

Table 3.3. Shorebird Species Observed on Shoreline of Black Point Project Site in 2010.

Species	Binomial	NSDNR Status	ACCDC Rank	Number Observed	
				Aug. 25	Sept. 23
Greater Yellowlegs	*Tringa melanoleuca*	Green	S3B,S5M	3	0
Semipalmated Sandpiper	*Calidris pusilla*	Green	S3M	4	0
Spotted Sandpiper	*Actitis macularius*	Green	S3S4B	4	0
Least Sandpiper	*Calidris minutilla*	Green	S1B,S5M	9	0
Semipalmated Plover	*Charadrius semipalmatus*	Green	S1S2B,S5M	10	4

Four seabird species, Northern Gannet (*Morus bassanus*), Herring Gull (*Larus argentatus*), Great Black-backed Gull (*L. marinus*) and Double-crested Cormorant (*Phalacrocorax auritus*) were observed feeding, flying, and/or resting on the water during the surveys. In addition, 20 landbird species were also observed on the Project Site during the fall surveys (Table 3.4).

Table 3.4. Additional Bird Species Identified During Fall Shorebird Surveys on Black Point Project Site in 2010.

Common Name	Binomial	NSDNR Status	ACCDC Rank
American Crow	*Corvus brachyrhynchos*	Green	S5
American Kestrel	*Falco sparverius*	Green	S5B
Bald Eagle	*Haliaeetus leucocephalus*	Green	S4
Belted Kingfisher	*Megaceryle alcyon*	Green	S5B
Black-capped Chickadee	*Poecile atricapilla*	Green	S5
Blue Jay	*Cyanocitta cristata*	Green	S5
Boreal Chickadee	*Poecile hudsonica*	Yellow	S3
Cedar Waxwing	*Bombycilla cedrorum*	Green	S5B
Common Raven	*Corvus corax*	Green	S5
Common Yellowthroat	*Geothlypis trichas*	Green	S5B
Dark-eyed Junco	*Junco hyemalis*	Green	S4S5
Golden-crowned Kinglet	*Regulus satrapa*	Green	S4
Hairy Woodpecker	*Picoides villosus*	Green	S5
Northern Flicker	*Colaptes auratus*	Green	S5B
Northern Harrier	*Circus cyaneus*	Green	S5B
Red-breasted Nuthatch	*Sitta canadensis*	Green	S4S5
Red-eyed Vireo	*Vireo olivaceus*	Green	S5B
Red-tailed Hawk	*Buteo jamaicensis*	Green	S5
Sharp-shinned Hawk	*Accipiter striatus*	Green	S4S5B
White-throated Sparrow	*Zonotrichia albicollis*	Green	S5B

3.1.3 Incidental Observations

Three additional species were observed on the Project Site or just offshore by AMEC staff in 2010, outside of the targeted bird surveys. These are listed in Table 3.5.

Table 3.5 Incidental Bird Observations on the Black Point Site, 2010.

Common Name	Binomial	NSDNR Status	ACCDC Rank
Common Eider	*Somateria mollisima*	Green	S4
Ruby–throated Hummingbird	*Archilochus colubris*	Green	S5B
Spruce Grouse	*Falcipennis canadensis*	Green	S5

A complete list of all bird species observed on the Black Point site or just offshore during the 2010 field season is provided in Table B.1-3 in Appendix B.

3.1.4 Bird Species of Conservation Concern

Bird Species at Risk are those listed under federal or provincial endangered species legislation, such as *SARA* or the *NSESA*. No bird species listed as rare or endangered under *SARA* or the *NSESA* were observed on the proposed Black Point Project Site.

Species of concern are those listed as Yellow (sensitive) or Red (at-risk) by NSDNR, or as S3 or lower (S2, S1) by ACCDC. Ten species of concern were documented on the Black Point Site by AMEC staff in 2010.

Four species listed by NSDNR as Yellow or sensitive to anthropogenic or natural events were found on the site (Table 3.6). Another six were listed as S3 or lower for some part of the population or life history (*i.e.* migration or breeding).

Table 3.6. Bird Species of Concern Identified on the Black Point Project Site in Fall 2010.

Common Name	Binomial	NSDNR Status	ACCDC Rank
Boreal Chickadee	*Poecile hudsonica*	Yellow	S3
Common Loon	*Gavia immer*	Yellow	S3B,S4N
Gray Jay	*Perisoreus canadensis*	Yellow	S3S4
Rusty Blackbird	*Euphagus carolinus*	Yellow	S2S3B
Greater Yellowlegs	*Tringa melanoleuca*	Green	S3B,S5M
Red-breasted Merganser	*Mergus serrator*	Green	S3B,S5N
Semipalmated Sandpiper	*Calidris pusilla*	Green	S3M
Spotted Sandpiper	*Actitis macularius*	Green	S3S4B
Least Sandpiper	*Calidris minutilla*	Green	S1B,S5M
Semipalmated Plover	*Charadrius semipalmatus*	Green	S1S2B,S5M

3.2 MAMMALS

3.2.1 Approach and Methodology

Mammal surveys were conducted simultaneously with surveys for other taxonomic groups and wetlands on the site throughout the 2010 (for specific dates, refer to Sections 2.1, 3.1, 4.1, 5.1, and 6.1). Any evidence of mammal species such as sightings, tracks, vocalizations, tufts of hair, scat, and skeletal remains was recorded.

3.2.2 Baseline Inventory

A list of terrestrial mammals determined to be utilizing habitats on the proposed Black Point project site is provided in Table 3.7.

Table 3.7. Mammal Species Identified on the Black Point Project Site in 2010.

Common Name	Binomial	NSDNR Status	ACCDC Rank	Evidence
Red Squirrel	*Tamiasciurus hudsonicus*	Green	S5	Sighting, vocalizations
Eastern Chipmunk	*Tamias striatus*	Green	S5	vocalizations

American Beaver	*Castor canadensis*	Green	S5	Dams, lodges
North American Porcupine	*Erethizon dorsatum*	Green	S5	Sighting
Eastern Coyote	*Canis latrans*	Green	S5	Scat, tracks
Black Bear	*Ursus americanus*	Green	S5	Sighting, scat
Short-tailed Weasel	*Mustela erminea*	Green	S5	Sighting
Varying Hare	*Lepus americanus*	Green	S5	Scat
White-tailed Deer	*Odocoileus virginianus*	Green	S5	Tracks, scat

Other mammals such as Bobcat (*Lynx rufus*), Raccoon (*Procycon lotor*), and Red Fox (*Vulpes vulpes*) may also be present. Small mammal species such as shrews, voles, and mice are assumed to be present.

Two species of marine mammals were observed off the site during field surveys in 2010, these were northern minke whale (*Balaenoptera acutorostrata*) and gray seal (*Halichoerus grypus*). Many other species of marine mammals are expected to occur in the vicinity of the study area.

3.3 HERPETILES

3.3.1 Approach and Methodology

During terrestrial and freshwater field surveys conducted on the Project site in 2010 (for specific dates, refer to Sections 2.1, 3.1, 4.1, 5.1, and 6.1), reptile and amphibian observations were recorded during surveys for other taxonomic groups. Any evidence of herpetile species, including sightings, vocalizations, cast skins (snakes), skeletal remains, egg masses or presence of larvae, was recorded. Ponds and watercourses and their banks were scanned using binoculars during the day to detect presence of turtles, either in the water or basking, night-time field work included listening for vocalizations of frogs and toads, and coarse woody debris such as fallen logs and branches was overturned to look for salamanders and newts.

3.3.2 Baseline Inventory

A list of herpetile species determined to be utilizing habitats on the proposed Black Point project site is provided in Table 3.8

Table 3.8 Herpetile Species Identified on the Black Point Project Site in 2010.

Common Name	Binomial	NSDNR Status	ACCDC Rank	Evidence
Yellow Spotted Salamander	*Ambystoma maculatum*	Green	S5	Sighting of larvae
American Toad	*Bufo americanus americanus*	Green	S5	Sighting of adults, vocalizations
Spring Peeper	*Pseudacaris crucifer crucifer*	Green	S5	Sighting of adults, vocalizations
Green Frog	*Rana clamitans melanota*	Green	S5	Sighting of adults, vocalizations
Maritime Garter Snake	*Thamnophis sirtalis*	Green	S5	Sighting
Northern Leopard Frog	*Rana pipiens*	Green	S5	Sighting
Bullfrog	*Rana catesbieana*	Green	S5	Sighting of adults and larvae

3.4 ODONATES

Odonate (dragonflies and damselflies) were surveyed on the site in June and July 2010 by local odonate expert Paul Brunelle, assisted by AMEC staff. Additional specimens were collected during August and September 2010 by AMEC staff, and added to Brunelle's report. The complete odonate report, including details on the approach and methodology, is provided in Appendix B.2.

3.4.1 Odonate Species of Conservation Concern

A single odonate species of concern was observed during the 2010 field surveys.

The spot-winged glider (*Pantala hymenaea*) is a large dragonfly species which is migratory in northeastern North America (Brunelle, 2010). It is listed as Yellow by NSDNR Meaning it is sensitive to anthropogenic or natural impacts. Globally, the spot-winged glider is listed as G5, and sub-nationally as S5B. A specimen was observed near shallow bog pools in Wetland 12 (Figure 1 in Appendix B.2), engaging in mating behaviour. However, it is not known if such bog pools are suitable for larval development of the fast-growing larvae of this genus (Paul Brunelle, pers. comm 2010.) See the Odonate report in Appendix B.2 for further details.

4.0 WETLANDS

4.1 APPROACH AND METHODOLOGY

Prior to conducting on-site wetland surveys, AMEC conducted a desktop study to identify potential wetland locations within the Project Site, using available information such as the Nova Scotia Wetland Database (NSDNR 2000), Nova Scotia Wet Areas Mapping (NSDNR 2009), and topographic mapping (NRCAN 1998). Field surveys consisted of visiting all areas identified during the desktop study as known wetland locations as well as areas having the potential to contain wetlands. Areas identified as "dry" during the desktop study were also verified in the field to ensure there were no wetlands located in these areas.

Wetland field surveys were conducted between August 31 and September 8, 2010 in conjunction with the August/September 2010 vascular plant surveys by AMEC senior botanist Marion Sensen and AMEC wetland biologist Scott Burley. The investigated sites were field-referenced using Global Positioning System (GPS) and recent aerial photography.

4.1.1 Wetland Determination/Identification

AMEC staff utilized standard wetland criteria to identify wetlands. To be determined a wetland, a site must meet the following three criteria:

- A majority of dominant vegetation species are wetland associated species;
- Hydrologic conditions exist that result in periods of flooding, ponding, or saturation during the growing season; and
- Hydric soils are present.

These criteria are briefly discussed in the following paragraphs.

Vegetation

Hydrophytic vegetation is defined as the sum total of macrophytic plant life that occurs in areas where the frequency and duration of inundation or soil saturation produce permanent or periodically saturated soils of sufficient duration to exert a controlling influence on the plant species present (Environmental Laboratory, 1987). The definition of wetlands includes the phrase "sustains aquatic processes as indicated by the presence of hydric soils, hydrophytic vegetation and biological activities adapted to wet conditions." Hydrophytic vegetation should be the dominant plant type and is characterized by the dominant plant species comprising the plant community (Environmental Laboratory, 1987). Accordingly, AMEC assessed dominance of hydrophytic vegetation in each wetland on the Project Site.

Soils

A hydric soil is defined as a soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (USDA-NRCS, 2007). Indicators that a hydric soil is present include soil color (gleyed soils and soils with bright mottles and/or low matrix chroma), aquic or preaquic moisture regime, reducing soil conditions, sulfidic material (odour), soils listed on the hydric soils list, iron and manganese

concretions, organic soils (histosols), histic epipedon, high organic content in surface layer in sandy soils, and organic streaking in sandy soils.

To determine soil characteristics in some wetlands, the AMEC team excavated a soil pit to a minimum depth of 30 cm or refusal within each wetland. The soil was then examined for hydric soil indicators. The matrix color and mottle color (if present) of the soil was determined using the Munsell Soil Color Chart.

Hydrology

Wetlands, by definition, either periodically or permanently have a water table at, near or above the land's surface or are saturated with water. To be classified as a wetland, a site should have at least one primary indicator or two secondary indicators of wetland hydrology. Primary indicators of wetland hydrology may include, but are not limited to: water marks, drift lines, sediment deposition, drainage patterns, visual observation of saturated soils, and visual observation of inundation. In addition to the primary indicators, there is a variety of secondary wetland hydrology indicators. Secondary indicators include, but are not limited to: oxidized root channels in the upper 12 inches, water-stained leaves, and local soil survey data. When no primary indicators of wetland hydrology are observed at a data point, two or more secondary indicators are required to confirm wetland hydrology. In accordance with this definition, the AMEC team recorded primary and/or secondary indicators within each wetland.

Although complete wetland delineations were beyond the scope of the current survey, in preparation of anticipated future wetland delineations, wetland determination sheets were completed for a portion (seven) of the 20 wetlands surveyed within the Project Area. Determination sheets for the remaining wetlands were planned to be completed during the wetland delineation component of the project. Completed wetland determination sheets for the seven wetlands are provided in Appendix C.1.

4.1.2 Biophysical Habitat Assessment

AMEC selected the methodology of the Canadian Wetland Classification System to identify wetland classes, forms and types (National Wetland Working Group, 1997). Wetland vegetation is the primary biological indicator of major ecological processes, their vitality, and its ability to support wildlife. Wetland vegetative abundance and diversity depend upon a range of factors including soil types and topography, but are most closely linked to the nature of the hydrologic regime (Glooschenko and Grondin, 1988). Plants most clearly illustrate the biological capability of the wetland. The nature and dynamics of the vegetative community ultimately define wetland habitat type and subsequent functional values of the site.

The field assessments were conducted during the August 2010 survey by a crew of two people, both with experience in wetland ecology, habitat identification, and functional assessment. Biophysical field investigations were conducted according to methods best defined in Dickinson (1994). Standardized wetland field data sheets were used to document the wetland information collected in the field, which includes information on vegetation assemblages, inundation, wildlife and disturbance.

4.1.3 Detailed Habitat Sketches

Detailed habitat sketches were prepared in the field for each wetland to document the wetland components (i.e., inflow, outflow, standing water, vegetation communities, *etc.*) (Appendix C.2).

4.2 BASELINE INVENTORY

A total of 20 wetlands were surveyed within the Project Site (Table 4.1). This includes the six wetlands previously identified in the NSDNR Wetland Database as well as 14 additional field identified wetlands (Figure 4-1). Table 4.1 provides a summary of wetland types along with corresponding UTM coordinates and approximate areas for each wetland encountered within the Project Site. Wetland sizes reported are only estimates based on preliminary field observations and air photo interpretation, as complete wetland delineations were not conducted. A representative photo of each wetland is provided in Appendix C.3.

Table 4.1 Wetland Types and Locations Identified on the Black Point Project Site in 2010.

Wetland #	Wetland Type	Easting	Northing	Approximate Size (ha)
WL 1	Riparian Treed Swamp	645767	5022425	0.21
WL 2	Emergent Marsh/Shrub Fen Complex	645476	5024110	*5.79
WL 3	Riparian Fen	645108	5024068	0.56
WL 4	Basin Bog	645101	5024214	0.09
WL 5	Sloped Riparian Fen	644447	5024113	0.98
WL 6	Basin Bog	644894	5024026	0.72
WL 7	Riparian Swamp	644829	5024353	0.04
WL 8	Riparian Treed Swamp	643949	5022628	1.23
WL 9	Domed Bog/Treed Swamp/Fen Complex	644093	5023099	*7.21
WL 10	Domed Bog	643742	5023320	5.36
WL 11	Treed Swamp	643859	5023682	0.12
WL 12	Domed Bog	644530	5023367	10.13
WL 13	Bog/Swamp Complex	644855	5023650	0.51
WL 14	Treed Swamp	644869	5023348	0.53
WL 15	Treed Bog/Treed Swamp/Fen Complex	645450	5023137	*7.60
WL 16	Riparian Fen	645276	5023531	0.13
WL 17	Domed Bog/Treed Swamp/Shrub Fen Complex	645496	5022619	*7.33
WL 18	Domed Bog	645563	5022824	2.28
WL 19	Basin Bog	645935	5022579	0.56
WL 20	Treed Swamp	645934	5022435	0.09

* Actual wetland area is larger than what is reported in the NSDNR Wetlands Database and covers a larger area than what is depicted in Figure 4-1 .

Vascular plant species recorded for each wetland are presented in Appendix C.4. The wetland assessment data sheets are provided in Appendix C.1 Photographs of each wetland are provided in Appendix C.4.

LEGEND:

- Site Boundary
- NSDNR Wetlands
  Nova Scotia Wetlands and Coastal Habitats Inventory (2000)
- Field Identified Wetlands

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CLIENT
Erdene Resource Development Corp.
Metropolitan Place
99 Wyse Road, Suite 1480
Dartmouth, NS B3A 4S5

PROJECT
Black Point Quarry Project

TITLE
Wetland Locations

DWN BY:	PROJECTION:	DATE:
DS	UTM Zone 20	February 2011
CHK'D BY:	DATUM:	PROJECT NO:
SB	NAD83	TV01017
REV. NO.:	SCALE:	FIGURE No.
N/A	N.T.S.	4-1

C 1340-1069

5.0 FRESHWATER HABITAT

5.1 APPROACH AND METHODOLOGY

Habitat assessment and fish community surveys were conducted on Fogherty Lake and three unnamed watercourses which were identified by field personnel with experience in fish habitat assessment methods. These freshwater habitats were identified using topographic mapping and aerial photography. Field work was conducted during two site visits, on August 24th to 26th and September 20th to 22nd, 2010. Locations of surveys are depicted on Figure 5-1.

Habitat Assessment

Physical dimensions and field-measured water quality parameters (pH, conductivity, water temperature and dissolved oxygen) of the lake and watercourses were noted. For each distinct habitat segment of the three watercourses, channel type, bank composition and stability, substrate composition and embeddedness, in-stream cover and overhanging vegetation was recorded. Locations were recorded using a hand-held Garmin GPS unit, and photographs were taken at representative sections of each water body. For the three watercourses, physical habitat characteristics along the surveyed sections of each watercourse were recorded on standard DNR&E/DFO New Brunswick Stream Survey and Habitat Assessment forms.

Water samples from each water body were collected in laboratory-supplied bottles and placed in a cooler with ice for shipping to AGAT Laboratories in Dartmouth, NS for analysis of general chemistry, total metals (including mercury), total suspended solids, and low-level phosphorous.

Fish Community Surveys

Fish sampling was conducted in Fogherty Lake and the three unnamed watercourses under a scientific permit (License # 323774) in accordance with the conditions outlined in Section 52 of the Fishery (General) Regulations (SOR/93-53) under the *Fisheries Act* (Government of Canada, 1985).

Five-minute spot checks were conducted on the watercourses with a backpack electrofishing unit, to determine presence or absence of fish species. Two multi-panel gillnets, with mesh sizes ranging from 2.5 cm to 10 cm, were deployed on Fogherty Lake for two hours on August 27, 2010. In addition, four minnow traps were baited with dry cat food and placed in shallow water near the shore of the lake for a total of four hours.

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PROJECT
Black Point Quarry Project

TITLE
Gillnetting and Electrofishing Locations

DWN BY:	PROJECTION:	DATE:
DS	UTM Zone 20	February 2011
CHK'D BY:	DATUM:	PROJECT NO:
SB	NAD83	TV01017
REV. NO.:	SCALE:	FIGURE No.
N/A	N.T.S.	5-1

C 1340-1071

5.2 BASELINE INVENTORY

Habitat Assessment

A brief description of each of the water bodies assessed is provided below. The completed watercourse habitat assessment forms and Site photographs are provided in Appendices D.1 and D.2, respectively. Water quality data, including analytical results and field-measured parameters, are presented in Table D.3-1 in Appendix D.3. Surface water on the Project Site tended to be very acidic (pH<4).

Fogherty Lake

Fogherty Lake is a shallow lake surrounded by trees, barrens and exposed rock. The water is clear but darkly tea-coloured, and visibility is nil at approximately one metre depth. The lake substrate is exposed bedrock and large boulders. There is some woody organic debris on the lake bed, which has a strong sulfurous smell. Vegetation surrounding the lake includes leatherleaf (*Chaemodaphne calyculata)*, sheep laurel (*Kalmia angustifolia*), possum-haw viburnum (*Viburnum nudum)*, rhodora (*Rhododendron canadense*), chokeberry (*Photina* sp.) Labrador tea (*Ledum groenlandicum*), bunchberry (*Cornus canadensis*), black spruce (*Picea mariana*) and tamarack *(Larix laricina*). Yellow water lily (*Nuphar lutea*) was observed growing in the lake. Water in this lake was found to be very acidic (pH in field=2.94) and dark tea-coloured (Table D.3-1 in Appendix D.3).

Unnamed Watercourses

Unnamed Watercourse 1 is the outflow of Fogherty Lake to the north. A beaver dam is located near the upstream end of the watercourse. Upstream of the dam, the channel is deep and wide and the substrate largely fines; downstream, the channel is a relatively narrow and shallow run with one area of natural deadwater. The northernmost 150m of this watercourse was not surveyed, as it flows down a steep dropoff; however, the dimensions and substrate of the downstream reaches appeared to be similar to the run portions of the channel.

Unnamed Watercourse 2 originates in a steep valley at the north of the Project Site, and flows in a northwesterly direction. There was a great deal of deadfall in the channel valley. The upstream reaches were dry at the time of the survey, and further downstream the stream was very shallow; this watercourse is probably ephemeral. The last 220 m of this watercourse was inaccessible, as it flows down a steep slope to the ocean, as does Unnamed Watercourse 1. However, the dimensions and substrate of the downstream reaches appeared to be similar to the rest of the channel.

Unnamed Watercourse 3 originates in the southeast portion of the Project Site, flows through softwood forest and fen habitat, and ultimately discharges into Hendsbee Lake, south of the Project Site. The downstream portion of the assessed section is a large pool resulting from a beaver dam on the watercourse just south of the Site property line.

Fish Community Surveys

No fish were seen in Fogherty Lake, although a few insect species were found in and around the minnow traps, namely dragonflies, damselfies, mayflies, whirligig beetles, caddisfly larvae, and giant water bugs.

Five minute electrofishing spot-checks were conducted on Unnamed Watercourses 1 and 3, Unnamed Watercourse 2 was too shallow to fish. No fish were observed in either watercourse during the electrofishing and habitat assessments. Other AMEC field personnel reported seeing a small unidentified fish approximately 2 cm in length in Unnamed Watercourse 3. Based on habitat limitations, it is unlikely that this was a juvenile salmonid; the pH values measured at the Site range from 2.9 to 3.5, and fish passage to the ocean is impossible due to the steep terrain at the north of the Site.

A fourth ephemeral watercourse was identified on the Project Site near the western property boundary. This watercourse appears to drain Wetlands 8 and 9 when water levels are high. It was not surveyed, as it was well away from the proposed Project footprint. A spot check showed the water pH to be 2.65, too acidic to support fish.

In summary, neither Fogherty Lake nor any of the unnamed watercourses represent fish habitat due to acidic conditions.

6.0 MARINE HABITAT

Three types of marine surveys were conducted on the proposed marine footprint of the Project. This includes a benthic habitat survey, a marine invertebrate community survey, and a marine sediment survey.

6.1 UNDERWATER BENTHIC HABITAT SURVEY

6.1.1 Approach and Methodology

Between August 31 and September 3, 2010, video survey techniques were used to map substrate types and document macrofaunal and macrofloral species presence and abundance in the footprint of the proposed marine infrastructure. AMEC contracted Connors Diving Services to perform the diving and video surveillance activities. An AMEC representative was on-site to guide the dive crew in the event that any issues arose.

A total of 1,200 metres (m) of video surveillance divided into six transects (T1, T2, T3, T4, T5, and T6) was conducted in and around the marine portion of the Project Site, as depicted in Figure 6-1. T1, T2, and T3 each measured 250m and were oriented parallel to the shoreline while T4, T5, and T6 each measured 150m in length and extended perpendicular from the shoreline. The transect locations were visually referenced in the field and coordinates were derived using a handheld Global Positioning System (GPS) to mark the start and end points of the transects. These coordinates are also provided in Figure 6-1.

The underwater surveillance of the transects required the use of an underwater video camera, operated by a Canadian Standards Association (CSA)-certified diver using SCUBA. As much as was practical, the underwater video surveillance encompassed a span of approximately 1m on either side of the transect line. Seabed characterization involved field observations made by the field crew and a review of the video surveillance tape. Observations along the video transect were made for every 5m segment.

6.1.2 Baseline Inventory

The results of the transect surveys for the proposed Project Site are presented in Appendix E.1 (Tables E1-1 to E.1-6). The following information is provided for each 5m increment of transect line:

- Visual estimate of substrate grain size distribution (in order of dominance);
- Identification and abundance of macrofaunal species; and
- Identification and percent coverage of macrofloral species.

A summary of the information provided in Tables E.1-1 to E.1-6 (Appendix E.1) is described in the following paragraphs. A species list has been included in Table E.1-7 in Appendix E.1.

For the purposes of the video survey review and species assessment, four categories were developed to characterize the observed abundances. The categories are as follows:

A = Abundant
Numerous (not quantifiable) observations made throughout the entire 5m segment.

C = Common
Numerous (not quantifiable) observations made intermittently along the 5m segment.

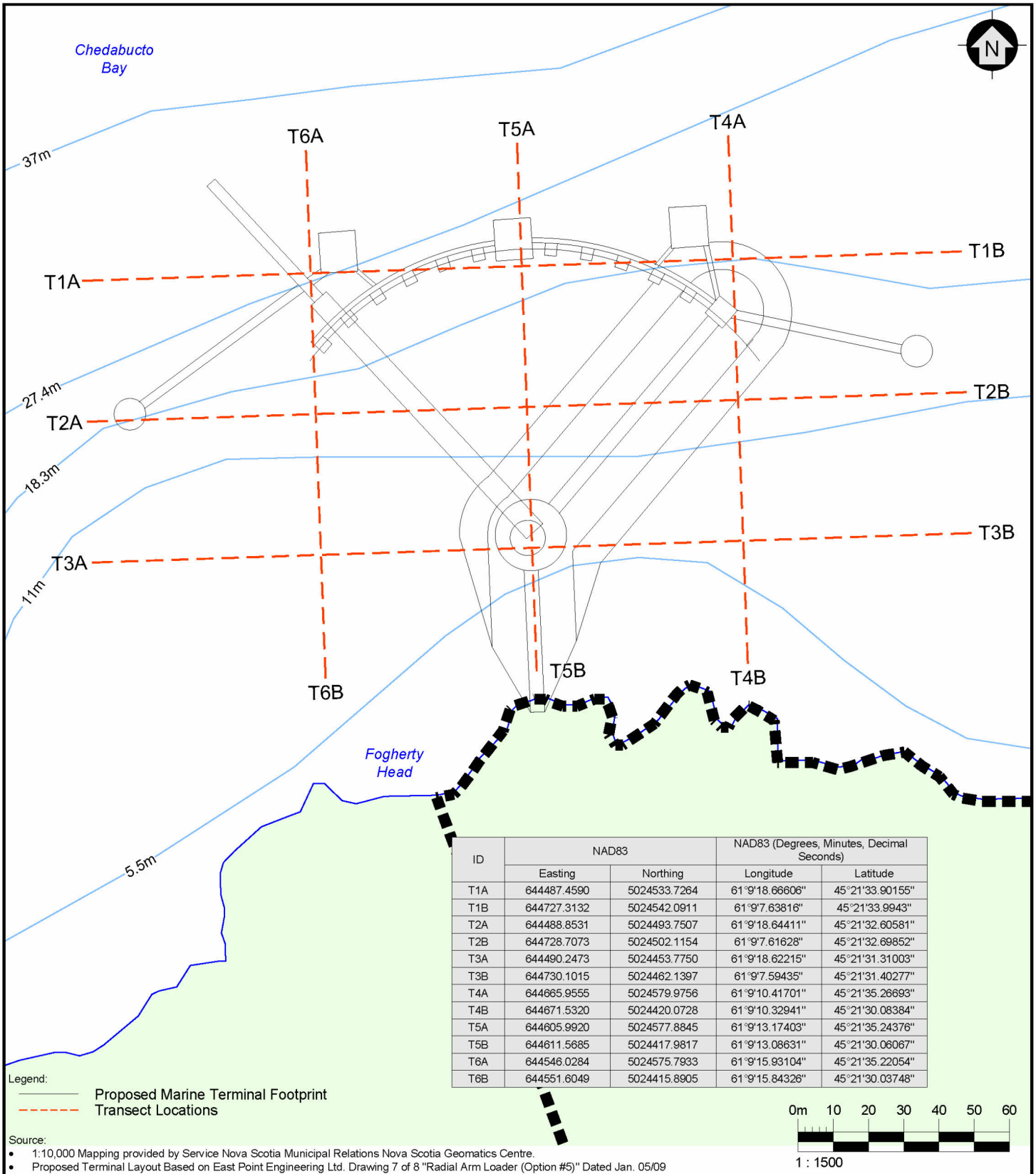
O = Occasional
Quantifiable observations made intermittently along the 5m segment.

U = Uncommon
Quantifiable observations made infrequently along the 5m segment.

The marine substrate within the characterized area consisted primarily of cobble, rock, and large boulders. Lesser amounts of sand and silt were observed throughout the transects. The high degree hard bottom supports a high diversity of both floral and faunal species.

Algal cover is sparse (0-10%) in deeper waters but increases markedly (50-90%) as the transects approached the near shore areas. The algal canopy is dominated by the brown algal species black whip weed (*Chordaria flagelliformis*), bladderwrack (*Fucus* sp.), and sea colander (*Agarum clathratum*). Other species present in lesser amounts included sugar kelp (*Laminaria saccharina*), tube weed (*Polysiphonia lanosa*), an encrusting red alga (*Leptophyllum* sp.), Irish moss (*Chondrus crispus*), a brown alga (*Pilayella littoralis*), a green alga (*Acrosiphonia arcta*), and a red alga (*Plumaria plumosa*). Of note, green fleece (*Codium fragile*), an invasive species in Nova Scotia (Invasive Species Alliance of Nova Scotia, 2011), was noted along T2. This species has been previously reported from around the Canso area (Watanabe *et al*. 2010).

The hard bottom and algal cover provides habitat for many species. The most common species noted included deep sea scallop (*Placopecten magellanicus*), blue mussel (*Mytilus edulis*), green sea urchin (*Strongylocentrotus droebachiensis*), and American lobster (*Homarus americanus*). Fish species noted along the transects were cunner (*Tautogolabrus adspersus*) and shorthorn sculpin (*Myoxocephalus scorpius*). Other invertebrate species observed along the transects included American oyster (*Crassostrea virginica*), northern rock barnacle (*Semibalanus balanoides*), Bowerbank's halichonidria (*Halichondria bowerbanki*), frilled anemone (*Metridium senile*), periwinkle (*Littorina* sp.), sea cucumber (*Cucumaria frondosa*), sea peach (*Holacynthia pyriformis*), sea star (*Asterias* sp.), and waved whelk (*Buccinum undatum*). Due to the depths of the surveyed areas divers had to move at speed greater than optimal for characterization. The combination of the speed of the diver's movement and a cobble bottom resulted in difficulty discerning the presence of small invertebrates such as periwinkles.



ID	NAD83		NAD83 (Degrees, Minutes, Decimal Seconds)	
	Easting	Northing	Longitude	Latitude
T1A	644487.4590	5024533.7264	61°9'18.66606"	45°21'33.90155"
T1B	644727.3132	5024542.0911	61°9'7.63816"	45°21'33.9943"
T2A	644488.8531	5024493.7507	61°9'18.64411"	45°21'32.60581"
T2B	644728.7073	5024502.1154	61°9'7.61628"	45°21'32.69852"
T3A	644490.2473	5024453.7750	61°9'18.62215"	45°21'31.31003"
T3B	644730.1015	5024462.1397	61°9'7.59435"	45°21'31.40277"
T4A	644665.9555	5024579.9756	61°9'10.41701"	45°21'35.26693"
T4B	644671.5320	5024420.0728	61°9'10.32941"	45°21'30.08384"
T5A	644605.9920	5024577.8845	61°9'13.17403"	45°21'35.24376"
T5B	644611.5685	5024417.9817	61°9'13.08631"	45°21'30.06067"
T6A	644546.0284	5024575.7933	61°9'15.93104"	45°21'35.22054"
T6B	644551.6049	5024415.8905	61°9'15.84326"	45°21'30.03748"

Legend:
- Proposed Marine Terminal Footprint
- Transect Locations

0m 10 20 30 40 50 60

1 : 1500

Source:
- 1:10,000 Mapping provided by Service Nova Scotia Municipal Relations Nova Scotia Geomatics Centre.
- Proposed Terminal Layout Based on East Point Engineering Ltd. Drawing 7 of 8 "Radial Arm Loader (Option #5)" Dated Jan. 05/09

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PROJECT	DWN BY:	DATUM:	DATE:
Black Point Quarry Project	DS	NAD83	February 2011
	CHK'D BY: CK	REV. NO.: N/A	PROJECT NO: TV01017
TITLE: Benthic Habitat Video Survey Transect Locations	PROJECTION: UTM Zone 20	SCALE: 1:1500	FIGURE No. 6-1

C 1340-1076

6.2 MARINE INVERTEBRATE COMMUNITY SURVEY

6.2.1 Approach and Methodology

Prior to field surveys, a grid was plotted over a map of the footprint of the proposed marine infrastructure, containing at least five times as many squares as the number of required sampling stations. A random number generator software program was then used to derive the sampling locations (squares) within the footprint, which are depicted on Figure 6-2.

Six benthic invertebrate samples were collected at the Project Site on September 1, 2010. Connors Diving Services was contracted by AMEC to perform the sample collection.

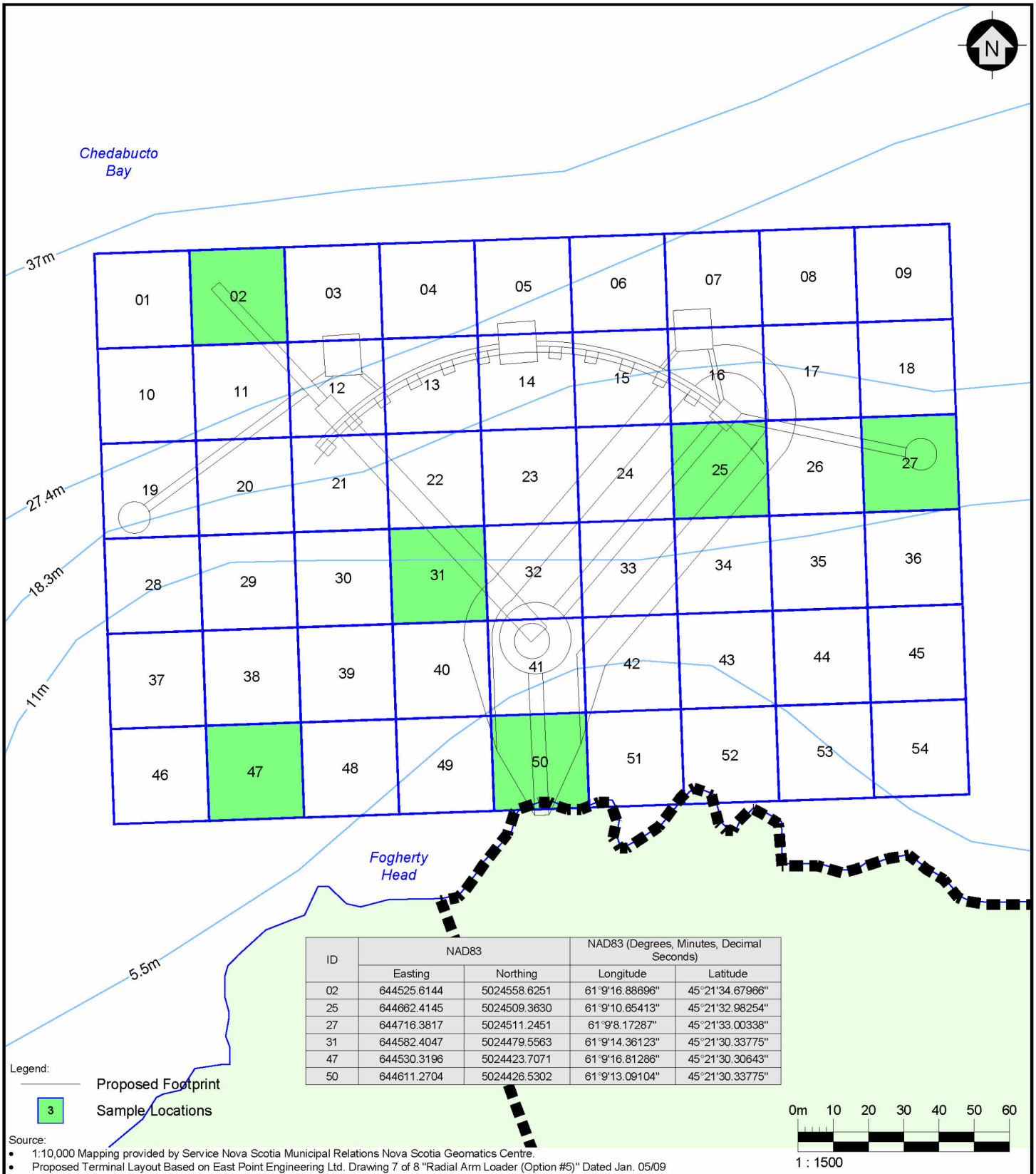
Once on station, the diver placed a 0.25 m^2 quadrat on the substrate surface and used a small container to penetrate the substrate, as much as was practical, to a depth greater than 5 cm. Several litres of sediment were collected at each of the benthic invertebrate sampling locations. This sediment was placed in a clean 20 L bucket and brought to the support vessel at the surface, where it was thoroughly mixed and 4 L were measured out for the benthic invertebrate sample.

Each sample was sieved through a 1.0 millimetre screen using filtered seawater to remove the risk of osmotic shock to any organisms present. The samples were preserved with 70% isopropanol in one or more 1 L glass Mason jars. Each jar was inverted several times to ensure proper mixing of the contents.

Samples were then shipped to BioTech Inc. (Smithtown, NB), for benthic invertebrate identification and enumeration.

Benthic invertebrate statistical indices compiled for this program consisted of the following:

- Benthic invertebrate identification and enumeration for each station;
- Number of species and number of individuals per species for each station;
- Number of species per station by major taxonomic group; and
- Density (number of organisms/m^2) and biomass (g/m^2 wet weight) for each station.



ID	NAD83		NAD83 (Degrees, Minutes, Decimal Seconds)	
	Easting	Northing	Longitude	Latitude
02	644525.6144	5024558.6251	61°9'16.88696"	45°21'34.67966"
25	644662.4145	5024509.3630	61°9'10.65413"	45°21'32.98254"
27	644716.3817	5024511.2451	61°9'8.17287"	45°21'33.00338"
31	644582.4047	5024479.5563	61°9'14.36123"	45°21'30.33775"
47	644530.3196	5024423.7071	61°9'16.81286"	45°21'30.30643"
50	644611.2704	5024426.5302	61°9'13.09104"	45°21'30.33775"

Source:
- 1:10,000 Mapping provided by Service Nova Scotia Municipal Relations Nova Scotia Geomatics Centre.
- Proposed Terminal Layout Based on East Point Engineering Ltd. Drawing 7 of 8 "Radial Arm Loader (Option #5)" Dated Jan. 05/09

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PROJECT	DWN BY:	DATUM:	DATE:
Black Point Quarry Project	DS	NAD83	February 2011
	CHK'D BY: MCM	REV. NO.: N/A	PROJECT NO: TV01017
TITLE	PROJECTION:	SCALE:	FIGURE No.
Benthic Invertebrate Sampling Locations	UTM Zone 20	1:1500	6-2

C 1340-1078

6.2.2 Baseline Inventory

The total number of organisms collected at each sample station (density) ranged from 109 organisms (436 organisms/m^2) at Station 4 to 318 organisms (1,272 organisms/m^2) at Station 2. The number of major taxonomic groups represented ranged from 17 at Station 4 to 47 at Station 1. Biomass calculations ranged from 3.24 g/m^2 at Station 4 to 79.28 g/m^2 at Station 5.

Three phyla and twelve classes were identified within the collected samples. The most prevalent taxa were the annelid worms (Polychaetes) and molluscs (Gastropods). The most common polychaetes indentified include the worm *Aricidea (*syn.*Acmira) catherinae*, sinistral spiral tubeworm *(Spirobis borealis)* and cirratulids (*Tharyx* spp.). The most prevalent bivalve species included the common tortoiseshell limpet (*Tectura testudinalis*) and interrupted turbonille *(Turbonilla interrupta)*.

A complete list of the species identified is included in Table E.2 1. of Appendix E.2. It should be noted that some bottles were broken during transport. Sample GQ 02 and GQ 47 had two of the three bottles damaged and GQ 27 had one of five bottles broken. Approximately 80% of the spilled sample from each bottle was recovered.

6.3 MARINE SEDIMENT SAMPLING PROGRAM

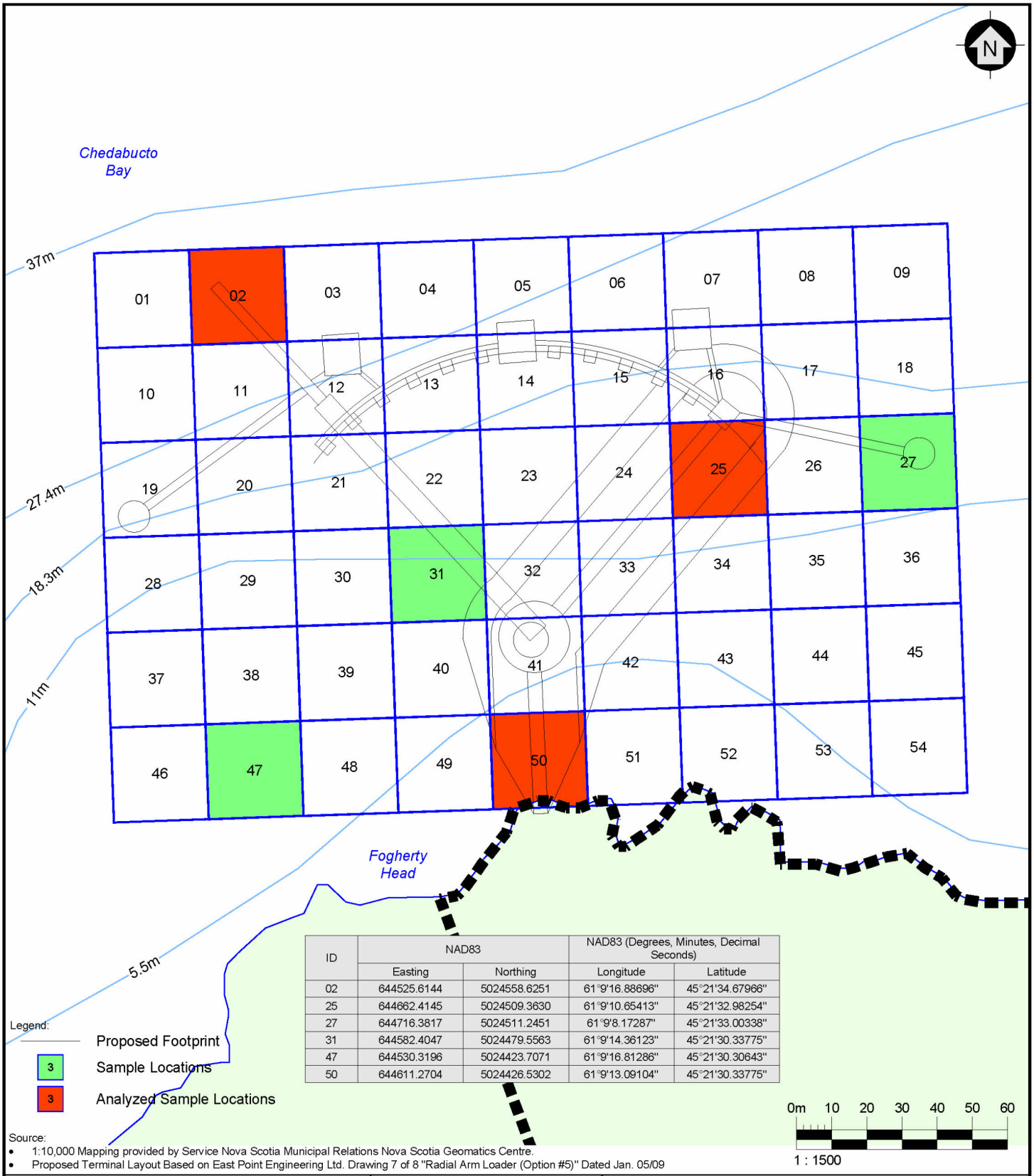
6.3.1 Approach and Methodology

The sample collection, preparation, and analyses were conducted in accordance with Environment Canada's publication *Guidance Document on Collection and Preparation of Sediments for Physicochemical Characterization and Biological Testing, December 1994.* Connors Diving Service was retained to collect the sediment samples.

A total of six marine sediment samples were collected on September 1, 2010 from within the footprint of the proposed marine infrastructure. A handheld Garmin Global Positioning System (GPS) was used to locate the sampling locations selected by AMEC prior to field program initiation. The coordinates of the sampling locations are listed on Figure 6-3 as UTM (Universal Transverse Mercator) and latitude and longitude (dd mm ss.sss) (Datum: NAD 83).

The sediment sample was obtained from the same well-mixed sample of substrate as the benthic invertebrate sample (outlined previously).

As per laboratory protocol, two 250 millilitre (ml) jars of sediment were collected per station. An additional 250 ml jar of sediment was collected at each of the sampling locations to safeguard against loss or damage during transport.



ID	NAD83		NAD83 (Degrees, Minutes, Decimal Seconds)	
	Easting	Northing	Longitude	Latitude
02	644525.6144	5024558.6251	61°9'16.88696"	45°21'34.67966"
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47	644530.3196	5024423.7071	61°9'16.81286"	45°21'30.30643"
50	644611.2704	5024426.5302	61°9'13.09104"	45°21'30.33775"

Source:
- 1:10,000 Mapping provided by Service Nova Scotia Municipal Relations Nova Scotia Geomatics Centre.
- Proposed Terminal Layout Based on East Point Engineering Ltd. Drawing 7 of 8 "Radial Arm Loader (Option #5)" Dated Jan. 05/09

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PROJECT: Black Point Quarry Project	DWN BY: DS	DATUM: NAD83	DATE: February 2011
	CHK'D BY: MCM	REV. NO.: N/A	PROJECT NO: TV01017
TITLE: Marine Sediment Sampling Locations	PROJECTION: UTM Zone 20	SCALE: 1:1500	FIGURE No. 6-3

C 1340-1080

Following sample collection, all samples were placed in a cooler on ice and delivered to Maxxam Analytics Inc. (Maxxam), in Bedford, NS for the required chemical analyses. Maxxam is accredited with the Standards Council of Canada (SCC).

Three of the six samples (GQ 02, GQ 25, and GQ 50; Figure 6-3) were analyzed for metals including mercury, hexavalent chromium, and low level selenium and tin; low level polycyclic aromatic hydrocarbons (PAHs); polychlorinated biphenyls (PCBs); low level benzene, toluene, ethylbenzene, and xylene (BTEX) including an assessment for presence/absence of creosote; total petroleum hydrocarbons (TPHs); total inorganic and total organic carbon (TIC/TOC); total dichloro-diphenyl-trichloroethane (DDT) (including 2,4'- and 4,4'-dichloro-diphenyldichloroethylene (DDE), 2,4'- and 4,4'-dichlorodiphenyldichloroethane (DDD), and 2,4'- and 4,4'-DDT); and grain size.

In order to facilitate the determination of all disposal options for sediment potentially removed during the construction of the proposed Project, the analytical sample results were compared to the following:

- *Canadian Environmental Protection Act* (CEPA) Disposal at Sea Regulations (formerly the *Ocean Dumping Control Act*);
- Canadian Council of Ministers of the Environment (CCME) Probable Effects Levels (PELs) for marine/estuarine sediment;
- CCME Soil Quality Guidelines (SQGs) for the Protection of Environment and Human Health in agricultural, residential/parkland, and commercial/industrial applications; and
- Atlantic Risk-Based Corrective Action (RBCA) Tier 1 Version 2.0 Risk-Based Screening Levels (RBSLs).

6.3.2 Baseline Inventory

The analytical results of the three marine sediment samples analyzed are summarized in Tables E.3-1 to E.3-4 (Appendix E.3). The complete set of analytical results, including laboratory Quality Assurance/Quality Control and Certificates of Analyses for all parameters tested, are provided in Appendix E.4.

There were no exceedances noted for any of the abovementioned guidelines.

Two samples (GQ 25 and GQ 50) were predominantly gravel (76-82%) with lesser amounts of sand (16-19%), silt (1-3%), and clay (<1-1%). Sample GQ 02 was a mix of gravel (51%) and sand (42%) with lesser amounts of silt (5%) and clay (3%) (Table E.3-5 in Appendix E.3). The three samples collected and analyzed had total carbon contents ranging from 0.6 to 1.62 grams per kilogram (g/kg) (Table E.3-5 in Appendix E.3).

7.0 REFERENCES

Bird Studies Canada (BSC), 2011. Atlantic Canada Nocturnal Owl Survey. www.bsc-eoc.org/volunteer/atowls/index.jsp?lang=EN

Canadian Wildlife Service (CWS) 2003 Atlantic Canada Shorebird Survey (ACSS) Protocol and Guidelines.

Dickinson, A. 1994. The Greater Moncton Wetlands Conservation Project, Phase 1- Wetlands Inventory and Evaluation.

Environmental Laboratory. 1987. Corps of Engineers Wetland Delineation Manual. Technical Report Y-87-1. U.S. Army Engineer Waterways Experiment Station. Vicksburg, Mississippi.

Glooschenko, V. and P. Grondin. 1988. Wetlands of Eastern Temperate Canada. In: Wetlands of Canada. National Wetlands working Group. Canada Committee on Ecological Land Classification. Environment Canada. Ecological Land Classification Series No. 24.

Government of Canada, (1985). Fishery (General) Regulations (SOR/93-53) http://laws.justice.gc.ca/en/F-14/SOR-93-53/index.html

Invasive Species Alliance of Nova Scotia. 2011. Aquatic Invasive Alien Species. Accessed at: http://www.invasivespeciesns.ca/aquatic-invasive-alien-species.html

National Wetlands Working Group, 1997. The Canadian Wetlands Classification System. Second Edition. Edited by B.G. Warner and C.D. A. Rubec. Wetlands Research Centre, University of Waterloo, Waterloo, Ontario.

NRCan (Natural Resources Canada) 1998. 1:50,000 topographic map, sheet #11F/06, Guysborough, NS.

NSDNR (Nova Scotia Department of Natural Resources), 2010. Forest Inventory. Available at: http://www.gov.ns.ca/natr/forestry/programs/inventory; accessed June 15, 2010.

NSDNR General Status Ranks of Wild Species, 2010. http://www.gov.ns.ca/natr/wildlife/genstatus/).

NSDNR, 2009. Wet Areas Mapping and Flow Accumulation Channels. http://www.gov.ns.ca/natr/forestry/gis/wamdownload.asp

NSDNR, 2000. Wetlands Database. NSDNR, Renewable Resources Branch.

Richardson, D. H. S. 1988. Understanding the pollution sensitivity of lichens. Botanical Journal of the Linnean Society 96:31-43.

U.S. Department of Agriculture, Natural Resources Conservation Service (USDA-NRCS). 2007. National Soil Survey Handbook, title 430-VI.[Online] Available: http://soils.usda.gov/technical/handbook/

Watanabe, S., R.E. Scheibling, and A. Metaxas (2010) Contrasting patterns of spread in interacting invasive species: *Membranipora membranacea* and *Codium fragile* off Nova Scotia. Biological Invasions 12:2329–2342

Personal Communications

Robert Cameron, Nova Scotia Environment, pers. comm. April 2010.

Appendix A.1

Vascular Plants

Table A-1-1. Vascular Plant Species Inventory on the Black Point Project Site, 2010 and 2014

Species	Common Name	General Status 2010 Rank*	NSDNR 2010	ACCDC 2010	2010 survey
Abies balsamea	Balsam Fir	4	Green	S5	x
Acer rubrum	Red Maple	4	Green	S5	x
Achillea millefolium	Yarrow	4	Green	S5	x
Agrostis scabra	Rough Bentgrass	4	Green	S5	x
Alnus incana	Speckled Alder	4	Green	S5	x
Alnus viridis ssp.crispa	Green Alder, Mountain Alder	4	Green	S5	
Amelanchier sp.	A Service Berry	NA	NA	NA	x
Ammophila brevitigulata	Beachgrass	4	Green	S5	x
Andromeda polifolia	Bog- Rosemary	4	Green	S5	x
Aralia hispida	Bristly Sarsaparilla	4	Green	S5	x
Aralia nudicaulis	Wild Sarsaparilla	4	Green	S5	x
Arctostaphylos uva-ursi	Bearberry	4	Green	S4	x
Arethusa bulbosa	Arethusa, Swamp- Pink	4	Green	S4	x
Argentina (Potentilla) anserina	Silverweed	4	Green	S5	x
Artemisia stelleriana	Dusty Miller	7	Exotic	SNA	x
Athyrium filix-femina	Northern Lady Fern	4	Green	S5	x
Atriplex glabriuscula	Northeastern Saltbush	4	Green	S4S5	x
Betula papyrifera var. cordifolia	Heart-leaved paper Birch	4	Green	S5	x
Cakile edentula	American Searocket	4	Green	S5	x
Calamagrostis canadensis	Blue Joint	4	Green	S5	x
Calystegia sepium	Hedge Bindweed	4	Green	S5	x
Carex aquatilis var. aquatilis	Leafy Tussock Sedge	4	Green	S5	x
Carex canescens	Hoary Sedge	4	Green	S5	x
Carex echinata	Little Prickley Sedge	4	Green	S5	x
Carex exilis	Coast Sedge	4	Green	S4	x
Carex folliculata	Long Sedge	4	Green	S5	x
Carex gynandra	Nodding Sedge	4	Green	S5	x
Carex intumescens	Bladder Sedge	4	Green	S5	x
Carex lenticularis	Shore Sedge	4	Green	S4	x
Carex magellanica var. irrigua	Stunted Sedge	4	Green	S5	x
Carex nigra	Smooth Black Sedge	4	4	S5	x
Carex paleacea	Chaffy Sedge	4	Green	S5	x
Carex pauciflora	Few-flowered Sedge	4	Green	S4S5	
Carex projecta	Necklace Sedge	4	Green	S4S5	x
Carex recta	Erect Sedge, Estuary Sedge	4	Green	S4?	
Carex retrorsa	Retrorse Sedge	4	Green	S4	x
Carex scoparia	Broom Sedge	4	Green	S5	x
Carex sp.	a Sedge	NA	NA	NA	x
Carex stipata	Stalk-grain sedge	4	Green	S5	x
Carex trisperma	Three-seeded Sedge	4	Green	S5	x
Cerastium sp.(none rare)	A chickweed	NA	NA	NA	x
Chamaedaphne calyculata	Leatherleaf	4	Green	S5	x
Chamerion (Epilobium) angustifolium	Fireweed	4	Green	S5	x
Clintonia borealis	Clintonia Lily	4	Green	S5	x
Coptis trifolia	Goldthread	4	Green	S5	x
Corema conradii	Broom Crowberry	4	Green	S4	x
Cornus canadensis	Bunchberry	4	Green	S5	x
Cypripedium acaule	Pink Lady's Slipper	4	Green	S5	x
Danthonia spicata	Poverty Oat-grass	4	Green	S5	x
Dennstaedtia punctilobula	Hay-Scented Fern	4	Green	S5	x
Deschampsia flexuosa	Wavy Hairgrass	4	Green	S5	x
Doellingeria (syn.Aster) umbellata	Tall White Aster	4	Green	S5	x
Drosera intermedia	Spoon-leaved Sundew	4	Green	S5	x
Drosera rotundifolia	Round-leaved Sundew	4	Green	S5	x
Dryopteris campyloptera	Mountain Woodfern	4	Green	S5	x
Dryopteris carthusiana	Spinulose Woodfern	4	Green	S5	x
Dryopteris cristata	Crested Shield-fern	4	Green	S5	x
Dryopteris sp.	a woodfern (seedling)	NA	NA	NA	x
Eleocharis sp.	Spike Rush	NA	NA	NA	x
Empetrum nigrum	Black Crowberry	4	Green	S5	x
Epigaea repens	Trailing Arbutis	4	Green	S5	x
Epilobium ciliatum	Hairy Willowherb	4	Green	S5	x
Epilobium palustre	Swamp willow-herb	4	Green	S5	
Equisetum arvense	Field Horsetail	4	Green	S5	x
Equisetum sylvaticum	Woodland Horsetail	4	Green	S5	x
Eriophorum tenellum	Rough Cotton-grass	4	Green	S4S5	x
Eriophorum vaginatum	Tussock cotton-grass	4	Green	S5	x
Eriophorum virginicum	Tawny Cotton-grass	4	Green	S5	x
Eurybia (syn. Aster) radula	Rough Wood-aster	4	Green	S5	x
Galium palustre	Marsh Bedstraw	4	Green	S5	x
Gaultheria hispidula	Snowberry	4	Green	S5	x
Gaultheria procumbens	Teaberry	4	Green	S5	x
Gaylussacia baccata	Black Huckleberry	4	Green	S5	x
Geocaulon lividum	Northern Comandra	3	Yellow	S3	
Glyceria canadensis	Rattlesnake Grass	4	Green	S5	x
Hieracium x floribundum	Yellow Hawkweed	Exotic	Exotic	SNA	x
Hypericum boreale	Northern St. John's Wort	4	Green	S5	
Hypericum canadense	Canadian St. John's Wort	4	Green	S5	x
Ilex verticillata	Black Holly	4	Green	S5	x
Iris hookeri (syn. I. setosa)	Hooker's Iris (Beach-head Iris)	4	Green	S4	x
Iris sp.	An Iris	7	NA	NA	x
Iris versicolor	Blueflag Iris	4	Green	S5	x
Juncus balticus (syn. J. arcticus)	Arctic rush (syn. baltic rush)	4	Green	S5	
Juncus brevicaudatus	Narrow-Panicled Rush	4	Green	S5	x
Juncus bufonius	Toad Rush	4	Green	S5	x
Juncus canadensis	Canada Rush	4	Green	S5	x
Juncus effusus	Soft Rush	4	Green	S5	x

Table A-1-1. Vascular Plant Species Inventory on the Black Point Project Site, 2010 and 2014

Species	Common Name	General Status 2010 Rank*	NSDNR 2010	ACCDC 2010	2010 survey
Juncus pelocarpus	Brown-Fruited Rush	4	Green	S5	X
Juniperus communis	Common Juniper	4	Green	S5	X
Juniperus horizontalis	Creeping Juniper	4	Green	S4	X
Kalmia angustifolia	Lambkill, Sheep-laurel	4	Green	S5	X
Kalmia polifolia	Bog Laurel, Pale Laurel	4	Green	S5	X
Larix laricina	Larch	4	Green	S5	X
Lathyrus japonicus (syn. L. maritimus)	Beach Pea	4	Green	S5	X
Ledum groenlandicum	Labrador-tea	4	Green	S5	X
Leontodon autumnalis	Fall Dandelion	7	Exotic	SNA	X
Leymus mollis	Wild Rye	4	Green	S5	X
Ligusticum scoticum	Scotch Lovage	4	Green	S5	X
Linnaea borealis	Twinflower	4	Green	S5	X
Listera australis	Southern Twayblade	2	Red	S2	X
Lonicera canadensis	American Fly Honeysuckle	4	Green	S5	X
Lycopodium annotinum	Stiff Clubmoss	4	Green	S5	X
Lycopodium obscurum	Tree Clubmoss	4	Green	S5	X
Lycopus americanus	Cut-leafed Water-horehound	4	Green	S5	
Lycopus uniflorus	Northern Bugleweed	4	Green	S5	X
Lysimachia terrestris	Swamp Loosestrife	4	Green	S5	X
Maianthemum (Smilacina) trifolia	Three-leaved False Solomon's Seal	4	Green	S5	X
Maianthemum canadense	Wild Lily-of-the-valley	4	Green	S5	X
Mertensia maritima	Sea Bluebells	4	Green	S5	X
Mitchella repens	Partridge Berry	4	Green	S5	X
Moehringia lateriflora	Grove Sandwort	4	Green	S5	X
Moneses uniflora	One-flowered Shinleaf	4	Green	S5	X
Monotropa uniflora	Indian-pipe	4	Green	S5	X
Myrica gale	Sweet Gale	4	Green	S5	X
Myrica pensylvanica	Bayberry	4	Green	S5	X
Nemopanthus mucronatus	False Mountain Holly	4	Green	S5	X
Nuphar sp.	Yellow pond-lily	NA	NA	NA	
Nymphaea sp.	Water Lily	NA	NA	NA	X
Oclemena (syn. Aster) acuminata	Whorled Wood Aster	4	Green	S5	X
Oclemena (syn.) Aster X blakei	Hybrid White Panicled American-Aste	NA	Green	SNR	X
Oclenema (Aster) nemoralis	Bog Aster	4	Green	S5	X
Osmunda cinnamomea	Cinnamon Fern	4	Green	S5	X
Osmunda claytoniana	Interrupted Fern	4	Green	S5	X
Oxalis montana	Wood-sorrel	4	Green	S5	X
Persicaria (Polygonum) sagittata	Arrow-leafed Tearthumb	4	Green	S5	X
Phegopteris connectilis	Northern Beech Fern	4	Green	S5	X
Photinia melanocarpa	Black Chokeberry	4	Green	S5	X
Picea glauca	White Spruce	4	Green	S5	X
Picea mariana	Black Spruce	4	Green	S5	X
Plantago maritima	Seashore-plantain	4	Green	S5	X
Platanthera blephariglottis	White Fringed orchid	4	Green	S4	
Platanthera clavellata	Club-spur Orchid	4	Green	S5	
Platanthera sp.	Rein orchid, Fringed Orchid	NA	NA	NA	
Platanthera sp. (aquilonis or dilatata)	Northern Bog Orchid	4	4	S4S5	X
Poa sp	Grass	NA	NA	NA	X
Potentilla simplex	Cinquefoil	4	Green	S5	X
Prenanthes trifoliolata	Lion's Paw	4	Green	S5	X
Prunus pensylvanica	Fire Cherry / Pin Cherry	4	Green	S5	X
Pteridium aquilinum	Bracken	4	Green	S5	X
Ranunculus acris	Tall Buttercup	7	Exotic	SNA	X
Rhodiola rosea (Sedum roseum)	Roseroot Stonecrop	4	Green	S4	X
Rhododendron canadense	Rhodora	4	Green	S5	X
Rhynchospora alba	White Beak-rush	4	Green	S5	X
Rosa nitida	Swamp Rose	4	Green	S4	X
Rosa rugosa	Rugose Rose	7	Exotic	SNA	X
Rosa sp.	A Rose	NA	NA	NA	
Rosa virginiana	Virginia Rose	4	Green	S5	X
Rubus allegheniensis	Common Blackberry	4	Green	S5	X
Rubus chamaemorus	Cloudberry, Bakeapple	4	Green	S4	X
Rubus hispidus	Bristly Dewberry	4	Green	S5	X
Rubus idaeus	Red Raspberry	4	Green	S5	X
Rubus pubescens	Dwarf Raspberry	4	Green	S5	X
Rubus sp.	a bramble	NA	NA	NA	X
Rumex acetosella	Sheep Sorrel	7	Exotic	SNA	X
Sagina procumbens or nodosa	Pearlwort	4	Green	S5	X
Salix sp	Willow	NA	NA	NA	X
Sarracenia purpurea	Pitcher-plant	4	Green	S5	X
Schoenoplectus subterminalis	Water- Bulrush	4	Green	S5	
Scirpus atrocinctus	Black-girdle Bullrush	4	Green	S5	X
Scirpus cyperinus	Cottongrass Bullrush	4	Green	S5	X
Sibbaldiopsis tridentata	Three- toothed- cinquefoil	4	Green	S5	X
Sisyrinchium montanum	Strict Blue-eyed-grass	4	Green	S5	X
Solidago macrophylla	Large-leaf Goldenrod	4	Green	S4	X
Solidago rugosa	Rough Goldenrod	4	Green	S5	X
Solidago sempervirens	Seaside Goldenrod	4	Green	S5	X
Solidago sp.	A Goldenrod	NA	NA	NA	
Solidago uliginosa	Bog Goldenrod	4	Green	S5	X
Sorbus americana	Mountain-ash	4	Green	S5	X
Sparganium sp.	Bur-reed	NA	NA	NA	X
Spiraea alba	Meadowsweet	4	Green	S5	X
Symphiotrichum (Aster) novi-belgii	New york Aster/ New Belgium Aster	4	Green	S5	X
Symphiotrichum (Aster) puniceum	Rough Aster	4	Green	S5	X
Thalictrum pubescens	Tall Meadow- Rue	4	Green	S5	X
Thelypteris noveboracensis	New York fern	4	Green	S5	

Table A-1-1. Vascular Plant Species Inventory on the Black Point Project Site, 2010 and 2014

Species	Common Name	General Status 2010 Rank*	NSDNR 2010	ACCDC 2010	2010 survey
Thelypteris palustris	Marsh Fern	4		S5	X
Triadenum fraseri	Marsh St. John's Wort	4	Green	S5	
Trichophorum (Scirpus) caespitosum	Tufted Leafless-Bullrush	4	Green	S5	X
Trientalis borealis	Starflower	4	Green	S5	X
Typha latifolia	Broadleaf cattail	4	Green	S5	X
Utricularia cornuta	Horned Bladderwort	4	Green	S5	X
Utricularia intermedia	Flatleaf Bladderwort	4	Green	S5	X
Utricularia minor	Lesser Bladderwort	4	Green	S4	X
Vaccinium angustifolium	Lowbush Blueberry	4	Green	S5	X
Vaccinium macrocarpon	Large Cranberry	4	Green	S5	X
Vaccinium myrtilloides	Velvetleaf Blueberry	4	Green	S5	X
Vaccinium oxycoccos	Small Cranberry	4	Green	S5	X
Vaccinium vitis-idaea	Mountain Cranberry	4	Green	S5	X
Viburnum nudum	Wild Raisin	4	Green	S5	X
Viola sp	Violet ---not a species at risk	NA	NA	NA	X

** General Status Ranks accurate as of September 22, 2014*

Appendix B. Fauna

Appendix B.1: Results of Migrant and Breeding Bird Surveys

Appendix B.2: Odonata Report

Appendix B.1

Results of Migrant and Breeding Bird Surveys

Table B.1-1. Results of Migrant & Early Breeding Bird Survey on Black Point Site in May 2010.

Common Name	Binomial	NSDNR Status	Early Morning Point Count Station																					Late Point Count Station						
			1	2	3	4	5	6	7	8	9	10	11	15	16	17	18	19	20	21	22	23	24	25	12	13	14	26	27	28	29
American Crow	*Corvus brachyrhynchos*	Green		2			3	1															1								
American Goldfinch	*Carduelis tristis*	Green					1				1	1	1							2			1								
American Redstart	*Setophaga ruticilla*	Green																						2							
American Robin	*Turdus migratorius*	Green													1																
Bald Eagle	*Haliaeetus leucocephalus*	Green																		1											
Bay-breasted Warbler	*Dendroica castanea*	Green					1																								
Black-and-white Warbler	*Mniotilta varia*	Green	1	1	1		1		1		1	1						2	2	1			1	2		1	1				
Black-backed Woodpecker	*Picoides arcticus*	Green	1																												
Black-capped Chickadee	*Poecile atricapilla*	Green	1					1							1			1					1				2				
Blackpoll Warbler	*Dendroica striata*	Green	1	1	1	1				1	1																				
Black-throated Green Warbler	*Dendroica virens*	Green					1													2	2			2				3			
Blue Jay	*Cyanocitta cristata*	Green					1	1	1												1										
Blue-headed Vireo	*Vireo solitarius*	Green				1									1					1	1	1	2			2					1
Boreal Chickadee	*Poecile hudsonica*	Yellow	1			4			2			1				2	1			1	3		1			1	1	1			
Brown Creeper	*Certhia americana*	Green																		1											
Common Loon	*Gavia immer*	Yellow							1																						
Common Raven	*Corvus corax*	Green																						1					1		
Common Yellowthroat	*Geothlypis trichas*	Green		3	1	2	2	2	3	1	1		2		2		3	2	3		1		1	1	2	1			1	1	2
Dark-eyed Junco	*Junco hyemalis*	Green	1	3	2	3	1	1	2	1	2	1		1		1	1		1		1					1		1	2	1	1	1
Downy Woodpecker	*Picoides pubescens*	Green																													1
Fox Sparrow	*Passerella iliaca*	Green	1																												
Golden-crowned Kinglet	*Regulus satrapa*	Green						1	1				1					1		1	1	2	1	1		1	1	2	1		
Grey Jay	*Perisoreus canadensis*	Yellow							1				1			1					1										
Hermit Thrush	*Catharus guttatus*	Green		1	1	1	1			1		2	1	1	1	1	2				1	1	1			1	1				
Herring Gull	*Larus argentatus*	Green																						1							
Lincoln's Sparrow	*Melospiza lincolnii*	Green			1																										
Magnolia Warbler	*Dendroica magnolia*	Green	1												1				1		1	1	1							1	
Merlin	*Falco columbarius*	Green																					1								
Nashville Warbler	*Vermivora ruficapilla*	Green												1											1	1					
Northern Flicker	*Colaptes auratus*	Green													2	1								1							
Northern Parula	*Parula americana*	Green																		1				2				1			
Palm Warbler	*Dendroica palmarum*	Green		3	3	1		1			2	2	2	1	1	1	2	2	2							2	1				1
Red-breasted Nuthatch	*Sitta canadensis*	Green													2												1				
Red-winged Blackbird	*Agelaius phoeniceus*	Green																						1							
Ruby-crowned Kinglet	*Regulus calendula*	Green	2	1	3	1	2	2	1	1	3	2	1		1	3	3	1	1	1	1	2		2			1	1	1	1	2
Rusty Blackbird	*Euphagus carolinus*	Yellow								1																					
Song Sparrow	*Melospiza melodia*	Green																									1	1			
Swainson's Thrush	*Catharus ustulatus*	Green																								1					
White-throated Sparrow	*Zonotrichia albicollis*	Green	2	1	3	2	3		1	1	1	2	1	1	4	2	3	1	2	1		1	2	2	2	1	2		1	2	
Winter Wren	*Troglodytes troglodytes*	Green	1												1				1		1		1	1			1				2
Yellow-rumped Warbler	*Dendroica coronata*	Green	1	2	1	4	4	2	2	1	3	2		2	2	4	3	2	2	2	2	1	3	1	2	2	3	1		2	

Table B.1-2. Results of Breeding Bird Survey on Black Point Site in June 2010.

Common Name	Binomial	NSDNR Status	Early Morning Point Count Station																					Late Point Count Station						
			1	2	3	4	5	6	7	8	9	10	11	15	16	17	18	19	20	21	22	23	24	25	12	13	14	26	27	28	29
Alder Flycatcher	*Empidonax alnorum*	Green	1	1	2						1	1	2		1																
American Crow	*Corvus brachyrhynchos*	Green			1	1	1	1												2	6	1	1		1					1	
American Goldfinch	*Carduelis tristis*	Green																1				1		1							
American Redstart	*Setophaga ruticilla*	Green			1												1				1			1							
American Robin	*Turdus migratorius*	Green	1		1																	1									
Bald Eagle	*Haliaeetus leucocephalus*	Green																		1											
Bay-breasted Warbler	*Dendroica castanea*	Green																					1								
Black-and-white Warbler	*Mniotilta varia*	Green	1	1	2	1	1	1	1		1	1		1			1	1	1	1	2		1	1			1	1			
Black-backed Woodpecker	*Picoides arcticus*	Green	1																												
Black-capped Chickadee	*Poecile atricapilla*	Green																					1				1				
Blackpoll Warbler	*Dendroica striata*	Green	1																												
Black-throated Green Warbler	*Dendroica virens*	Green	1				1	1												2	2		1	1				1			
Blue-headed Vireo	*Vireo solitarius*	Green							1											2			1	1		1		1			
Boreal Chickadee	*Poecile hudsonica*	Yellow								1		1			2	1	1									1	1	1			
Chipping Sparrow	*Spizella passerina*	Green																					1								
Common Raven	*Corvus corax*	Green					1																								
Common Yellowthroat	*Geothlypis trichas*	Green	2	3	3	3	1	1	1		2		1	1	3	2		2	1	2	1	1	1		3		2				2
Dark-eyed Junco	*Junco hyemalis*	Green	1	1	1	1		1	1		1	1	1	3		2	1	1	1	1				1	1	2	1	1	1	1	1
Golden-crowned Kinglet	*Regulus satrapa*	Green		1						1		1			1					1	1	1				2				
Grey Jay	*Perisoreus canadensis*	Yellow			2				1																			1			
Hairy Woodpecker	*Picoides villosus*	Green								2														1							
Hermit Thrush	*Catharus guttatus*	Green								1	1	2	1	1	1		2	3	4	1	1	1	2	1	1		1	2	1		2
Herring Gull	*Larus argentatus*	Green			1		1																								
Lincoln's Sparrow	*Melospiza lincolnii*	Green												1																	1
Magnolia Warbler	*Dendroica magnolia*	Green	1	1	1		1			2	2		1			1	1		1				1	1		1		1	1	1	
Mourning Warbler	*Oporornis philadelphia*	Green								1											1										
Nashville Warbler	*Vermivora ruficapilla*	Green					1				1	1											1				1			1	
Northern Flicker	*Colaptes auratus*	Green																1													
Northern Parula	*Parula americana*	Green																		1											
Palm Warbler	*Dendroica palmarum*	Green	1	2	2	2			1		2					1	1	2	1	1		1					2	1	1		2
Ruby-crowned Kinglet	*Regulus calendula*	Green	3	1	2	2	1	1	1				1		2									1			1	1		1	1
Song Sparrow	*Melospiza melodia*	Green			1																										
Swainson's Thrush	*Catharus ustulatus*	Green	1					1															1								
Swamp Sparrow	*Melospiza georgiana*	Green											1																		
White-throated Sparrow	*Zonotrichia albicollis*	Green	2	3	2	2	1	1	2	1	1	1	2	1	1	3	3	4	2	1	2		1	4	3	1	2			2	1
White-winged Crossbill	*Loxia leucoptera*	Undetermined				1															1						2				
Winter Wren	*Troglodytes troglodytes*	Green	1						1		1			1					1	1	2	1	1	1				1			2
Yellow Warbler	*Dendroica petechia*	Green																					1								
Yellow-bellied Flycatcher	*Empidonax flaviventris*	Green												1	1		1	1									1				
Yellow-rumped Warbler	*Dendroica coronata*	Green	1			1	1				1	1		1	1		1	1	1					1		1	1		1		

Table B.1-3. List of all Bird Species Identified on or Offshore of the Black Point Site in 2010.

Common Name	Binomial	NSDNR Status	ACCDC SRANK
Alder Flycatcher	*Empidonax alnorum*	Green	S5B
American Black Duck	*Anas rubripes*	Green	S5
American Crow	*Corvus brachyrhynchos*	Green	S5
American Goldfinch	*Carduelis tristis*	Green	S5
American Kestrel	*Falco sparverius*	Green	S5B
American Redstart	*Setophaga ruticilla*	Green	S5B
American Robin	*Turdus migratorius*	Green	S5B
Bald Eagle	*Haliaeetus leucocephalus*	Green	S4
Bay-breasted Warbler	*Dendroica castanea*	Green	S3S4B
Belted Kingfisher	*Megaceryle alcyon*	Green	S5B
Black-and-white Warbler	*Mniotilta varia*	Green	S4S5B
Black-backed Woodpecker	*Picoides arcticus*	Green	S3S4
Black-capped Chickadee	*Poecile atricapilla*	Green	S5
Blackpoll Warbler	*Dendroica striata*	Green	S3S4B
Black-throated Green Warbler	*Dendroica virens*	Green	S4S5B
Blue Jay	*Cyanocitta cristata*	Green	S5
Blue-headed Vireo	*Vireo solitarius*	Green	S5B
Boreal Chickadee	*Poecile hudsonica*	Yellow	S3
Brown Creeper	*Certhia americana*	Green	S5
Cedar Waxwing	*Bombycilla cedrorum*	Green	S5B
Common Eider	*Somateria mollisima*	Green	S4
Common Loon	*Gavia immer*	Yellow	S3B,S4N
Common Raven	*Corvus corax*	Green	S5
Common Yellowthroat	*Geothlypis trichas*	Green	S5B
Dark-eyed Junco	*Junco hyemalis*	Green	S4S5
Double-crested Cormorant	*Phalacrocorax auritus*	Green	S5B
Downy Woodpecker	*Picoides pubescens*	Green	S5
Fox Sparrow	*Passerella iliaca*	Green	S3S4B
Golden-crowned Kinglet	*Regulus satrapa*	Green	S4
Gray Jay	*Perisoreus canadensis*	Yellow	S3S4
Great Black-backed Gull	*Larus marinus*	Green	S4
Greater Yellowlegs	*Tringa melanoleuca*	Green	S3B,S5M
Hairy Woodpecker	*Picoides villosus*	Green	S5
Hermit Thrush	*Catharus guttatus*	Green	S5B
Herring Gull	*Larus argentatus*	Green	S4S5
Least Sandpiper	*Calidris minutilla*	Green	S1B,S5M
Lincoln's Sparrow	*Melospiza lincolnii*	Green	S4B
Magnolia Warbler	*Dendroica magnolia*	Green	S5B
Merlin	*Falco columbarius*	Green	S5B
Mourning Warbler	*Oporornis philadelphia*	Green	S4B
Nashville Warbler	*Vermivora ruficapilla*	Green	S5B

Table B.1-3. List of all Bird Species Identified on or Offshore of the Black Point Site in 2010.

Common Name	Binomial	NSDNR Status	ACCDC SRANK
Northern Flicker	*Colaptes auratus*	Green	S5B
Northern Gannet	*Morus bassanus*	Green	SHB,S5M
Northern Harrier	*Circus cyaneus*	Green	S5B
Northern Parula	*Parula americana*	Green	S5B
Palm Warbler	*Dendroica palmarum*	Green	S5B
Pileated Woodpecker	*Dryocopus pileatus*	Green	S5
Red-breasted Merganser	*Mergus serrator*	Green	S3B,S5N
Red-breasted Nuthatch	*Sitta canadensis*	Green	S3B,S5N
Red-eyed Vireo	*Vireo olivaceus*	Green	S5B
Red-tailed Hawk	*Buteo jamaicensis*	Green	S5
Red-winged Blackbird	*Agelaius phoeniceus*	Green	SNA
Ruby-crowned Kinglet	*Regulus calendula*	Green	SNA
Ruffed Grouse	*Bonasa umbellus*	Green	S4S5
Rusty Blackbird	*Euphagus carolinus*	Yellow	SNA
Semipalmated Plover	*Charadrius semipalmatus*	Green	S1S2B,S5M
Semipalmated Sandpiper	*Calidris pusilla*	Green	S3M
Sharp-shinned Hawk	*Accipiter striatus*	Green	S4S5B
Song Sparrow	*Melospiza melodia*	Green	S1?B,S4S5M
Spotted Sandpiper	*Actitis macularius*	Green	S3S4B
Spruce Grouse	*Falcipennis canadensis*	Green	S5
Swainson's Thrush	*Catharus ustulatus*	Green	S4S5B
Swamp Sparrow	*Melospiza georgiana*	Green	S5B
White-throated Sparrow	*Zonotrichia albicollis*	Green	S5B
White-winged Crossbill	*Loxia leucoptera*	Undetermined	S4S5
Winter Wren	*Troglodytes troglodytes*	Green	S5B
Yellow-bellied Flycatcher	*Empidonax flaviventris*	Green	S3S4B
Yellow-rumped Warbler	*Dendroica coronata*	Green	S5B

Appendix B.2

Odonata Report

Odonata Survey 2010 (Damselflies and Dragonflies)

Black Point Quarry

Prepared for:
AMEC Earth and Environmental

Paul M. Brunelle
January 26 2011

Paul Brunelle and Beth Cameron spent five field days, over the periods June 9th to 11th and July 14th to 16th, surveying for adult Odonata in the proposed Black Point Quarry locale, near Black Point, Guysborough County, Nova Scotia. All types of freshwater aquatic habitats identified on the property were sampled.

The 2010 season was an unusually early one for odonate flight, and emergence in the Black Point area was just beginning during the first visit – the flight period at this locale is apparently heavily influenced (delayed)by the moderation from coastal weather, as it is adjacent to the ocean to the north, and only about 14km from it to the south.

There is no known prior survey for Odonata in the project area, and Guysborough County itself has been rather lightly surveyed to date.

Results

A modest diversity of Odonata species was encountered – 25 species (22%) of the 115 recorded in Mainland Nova Scotia. A further 41 species are considered possible for the habitat types known on the property, and at these latitudes, consequently 38% of the potential list was taken in 2010.

Forty-seven records (species/site/date) were recorded.

The greatest number of species taken at any one site was twelve; at Wetland 12 (site NS1690, a true bog), with nine at Wetland 2, Ponds 1 and 2 (site NS1697) being second. Most habitats proved to be sparse in species during the visits.

One species of conservation interest in Nova Scotia was encountered, at Wetland 12 (NS1690, a true bog). A male *Pantala hymenaea* (Say 1839, Spot-winged Glider), ranked as Yellow by NSDNR, was observed several times at a secondary pond, at times apparently guarding an ovipositing *P. flavescens* (Fabricius 1798, Wandering Glider). Although *Pantala* species have been observed ovipositing in bog ponds before, it is not known whether that is a viable habitat for the extremely rapid growth of their larvae, a characteristic of this migratory genus. Extra-specific guarding, possibly indicating hybridization, has not been observed in the region in this genus before.

Following Brunelle's involvement AMEC staff took a number of further specimens which were determined by Brunelle; the results given in Appendix 3.

On the cover:
Fogherty Head Shoreline, site NS1698, Guysborough County, Nova Scotia, June 11, 2010.
Left side (top down):
Leucorrhinia glacialis Hagen 1890, Crimson-ringed Whiteface, teneral male, site NS1694, Wetland 17, June 11, 2010.
Enallagma boreale (Sélys 1875), Boreal Bluet.
Dorocordulia lepida (Hagen in Sélys 1871), Petite Emerald, female.

Survey Tactics

Methodology for survey, curation and documentation followed the ADIP (Atlantic Dragonfly Inventory Program) protocols, which have evolved over the last twenty years, and which reflect current practice in the study of odonates.

Habitat Location

After discussions with the client, airphotos of the project region were reviewed and a target aquatic habitat list prepared. This list was confirmed and amended during the field trips.

Each site was given an ADIP identification code beginning with 'NS'.

Field Survey

Personnel

All survey was done by Paul M. Brunelle and Beth H. Cameron.

Lifestage

Principal survey was for flying adults and tenerals (the latter are recently-emerged adults), however exuviae (the abandoned skins of the emerged insects) were also collected when found. Exuviae collection may present the most effective means of inventory for these habitats, and firmly establishes residence status (see Appendix 1), however field survey must be scheduled carefully to collect this material, and tends to be protracted.

Larval survey can yield excellent information on the residence status of species, however it is decidedly protracted in the field and in the lab.

Adults were captured by net and retained in field envelopes until preserved.

Frequency of Survey

One visit to a water body per year is insufficient to acquire a reasonably complete species list, due to the diverse flight periods of species, however the results of even one trip per year can be suggestive as to the health of the aquatic habitat.

For this project all sites were visited at least twice.

Diel

Survey was done during the peak periods of adult odonate activity, roughly 10:00 to 17:00.

Weather

Field days were chosen which had weather suitable for surveying for adults – sunny and hot, with no more than moderate winds. However, extensive overcast developed during some survey days and rain ended a few days early.

Voucher Specimens

Specimens were taken pro forma in many cases, and in all cases where field determination of particular species was considered untrustworthy.

The specimens were force-dried in acetone (adults and tenerals) or air-dried (exuviae) and are stored in clear mylar envelopes with a label giving all identification and accession information.

Each specimen was given a 6-digit ADIP accession number, unique among specimens of odonates taken in Atlantic Canada and northern New England and catalogued in the ADIP databases. The accession number has an alphabetical suffix which indicates the provenance on which the record is based;

v vouchered specimen,
o observed on the wing or perched,
h determined in the hand then released,
p photographed, and,
c indicating that the determination of vouchers has been confirmed by another worker.

The specimens have been deposited at the Nova Scotia Museum of Natural History, Halifax.

Documentation

Photography

General habitat photos were taken during each visit, converted to jpg format, catalogued, and will be tendered to the client for project use if requested.

Data

Field notes, species observations and specimen details were entered into a Filemaker Pro 8.5 relational database structure, which will be translated into Excel 11.3.5 database form for deposit with the client.

Section A: Introduction	**A.01**
Section B: Sites and Results	**B.01**
Lakes and Ponds	**B.02**
NS1689 – Fogherty Lake	B.02
NS1697 – Wetland 2, Ponds 1 and 2	B.03
NS1695 – Beaverpond	B.04
Peatlands	**B.05**
NS1702 – Wetland 2	B.09
NS1700 – Wetland 5	B.07
NS1690 – Wetland 9	B.08
NS1690 – Wetland 12	B.06
NS1694 – Wetland 17	B.10
NS1696 – Wetland 19	B.05
Running Waters	**B.11**
NS1693 – Brook 1	B.11
NS1703 – Brook 2	B.12
Land Sites	**B.13**
NS1701 – Barrens	B.13
NS1698 – Shoreline	B.13
NS1699 – Woods	B.13
Section C: Nova Scotia Species List	**C.01**
Suborder Zygoptera (Damselflies)	C.02
Family Calopterygidae	C.02
Family Lestidae	C.02
Family Coenagrionidae	C.02
Suborder Anisoptera (Dragonflies)	C.03
Family Aeshnidae	C.03
Family Gomphidae	C.03
Family Gomphidae cont...	C.04
Family Cordulegastridae	C.04
Family Macromiidae	C.04
Family Corduliidae	C.04
Family Libellulidae	C.05
Appendix 1: Status and Rank Definitions	**D.01**
Appendix 2: The Nature of Odonates	**D.02**
Appendix 3: Supplementary Odonata Specimens	**D.03**
Appendix 4: Site Map	**D.04**

Sites are listed by aquatic type, then by name (some are generic names). The wetland 'names' are the identifiers used by AMEC Earth and Environmental, which pertain to studies of a broader taxonomic base.

A map of sites is given in Appendix 4.

In the accounts the ADIP (Atlantic Dragonfly Inventory Program) site code is given first, followed by the field code in brackets.

The Nova Scotia mapbook grid is given next, followed by the grid for the previous series of mapbooks, which were on a different grid and are still employed by some authorities. The National Topographic Information System (NTIS) 1/50,000 map reference is then provided.

Coordinates are given in decimal notation, followed by them formatted in a manner which facilitates their lookup in the Google Earth web software.

Visits were all made in 2010. The month and day are given first, followed by the time on site and minutes used, the amount of sky coverage (averaged, the amount of cloud will generally have varied during the visit), and the strength of the wind.

P.M. Brunelle and B.H. Cameron were present during all visits.

Species encountered are listed in taxonomic order to family, in alphabetical order by genus and species. The scientific name is first given, followed by the attribution and description date, then the accepted English name and family.

The ranking by various authorities is then given (see Appendix 1 for details);

NTSV G = NatureServe Global Rank,
NGSCDA = National General Status Canadian Rank,
NSDNR = NS Dept. of Natural Resources Colour Rank,
NGSNS = National General Status Nova Scotia Rank,
NTSV S = NatureServe Nova Scotia Rank.

Records of the species encountered are first given by their ADIP record number, with an alphabetical suffix indicating the provenance of the record. The month and day of the date are next, followed by the surveyor of record (COLL.), if only one individual.

Lifestage(s) encountered are then given (see Appendix 2 for definitions), followed by the ADIP Residence Status code (RSTAT), which indicates the degree to which we know or infer that the species is present in the aquatic habitat through the full development of individuals (see Appendix 2), and hence whether the record has conservation significance. A brief explanation of the code is also given.

Code Site: NS1689 (aka FoL).
Mapbook: 43y04 (old 35e02), NTIS Map: 11F6.
45.3489°N, -61.1589°W [45.348904N, 61.158904W].

Visits:
June 9 – 14:30 to 15:10 (40 min), cloudy 90%, light to moderate.
June 10 – 10:25 to 15:15 (95 min), sunny 95%, light to moderate.
July 16 – 11:45 to 12:30 (45 min), sunny 100%, none to light.

All Species Recorded – 5.

Enallagma boreale (Sélys 1875)
Boreal Bluet, Coenagrionidae.
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S3.
Record 313060v, July 16, COLL. Beth H. Cameron.
Adult, Teneral, RSTAT 1 (emergence proven).

Basiaeschna janata (Say 1839)
Springtime Darner, Aeshnidae.
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S3.
Record 313048o, June 10, Adult,
RSTAT 8 (males at appropriate habitat).

Somatochlora cingulata Sélys 1871
Lake Emerald, Corduliidae.
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S2.
Record 313079o, July 16, Adult,
RSTAT 8 (males at appropriate habitat).

Ladona julia (Uhler 1857)
Chalk-fronted Corporal, Libellulidae.
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S3.
Record 313029v, June 9, Teneral,
RSTAT 1 (emergence proven).

Pantala flavescens (Fabricius 1798)
Wandering Glider, Libellulidae.
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV SA.
Record 313078o, July 16, Adult,
RSTAT 10 (not at water).

Comments: This lake appears to have an unusually short odonate list.

Code Site: **NS1697** (aka FBBP).
Mapbook: 43y04 (old 35e02), NTIS Map: 11F6.
45.35508°N, -61.14255°W [45.355083N, 61.142546W].

Visits:
June 11 – 14:10 to 14:45 (35 min), sunny 100%, none to light.
July 15 – 10:25 to 12:40 (125 min), sunny 100%, none to light.

All Species Recorded – 9.

Lestes disjunctus Sélys 1862
Common Spreadwing, Lestidae.
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S5.
Record 313071v, July 15, COLL. Paul M. Brunelle, Beth H. Cameron. Teneral, RSTAT 1 (emergence proven).

Enallagma boreale (Sélys 1875)
Boreal Bluet, Coenagrionidae.
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S3.
Record 313074v, July 15, COLL. Beth H. Cameron. Adult, RSTAT 8 (males at appropriate habitat).

Enallagma ebrium (Hagen 1861)
Marsh Bluet, Coenagrionidae.
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S3.
Record 313075v, July 15, Adult, RSTAT 8 (males at appropriate habitat).

Enallagma hageni (Walsh 1863)
Hagen's Bluet, Coenagrionidae.
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S3.
Record 313073v, July 15, COLL. Beth H. Cameron. Adult, RSTAT 8 (males at appropriate habitat).

Ischnura posita (Hagen 1861)
Fragile Forktail, Coenagrionidae.
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S3.
Record 313076v, July 15, Adult, RSTAT 8 (males at appropriate habitat).

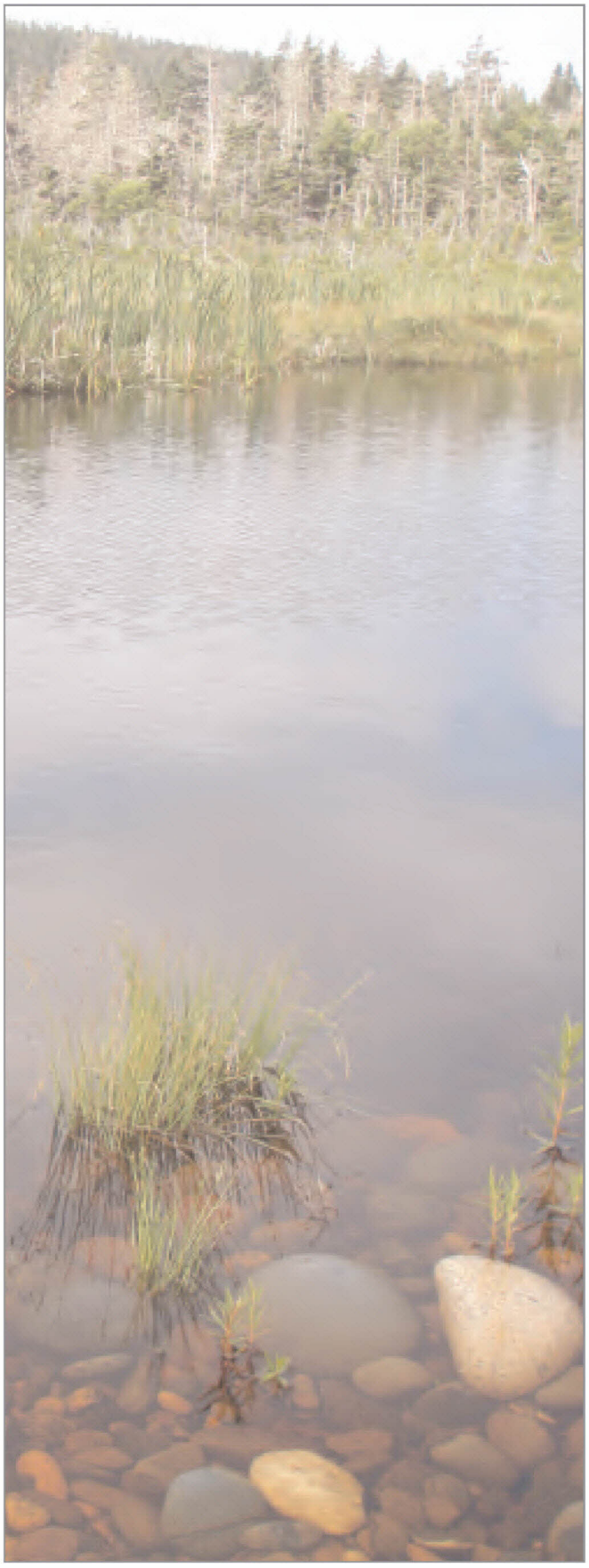
Ischnura verticalis (Say 1839)
Eastern Forktail, Coenagrionidae.
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S5.
Record 313070v, July 15, COLL. Beth H. Cameron. Adult, Teneral, RSTAT 1 (emergence proven).

Aeshna interrupta interrupta Walker 1908
Variable Darner, Aeshnidae.
NTSV G5T5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S3.
Record 313072v, July 15, Exuvia, RSTAT 1 (emergence proven).

Libellula quadrimaculata Linnaeus 1758
Four-spotted Skimmer, Libellulidae.
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S5.
Record 313077v, July 15, Adult, RSTAT 8 (males at appropriate habitat).

Sympetrum internum Montgomery 1943
Cherry-faced Meadowhawk, Libellulidae,
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S5.
Record 313081v, July 15, Teneral, RSTAT 1 (emergence proven).

Comments: Barrachois ponds bordered by both bog and Typha latifolia marsh. They are likely inundated by seawater periodically, but nevertheless house a comparatively large odonate list.



Code Site: **NS1695** (aka LMSW).
Mapbook: 43y04 (old 35e02), NTIS Map: 11F6. CHECK
45.33996°N, -61.138757°W [45.33996N, 61.138757W]. CHECK

Visits:
June 11 – 11:10 to 11:30 (20 min), sunny 100%, none to light.
July 14 – 13:35 to 14:25 (50 min), light overcast, none to light.

All Species Recorded – 0.

Comments: A stillwater formed by a beaver dam. Although some Aeshna species (determination to species was not possible) were seen flying over the ponds on July 14th, they otherwise showed no odonate species, however weather was not ideal for odonates during the second visit.

Code Site: **NS1702** (aka FBBB).
Mapbook: 43y04 (old 35e02), NTIS Map: 11F6.
45.35502°N, -61.14306°W [45.35502N, 61.143055W].

Visits:
July 15 – 13:15 to 14:20 (65 min), sunny 100%, none to light

All Species Recorded – 3.

Enallagma boreale (Sélys 1875)
Boreal Bluet, Coenagrionidae.
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S3.
Record 313084o, July 15,
Adult, RSTAT 8 (males at appropriate habitat).

Aeshna eremita Scudder 1866
Lake Darner, Aeshnidae.
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S3.
Record 313086v, July 15, Adult,
RSTAT 9 (inappropriate habitat).

Libellula quadrimaculata Linnaeus 1758
Four-spotted Skimmer, Libellulidae.
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S5.
Record 313085o, July 15,
Adult, RSTAT 8 (males at appropriate habitat).

Comments: Diverse bogs in a series inland from the Fox Bay pond's shorelines. Those which are nearest to the ponds may be subject to periodic inundation by seawater.

Code Site: **NS1700** (aka FHSF).
Mapbook: 43y03 (old 35e02), NTIS Map: 11F6.
45.35582°N, -61.15614°W [45.355823N, 61.156136W].

Visits:
June 11 – 15:40 to 16:05 (25 min), sunny 100%, none to light.
July 15 – 16:00 to 17:15 (75 min), sunny 100%, none to light.

All Species Recorded – 2.

Aeshna eremita Scudder 1866
Lake Darner, Aeshnidae.
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S3.
Record 313082o, July 15, Adult,
RSTAT 9 (inappropriate habitat).

Pantala flavescens (Fabricius 1798)
Wandering Glider, Libellulidae.
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV SA.
Record 313083v, July 15, Adult,
RSTAT 9 (inappropriate habitat).

Comments: An abruptly sloped fen with some open water. The only species seen at this site were not behaving as residents – apparently only foraging.

Code Site: **NS1692** (aka FSWB).
Mapbook: 43y04 (old 35e02), NTIS Map: 11F6.
45.347094°N, -61.161008°W [45.347094N, 61.161008W].

Visits:
June 9 – 16:45 to 17:00 (15 min), cloudy 90%, light to moderate.
June 10 – 09:55 to 10:15 (20 min), sunny 95%, light to moderate.

All Species Recorded – 0.

Comments: This is a comparatively dry domed bog – only one small pot-hole was observed to have surface water.

Code Site: **NS1690** (aka FEBc).
43y04 (old 35e02), 11F6.
45.34989°N, -61.1555°W [45.34989N, 61.1555W].

Visits:
June 9 – 15:25 to 16:30 (50 min), cloudy 90%, light to moderate.
June 10 – 11:30 to 14:25 (20 min), sunny 95%, light to moderate.
June 11 – 18:10 to 18:35 (25 min), sunny 100%, none to light.
July 16 – 12:35 to 16:05 (210 min), light overcast, moderate to strong.

All Species Recorded – 12.

Lestes disjunctus Sélys 1862
Common Spreadwing, Lestidae.
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S5.
Record 313090v, July 16, COLL. Beth H. Cameron.
Teneral, RSTAT 1 (emergence proven).

Enallagma annexum Hagen 1861
Northern Bluet, Coenagrionidae.
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S3.
Record 313051v, June 10,
Teneral, Exuvia, RSTAT 1 (emergence proven).

Enallagma boreale (Sélys 1875)
Boreal Bluet, Coenagrionidae.
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S3.
Record 313080v, July 16, COLL. Beth H. Cameron.
Adult, Teneral, RSTAT 1 (emergence proven).

Ischnura verticalis (Say 1839)
Eastern Forktail, Coenagrionidae.
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S5.
Record 313065o, July 16, Adult,
RSTAT 8 (males at appropriate habitat).

Nehalennia gracilis Morse 1895
Sphagnum Sprite, Coenagrionidae.
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S2.
Record 313067v, July 16, COLL. Beth H. Cameron.
Adult, RSTAT 7 (females at appropriate habitat).

Aeshna subarctica Walker 1908
Subarctic Darner, Aeshnidae.
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S3.
Record 313057v, June 10, COLL. Beth H. Cameron.
Larva, Molt, RSTAT 2 (larvae collected).
Record 313091v, July 16, COLL. Beth H. Cameron.
Exuvia, RSTAT 1 (emergence proven).

Cordulia shurtleffii Scudder 1866
American Emerald, Corduliidae.
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S3.
Record 313031v, June 10,
Teneral, RSTAT 1 (emergence proven).

Ladona julia (Uhler 1857)
Chalk-fronted Corporal, Libellulidae.
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S3.
Record 313056v, June 10, Teneral, Exuvia (assoc.),
RSTAT 1 (emergence proven).
Record 313061o, July 16, Adult,
RSTAT 8 (males at appropriate habitat).

Leucorrhinia glacialis Hagen 1890
Crimson-ringed Whiteface, Libellulidae.
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S3.
Record 313055v, June 10,
Teneral, Exuvia (assoc.), RSTAT 1 (emergence proven).
Record 313062v, July 16, COLL. Beth H. Cameron.
Adult, RSTAT 3 (ovipositing observed).

Pantala flavescens (Fabricius 1798)
Wandering Glider, Libellulidae.
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV SA.
Record 313063o, July 16, Adult,
RSTAT 3 (ovipositing observed).

Pantala hymenaea (Say 1839)
Spot-winged Glider, Libellulidae.
NTSV G5, NGSCDA 4, NSDNR Yellow, NGSNS 3, NTSV SA.
Record 313064o, July 16, Adult,
RSTAT 8 (males at appropriate habitat).

Sympetrum internum Montgomery 1943
Cherry-faced Meadowhawk, Libellulidae,
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S5.
Record 313066v, July 16,
COLL. Paul M. Brunelle. Teneral, RSTAT 1 (emergence proven).

Comments: A true domed bog, with secondary ponds and peripheral fens. The odonate list is extensive, but probably not complete.

Code Site: **NS1694** (aka SEPF).
Mapbook: 43y04 (old 35e02), NTIS Map: 11F6.
45.34038°N, -61.14361°W [45.340379N, 61.143614W].

Visits:
June 11 – 10:15 to 10:50 (35 min), sunny 100%, none to light.
July 14 – 12:20 to 13:15 (55 min), sunny 100%, none to light.

All Species Recorded – 4.

Nehalennia gracilis Morse 1895
Sphagnum Sprite, Coenagrionidae.
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S2.
Record 313058v, July 14,
Adult, Teneral, RSTAT 1 (emergence proven).

Leucorrhinia glacialis Hagen 1890
Crimson-ringed Whiteface, Libellulidae.
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S3.
Record 313041v, June 11,
Teneral, Exuvia (assoc.), RSTAT 1 (emergence proven).
Record 313059v, July 14, COLL. Beth H. Cameron.
Adult, RSTAT 8 (males at appropriate habitat).

Leucorrhinia hudsonica (Sélys 1850)
Hudsonian Whiteface, Libellulidae.
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S3.
Record 313054v, June 11,
Adult, RSTAT 8 (males at appropriate habitat).

Leucorrhinia proxima Calvert 1890
Belted Whiteface, Libellulidae.
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S3.
Record 313088v, July 14, COLL. Beth H. Cameron.
Adult, RSTAT 8 (males at appropriate habitat).

Comments: This fairly rich domed fen should support a larger odonate list than was recorded.

Code Site: **NS1696** (aka ECPF).
Mapbook: 43y04 (old 35e02), NTIS Map: 11F6.
45.34126°N, -61.13718°W [45.341262N, 61.137182W].

Visits:
June 11 – 11:55 to 12:30 (35 min), sunny 100%, none to light.
July 14 – 14:45 to 15:00 (15 min), heavy overcast, none.

All Species Recorded – 2.

Epitheca (Tetragoneuria) spinigera (Sélys 1871)
Spiny Baskettail, Corduliidae,
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S3.
Record 313042o, June 11, Adult,
RSTAT 9 (inappropriate habitat).

Leucorrhinia hudsonica (Sélys 1850)
Hudsonian Whiteface, Libellulidae.
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S3.
Record 313043o, June 11, Adult,
RSTAT 8 (males at appropriate habitat).

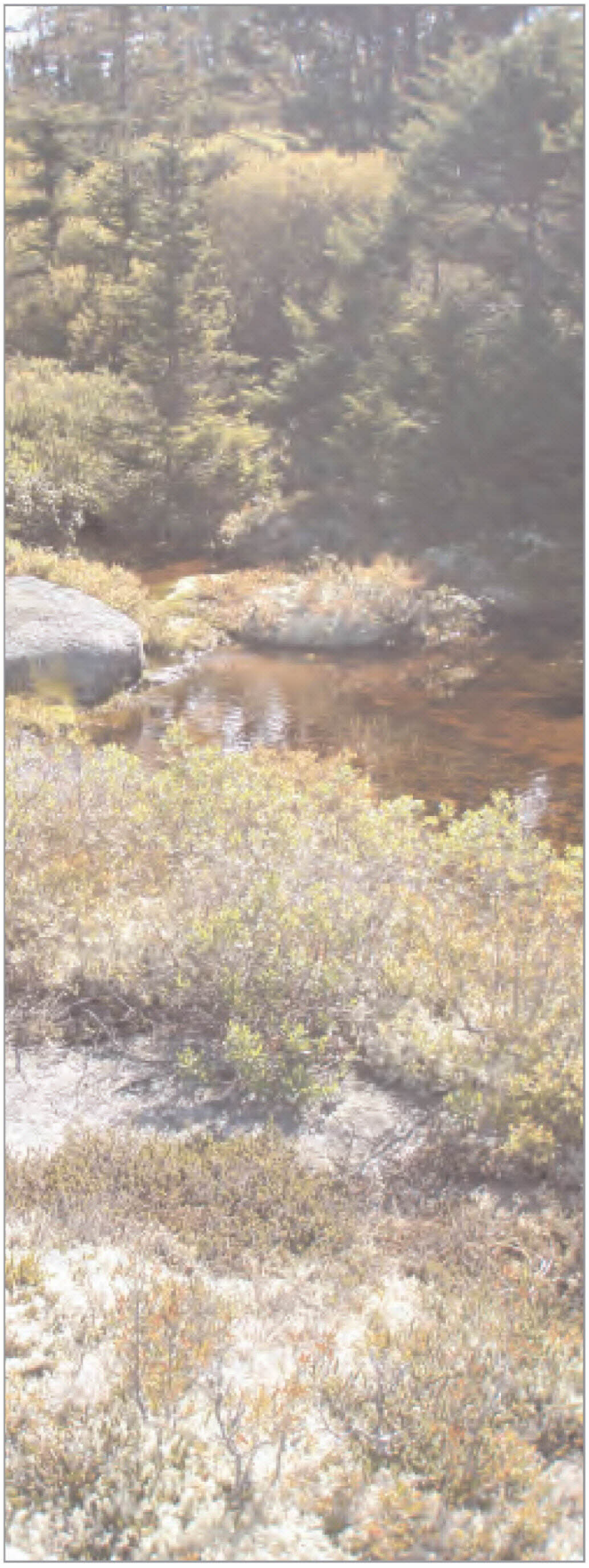
Comments: A small true bog a short distance north of the power-line cut along the eastern property cutline. The list of odonates observed at this site seemed depauperate.

Code Site: **NS1693** (aka FB).
Mapbook: 43y04 (old 35e02), NTIS Map: 11F6.
45.345431°N, -61.161658°W [45.345431N, 61.161658W].

Visits:
June 9 – 17:15 to 17:25 (10 min), cloudy 90%, light to moderate.
June 10 – 09:30 to 09:50 (20 min), sunny 95%, light to moderate.

All Species Recorded – 0.

Comments: This small stream drains Wetlands 8 and 9, flowing through forested bog and largely over bedrock. It has very little substrate other then that bedrock, and no odonate species were observed during the visits. This site is likely representative of the upper reaches of all brooks on the property.



Code Site: **NS1703** (aka LMSB).
Mapbook: 43y04 (old 35e02), NTIS Map: 11F6. CHECK
45.34038°N, -61.14361°W [45.340379N, 61.143614W]. CHECK

Visits:
June 11 – visited briefly in passing.
July 14 – visited briefly in passing.

All Species Recorded – 0.

Comments: This stream was visited where it drains the Beaverpond (site NS1695), and hence at that locale is just south of the project footprint. It flows strongly through forest, is heavily shaded, and likely represents the habitat type of the lower courses of most running waters on the property.

Barrens

Code Site: **NS1701** (aka FBa).
Mapbook: 43y04 (old 35e02), NTIS Map: 11F6.
45.34583°N, -61.15409°W [45.345826N, 61.154094W].

Visits: The barrens were passed through on all survey days.

All Species Recorded – 1.

Enallagma boreale (Sélys 1875)
Boreal Bluet, Coenagrionidae.
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S3.
Record 313050v, June 10, Adult, RSTAT 10 (not at water).

Comments: The barrens have very little soil over granite bedrock – no likely odonate habitats were seen, they seem well-drained.

Shoreline

Code Site: NS1698 (aka FHS).
Mapbook: 43y03 (old 35e02), NTIS Map: 11F6.
45.35742°N, -61.1459°W [45.357415N, 61.145902W].

Visits:
June 11 – 13:15 to 15:40 (95 min), sunny 100%, none to light.
July 15 – 10:00 to 18:00 (120 min), sunny 100%, none to light.

All Species Recorded – 4.

Anax junius (Drury 1770)
Common Green Darner, Aeshnidae.
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S3.
Record 313068o, July 15, Adult, RSTAT 10 (not at water).
Cordulia shurtleffii Scudder 1866
American Emerald, Corduliidae.
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S3.
Record 313045o, June 11, Adult, RSTAT 10 (not at water).
Epitheca (Tetragoneuria) spinigera (Sélys 1871)
Spiny Baskettail, Corduliidae
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S3.
Record 313044o, June 11, Adult, RSTAT 10 (not at water).
Somatochlora cingulata Sélys 1871
Lake Emerald, Corduliidae.
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S2.
Record 313069v, July 15, COLL. Beth H. Cameron.
Adult, RSTAT 10 (not at water).

Comments: An abrupt, cliffed shoreline with cobble beaches – the only potential odonate habitat seen there was pools in the bedrock. No odonates were seen in the pools. All adults taken along the shore appeared to be foraging.

Woods

Code Site: NS1699 (aka FHW).
Mapbook: 43y03 (old 35e02), NTIS Map: 11F6.
45.35379°N, -61.15743°W [45.353793N, 61.157434W].

Visits: The woods were passed through on most survey days.

All Species Recorded – 1.

Cordulia shurtleffii Scudder 1866
American Emerald, Corduliidae.
NTSV G5, NGSCDA 4, NSDNR Green, NGSNS 4, NTSV S3.
Record 313047o, June 11, Adult, RSTAT 10 (not at water).

Comments: The woods on the property are either dense coniferous growth, with a mossy forest floor, or dense stands of woody brush. Only foraging odonates were seen in the forest.

The full list of odonates for the province is provided in the following table. Species encountered during 2010 survey are highlighted in yellow.

Species have been characterized as occupying the following basic habitat types;

lotic obligate (running waters, blue) – 13 species, possibilities for running waters on the property,

peatlands obligate (brown) – 23 species, possibilities for bogs on the property,

saltmarsh obligate (green) – 1 species (E. berenice),

The balance are lentic (slow waters) inhabitants, possibilities for the property.

Note that there are issues of range within the province (latitude and elevation related), micro-habitat preferences, and flexibility of habitat use which have not been addressed in this basic assignment.

The various status ranks are given and are current (see Appendix 1 for definitions); those of conservation interest are given in bold.

The best residence status and the greatest observed abundance of each species encountered at each site is given in the site columns.

Residence Status:
1 = emergence proven,
2 = larvae collected,
3 = laying observed,
4 = mating observed,
5 = reproductive behaviour obs.,
6 = both sexes obs.,
7 = females only obs.,
8 = males only obs.,
9 = inappropriate habitat,
10 = not at an aquatic habitat.

Abundance Codes:
A = 1 individual,
B = 2–5,
C = 6–25,
D = >25.

Taxa	Basic Habitat Type *lotic obligate* *lentic (diverse types)* *peatland obligate* *saltmarsh obligate*	Statuses					*Lakes and Ponds*	NS1689 Fogherty Lake	NS1697 WL2, Ponds 1 and 2	NS1693 Beaverpond	*Peatlands*	NS1702 Wetland 2	NS1700 Wetland 5	NS1690 Wetland 9	NS1690 Wetland 12	NS1694 Wetland 17	NS1696 Wetland 19	*Running Waters*	NS1693 Brook 1	NS1703 Brook 2	*Land Sites*	NS1701 Barrens	NS1698 Shoreline	NS1699 Woods
		Global (NatureServe)	NGS Canada	NSDNR Colour Ranks	NGS Nova Scotia	Subnational (AC CDC)																		
Number of Species/Site								5	9	0		3	2	0	12	4	2		0	0		1	4	1
Zygoptera - Damselflies																								
Family **Calopterygidae**																								
Genus ***Calopteryx***																								
C. aequabilis		G5	4	Gr	4	S5																		
C. amata		G4	4	Gr	4	S5																		
C. maculata		G5	4	Gr	4	S5																		
Family **Lestidae**																								
Genus ***Lestes***																								
L. congener		G5	4	Gr	4	S5																		
L. disjunctus		G5	4	Gr	4	S5			1B						1A									
L. dryas		G5	4	Gr	4	S5																		
L. eurinus		G4	4	Gr	4	S4																		
L. forcipatus		G5	4	Gr	4	S5																		
L. rectangularis		G5	4	Gr	4	S5																		
L. unguiculatus		G5	4	Gr	4	S5																		
L. vigilax		G5	3	Gr	4	S5																		
Family **Coenagrionidae**																								
Genus ***Amphiagrion***																								
A. saucium		G5	4	Gr	4	S3																		
Genus ***Argia***																								
A. fumipennis violacea		G5T	4	Gr	4	S5																		
A. moesta		G5	4	Gr	4	S5																		
Genus ***Chromagrion***																								
C. conditum		G5	4	Gr	4	S5																		
Genus ***Coenagrion***																								
C. interrogatum		G5	4	Re	2	S1																		
C. resolutum		G5	4	Re	2	S1																		
Genus ***Enallagma***																								
E. annexum		G5	4	Gr	4	S5									1C									
E. aspersum		G5	4	Gr	4	S5																		
E. boreale		G5	4	Gr	4	S5		1C	8B			8B			1D							10A		
E. carunculatum		G5	4	In	5	SNA																		
E. civile		G5	4	Gr	4	S5																		
E. ebrium		G5	4	Gr	4	S5			8B															
E. exsulans		G5	4	Gr	4	S5																		
E. hageni		G5	4	Gr	4	S5			8B															
E. minusculum		G4	3	Gr	4	S4																		
E. signatum		G5	4	Re	2	S1																		
E. vernale		G4	4	In	5	SNA																		
E. vesperum		G5	4	Ye	3	S3																		
Genus ***Ischnura***																								
I. hastata		G5	2	In	In	SU																		
I. posita		G5	4	Gr	4	S5			8B															
I. verticalis		G5	4	Gr	4	S5			1D						8B									
Genus ***Nehalennia***																								
N. gracilis		G5	4	Gr	4	S4									7A	1B								
N. irene		G5	4	Gr	4	S5																		

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C = 6–25,
D = >25.

Basic Habitat Type
lotic obligate
lentic (diverse types)
peatland obligate
saltmarsh obligate

Taxa	Statuses: Global (NatureServe)	NGS Canada	NSDNR Colour Ranks	NGS Nova Scotia	Subnational (AC CDC)	*Lakes and Ponds*	NS1689 Fogherty Lake	NS1697 WL2, Ponds 1 and 2	NS1693 Beaverpond	*Peatlands*	NS1702 Wetland 2	NS1700 Wetland 5	NS1690 Wetland 9	NS1690 Wetland 12	NS1694 Wetland 17	NS1696 Wetland 19	*Running Waters*	NS1693 Brook 1	NS1703 Brook 2	*Land Sites*	NS1701 Barrens	NS1698 Shoreline	NS1699 Woods
Anisoptera - Dragonflies																							
Family **Aeshnidae**																							
Genus ***Aeshna***																							
A. canadensis	G5	4	Gr	4	S5																		
A. clepsydra	G4	4	Gr	4	S3																		
A. constricta	G5	4	Gr	4	S3																		
A. eremita	G5	4	Gr	4	S4						9B	9B											
A. i. interrupta	G5T	4	Gr	4	S5			1A															
A. septentrionalis	G5	4	In	5	SNA																		
A. sitchensis	G5	4	Gr	4	S4																		
A. subarctica	G5	4	Gr	4	S4									1B									
A. tuberculifera	G4	4	Gr	4	S5																		
A. u. umbrosa	G5T	4	Gr	4	S5																		
A. verticalis	G5	4	Gr	4	S4																		
Genus ***Anax***																							
A. junius	G5	4	Gr	4	S5B																	10A	
Genus ***Basiaeschna***																							
B. janata	G5	4	Gr	4	S5		8A																
Genus ***Boyeria***																							
B. grafiana	G5	4	Ye	3	S3																		
B. vinosa	G5	4	Gr	4	S4																		
Genus ***Gomphaeschna***																							
G. furcillata	G5	2	Ye	3	S3																		
Genus ***Rhionaeschna***																							
R. mutata	G3/4	2	In	5	SNA																		
Family **Gomphidae**																							
Genus ***Dromogomphus***																							
D. spinosus	G5	4	Gr	4	S5																		
Genus ***Gomphus***																							
G. adelphus	G4	4	Gr	4	S5																		
G. borealis	G4	4	Gr	4	S5																		
G. descriptus	G4	4	Ye	3	S2																		
G. exilis	G5	4	Gr	4	S5																		
G. spicatus	G5	4	Gr	4	S5																		
G. ventricosus	G3	2	In	2	S1																		
Genus ***Hagenius***																							
H. brevistylus	G5	4	Gr	4	S5																		
Genus ***Lanthus***																							
L. parvulus	G4	4	Gr	4	S3																		
Genus ***Ophiogomphus***																							
O. aspersus	G3/4	4	Re	2	S1																		
O. carolus	G5	4	Gr	4	S3																		
O. mainensis	G4	4	Re	2	S1																		
O. rupinsulensis	G5	4	Re	2	S1.5																		

Families Gomphidae (part), Cordulegastridae, Macromiidae, Corduliidae

Residence Status:
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lotic obligate
lentic (diverse types)
peatland obligate
saltmarsh obligate

Taxa	Statuses: Global (NatureServe)	NGS Canada	NSDNR Colour Ranks	NGS Nova Scotia	Subnational (AC CDC)	Lakes and Ponds	NS1689 Fogherty Lake	NS1697 WL2, Ponds 1 and 2	NS1693 Beaverpond	Peatlands	NS1702 Wetland 2	NS1700 Wetland 5	NS1690 Wetland 9	NS1690 Wetland 12	NS1694 Wetland 17	NS1696 Wetland 19	Running Waters	NS1693 Brook 1	NS1703 Brook 2	Land Sites	NS1701 Barrens	NS1698 Shoreline	NS1699 Woods
Family Gomphidae *cont.*																							
Genus ***Stylogomphus***																							
S. albistylus	G5	4	Gr	4	S5																		
Genus ***Stylurus***																							
S. scudderi	G4	4	**Re**	**4**	S1.5																		
Family **Cordulegastridae**																							
Genus ***Cordulegaster***																							
C. diastatops	G5	4	Gr	4	S5																		
C. maculata	G5	4	Gr	4	S5																		
Family **Macromiidae**																							
Genus ***Didymops***																							
D. transversa	G5	4	Gr	4	S5																		
Genus ***Macromia***																							
M. i. illinoiensis	G5	4	Gr	4	S5																		
Family **Corduliidae**																							
Genus ***Cordulia***																							
C. shurtleffii	G5	4	Gr	4	S5									1A								10B	10A
Genus ***Dorocordulia***																							
D. lepida	G5	4	Gr	4	S5																		
D. libera	G5	4	Gr	4	S4																		
Genus ***Epitheca***																							
E. canis	G5	4	Gr	4	S5																		
E. cynosura	G5	4	**In**	**5**	SNa																		
E. princeps	G5	4	**Ye**	**3**	S2																		
E. semiaquea	G4	**5**	**In**	**5**	SNR																		
E. spinigera	G5	4	Gr	4	S5											9B						10B	
Genus ***Helocordulia***																							
H. uhleri	G5	4	Gr	4	S5																		
Genus ***Somatochlora***																							
S. albicincta	G5	4	**Re**	**2**	S1																		
S. brevicincta	G3	**3**	**Re**	**2**	S1																		
S. cingulata	G5	4	Gr	4	S4		8A															10A	
S. elongata	G5	4	Gr	4	S4																		
S. forcipata	G5	4	**Re**	**2**	S2																		
S. franklini	G5	4	**Ye**	**3**	S1																		
S. incurvata	G4	4	Gr	4	S5																		
S. kennedyi	G5	4	**Re**	**2**	S1.5																		
S. minor	G5	4	Gr	4	S4																		
S. septentrionalis	G5	4	**Ye**	**3**	S2																		
S. tenebrosa	G5	**3**	Gr	4	S3																		
S. walshii	G5	4	Gr	4	S5																		
S. williamsoni	G5	4	**Re**	**2**	S1																		
Genus ***Williamsonia***																							
W. fletcheri	G3/4	**3**	**Re**	**2**	S1																		

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Family **Libellulidae**																							
Genus ***Celithemis***																							
C. elisa	G5	4	Gr	4	S5																		
C. martha	G4	**5**	Gr	4	S4																		
Genus ***Erythrodiplax***																							
E. berenice (saltmarshes)	G5	**2**	**Ye**	**2**	S**3**																		
Genus ***Ladona***																							
L. exusta	G4	4	Gr	4	S5																		
L. julia	G5	4	Gr	4	S5		**1B**							**1C**									
Genus ***Leucorrhinia***																							
L. frigida	G5	4	Gr	4	S5																		
L. glacialis	G5	4	Gr	4	S5									**1C**	**1C**								
L. hudsonica	G5	4	Gr	4	S5										**8B**	**8A**							
L. intacta	G5	4	Gr	4	S5																		
L. patricia	G4	4	**Re**	**2**	S**1**																		
L. proxima	G5	4	Gr	4	S5										**8A**								
Genus ***Libellula***																							
L. incesta	G5	4	Gr	4	S5																		
L. luctuosa	G5	4	**In**	**5**	S**NA**																		
L. pulchella	G5	4	Gr	4	S5B																		
L. quadrimaculata	G5	4	Gr	4	S5			**8B**			**8B**												
Genus ***Nannothemis***																							
N. bella	G4	4	Gr	4	S**3**																		
Genus ***Pantala***																							
P. flavescens (puddles)	G5	4	Gr	4	S5B		**9B**					**9B**		**3A**									
P. hymenaea (puddles)	G5	4	**Ye**	**3**	S5B									**8A**									
Genus ***Plathemis***																							
P. lydia	G5	4	Gr	4	S5																		
Genus ***Sympetrum***																							
S. corruptum	G5	4	**Ac**	**8**	sNA																		
S. costiferum	G5	4	Gr	4	S5																		
S. danae	G5	4	**Ye**	**3**	S**3**																		
S. internum	G5	4	Gr	4	S5			**1B**						**1A**									
S. obtrusum	G5	4	Gr	4	S5	**1A**																	
S. rubicundulum	G5	4	**In**	**5**	S5																		
S. semicinctum	G5	4	Gr	4	S5																		
S. vicinum	G5	4	Gr	4	S5																		
Genus ***Tramea***																							
T. carolina	G5	**5**	**In**	**5**	S**1B**																		
T. lacerata	G5	**4**	**Re**	**2**	S**U**																		

Conservation Statuses

Italic comments are by Brunelle.

NatureServe Global Ranks

G1 Extremely rare throughout its range (typically 5 or fewer occurrences or very few remaining individuals). May be especially vulnerable to extirpation.

G2 Rare throughout its range (6 to 20 occurrences or few remaining individuals). May be vulnerable to extirpation due to rarity or other factors.

G3 Uncommon throughout its range, or found only in a restricted range, even if abundant in at some locations. (21 to 100 occurrences).

G4 Usually widespread, fairly common throughout its range, and apparently secure with many occurrences, but the Element is of long term concern (e.g. watch list, 100+ occurrences).

G5 Demonstrably widespread, abundant, and secure throughout its range, and essentially ineradicable under present conditions.

T This suffix indicates that there is some taxonomic confusion with the species.

/ This indicates that the rank is intermediate between two ranks.

National General Status Ranks – Canada and Nova Scotia

1 **At risk:** species for which a formal assessment has been completed and determined to be at risk of extirpation or extinction (i.e., endangered or threatened).

2 **May be at risk:** species that may be at risk of extirpation or extinction, and are therefore candidates for a detailed risk assessment.

3 **Sensitive:** species which are not believed to be at risk of extirpation or extinction, but may require special attention or protection to prevent them from becoming at risk.

4 **Secure:** species which are not believed to be 'at risk' or 'sensitive'.

5 **Undetermined:** species for which insufficient data, information, or knowledge is available to reliably evaluate their status. Generally rare where known.

6 **Not assessed:** species known or believed to be present but which have not yet been assessed. This status is usually is applied to recent discoveries.

7 **Exotic:** species that have been introduced as a result of human activity.

8 **Extirpated/extinct:** species no longer thought to be present in the jurisdiction or that are believed to be extinct.

9 **Accidental/vagrant:** species occurring infrequently and unpredictably, outside their usual range.

Nova Scotia DNR Colour Ranks

Red May be at risk (Re).
Yellow Sensitive (Ye).
Green Secure (Gr)
Blue Thought to be extirpated (Bl).
Accidental Thought not to be resident (Ac).
Indeterminate Rank not determined (In). Generally rare and of conservation concern, or the subject of taxonomic concerns. This rank is also given to recent additions to the provincial list, pending further consideration.

National General Status Ranks – Nova Scotia

See definitions for Canada above.

AC CDC (NatureServe) Subnational Ranks – Nova Scotia

See definitions for Global above, but subnational ranks are given with an 's' prefix.

Residence Status

Developed by ADIP, residence status is a metric of the nature of a species' presence in a water body or wetland, based on the degree to which it has been indicated or proven that the larvae of the species develop successfully to emergence.

1 **Emergence recorded;**
- directly observed,
- collection of exuvia, or,
- teneral on its maiden flight near the site.

2 **Larvae collected,** unambiguous determination.

3 **Laying observed.**

4 **Mating observed.**

5 **Reproductive behavior observed;**
- male display for female,
- male priming (transferring semen to secondary genitalia), or,
- male towing female (an indicator of laying).

6 **Males and females observed,** at the aquatic habitat appropriate for the species.

7 **Females only observed,** at appropriate aquatic habitat.

8 **Males only observed,** at appropriate aquatic habitat.

9 **Not encountered at an appropriate aquatic habitat.**

10 **Not encountered at any aquatic habitat.**

Abundance Codes

Developed by ADIP, these codes are an estimate of the number of individuals of the species seen in each record. The number range is used in the site accounts, the letter code in the Nova Scotia Species list.

1	A	1 individual seen.
2–5	B	2 to 5 individuals seen.
6–25	C	6 to 25 individuals seen.
>25	D	more than 25 individuals seen.

Adults of the insect order Odonata are of one of the most ancient and widely-recognized groups of insects – with very few exceptions they are identifiable to suborder even by children.

Taxonomy

The suborder Zygoptera comprises the damselflies; very slim, with eyes widely separated on a short head, and wings of similar shape generally held together over the back when perched.

The suborder Anisoptera comprises the dragonflies; which tend to be larger and more robust, and which hold their differently-shaped fore and hindwings more or less flat out to the side when perched.

History of Study

There has been an extraordinary surge in interest in odonates in the last twenty years – fueled in part by the availability of photographs of these brilliantly-coloured insects and the publication of field guides, but also by increased interest in rare and endangered species among conservation and government authorities.

In the northeast of North America, this interest was first manifested in the formation of volunteer surveys – ADIP (Atlantic Dragonfly Inventory Program) in Atlantic Canada, and MDDS (Maine Damselfly and Dragonfly Survey). Based on these largely volunteer efforts, government and conservation authorities have begun supporting studies, and odonates are now often included in environmental assessments.

Much remains to be done before we have a firm body of knowledge upon which to base assumptions in the region – however the 58,000 records in hand for Acadia (Maritime Provinces and Maine) are a substantial baseline for further work.

Listing

See Appendix 1 for status definitions.

Until recently the NatureServe listing for the Maritime Provinces was not complete on the subnational (provincial) level – recent efforts by the Atlantic Canada Conservation Data Centre have addressed that.

Recently, the odonates of Canada were assigned statuses in the National General Status structure, as were species in all provinces and territories.

The Nova Scotia Department of Natural Resources uses a system of colour statuses which largely reflects the National General Status definitions.

Significance to Humans

The order is an important component in all freshwater aquatic habitats – as predators high on the aquatic foodchain they consume many organisms we consider injurious, and are prey for many others we value.

They are, in particular, an important brake on the abundance of the aquatic biting insects.

Impacts on Odonata

Human impacts on odonates are principally those from aquatic habitat alteration, and tend to favour the common species over those rarer in the natural environments. On the positive side, we have constructed ponds, reservoirs, bogs and ditches which generally house good lists of lentic (slow-water) species. The formation of bogs has been particularly beneficial to northern species. One the negative side, we have greatly altered and in some cases eliminated all sizes of lotic (running water) habitats, and as a result have negatively impact many of those species which are obligate to those habitats.

Direct impacts are confined to collection for scientific purposes and road-kill. The latter can be a powerful impact on species depending upon their flying characteristics, however the former is rarely intense enough to endanger even the most restricted species population.

Lifestages

Odonata are largely aquatic insects, spending their infancy in the water. Unlike many aquatic insects, their larvae breath the water (rather than taking their breath from the surface) and are hence vulnerable to a degree to changes in water chemistry. The larvae molt up to fourteen times during their development in the water, leaving molts or castoffs behind.

After a maturation period, variable by species, they emerge into the teneral lifestage, leaving the empty shell of the larva behind (called an exuvia). The teneral is soft-bodied and does not generally have the brilliant colours of the adult. When a teneral is taken with its exuviae it is called 'associated'.

After a period away from the water spent foraging and firming up, they return to their breeding arenas (usually at the water's edge).

Mature adults may be significantly different in colour and pattern from their tenerals, and in some groups there is considerable sexual dichromatism.

Behaviour

Major behaviours observed informed the establishment of residence status (see Appendix 1), and are: emergence (a teneral leaving its larval form), mating and towing (indicative of laying), laying, males fighting (indicative of territoriality at a larval habitat),
nuptial (reproductive behaviour), wandering (an adult thought to be foraging away from its normal larval habitat).

Appendix 3-Table 1. Supplementary Odonata Specimens Collected by AMEC on the Black Point site, 2010.

Binomial	Common name	ACCDC Rank	General Status Rank-NS	AMEC Sample ID	ADIP Record Number	Site Name	Collection Date	Lifestage	Sex
Anax junius (Drury 1770)	Common Green Darner	5B	Green (4)	BC2010.09	354453	Barrens	27-Aug-10	Adult	Female
Lestes disjunctus (Sélys 1862)	Common Spreadwing	5	Green (4)	BC2010.11	354455	Barrens	27-Aug-10	Adult	Female
Lestes disjunctus (Sélys 1862)	Common Spreadwing	5	Green (4)	BC2010.13	354457	Wetland 2	23-Sep-10	Adult	Female
Aeshna eremita (Scudder 1866)	Lake Darner	4	Green (4)	BC2010.07	354451	Wetland 2 Ponds 1 and 2	24-Aug-10	Adult	Female
Ischnura verticalis (Say 1839)	Eastern Forktail	5	Green (4)	BC2010.06	354450	Wetland 2 Ponds 1 and 2	24-Aug-10	Adult	Female
Lestes disjunctus (Sélys 1862)	Common Spreadwing	5	Green (4)	BC2010.01,	354445	Wetland 2 Ponds 1 and 2	24-Aug-10	Adult	Male
Lestes disjunctus (Sélys 1862)	Common Spreadwing	5	Green (4)	BC2010.05	354445	Wetland 2 Ponds 1 and 2	24-Aug-10	Teneral	Female
Sympetrum rubicundulum (Say 1839)	Ruby Meadowhawk	5	Green (4)	BC2010.04	354448	Wetland 2 Ponds 1 and 2	24-Aug-10	Adult	NA
Sympetrum internum (Montgomery 1943)	Cherry-faced Meadowhawk	5	Green (4)	BC2010.12	354456	Wetland 2 Ponds 1 and 2	22-Sep-10	Adult	Male
Aeshna umbrosa umbrosa (Walker 1908)	Variable Darner	5	Green (4)	BC2010.14	354458	Wetland 2 Ponds 1 and 2	23-Sep-10	Adult	Male
Sympetrum costiferum (Hagen 1861)	Saffron-winged Meadowhawk	5	Green (4)	BC2010.16	354460	Wetland 2 Ponds 1 and 2	23-Sep-10	Adult	Male
Sympetrum internum (Montgomery 1943)	Cherry-faced Meadowhawk	5	Green (4)	BC2010.17	354461	Wetland 2 Ponds 1 and 2	23-Sep-10	Adult	Male
Aeshna eremita (Scudder 1866)	Lake Darner	4	Green (4)	BC2010.02	354446	Shoreline	23-Sep-10	Adult	Male
Aeshna eremita (Scudder 1866)	Lake Darner	4	Green (4)	BC2010.03	354446	Shoreline	24-Aug-10	Adult	Female
Aeshna umbrosa umbrosa (Walker 1908)	Shadow Darner	5	Green (4)	BC2010.15	354459	Shoreline	23-Sep-10	Adult	Male
Aeshna eremita (Scudder 1866)	Lake Darner	4	Green (4)	BC2010.10	354454	Fogherty Lake	27-Aug-10	Adult	Male
Aeshna umbrosa umbrosa (Walker 1908)	Shadow Darner	5	Green (4)	BC2010.08	354452	Fogherty Lake	27-Aug-10	Adult	Male
Aeshna eremita (Scudder 1866)	Lake Darner	4	Green (4)	BC2010.18	354462	Fogherty Lake	23-Aug-10	Exuvia	NA

Appendix 3. Supplementary Odonata Specimens.

LEGEND:

Odonata Sampling Location

AMEC Earth & Environmental
50 Troop Avenue, Unit 300
Dartmouth, N.S., B3B 1Z1
(P) 902-468-2848 (F) 902-468-1314

CLIENT
Erdene Resource Development Corp.
Metropolitan Place
99 Wyse Road, Suite 1480
Dartmouth, NS B3A 4S5

PROJECT
Black Point Quarry Project

TITLE
Odonata Sampling Locations

DWN BY: DS	PROJECTION: UTM Zone 20	DATE: February 2011
CHK'D BY: SB	DATUM: NAD83	PROJECT NO: TV01017
REV. NO.: N/A	SCALE: N.T.S.	FIGURE No. Appendix 4 Figure 1

C 1340-1126

Appendix C. Wetlands

Appendix C.1: Wetland Determination Sheets

Appendix C.2: Wetland Habitat Sketches

Appendix C.3: Wetland Photos

Appendix C.4: Wetland Vascular Plant Species List

Appendix C.1

Wetland Determination Sheets

WETLAND DETERMINATION DATA FORM – NOVA SCOTIA

Project/Site: Gr RQ Municipality/County: Guysborough Sampling Date: Sept. 1/10

Applicant/Owner: Ecolme Sampling Point: WP5=WP1

Investigator(s): S. Burley Section, Township, Range: Blucks Point

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Convex

Slope (%): 25% E: 644453 N: 5024120 Datum: NAD 83

Soil Map Unit Name: Rockland Wetland Type: Upland

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ___	Is the Sampled Area within a Wetland? Yes ___ No ✓
Hydric Soil Present?	Yes ___	No ✓	
Wetland Hydrology Present?	Yes ___	No ✓	If yes, optional Wetland Site ID: ___

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10 m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Picea glauca	20%	FACU	✓
2. Abies balsamea	5%	FAC	✓
3.			
4.			
5.			
	25	= Total Cover	

Sapling/Shrub Stratum (Plot size: 5 m)			
1. Alnus incana	15%	FACW	✓
2.			
3.			
4.			
5.			
	15	= Total Cover	

Herb Stratum (Plot size: 1 m)			
1. Cornus canadensis	15%	FAC	✓
2. Dryopteris cristata	20%	FAC	✓
3. Solidago rugosa	5%	FAC	
4. Rhodora sp	5%		
5. Rosa sp	5%		
6. Dasschampsia flexuosa	10%	NI	
7. Maianthemum canadense	2%		
8.			
9.			
10.			
	72%	= Total Cover	

Woody Vine Stratum (Plot size: ___)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 80% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species ___	x 1 = ___
FACW species ___	x 2 = ___
FAC species ___	x 3 = ___
FACU species ___	x 4 = ___
UPL species ___	x 5 = ___
Column Totals: ___ (A)	___ (B)

Prevalence Index = B/A = ___

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ___

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2009)

C 1340-1131

Sampling Point: WL5-UP1

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2								Du H
2-35	7.5YR 4/4	100					Sandy loam	well drained

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Depleted Dark Surface (F7)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Redox Depressions (F8)
- ___ Red Parent Material (TF2)

Indicators for Problematic Hydric Soils[3]:

- ___ Sandy Gleyed Matrix (S4)
- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (cm): _____

Hydric Soil Present? Yes _____ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (cm): _____

Water Table Present? Yes _____ No _____ Depth (cm): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (cm): _____

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2009)

WETLAND DETERMINATION DATA FORM – NOVA SCOTIA

Project/Site: GLC2 Municipality/County: Guysborough Sampling Date: Sept 1/10

Applicant/Owner: Enbridge Sampling Point: WL5-up1

Investigator(s): S. Burley Section, Township, Range: Blacks Point

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): concave

Slope (%): 15% Lat: E 644453 Long: 5024118 Datum: NAD 83

Soil Map Unit Name: Rockland Wetland Type: Herb Fen

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	Is the Sampled Area within a Wetland? Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	
Wetland Hydrology Present?	Yes ✓	No ____	If yes, optional Wetland Site ID: WL5

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10 m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Picea glauca	2%		
2.			
3.			
4.			
5.			
	2	= Total Cover	
Sapling/Shrub Stratum (Plot size: 5 m)			
1. Acer rubrum	2%		
2.			
3.			
4.			
5.			
	2	= Total Cover	
Herb Stratum (Plot size: 1 m)			
1. Vaccinium macrocarpon	15%	✓	OBL
2. Eriophorum vaginatum	10%	✓	OBL
3. Aster nemoralis	20%	✓	FACW
4. Iris versicolor	5%		
5. Rubus - Black Berry	5%		
6.			
7.			
8.			
9.			
10.			
	55	= Total Cover	
Woody Vine Stratum (Plot size: —)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species ____	x 1 = ____
FACW species ____	x 2 = ____
FAC species ____	x 3 = ____
FACU species ____	x 4 = ____
UPL species ____	x 5 = ____
Column Totals: ____ (A)	____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ✓ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2009)

Sampling Point: GL5-WP1

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
+40-0							Histosol	Peat

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ✓ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ✓ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Depleted Dark Surface (F7)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Redox Depressions (F8)
- ___ Red Parent Material (TF2)

Indicators for Problematic Hydric Soils[3]:

- ___ Sandy Gleyed Matrix (S4)
- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (cm): ___

Hydric Soil Present? Yes ✓ No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ✓ No ___ Depth (cm): 3 cm

Water Table Present? Yes ✓ No ___ Depth (cm): Surface

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (cm): 0

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2009)

WETLAND DETERMINATION DATA FORM – NOVA SCOTIA

Project/Site: GRC Municipality/County: Guysborough Sampling Date: Sept. 1/10
Applicant/Owner: Eredonia Sampling Point: WL6-UP1
Investigator(s): S. Burley Section, Township, Range: Blacks Point
Landform (hillslope, terrace, etc.): Local relief (concave, convex, none):
Slope (%): 5% Lat: 6446716 Long: 502 4127 Datum: NAD 83 UTM
Soil Map Unit Name: Rockland Wetland Type: Upland
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ✓ No ____
Hydric Soil Present? Yes ____ No ✓
Wetland Hydrology Present? Yes ____ No ✓
Is the Sampled Area within a Wetland? Yes ____ No ✓
If yes, optional Wetland Site ID: ____
Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Abies balsamea	15%	✓	FAC
2.			
3.			
4.			
5.			
	15 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. Abies balsamea	15%	✓	FAC
2. Picea mariana	5%		FACW
3. Rubus pubescens	2%		FAC
4.			
5.			
	22 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. Maianthemum canadense	5%	✓	FAC
2. Viola incognita x sororia	5%	✓	FAC
3. Linnaea borealis	10%	✓	FAC
4. Mitchella repens	5%	✓	FACU
5. Picea mariana	2%		FACW
6. Abies balsamea	2%		FAC
7.			
8.			
9.			
10.			
	29 = Total Cover		
Woody Vine Stratum (Plot size: —)			
1.			
2.			
	____ = Total Cover		

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)
Total Number of Dominant Species Across All Strata: 6 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 83 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	7	x 2 =	14
FAC species	54	x 3 =	162
FACU species	5	x 4 =	20
UPL species		x 5 =	
Column Totals:	66 (A)		196 (B)

Prevalence Index = B/A = 2.97

Hydrophytic Vegetation Indicators:
___ Rapid Test for Hydrophytic Vegetation
___ Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2009)

C 1340-1135

Sampling Point: WL6-UP1

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (~~inches~~ cm)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0								Duff
0-10	7.5YR 6/1						Sandy loam	
10-30	7.5YR 4/6						Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Depleted Dark Surface (F7)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Redox Depressions (F8)
- ___ Red Parent Material (TF2)

Indicators for Problematic Hydric Soils[3]:

- ___ Sandy Gleyed Matrix (S4)
- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (~~inches~~ cm): _____

Hydric Soil Present? Yes _____ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (~~inches~~ cm): _____

Water Table Present? Yes _____ No _____ Depth (~~inches~~ cm): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (~~inches~~ cm): _____

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2009)

WETLAND DETERMINATION DATA FORM – NOVA SCOTIA

Project/Site: GRQ Municipality/County: Guysborough Sampling Date: Sept. 1/10

Applicant/Owner: Erdware Sampling Point: WL6 - UP1

Investigator(s): S. Burley Section, Township, Range: Blacks Point

Landform (hillslope, terrace, etc.): Flat Local relief (concave, convex, none): Concave

Slope (%): 2% ~~Lat:~~ E 644740 ~~Long:~~ N 5024111 Datum: NAD83

Soil Map Unit Name: Rockland Wetland Type: Bog

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓ No ____	Is the Sampled Area within a Wetland?	Yes ✓ No ____
Hydric Soil Present?	Yes ✓ No ____		
Wetland Hydrology Present?	Yes ✓ No ____	If yes, optional Wetland Site ID:	WL6

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer rubrum	2%		FAC
2. Abies balsamea	5%	✓	FAC
3. Picea mariana	5%	✓	FAC
4.			
5.			
	12	= Total Cover	

Sapling/Shrub Stratum (Plot size: 5m)			
1. Acer rubrum	1%		FAC
2. Picea mariana	5%	✓	FACW
3. Alnus incana	2%		FACW
4. Myrica pensylvanica	10%	✓	FAC
5. Corylus cornuta	5%	✓	FACU
	23	= Total Cover	

Herb Stratum (Plot size: 1m)			
1. Maianthemum trifolia	20%	✓	OBL
2. Eriophorum virginicum	10%	✓	OBL
3. Corylus cornuta	5%		FACU
4. Ledum groenlandicum	5%		OBL
5. Aster nemoralis	2%		FACW
6. Rubus hispidus	2%		FACW
7. Rhynchospora alba	2%		OBL
8.			
9.			
10.			
	46	= Total Cover	

Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 6 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 86 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species	x 1 =	
FACW species	x 2 =	
FAC species	x 3 =	
FACU species	x 4 =	
UPL species	x 5 =	
Column Totals: (A)		(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ✓ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2009)

C 1340-1137

Sampling Point: WL6-WP1

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (~~inches~~ cm)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-40							organic	Peat

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ✓ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ✓ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Depleted Dark Surface (F7)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Redox Depressions (F8)
- ___ Red Parent Material (TF2)

Indicators for Problematic Hydric Soils[3]:

- ___ Sandy Gleyed Matrix (S4)
- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (~~inches~~ cm): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (~~inches~~ cm): _____

Water Table Present? Yes ✓ No ___ Depth (~~inches~~ cm): Surface

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (~~inches~~ cm): 0

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2009)

WETLAND DETERMINATION DATA FORM – NOVA SCOTIA

Project/Site: GRA Municipality/County: Guysborough Sampling Date: Sept 1/10

Applicant/Owner: Erdmann Sampling Point: WL7-WP1

Investigator(s): S. Burley Section, Township, Range: Blacks Point

Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): Flat

Slope (%): 2% Lat: 644035 Long: 502438 Datum: NAD83 UTM

Soil Map Unit Name: Rockland Wetland Type: Shrub Swamp

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	Is the Sampled Area within a Wetland? Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	
Wetland Hydrology Present?	Yes ✓	No ____	If yes, optional Wetland Site ID: WL7

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Picea mariana	10%	✓	FACW
2. Picea glauca	5%	✓	FACU
3.			
4.			
5.			
	15	= Total Cover	
Sapling/Shrub Stratum (Plot size: 5m)			
1. Alnus incana	5%		FAC
2. Alnus incana	2%		FACW
3. Gaylussacia baccata	5%		FACU
4. Picea glauca	10%		FACU
5. Osmundastrum cinnamomeum	50%	✓	FACW
	72	= Total Cover	
Herb Stratum (Plot size: 1m)			
1. Calamagrostis canadensis	15%	✓	FACW
2. Aster nemoralis	40%	✓	FACW
3. Eutrochium angustifolium	2%		FAC
4. Rubus hispidus	5%		FACW
5. Rubus pubescens	5%		FACW
6.			
7.			
8.			
9.			
10.			
	37	= Total Cover	
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 80 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species	x 1 =	
FACW species	x 2 =	
FAC species	x 3 =	
FACU species	x 4 =	
UPL species	x 5 =	
Column Totals: (A)		(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ✓ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2009)

C 1340-1139

Sampling Point: Pit 7 - WP1

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 to 40-0							Histosol	Peat

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ✓ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Depleted Dark Surface (F7)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Redox Depressions (F8)
- ___ Red Parent Material (TF2)

Indicators for Problematic Hydric Soils[3]:

- ___ Sandy Gleyed Matrix (S4)
- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (cm): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ✓ No ___ Depth (cm): 10 cm

Water Table Present? Yes ✓ No ___ Depth (cm): 5 cm

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (cm): 0 cm

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2009)

WETLAND DETERMINATION DATA FORM – NOVA SCOTIA

Project/Site: GRC Municipality/County: Guysborough Sampling Date: Sept 1/10
Applicant/Owner: Erickson Sampling Point: WL8-WP1
Investigator(s): S. Burley Section, Township, Range: Blacks Point
Landform (hillslope, terrace, etc.): Flat Local relief (concave, convex, none): Hummocky
Slope (%): 1% Lat: 6439419 Long: 5022628 Datum: NAD 83 UTM
Soil Map Unit Name: Rockland Wetland Type: Treed Swamp
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	Is the Sampled Area within a Wetland? Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	If yes, optional Wetland Site ID: WL8
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer Rubrum	50	✓	FAC
2. Picea Glauca	15	✓	FAC
3.			
4.			
5.			
	20	= Total Cover	

Sapling/Shrub Stratum (Plot size: 5m)			
1. Sorbus americana	5		FACU
2. Picea Glauca	5		FAC
3. Osmunda cinnamomea	45	✓	FACW
4. Picea mariana	2		FACU
5.			
	57	= Total Cover	

Herb Stratum (Plot size: 1m)			
1. Osmunda cinnamomea	35	✓	FACW
2. Carex trisperma	25	✓	OBL
3. Cornus canadensis	5		FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	60	= Total Cover	

Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____	= Total Cover	

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)
Total Number of Dominant Species Across All Strata: 5 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species	x 1 =	
FACW species	x 2 =	
FAC species	x 3 =	
FACU species	x 4 =	
UPL species	x 5 =	
Column Totals: (A)		(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:
___ Rapid Test for Hydrophytic Vegetation
✓ Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2009)

C 1340-1141

Sampling Point: WL8-WP1

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-40+								Peat

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ✓ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Depleted Dark Surface (F7)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Redox Depressions (F8)
- ___ Red Parent Material (TF2)

Indicators for Problematic Hydric Soils[3]:

- ___ Sandy Gleyed Matrix (S4)
- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (cm): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ✓ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (cm): _____

Water Table Present? Yes ✓ No ___ Depth (cm): 25cm

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (cm): 0cm

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2009)

WETLAND DETERMINATION DATA FORM – NOVA SCOTIA

Project/Site: GRQ Municipality/County: Queensborough Sampling Date: Sept. 2/10

Applicant/Owner: Erdem Sampling Point: WL-WP1

Investigator(s): S. Burley Section, Township, Range: Blacks Point

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Hummocky

Slope (%): 5% E: 643859 ~~Lat.~~ N: ~~Long:~~ 5023682 Datum: NAD 83 CSRS

Soil Map Unit Name: Rockland Wetland Type: Treed Swamp

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	Is the Sampled Area within a Wetland? Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	
Wetland Hydrology Present?	Yes ✓	No ____	If yes, optional Wetland Site ID: 4, 11

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10M)	Absolute % Cover	Dominant Species?	Indicator Status
1. Abies balsamea	20%	✓	FAC
2. Picea mariana	30%	✓	FACW
3.			
4.			
5.			
	50	= Total Cover	

Sapling/Shrub Stratum (Plot size: 5M)			
1. Abies balsamea	20%	✓	FAC
2. Viburnum nudum	15%	✓	OBL
3. Sorbus americana	1%		FACU
4.			
5.			
	36	= Total Cover	

Herb Stratum (Plot size: 1M)			
1. Cornus canadensis	5%	✓	OBL
2. Carex canadensis	2%		FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	7	= Total Cover	

Woody Vine Stratum (Plot size: ____)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species	x 1 =	
FACW species	x 2 =	
FAC species	x 3 =	
FACU species	x 4 =	
UPL species	x 5 =	
Column Totals: (A)		(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ✓ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2009)

C 1340-1143

Sampling Point: WU-WP1

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (~~inches~~ cm)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-40							organic	Peat

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ✓ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Depleted Dark Surface (F7)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Redox Depressions (F8)
- ___ Red Parent Material (TF2)

Indicators for Problematic Hydric Soils[3]:

- ___ Sandy Gleyed Matrix (S4)
- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Bedrock

Depth (~~inches~~ cm): 40cm

Hydric Soil Present? Yes ✓ No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ✓ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ___ Depth (~~inches~~ cm): ___

Water Table Present? Yes ___ No ___ Depth (~~inches~~ cm): ___

Saturation Present? (includes capillary fringe) Yes ___ No ___ Depth (~~inches~~ cm): ___

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2009)

WETLAND DETERMINATION DATA FORM – NOVA SCOTIA

Project/Site: ORQ Municipality/County: Guysborough Sampling Date: Sept 3/10

Applicant/Owner: Enclume Sampling Point: WL13-upl

Investigator(s): S. Burley Section, Township, Range: Black Point

Landform (hillslope, terrace, etc.): Flat Local relief (concave, convex, none): Hummocky

Slope (%): 19 ~~Lat:~~ 6044879 ~~Long:~~ 5023522 Datum: NAD 83 UTM

Soil Map Unit Name: Rockland Wetland Type: Shrub Swamp/Bog

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	Is the Sampled Area within a Wetland? Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	If yes, optional Wetland Site ID: WL13
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10 m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Picea mariana	10%	✓	FACW
2. Abies balsamea	2%		FAC
3.			
4.			
5.			
	12	= Total Cover	

Sapling/Shrub Stratum (Plot size: 5 m)			
1. Rhododendron canadense	15%	✓	OBL
2. Viburnum nudum	10%		FACW
3. Chamaedaphne calyculata	6%	✓	FACW
4. Gaylussacia baccata	5%		FACW
5. Myrica gale	5%		
	35	= Total Cover	

Herb Stratum (Plot size: 1 m)			
1. Sarracenia purpurea	1%		OBL
2. Carex trisperma	5%	✓	OBL
3. Coptis trifolia	5%	✓	FACW
4. Rhodora canadensis	5%	✓	FAC
5.			
6.			
7.			
8.			
9.			
10.			
	16	= Total Cover	

Woody Vine Stratum (Plot size: ____)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 6 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species	x 1 =	
FACW species	x 2 =	
FAC species	x 3 =	
FACU species	x 4 =	
UPL species	x 5 =	
Column Totals: (A)		(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ✓ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2009)

C 1340-1145

Sampling Point: WL13-UPL

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-40							Organic	Peat

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ✓ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Depleted Dark Surface (F7)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Redox Depressions (F8)
- ___ Red Parent Material (TF2)

Indicators for Problematic Hydric Soils[3]:

- ___ Sandy Gleyed Matrix (S4)
- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (cm): ___

Hydric Soil Present? Yes ✓ No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (cm): ___

Water Table Present? Yes ✓ No ___ Depth (cm): 15cm

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (cm): 0

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2009)

WETLAND DETERMINATION DATA FORM – NOVA SCOTIA

Project/Site: GRQ Municipality/County: Guysborough Sampling Date: Sept. 3/16
Applicant/Owner: Fortune Sampling Point: WL14 - WP1
Investigator(s): S. Burley Section, Township, Range: Blue Rks Point
Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): Hummocky
Slope (%): 2-3% E Lat: 644869 ~~Long~~ N: 5023348 Datum: NAD 83 UTM
Soil Map Unit Name: Rockland Wetland Type: Treed Swamp
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ✓ No ____
Hydric Soil Present? Yes ✓ No ____
Wetland Hydrology Present? Yes ✓ No ____
Is the Sampled Area within a Wetland? Yes ✓ No ____
If yes, optional Wetland Site ID: WL14
Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer Rubrum	15%	✓	FAC
2. Picea Mariana	15%	✓	FACW
3. Rubus pubescens	5%		FAC
4.			
5.			
	35	= Total Cover	

Sapling/Shrub Stratum (Plot size: 5m)			
1. Nemopanthus mucronata	10%	✓	OBL
2. Viburnum nudum	5%	✓	FACW
3. Osmunda cinnamomea	10%	✓	FACW
4.			
5.			
	25	= Total Cover	

Herb Stratum (Plot size: 1m)			
1. Carex trisperma	50%	✓	OBL
2. Maianthemum canadense	20%	✓	FAC
3. Picea mariana	5%		FACW
4. Kalmia angustifolia	10%		FAC
5.			
6.			
7.			
8.			
9.			
10.			
	65	= Total Cover	

Woody Vine Stratum (Plot size: ____)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 7 (A)
Total Number of Dominant Species Across All Strata: 7 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species ____	x 1 = ____
FACW species ____	x 2 = ____
FAC species ____	x 3 = ____
FACU species ____	x 4 = ____
UPL species ____	x 5 = ____
Column Totals: ____ (A)	____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:
___ Rapid Test for Hydrophytic Vegetation
✓ Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2009)

C 1340-1147

Sampling Point: WL14-UP1

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
O 20-0							organic	Peat
A 0-20	5YR 2.5/1						Silt	High organic content

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ✓ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ✓ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Depleted Dark Surface (F7)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Redox Depressions (F8)
- ___ Red Parent Material (TF2)

Indicators for Problematic Hydric Soils[3]:

- ___ Sandy Gleyed Matrix (S4)
- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (cm): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ✓ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (cm): _____

Water Table Present? Yes ___ No ✓ Depth (cm): _____

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (cm): 0 cm

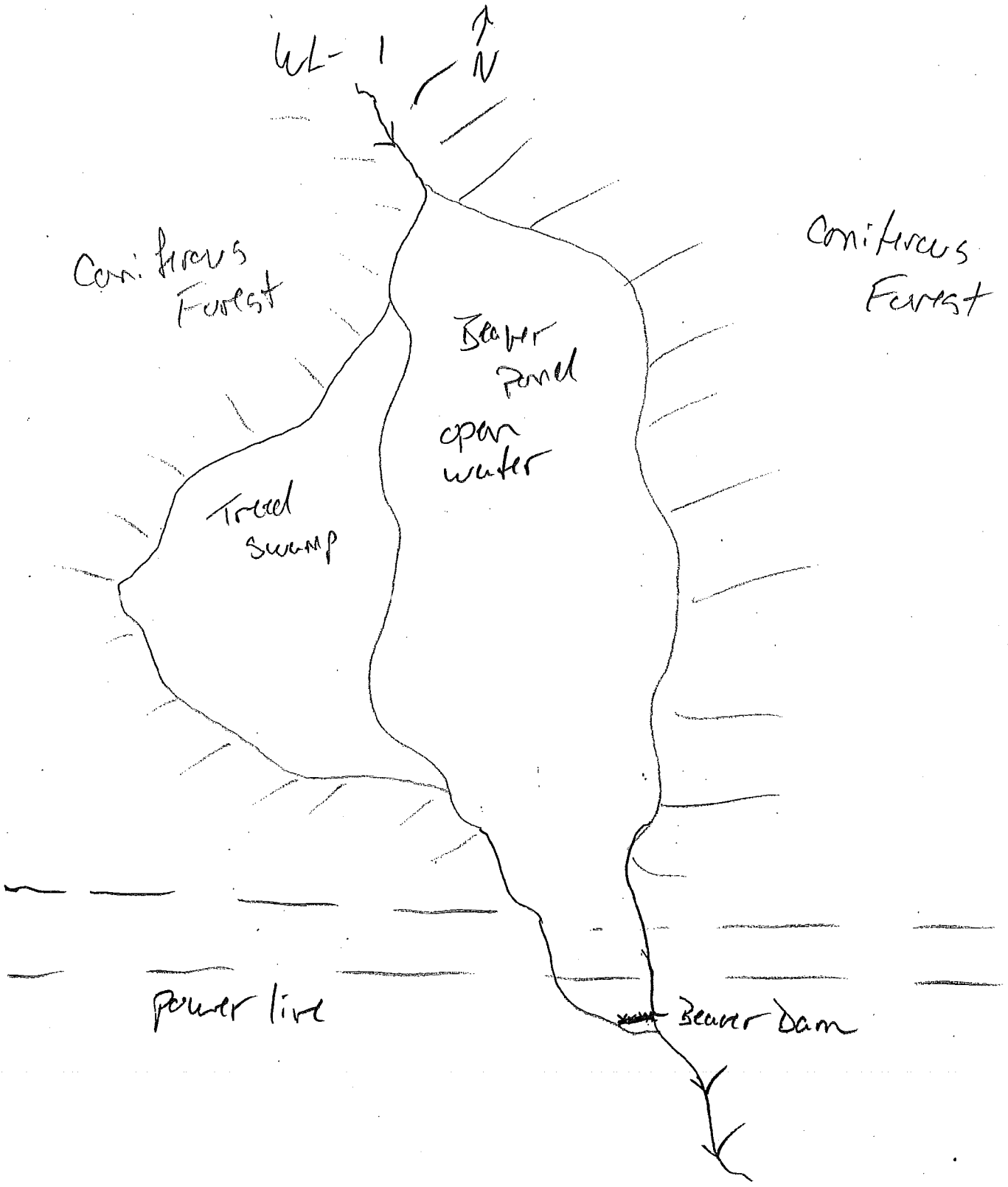
Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

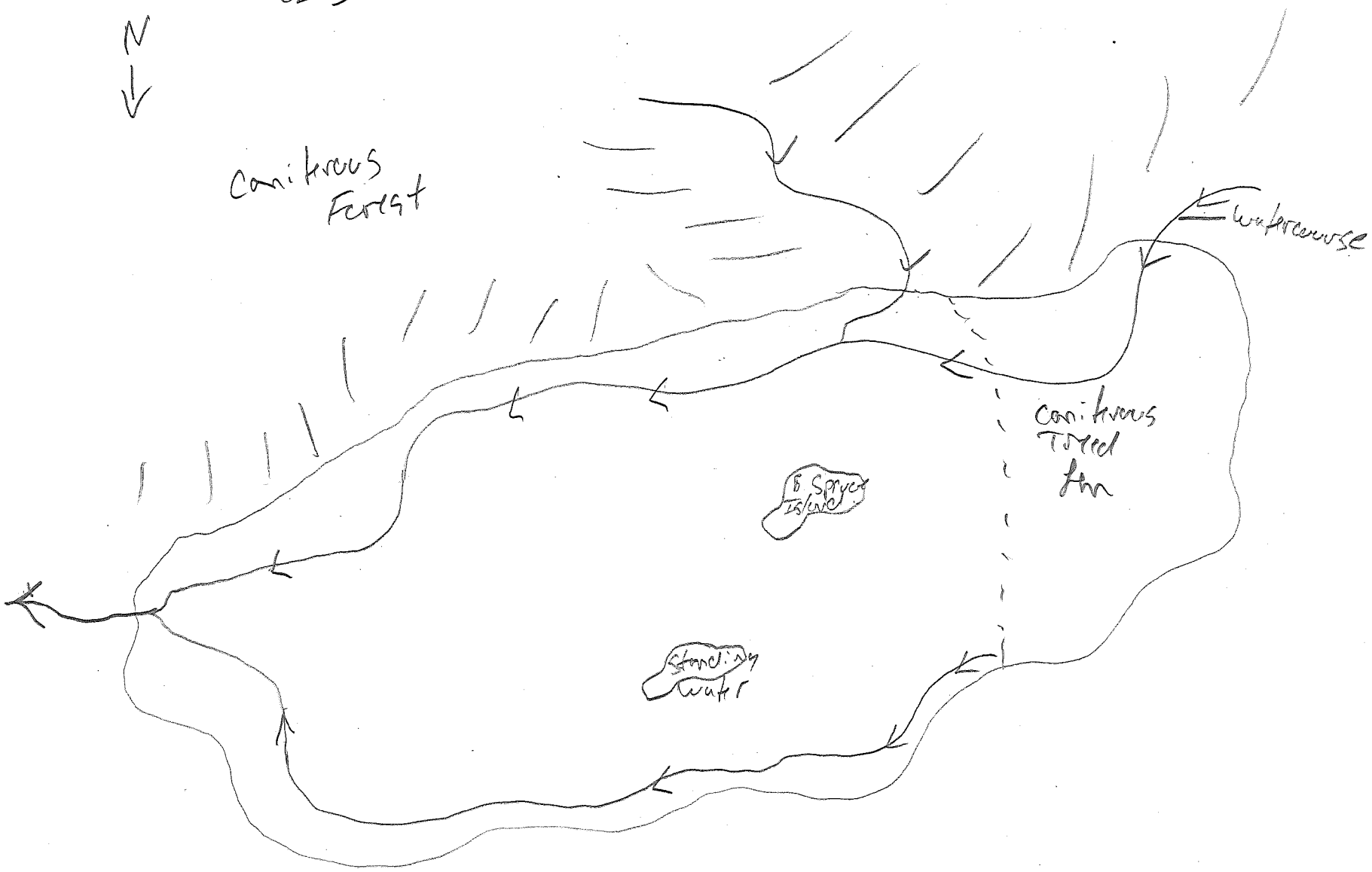
Appendix C.2

Wetland Habitat Sketches

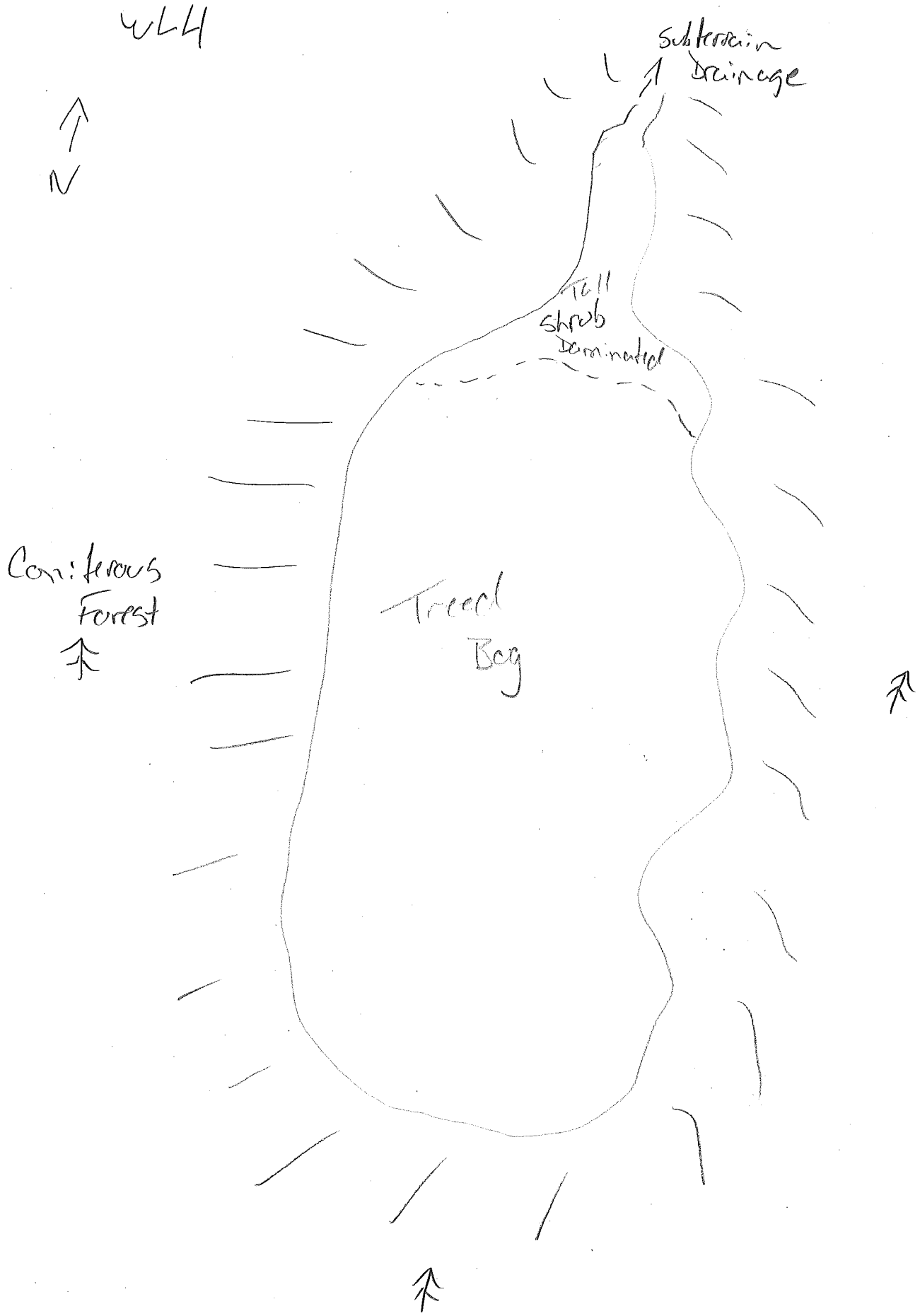

WL-1
N
Coniferous Forest
Coniferous Forest
Beaver Pond
open water
Treed Swamp
power line
Beaver Dam

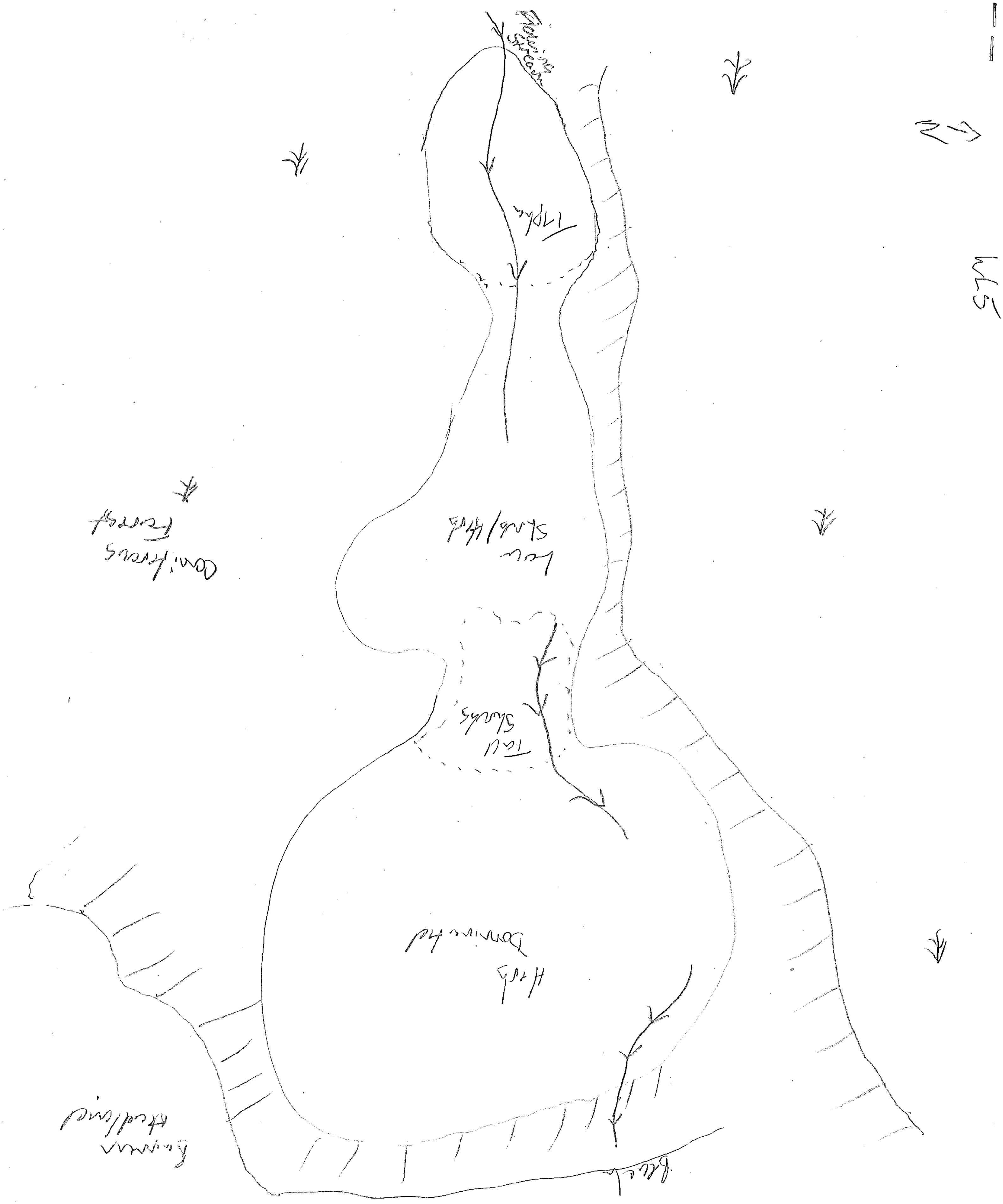
WL2
N
Beach
Natural Stone Berm
Robust Emergent Marsh
Typha angustifolia
Saline Pond
Herb Fen
Eriophorum
Juncus
Osmunda
Tall Shrub Fen
Osmunda
Alnus
Salix
Stream
Spring
Channels

C 1340-1152

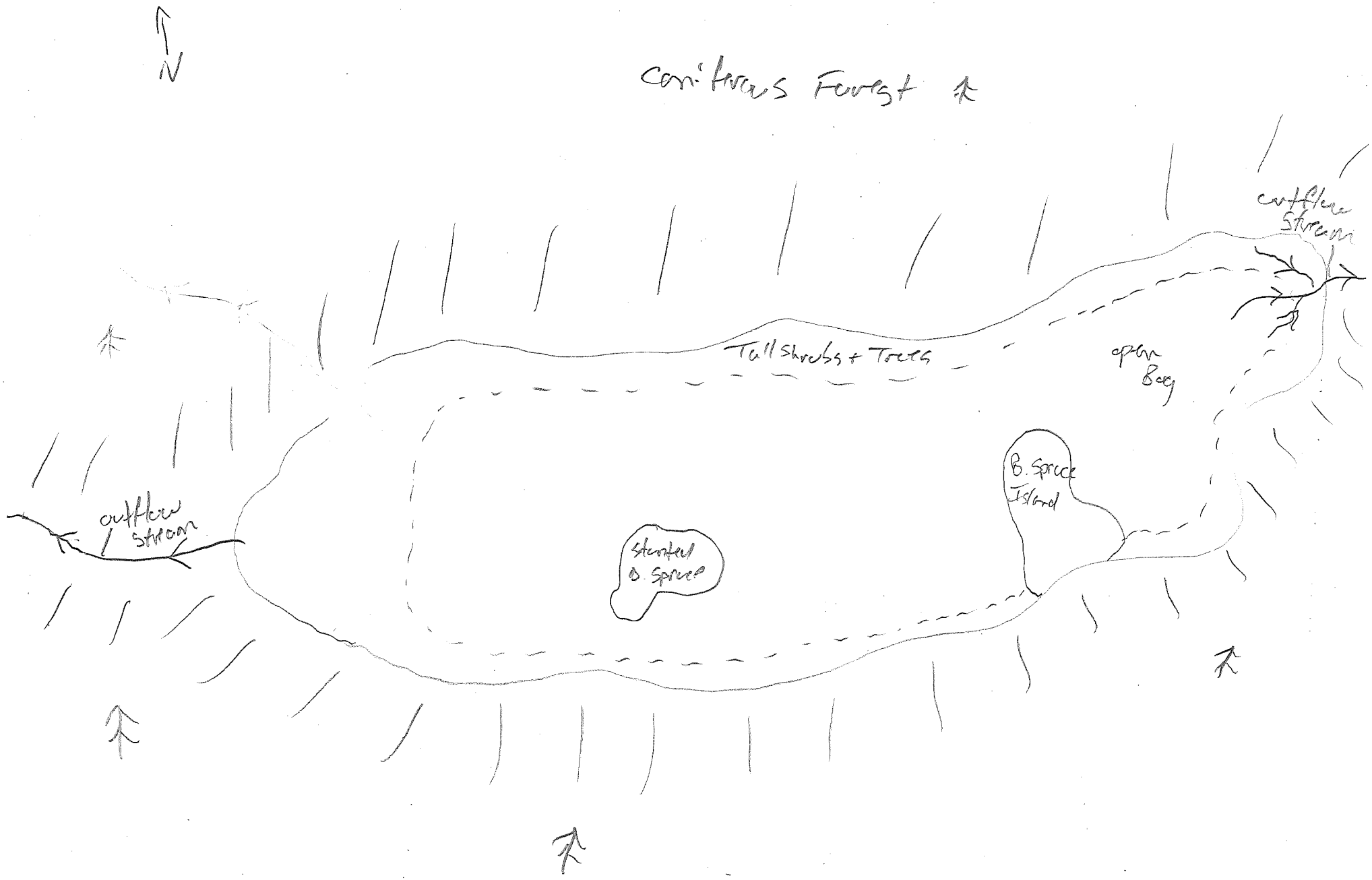

N
Coniferous Forest
Watercourse
Coniferous Treed Fen
Standing Water

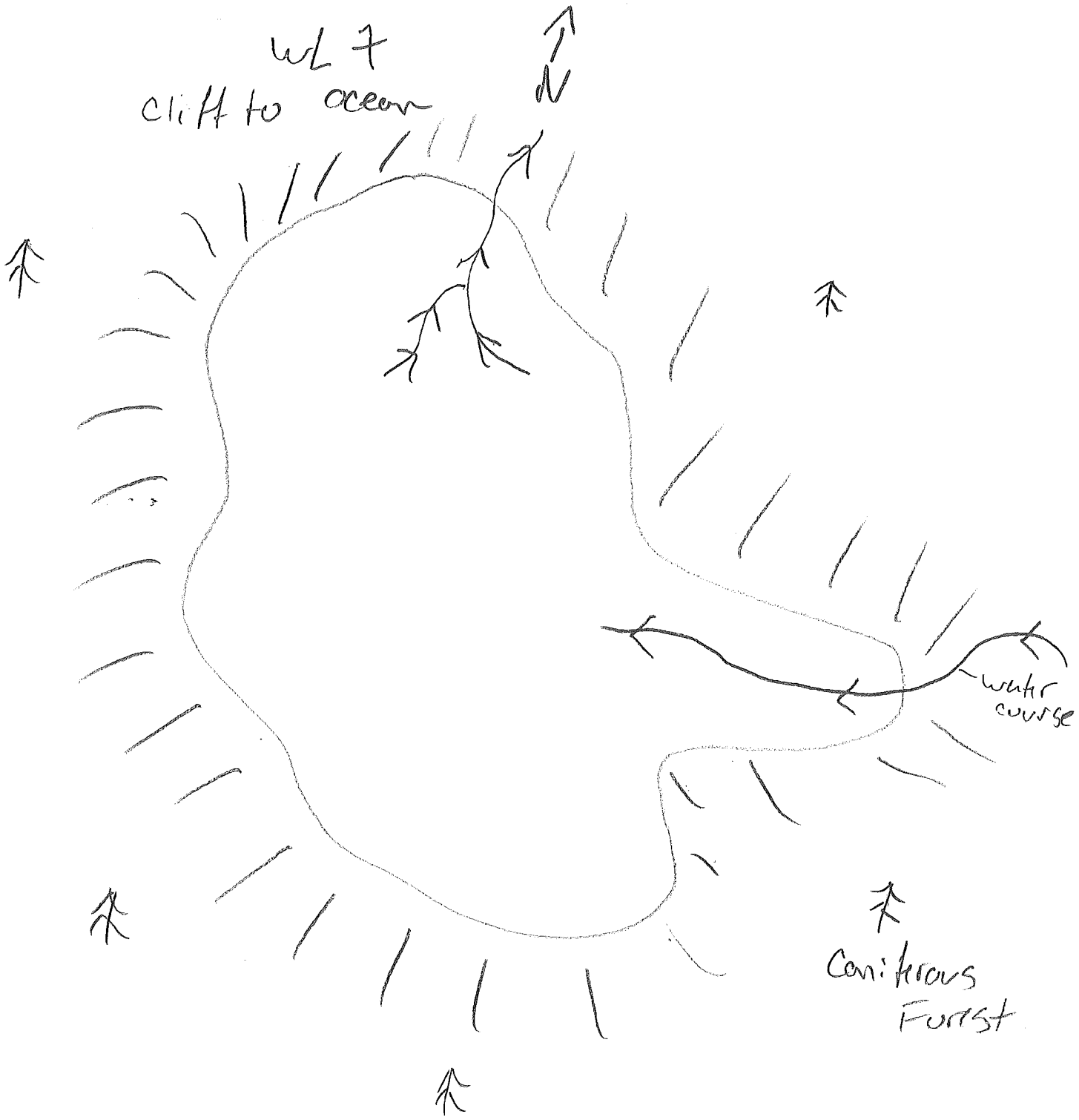
C 1340-1153

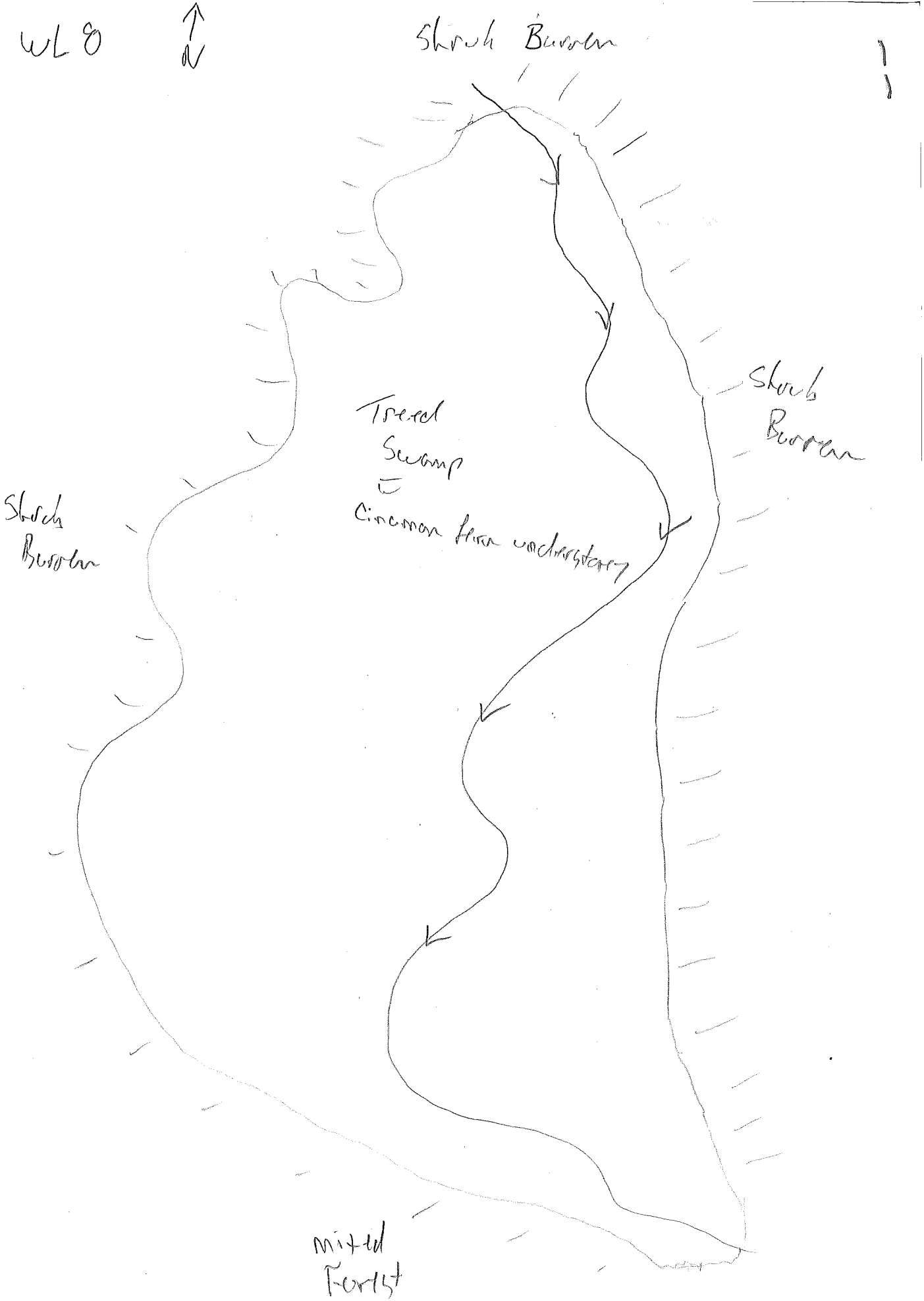

4LL4
Subterrain Drainage
N
Tall shrub dominated
Coniferous Forest
Treed Bog


Flowing Stream
Typha
Low Shrub/Herb
Coniferous Forest
Tall Shrubs
Herb Dominated
WL5

WLG

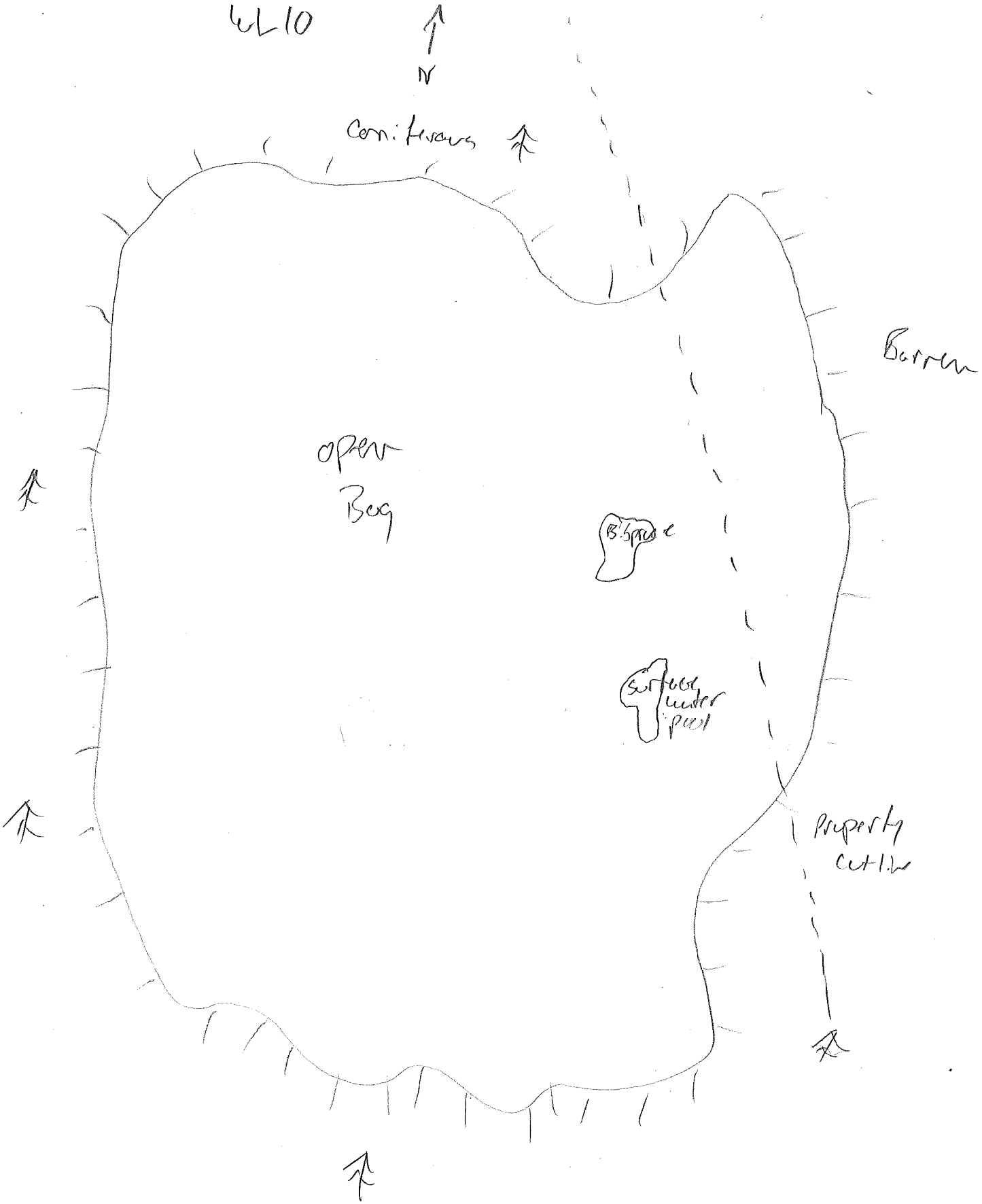

N
coniferous Forest
outflow stream
Tall shrubs + Trees
open Bog
outflow Stream
B. Spruce Island
stunted B. Spruce

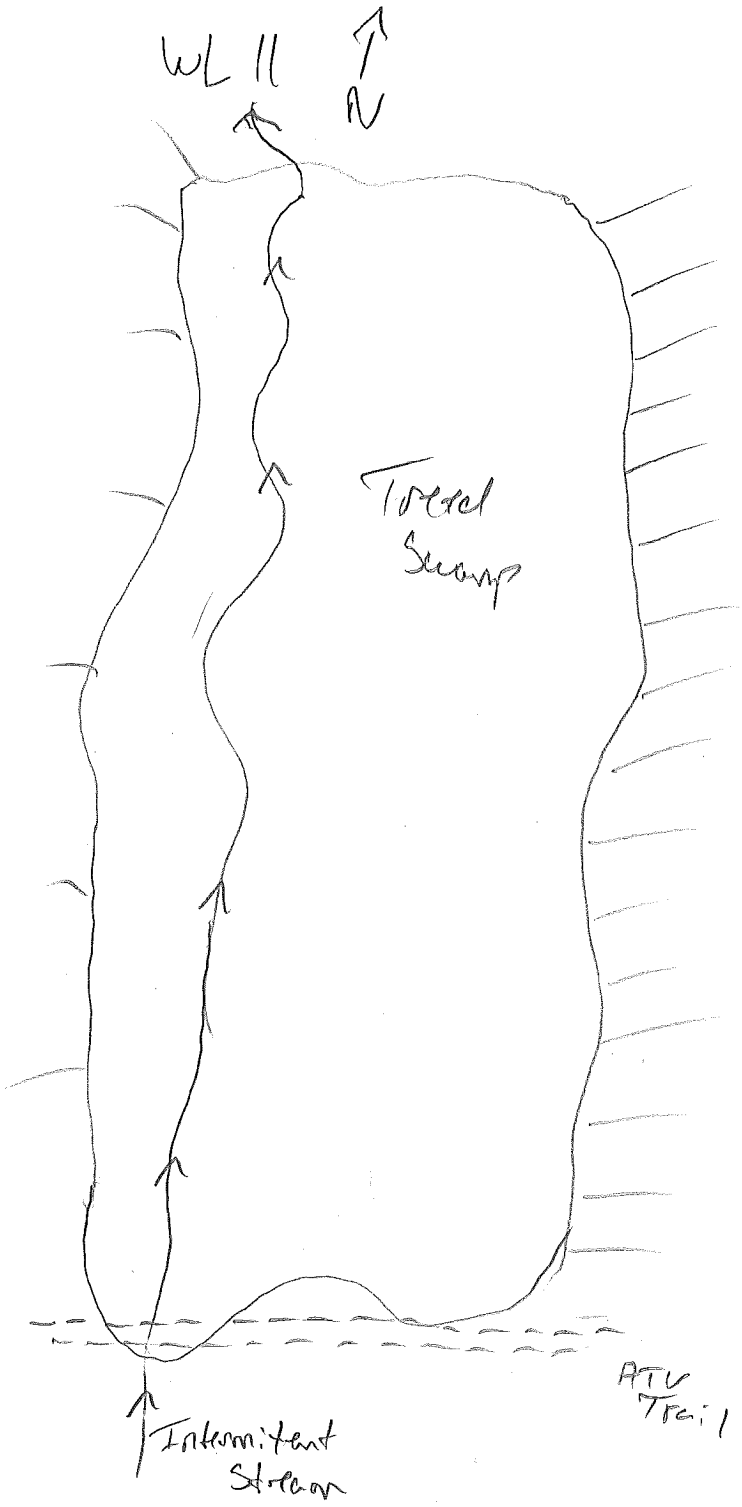

WL 7
cliff to ocean
N
water course
Coniferous Forest

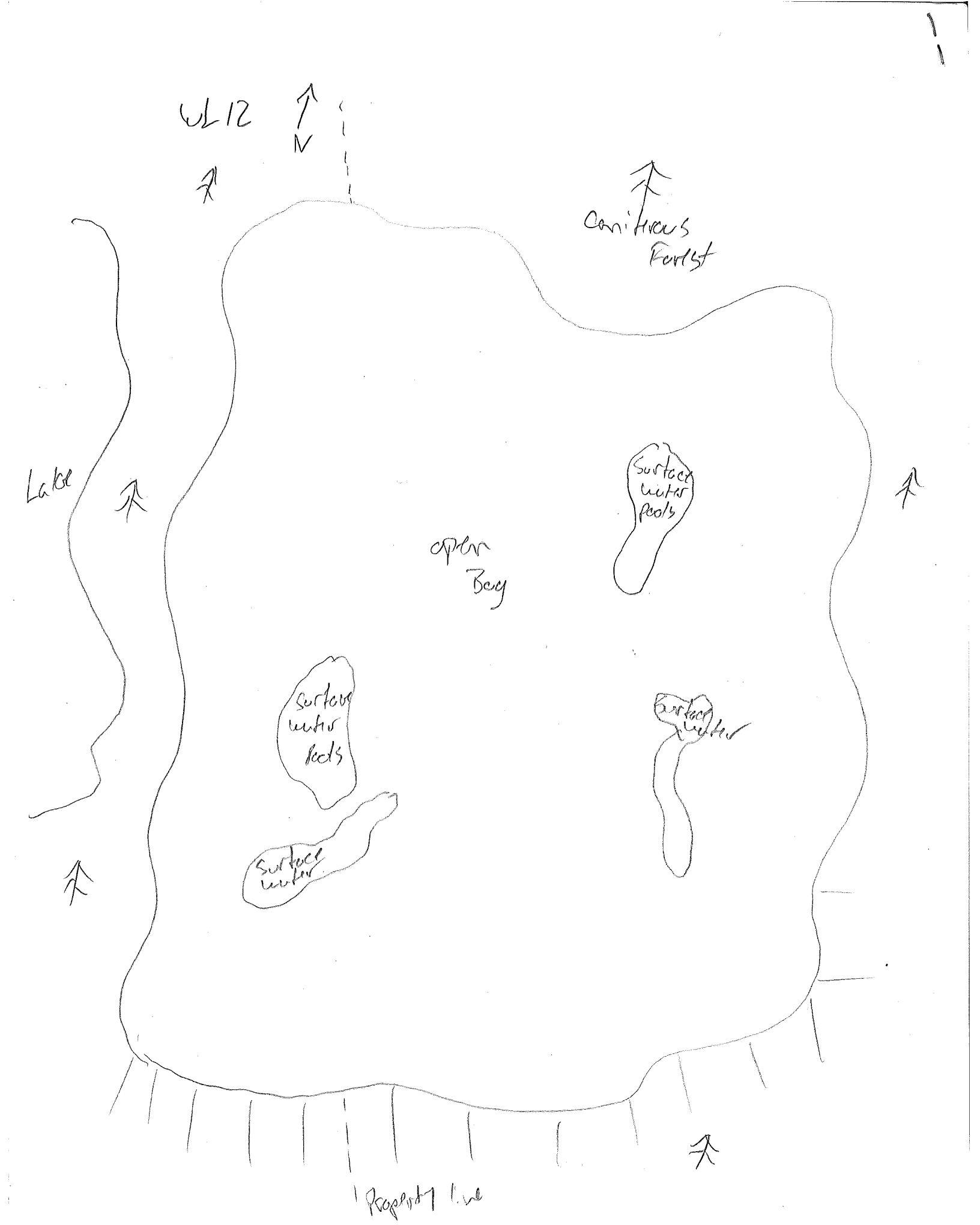

WL 8
N
Shrub Burrow
Shrub Burrow
Shrub Burrow
Treed Swamp
= Cinnamon fern understory
mixed Forest

Lake
Shrub Fen
Barren
coniferous forest
Tall shrub
Barren
mound
open bog
treed swamp

C 1340-1159


4L10
N
Coniferous
Barren
open
Bog
B. Spruce
Property
Cut line

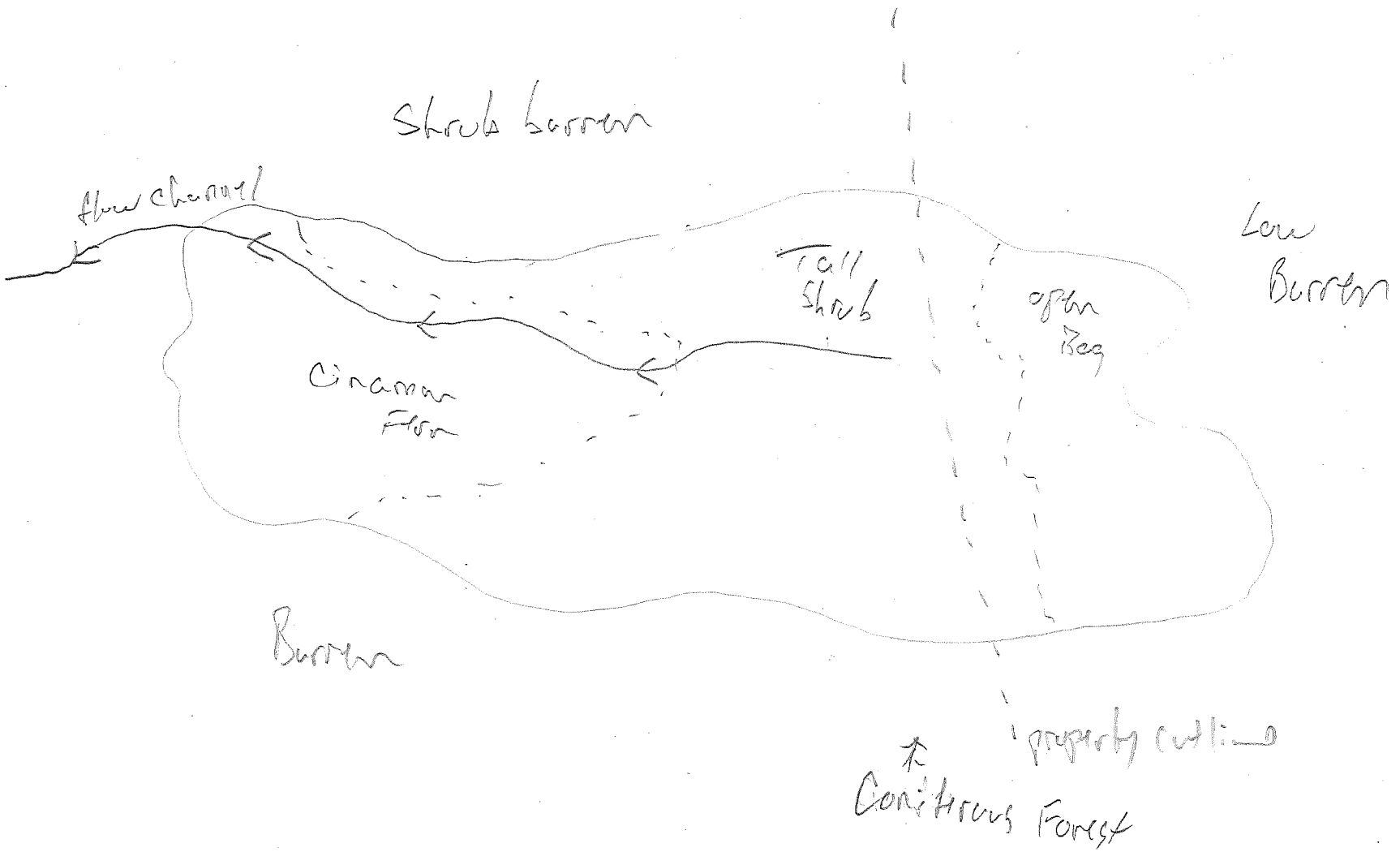

WL 11
N
Forested
Swamp
ATV
Trail
Intermittent
Stream

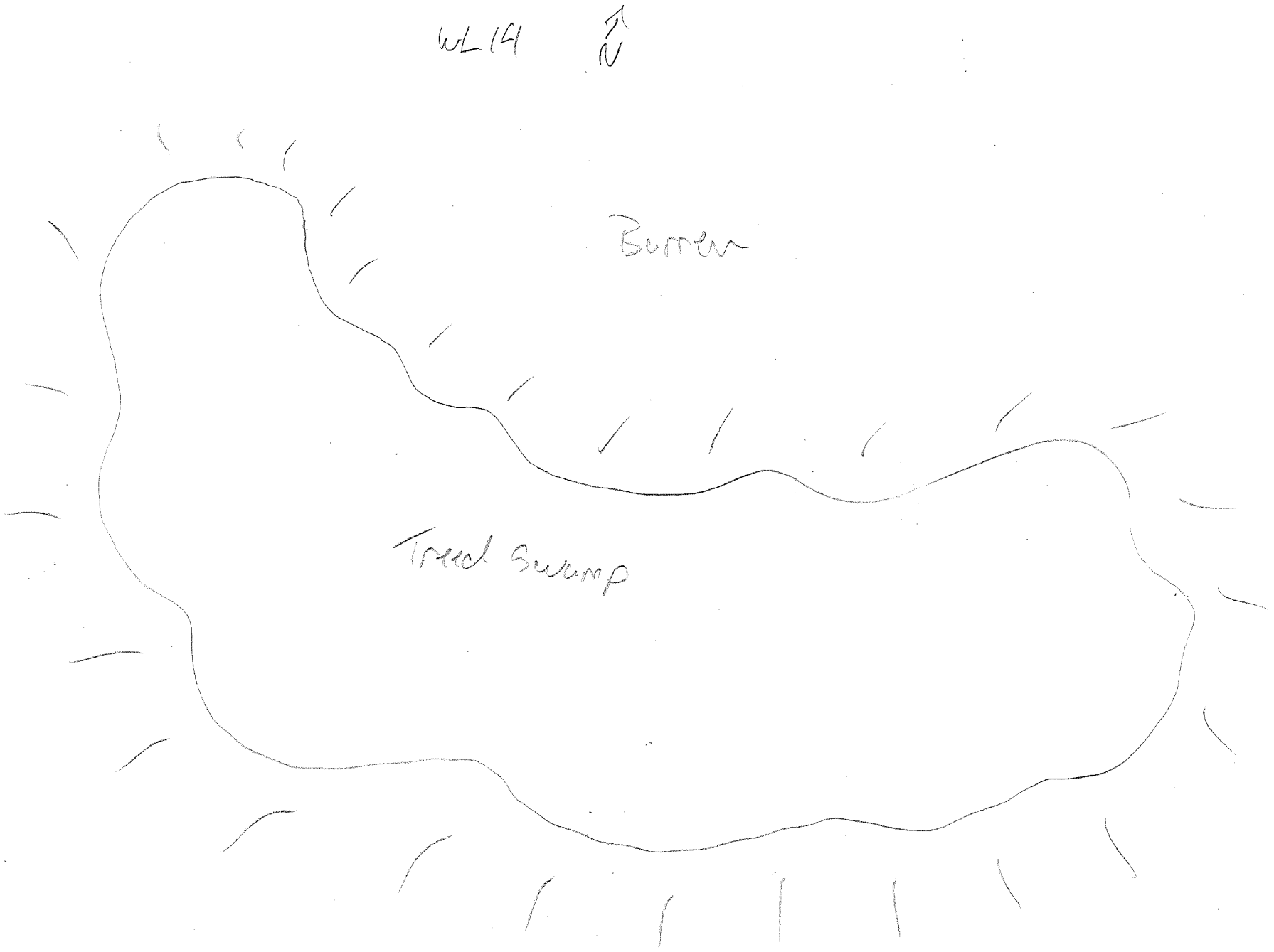

WL 12
N
Coniferous Forest
Lake
Surface water pools
open Bay
Surface water pools
Surface water
Surface water
Property line

C 1340-1162

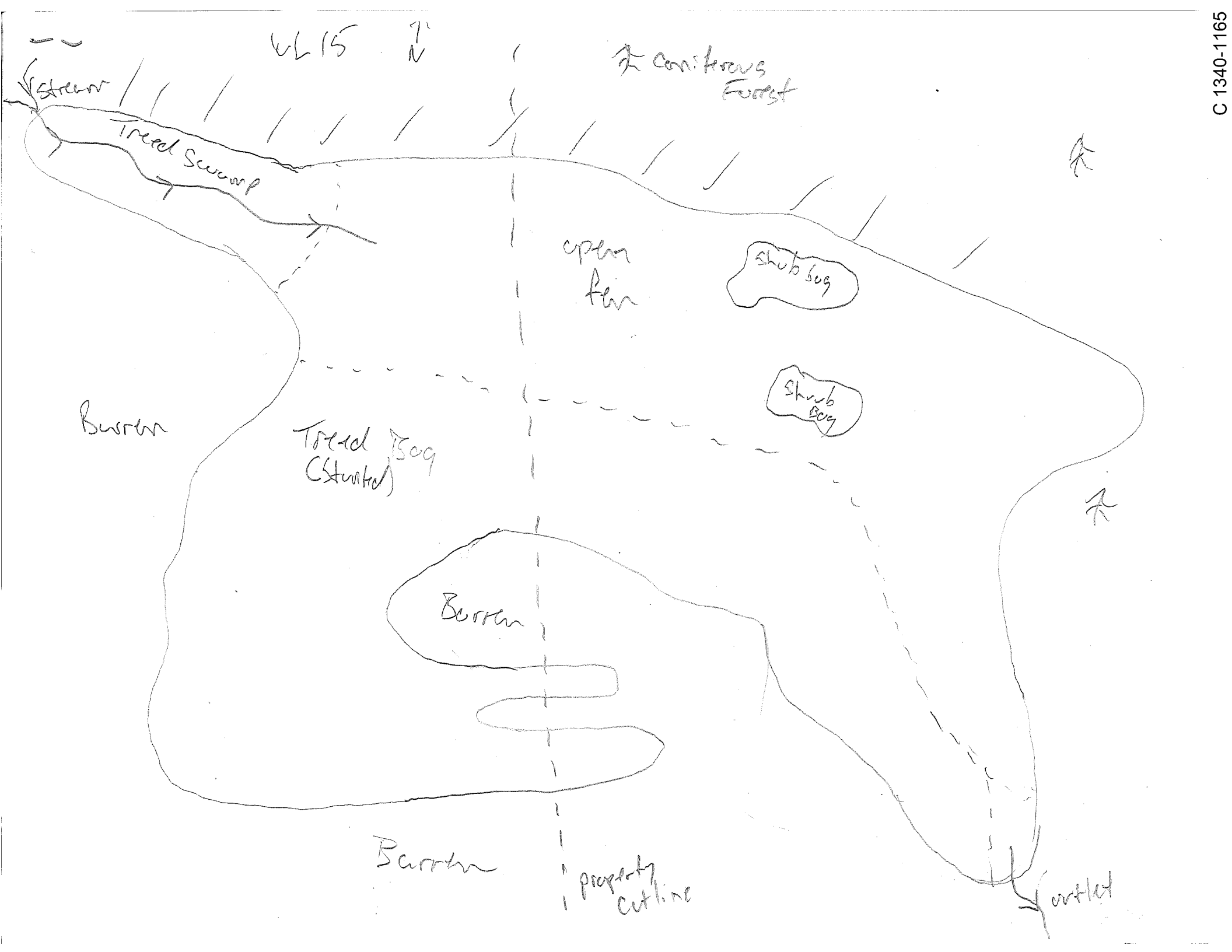
C 1340-1163

WL13



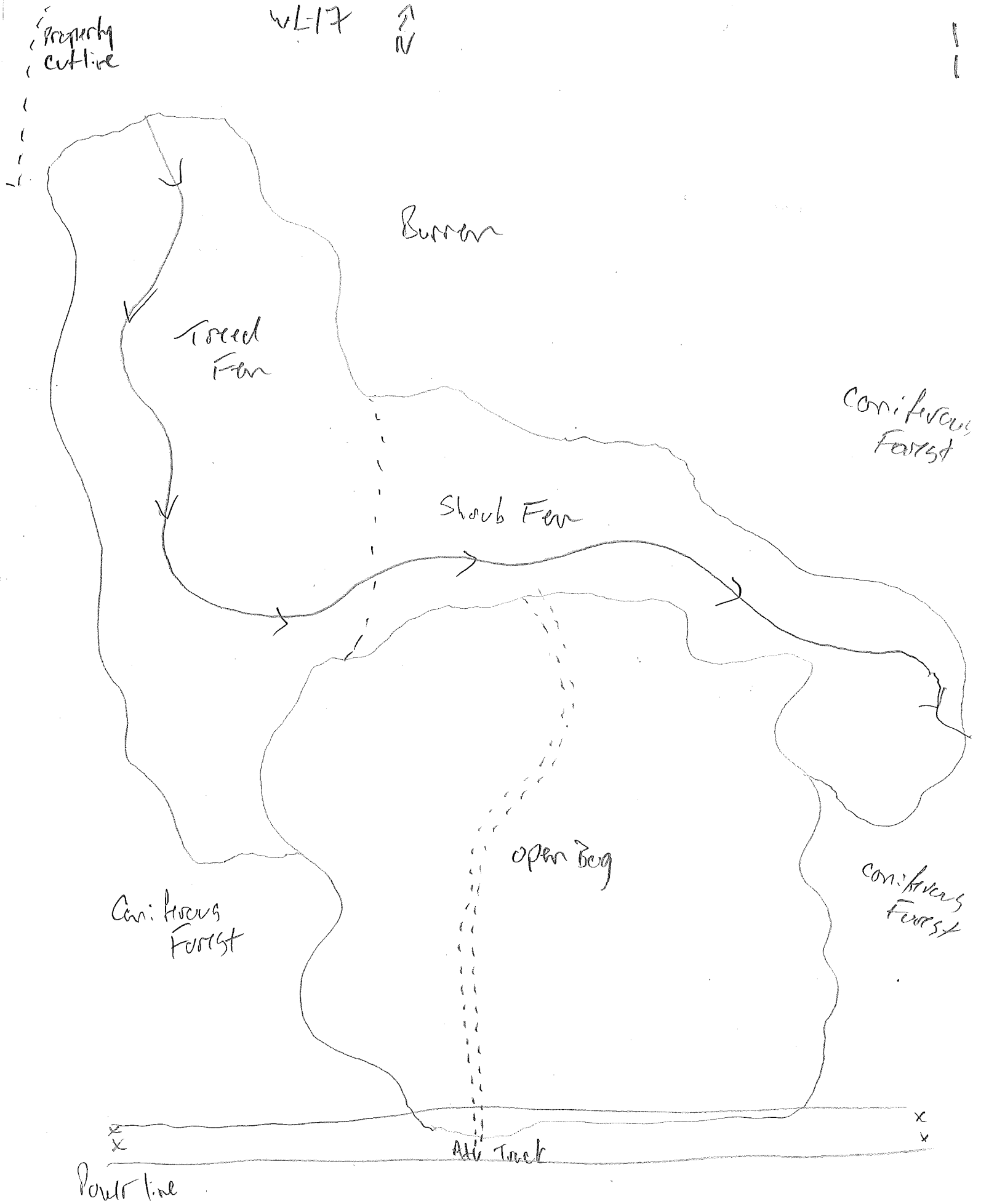


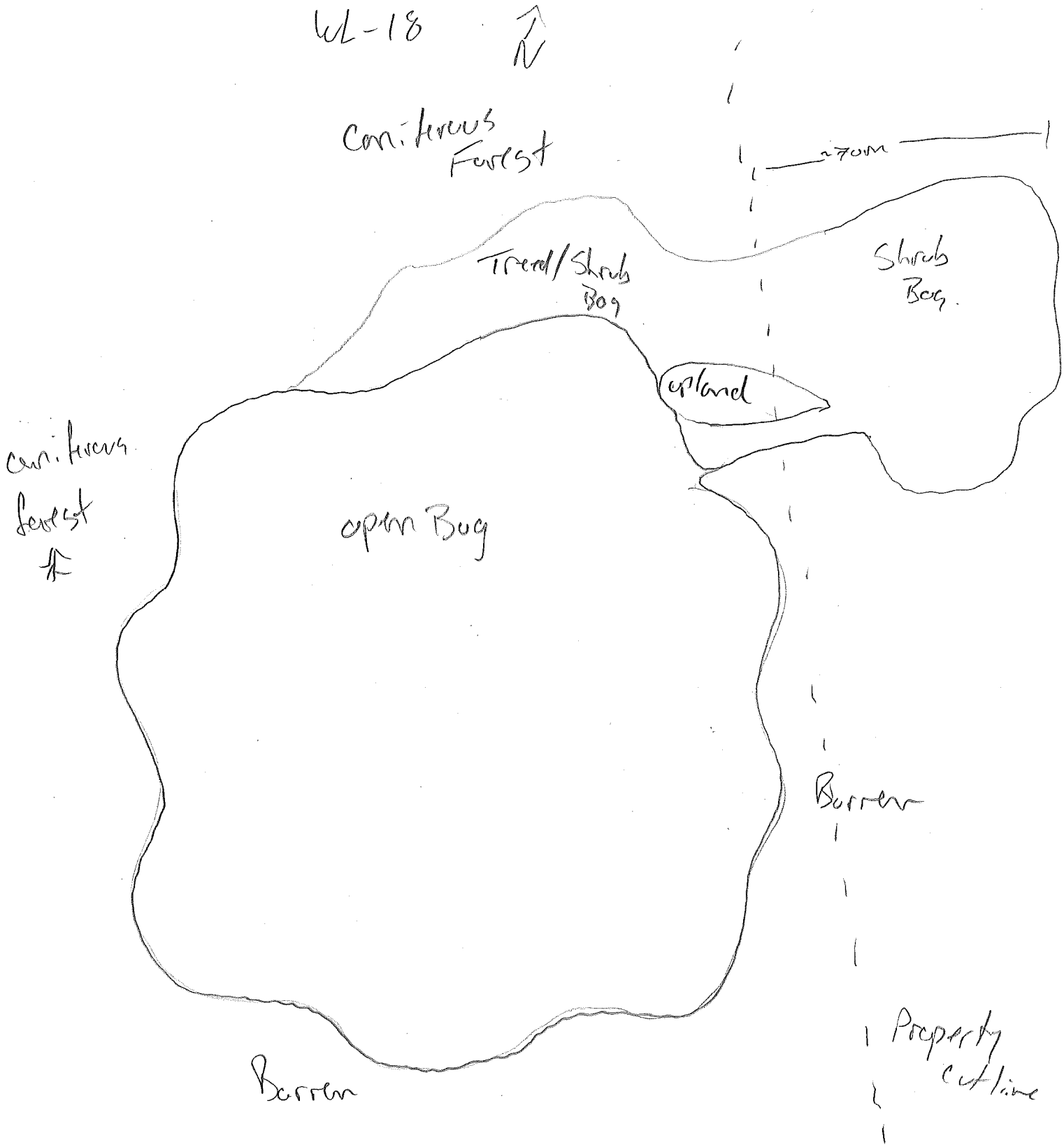
C 1340-1164

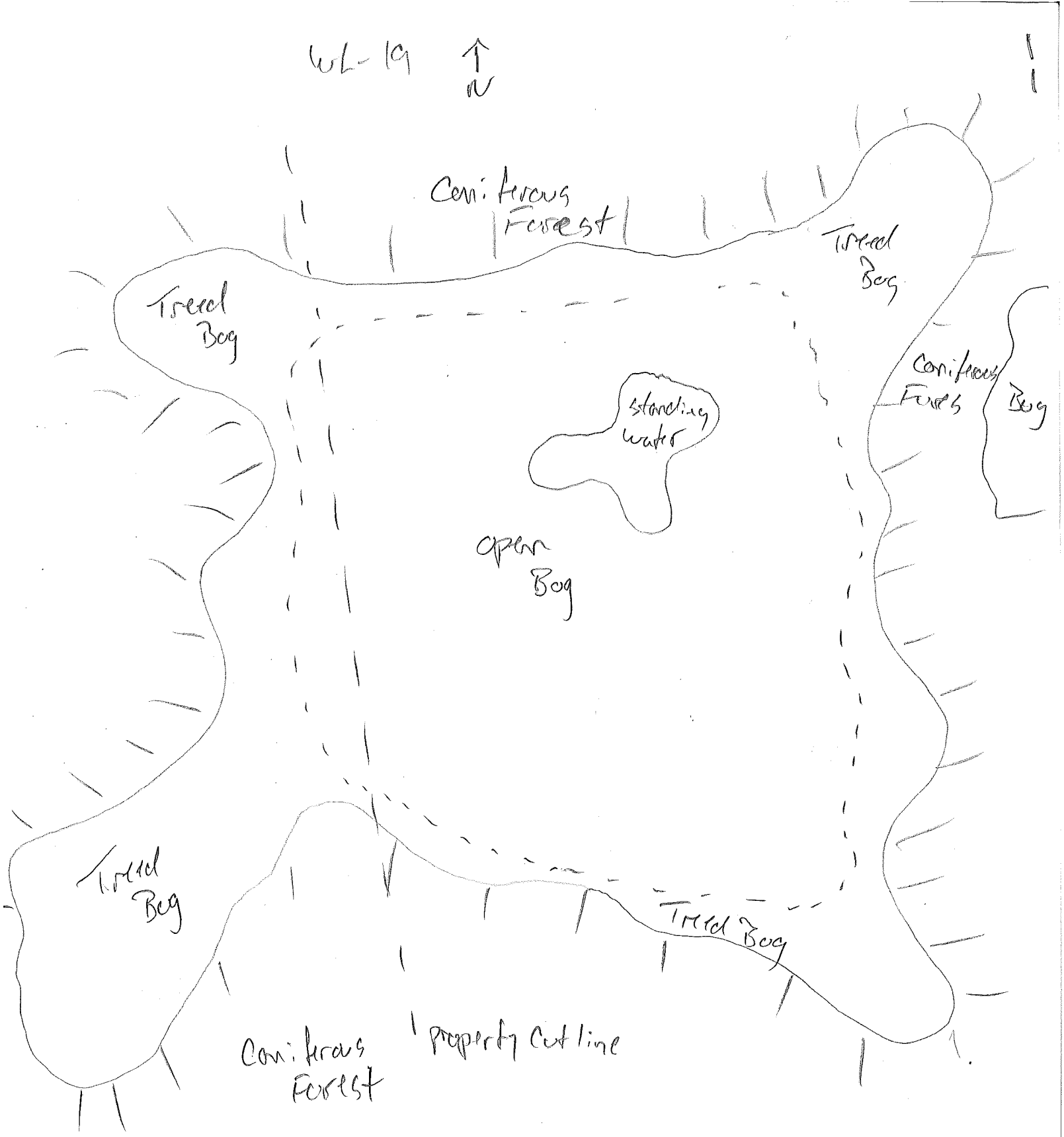

stream
Treed Swamp
Coniferous Forest
open fen
Shrub bog
Shrub bog
Barren
Treed Bog (Stunted)
Barren
Barren
property cutline
outlet

C 1340-1165

Tall Shrubs
Low Fen
Drill Rig Track
Standing water


Property cutline
WL-17
N
Burn
Treed Fen
Coniferous Forest
Shrub Fen
open bog
Coniferous Forest
Coniferous Forest
ATV Track
Power line

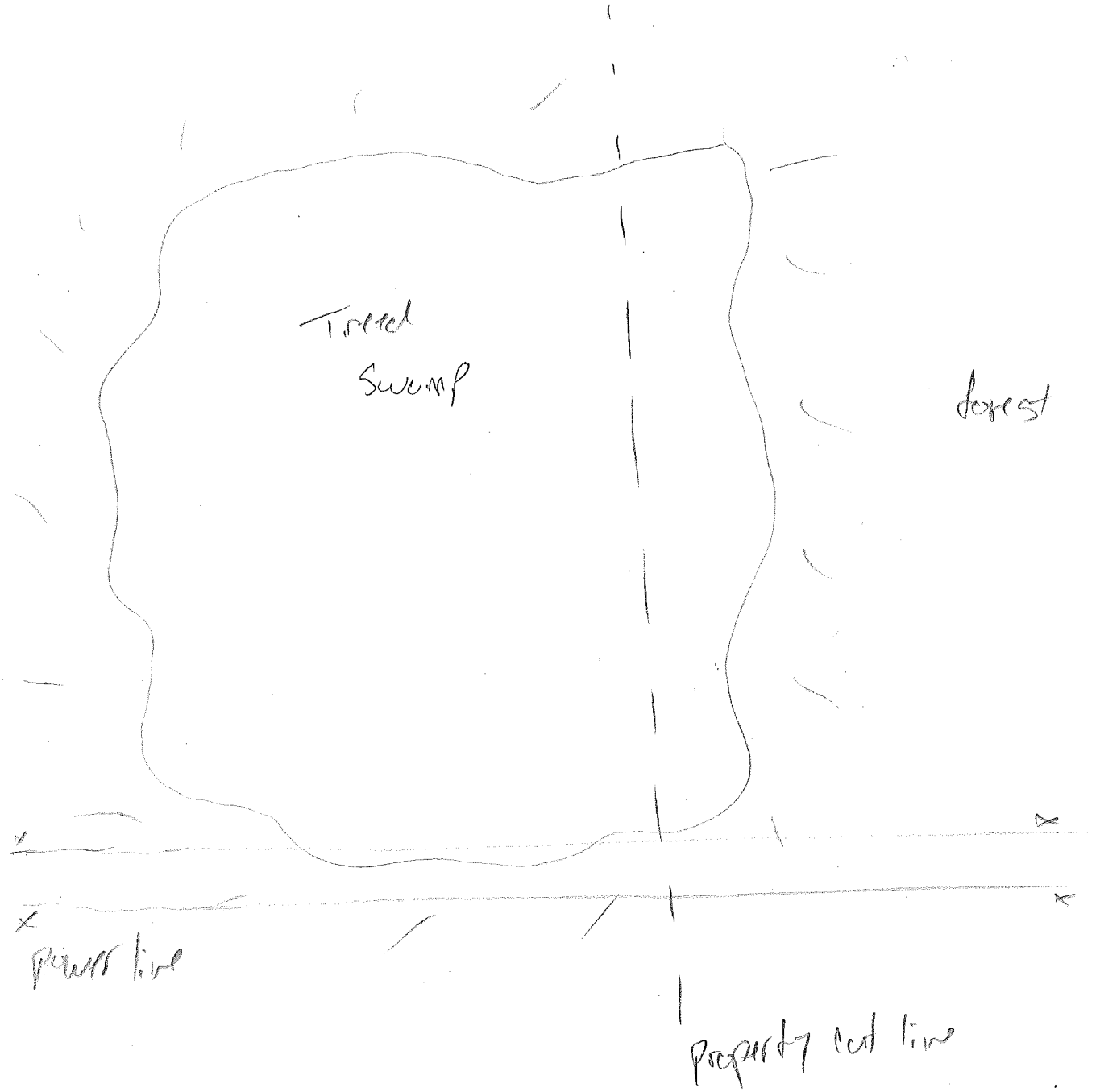

WL-18
N
Coniferous Forest
~70m
Treed/Shrub Bog
Shrub Bog
upland
coniferous forest
open Bog
Barren
Barren
Property outline


WL-19
N
Coniferous Forest
Treed Bog
Treed Bog
Coniferous Forest
Bog
standing water
open Bog
Treed Bog
Treed Bog
Coniferous Forest
Property Cut line

C 1340-1169

WL - 20

N



Appendix C.3

Wetland Photos

Photo C.3-1. Wetland 1 – Treed Swamp

Photo C.3-2. Wetland 2 – Emergent Marsh/Shrub Fen Complex

Photo C.3-3. Wetland 3 – Riparian Fen

Photo C.3-4. Wetland 4 – Basin Bog

Photo C.3-5. Wetland 5 - Sloped Riparian Fen

Photo C.3-6. Wetland 6 – Basin Bog

Photo C.3-7. Wetland 7 – Riparian Swamp

Photo C.3-8. Wetland 8 – Riparian Treed Swamp

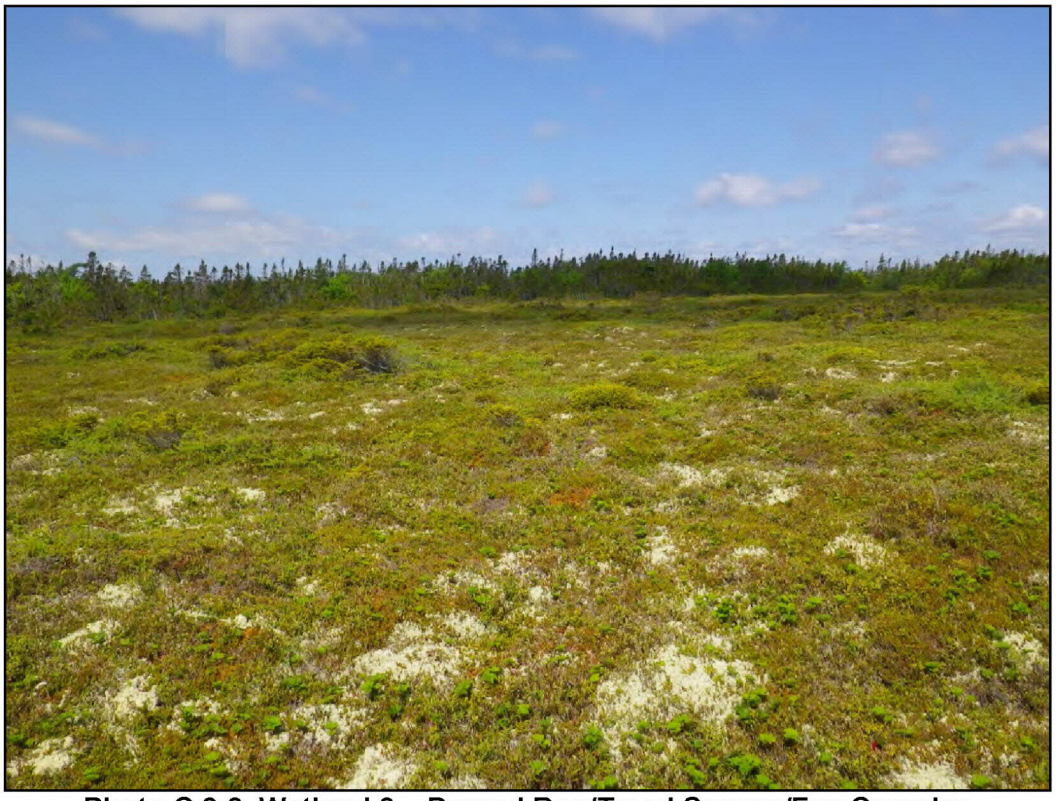


Photo C.3-9. Wetland 9 – Domed Bog/Treed Swamp/Fen Complex

Photo C.3-10. Wetland 10 – Domed Bog

Photo C.3-11. Wetland 11 – Treed Swamp

Photo C.3-12. Wetland 12 – Domed Bog

Photo C.3-13. Wetland 13 – Bog/Swamp Complex

Photo C.3-14. Wetland 14 – Treed Swamp

Photo C.3-15. Wetland 15 – Treed Bog/Treed Swamp/Fen Complex

Photo C.3-16. Wetland 16 – Riparian Fen

Photo C.3-17. Wetland 17 – Domed Bog/Treed Swamp/Shrub Fen Complex

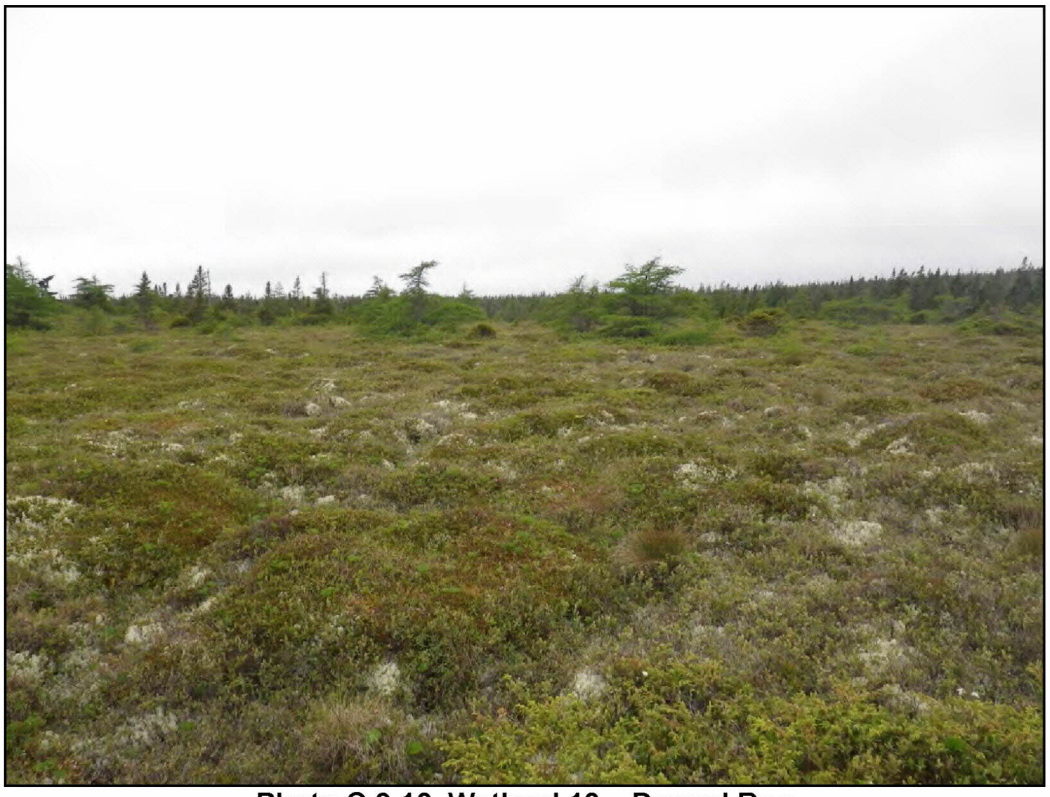


Photo C.3-18. Wetland 18 – Domed Bog

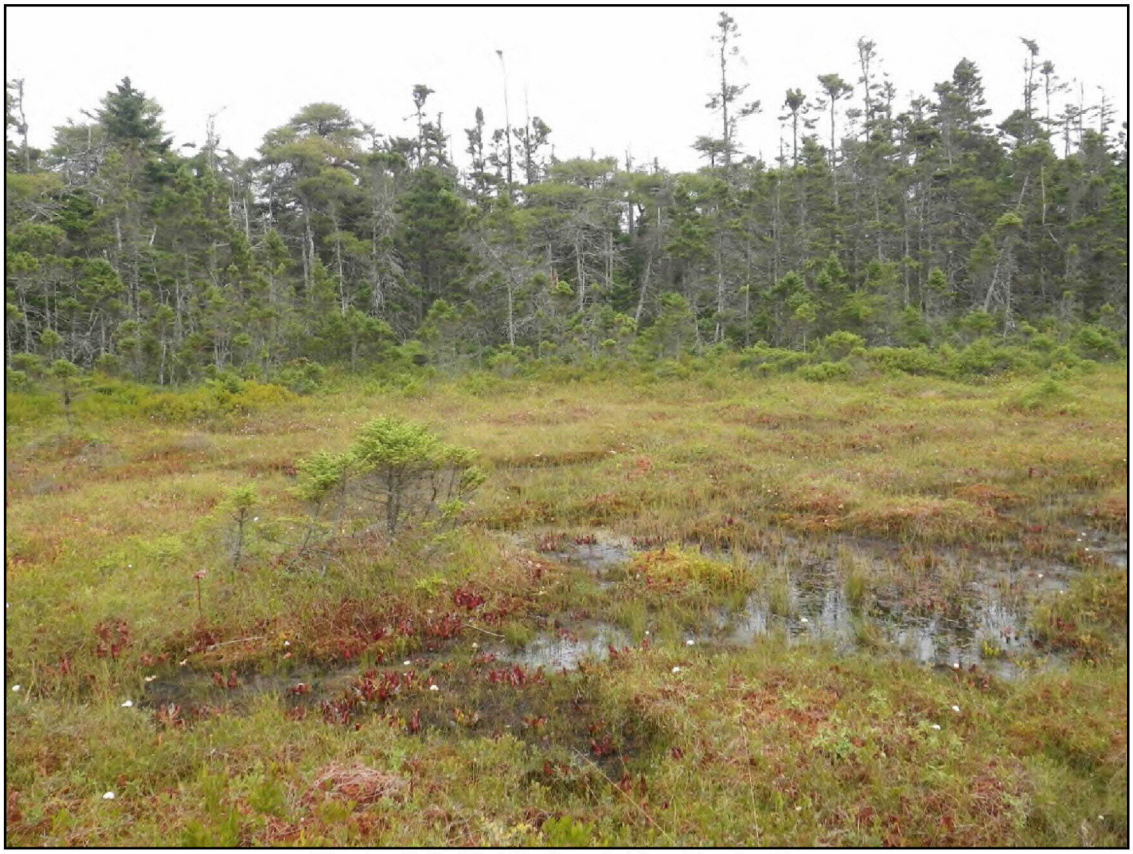


Photo C.3-19. Wetland 19 – Basin Bog

Appendix C.4

Wetland Vascular Plant Species List

Table C.4-1. Vascular Plant Species by Wetland on the Black Point Project Site in June and August 2010 and August 2014.

Species	Common Name	General Status 2010 Rank*	NSDNR 2010	ACCDC 2010	2010 survey	WL 1	WL 2	WL 3	WL 4	WL 5	WL 6	WL 7	WL 8	WL 9	WL 10	WL 11	WL 12	WL 13	WL 14	WL 15	WL 16	WL17	WL18	WL19	WL20	WL21	WL22
Abies balsamea	Balsam Fir	4	Green	S5	x	x	x		x	x		x	x	x	x	x		x			x		x	x	x		
Acer rubrum	Red Maple	4	Green	S5	x	x	x			x	x		x	x	x	x		x		x		x	x	x		x	x
Achillea millefolium	Yarrow	4	Green	S5	x																						
Agrostis scabra	Rough Bentgrass	4	Green	S5	x																					x	
Alnus incana	Speckled Alder	4	Green	S5	x	x	x			x			x			x											
Alnus viridis ssp.crispa	Green Alder, Mountain Alder	4	Green	S5																			x	x	x	x	x
Amelanchier sp.	A Service Berry	NA	NA	NA	x	x				x															x		
Ammophila breviligulata	Beachgrass	4	Green	S5	x																						
Andromeda polifolia	Bog- Rosemary	4	Green	S5	x	x	x			x			x	x		x											
Aralia hispida	Bristly Sarsaparilla	4	Green	S5	x															x							
Aralia nudicaulis	Wild Sarsaparilla	4	Green	S5	x	x				x		x				x	x						x				
Arctostaphylos uva-ursi	Bearberry	4	Green	S4	x						x																
Arethusa bulbosa	Arethusa, Swamp- Pink	4	Green	S4	x	x								x		x			x		x						
Argentina (Potentilla) anserina	Silverweed	4	Green	S5	x																						
Artemisia stelleriana	Dusty Miller	7	Exotic	SNA	x																						
Athyrium filix-femina	Northern Lady Fern	4	Green	S5	x					x		x															
Atriplex glabriuscula	Northeastern Saltbush	4	Green	S4S5	x																						
Betula papyrifera var. cordifolia	Heart-leaved paper Birch	4	Green	S5	x	x	x						x		x			x		x		x					x
Cakile edentula	American Searocket	4	Green	S5	x																						
Calamagrostis canadensis	Blue Joint	4	Green	S5	x	x	x			x		x										x			x	x	x
Calystegia sepium	Hedge Bindweed	4	Green	S5	x																						
Carex aquatilis var. aquatilis	Leafy Tussock Sedge	4	Green	S5	x					x			x	x											x		x
Carex canescens	Hoary Sedge	4	Green	S5	x																						
Carex echinata	Little Prickley Sedge	4	Green	S5	x	x				x	x	x									x					x	
Carex exilis	Coast Sedge	4	Green	S4	x	x				x												x			x		
Carex folliculata	Long Sedge	4	Green	S5	x																						
Carex gynandra	Nodding Sedge	4	Green	S5	x																					x	
Carex intumescens	Bladder Sedge	4	Green	S5	x			x				x															
Carex lenticularis	Shore Sedge	4	Green	S4	x																						
Carex magellanica var. irrigua	Stunted Sedge	4	Green	S5	x	x	x	x		x	x	x							x	x							
Carex nigra	Smooth Black Sedge	4	4	S5	x					x	x														x		x
Carex paleacea	Chaffy Sedge	4	Green	S5	x					x																	
Carex pauciflora	Few-flowered Sedge	4	Green	S4S5																					x		
Carex projecta	Necklace Sedge	4	Green	S4S5	x																						
Carex recta	Erect Sedge, Estuary Sedge	4	Green	S4?																						x	
Carex retrorsa	Retrorse Sedge	4	Green	S4	x																						
Carex scoparia	Broom Sedge	4	Green	S5	x																						
Carex sp.	a Sedge	NA	NA	NA	x		x			x			x	x									x				
Carex stipata	Stalk-grain sedge	4	Green	S5	x																						
Carex trisperma	Three-seeded Sedge	4	Green	S5	x	x	x		x	x		x	x	x		x	x	x		x	x	x	x		x		
Cerastium sp.(none rare)	A chickweed	NA	NA	NA	x																						
Chamaedaphne calyculata	Leatherleaf	4	Green	S5	x	x		x			x		x	x		x	x		x		x	x	x	x	x	x	x
Chamerion (Epilobium) angustifolium	Fireweed	4	Green	S5	x																						
Clintonia borealis	Clintonia Lily	4	Green	S5	x	x																	x				
Coptis trifolia	Goldthread	4	Green	S5	x								x	x				x					x		x		
Corema conradii	Broom Crowberry	4	Green	S4	x																						
Cornus canadensis	Bunchberry	4	Green	S5	x	x	x	x		x	x	x	x	x		x		x	x			x	x	x	x	x	
Cypripedium acaule	Pink Lady's Slipper	4	Green	S5	x								x														
Danthonia spicata	Poverty Oat-grass	4	Green	S5	x																						
Dennstaedtia punctilobula	Hay-Scented Fern	4	Green	S5	x																						
Deschampsia flexuosa	Wavy Hairgrass	4	Green	S5	x																						
Doellingeria (syn.Aster) umbellata	Tall White Aster	4	Green	S5	x							x														x	x
Drosera intermedia	Spoon-leaved Sundew	4	Green	S5	x											x										x	
Drosera rotundifolia	Round-leaved Sundew	4	Green	S5	x	x		x	x				x	x		x		x	x	x	x	x		x		x	
Dryopteris campyloptera	Mountain Woodfern	4	Green	S5	x																					x	x
Dryopteris carthusiana	Spinulose Woodfern	4	Green	S5	x																					x	
Dryopteris cristata	Crested Shield-fern	4	Green	S5	x															x							
Dryopteris sp.	a woodfern (seedling)	NA	NA	NA	x																						
Eleocharis sp.	Spike Rush	NA	NA	NA	x											x											
Empetrum nigrum	Black Crowberry	4	Green	S5	x	x		x		x	x		x	x		x					x	x	x	x		x	
Epigaea repens	Trailing Arbutis	4	Green	S5	x																						
Epilobium ciliatum	Hairy Willowherb	4	Green	S5	x																						
Epilobium palustre	Swamp willow-herb	4	Green	S5																							x
Equisetum arvense	Field Horsetail	4	Green	S5	x																					x	
Equisetum sylvaticum	Woodland Horsetail	4	Green	S5	x																						

Table C.4-1. Vascular Plant Species by Wetland on the Black Point Project Site in June and August 2010 and August 2014.

Species	Common Name	General Status 2010 Rank*	NSDNR 2010	ACCDC 2010	2010 survey	WL 1	WL 2	WL 3	WL 4	WL 5	WL 6	WL 7	WL 8	WL 9	WL 10	WL 11	WL 12	WL 13	WL 14	WL 15	WL 16	WL17	WL18	WL19	WL20	WL21	WL22
Eriophorum tenellum	Rough Cotton-grass	4	Green	S4S5	x					x																	
Eriophorum vaginatum	Tussock cotton-grass	4	Green	S5	x	x				x																	
Eriophorum virginicum	Tawny Cotton-grass	4	Green	S5	x	x	x	x		x	x		x	x		x	x		x	x	x	x	x	x	x	x	
Eurybia (syn. Aster) radula	Rough Wood-aster	4	Green	S5	x		x	x			x	x										x					
Galium palustre	Marsh Bedstraw	4	Green	S5	x	x							x														
Gaultheria hispidula	Snowberry	4	Green	S5	x	x			x		x		x	x				x									
Gaultheria procumbens	Teaberry	4	Green	S5	x	x																					
Gaylussacia baccata	Black Huckleberry	4	Green	S5	x	x					x		x	x		x	x	x	x		x		x	x	x		
Geocaulon lividum	Northern Comandra	3	Yellow	S3																			x				
Glyceria canadensis	Rattlesnake Grass	4	Green	S5	x	x				x																x	x
Hieracium x floribundum	Yellow Hawkweed	Exotic	Exotic	SNA	x																						
Hypericum boreale	Northern St. John's Wort	4	Green	S5			x																				
Hypericum canadense	Canadian St. John's Wort	4	Green	S5	x		x			x		x			x											x	
Ilex verticillata	Black Holly	4	Green	S5	x	x	x	x		x		x				x										x	x
Iris hookeri (syn. I. setosa)	Hooker's Iris (Beach-head Iris)	4	Green	S4	x			x																			
Iris sp.	An Iris	7	NA	NA	x			x																			x
Iris versicolor	Blueflag Iris	4	Green	S5	x																					x	x
Juncus balticus (syn. J. arcticus)	Arctic rush (syn. baltic rush)	4	Green	S5			x																				
Juncus brevicaudatus	Narrow-Panicled Rush	4	Green	S5	x																						
Juncus bufonius	Toad Rush	4	Green	S5	x		x	x		x						x											
Juncus canadensis	Canada Rush	4	Green	S5	x		x	x		x					x					x						x	x
Juncus effusus	Soft Rush	4	Green	S5	x	x		x		x					x				x							x	x
Juncus pelocarpus	Brown-Fruited Rush	4	Green	S5	x	x	x																			x	x
Juniperus communis	Common Juniper	4	Green	S5	x	x	x			x			x	x		x						x	x	x	x		
Juniperus horizontalis	Creeping Juniper	4	Green	S4	x	x							x			x											
Kalmia angustifolia	Lambkill, Sheep-laurel	4	Green	S5	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	
Kalmia polifolia	Bog Laurel, Pale Laurel	4	Green	S5	x	x		x		x	x			x		x	x					x	x	x	x	x	
Larix laricina	Larch	4	Green	S5	x	x					x					x					x	x	x	x	x		
Lathyrus japonicus (syn. L. maritimus)	Beach Pea	4	Green	S5	x																						
Ledum groenlandicum	Labrador-tea	4	Green	S5	x	x	x	x		x	x		x	x		x	x	x	x	x	x	x	x	x	x	x	
Leontodon autumnalis	Fall Dandelion	7	Exotic	SNA	x																						
Leymus mollis	Wild Rye	4	Green	S5	x																						
Ligusticum scoticum	Scotch Lovage	4	Green	S5	x																						
Linnaea borealis	Twinflower	4	Green	S5	x	x						x										x	x				
Listera australis	Southern Twayblade	2	Red	S2	x																						
Lonicera canadensis	American Fly Honeysuckle	4	Green	S5	x																						
Lycopodium annotinum	Stiff Clubmoss	4	Green	S5	x	x																x		x	x		
Lycopodium obscurum	Tree Clubmoss	4	Green	S5	x	x																			x		
Lycopus americanus	Cut-leafed Water-horehound	4	Green	S5																							x
Lycopus uniflorus	Northern Bugleweed	4	Green	S5	x							x															
Lysimachia terrestris	Swamp Loosestrife	4	Green	S5	x		x																				x
Maianthemum (Smilacina) trifolia	Three-leaved False Solomon's Seal	4	Green	S5	x	x	x	x	x	x	x		x	x			x	x	x	x	x	x	x			x	x
Maianthemum canadense	Wild Lily-of-the-valley	4	Green	S5	x	x		x					x	x		x											
Mertensia maritima	Sea Bluebells	4	Green	S5	x																						
Mitchella repens	Partridge Berry	4	Green	S5	x																						
Moehringia lateriflora	Grove Sandwort	4	Green	S5	x																						
Moneses uniflora	One-flowered Shinleaf	4	Green	S5	x																						
Monotropa uniflora	Indian-pipe	4	Green	S5	x																						
Myrica gale	Sweet Gale	4	Green	S5	x								x	x			x	x	x			x	x		x		
Myrica pensylvanica	Bayberry	4	Green	S5	x	x	x	x		x	x	x	x	x		x			x	x						x	
Nemopanthus mucronatus	False Mountain Holly	4	Green	S5	x	x	x	x	x		x		x	x	x	x	x	x	x			x	x	x	x		x
Nuphar sp.	Yellow pond-lily	NA	NA	NA		x										x											
Nymphaea sp.	Water Lily	NA	NA	NA	x									x		x											
Oclemena (syn. Aster) acuminata	Whorled Wood Aster	4	Green	S5	x	x						x															
Oclemena (syn.) Aster X blakei	Hybrid White Panicled American-Ast	NA	Green	SNR	x																						
Oclenema (Aster) nemoralis	Bog Aster	4	Green	S5	x	x	x			x						x			x						x	x	x
Osmunda cinnamomea	Cinnamon Fern	4	Green	S5	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x			x		x	x	x
Osmunda claytoniana	Interrupted Fern	4	Green	S5	x																						
Oxalis montana	Wood-sorrel	4	Green	S5	x	x																					
Persicaria (Polygonum) sagittata	Arrow-leafed Tearthumb	4	Green	S5	x																						x
Phegopteris connectilis	Northern Beech Fern	4	Green	S5	x					x		x															
Photinia melanocarpa	Black Chokeberry	4	Green	S5	x	x		x	x	x	x								x	x		x	x			x	
Picea glauca	White Spruce	4	Green	S5	x																						
Picea mariana	Black Spruce	4	Green	S5	x	x	x	x	x	x		x	x	x	x	x		x	x		x	x	x		x	x	
Plantago maritima	Seashore-plantain	4	Green	S5	x																						

Table C.4-1. Vascular Plant Species by Wetland on the Black Point Project Site in June and August 2010 and August 2014.

Species	Common Name	General Status 2010 Rank*	NSDNR 2010	ACCDC 2010	2010 survey	WL 1	WL 2	WL 3	WL 4	WL 5	WL 6	WL 7	WL 8	WL 9	WL 10	WL 11	WL 12	WL 13	WL 14	WL 15	WL 16	WL17	WL18	WL19	WL20	WL21	WL22
Platanthera blephariglottis	White Fringed orchid	4	Green	S4		x																				x	
Platanthera clavellata	Club-spur Orchid	4	Green	S5																						x	
Platanthera sp.	Rein orchid, Fringed Orchid	NA	NA	NA																		x					
Platanthera sp. (aquilonis or dilatata)	Northern Bog Orchid	4	4	S4S5	x																						
Poa sp	Grass	NA	NA	NA	x																					x	
Potentilla simplex	Cinquefoil	4	Green	S5	x																						
Prenanthes trifoliolata	Lion's Paw	4	Green	S5	x	x																					
Prunus pensylvanica	Fire Cherry / Pin Cherry	4	Green	S5	x	x																					
Pteridium aquilinum	Bracken	4	Green	S5	x	x	x		x		x	x	x	x				x	x	x			x	x			
Ranunculus acris	Tall Buttercup	7	Exotic	SNA	x																						
Rhodiola rosea (Sedum roseum)	Roseroot Stonecrop	4	Green	S4	x																						
Rhododendron canadense	Rhodora	4	Green	S5	x	x				x	x		x	x			x				x			x	x	x	
Rhynchospora alba	White Beak-rush	4	Green	S5	x	x		x			x			x		x					x	x		x	x	x	
Rosa nitida	Swamp Rose	4	Green	S4	x	x																				x	x
Rosa rugosa	Rugose Rose	7	Exotic	SNA	x																						
Rosa sp.	A Rose	NA	NA	NA																							x
Rosa virginiana	Virginia Rose	4	Green	S5	x					x		x															
Rubus allegheniensis	Common Blackberry	4	Green	S5	x	x				x										x							
Rubus chamaemorus	Cloudberry, Bakeapple	4	Green	S4	x	x							x	x		x			x			x	x	x	x		
Rubus hispidus	Bristly Dewberry	4	Green	S5	x	x				x																	
Rubus idaeus	Red Raspberry	4	Green	S5	x																						
Rubus pubescens	Dwarf Raspberry	4	Green	S5	x					x		x															
Rubus sp.	a bramble	NA	NA	NA	x																				x	x	x
Rumex acetosella	Sheep Sorrel	7	Exotic	SNA	x																						
Sagina procumbens or nodosa	Pearlwort	4	Green	S5	x																						
Salix sp	Willow	NA	NA	NA	x															x							
Sarracenia purpurea	Pitcher-plant	4	Green	S5	x	x	x				x		x	x		x	x	x	x		x	x	x	x	x		
Schoenoplectus subterminalis	Water- Bulrush	4	Green	S5		x																					
Scirpus atrocinctus	Black-girdle Bullrush	4	Green	S5	x																						
Scirpus cyperinus	Cottongrass Bullrush	4	Green	S5	x														x	x						x	
Sibbaldiopsis tridentata	Three- toothed- cinquefoil	4	Green	S5	x					x																	
Sisyrinchium montanum	Strict Blue-eyed-grass	4	Green	S5	x																						
Solidago macrophylla	Large-leaf Goldenrod	4	Green	S4	x																						
Solidago rugosa	Rough Goldenrod	4	Green	S5	x	x																					
Solidago sempervirens	Seaside Goldenrod	4	Green	S5	x																						
Solidago sp.	A Goldenrod	NA	NA	NA																				x			
Solidago uliginosa	Bog Goldenrod	4	Green	S5	x	x	x	x			x		x	x		x								x	x	x	x
Sorbus americana	Mountain-ash	4	Green	S5	x	x						x	x					x						x	x	x	
Sparganium sp.	Bur-reed	NA	NA	NA	x		x	x				x															
Spiraea alba	Meadowsweet	4	Green	S5	x	x																					
Symphiotrichum (Aster) novi-belgii	New york Aster/ New Belgium Aster	4	Green	S5	x							x															
Symphiotrichum (Aster) puniceum	Rough Aster	4	Green	S5	x																						
Thalictrum pubescens	Tall Meadow- Rue	4	Green	S5	x			x				x															
Thelypteris noveboracensis	New York fern	4	Green	S5																						x	
Thelypteris palustris	Marsh Fern	4		S5	x	x				x																	
Triadenum fraseri	Marsh St. John's Wort	4	Green	S5																						x	
Trichophorum (Scirpus) caespitosum	Tufted Leafless-Bullrush	4	Green	S5	x	x							x	x		x					x		x	x	x		
Trientalis borealis	Starflower	4	Green	S5	x	x							x					x						x	x		
Typha latifolia	Broadleaf cattail	4	Green	S5	x		x			x																	
Utricularia cornuta	Horned Bladderwort	4	Green	S5	x	x								x		x										x	
Utricularia intermedia	Flatleaf Bladderwort	4	Green	S5	x									x							x						
Utricularia minor	Lesser Bladderwort	4	Green	S4	x																						
Vaccinium angustifolium	Lowbush Blueberry	4	Green	S5	x	x	x		x	x			x	x			x			x			x	x			x
Vaccinium macrocarpon	Large Cranberry	4	Green	S5	x	x				x		x									x						
Vaccinium myrtilloides	Velvetleaf Blueberry	4	Green	S5	x								x	x											x		
Vaccinium oxycoccos	Small Cranberry	4	Green	S5	x	x	x	x		x	x			x		x			x			x	x	x			x
Vaccinium vitis-idaea	Mountain Cranberry	4	Green	S5	x	x	x		x			x	x	x									x				
Viburnum nudum	Wild Raisin	4	Green	S5	x	x	x			x			x	x			x	x		x	x	x	x	x	x	x	
Viola sp	Violet —not a species at risk	NA	NA	NA	x							x															

** General Status Ranks accurate as of September 22, 2014*

Appendix D. Freshwater Habitat

Appendix D.1: Watercourse Assessment Forms

Appendix D.2: Watercourse Photos

Appendix D.3: Water Quality Results

Appendix D.4: AGAT QA/QC Forms for Freshwater Samples

Appendix D.1

Watercourse Assessment Forms

11-06

DNR&E / DFO - NEW BRUNSWICK
STREAM SURVEY and HABITAT ASSESSMENT

__of__

River:
Date: 24-Aug-10
Personnel:

Start Point: WPT 171 **End Point:** WPT 195

Stream/River No.
Stream Order No.

Unit No.	Stream Type	Channel Type	WPT at end	Length (m)	Ave Width (m)		Substrate (%)							Ave Depth – Wet Width (cm)	Undercut Bank 0-50%		Over-Hanging Bank Vegetation 0-50%		Large Woody Debris In-Stream (m)	Embedded (Criteria) 1: < 20% 2: 20 - 35% 3: 35 - 50% 4: > 50%	In-Stream Vegetation	Comments
					Wet	Bank Channel	Bedrock	Boulder	Rock	Rubble	Gravel	Sand	Fines		L	R	L	R				
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a		n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a		n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a		n/a

STREAM TYPE						CHANNEL TYPE	SUBSTRATE	FLOW TYPE	POOL RATING (reverse side)	
FASTWATER		POOLS							CRITERIA (NO.)	% OF POOLS IN SITE (LETTER)
1. Fall	6. Sheet (ledge)	10. Midchannel	14. Trench	18. Eddy	22. Wood Debris	1. Main (if measurement refers to main area of river)	1. Bedrock , Ledge 2. Boulder = > 461 mm 3. Rock = 180 - 460 mm 4. Rubble = 54 - 179 mm 5. Gravel = 2.6 - 53 mm 6. Sand = 0.06 - 2.5 mm 7. Fines = 0.0005 - 0.05 mm	1. Survey Stream	Pool Depth > 1.5 m 1 - Instream Cover > 30% 2 - Instream Cover < 30%	a - > 30% b - 10% to 30% c - < 10%
2. Cascade	7. Chute	11. Convergence	15. Plunge	19. Gabion	23. Man-Made Dam	* 2. Side Channel (water diverted by islands)		2. Spring		
3. Riffle (GR/RB)	8. Run	12. Lateral	16.	20. Log Structure	24. Natural Deadwater	* 3. Split (if river is split into various different stream types)		3. Brook/River Tributary		
4. Riffle (R/B)	9. Rapid	13. Beaver	17. Bogan	21. Road Crossing		* 4. Bogan		4. Spring Seep	Pool Depth .5 to 1.5m 3 - Instream Cover 5 - 30% 4 - Instream Cover > 30%	a - > 50% b - < 50%
5. Riffle (Sand)						*- Specify Left (L), Right (R) or Middle (M)				

C 1340-1192

River:

Valley Slope L/M/H	Bank Height (m)	Flood Plain Width (m)	Shade (%)	Stream Banks									0^2 (Mg/L)	pH	Water Temperature (°C)	Fish Species	Pool Rating		Pool Tail			Turbulence (%)
				Vegetation (%)				Erosion (%)											Embedded (Criteria) 1: < 20% 2: 20 - 35% 3: 35 - 50% 4: > 50%	Mean Substrate Size(cm)	Fines (%)		
				Bare	Grasses	Shrubs	Trees	Left Bank (0-50%)			Right Bank (0-50%)							No.	Letter				
								Stable	Bare Stable	Eroding	Stable	Bare Stable	Eroding										
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

NOTE: * For selected site study, these columns (reverse side) should be done for a habitat assessment

WATER FLOW MEASUREMENT

RIFFLE GRADIENT			UNIT No.	STREAM TYPE	WET WIDTH (m)	DEPTH (cm)			AVERAGE DEPTH SUM / 4		COEFFICIENT (0.9 - smooth) (0.8 - rough)	LENGTH (3m)	FLOAT TIME (sec)				FLOW cm/s
LENGTH M	DROP M	GRADIENT %				1/4 way	1/2 way	3/4 way	CENTIMETERS	METERS (m)			1/4 way	1/2 way	3/4 way	AVERAGE	

Formula (CMS) = W (m) x D (m) x A x L (m) / T (sec) Where: W = width, D = depth, L = length, A is a coefficient for the stream bottom (A= 0.8 for rough bottom; 0.9 for smooth)

CRITERIA:

1. Chute: water depth equal to or greater than channel width
2. Riffle: GR/RB - is a riffle flowing over a gravel and/or rubble bottom
   R/B - is a riffle flowing over & through large substrates (e.g. rock and /or boulder), some of which protrudes the surface
3. Side channels - treat as a separate stream type
4. Undercut Bank - % of bank overhang (above water edge for stream type. Specify left (L) or right (R)
5. Over-hanging Bank Vegetation - % of vegetation overhang for stream type. Specify L or R
6. Visual Embeddedness - % of sands or fines surrounding the larger substrates, up to 100%
7. Woody Debris - total width should be >10 cm in diameter

11-06

DNR&E / DFO - NEW BRUNSWICK
STREAM SURVEY and HABITAT ASSESSMENT

Start Point: WPT 171 End Point: WPT 195

__of__

River:
Date: 24-Aug-10
Personnel:

Stream / River No.
Stream Order No.

Unit No.	Stream Type	Channel Type	WPT at end	Length (m)	Ave Width (m)		Substrate (%)							Ave Depth – Wet Width (cm)	Undercut Bank 0-50%		Over-Hanging Bank Vegetation 0-50%		Large Woody Debris In-Stream (m)	Embedded (Criteria) 1: < 20% 2: 20 - 35% 3: 35 - 50% 4: > 50%	In-Stream Vegetation	Comments
					Wet	Bank Channel	Bedrock	Boulder	Rock	Rubble	Gravel	Sand	Fines		L	R	L	R				
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a		n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a		n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a		n/a

STREAM TYPE						CHANNEL TYPE	SUBSTRATE	FLOW TYPE	POOL RATING (reverse side)	
FASTWATER		POOLS							CRITERIA (NO.)	% OF POOLS IN SITE (LETTER)
1. Fall	6. Sheet (ledge)	10. Midchannel	14. Trench	18. Eddy	22. Wood Debris	1. Main (if measurement refers to main area of river)	1. Bedrock , Ledge 2. Boulder = > 461 mm 3. Rock = 180 - 460 mm 4. Rubble = 54 - 179 mm 5. Gravel = 2.6 - 53 mm 6. Sand = 0.06 - 2.5 mm 7. Fines = 0.0005 - 0.05 mm	1. Survey Stream	Pool Depth > 1.5 m 1 - Instream Cover > 30% 2 - Instream Cover < 30%	a - > 30% b - 10% to 30% c - < 10%
2. Cascade	7. Chute	11. Convergence	15. Plunge	19. Gabion	23. Man-Made Dam	* 2. Side Channel (water diverted by islands)		2. Spring		
3. Riffle (GR/RB)	8. Run	12. Lateral	16.	20. Log Structure	24. Natural Deadwater	* 3. Split (if river is split into various different stream types)		3. Brook/River Tributary	Pool Depth .5 to 1.5m 3 - Instream Cover 5 - 30% 4 - Instream Cover > 30%	a - > 50% b - < 50%
4. Riffle (R/B)	9. Rapid	13. Beaver	17. Bogan	21. Road Crossing		* 4. Bogan		4. Spring Seep		
5. Riffle (Sand)						*- Specify Left (L), Right (R) or Middle (M)				

River:

Valley Slope L/ M/ H	Bank Height (m)	Flood Plain Width (m)	Shade (%)	Stream Banks											0^2 (Mg/ L)	pH	Water Temperature (°C)	Fish Species	Pool Rating		Pool Tail			Turbulence (%)
				Vegetation (%)				Erosion (%)													Embedded (Criteria) 1: < 20% 2: 20 - 35% 3: 35 - 50% 4: > 50%	Mean Substrate Size(cm)	Fines (%)	
				Bare	Grasses	Shrubs	Trees	Left Bank (0-50%)			Right Bank (0-50%)								No.	Letter				
								Stable	Bare Stable	Eroding	Stable	Bare Stable	Eroding											
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

NOTE: * For selected site study, these columns (reverse side) should be done for a habitat assessment

WATER FLOW MEASUREMENT

RIFFLE GRADIENT			UNIT No.	STREAM TYPE	WET WIDTH (m)	DEPTH (cm)			AVERAGE DEPTH SUM / 4		COEFFICIENT (0.9 - smooth) (0.8 - rough)	LENGTH (3m)	FLOAT TIME (sec)				FLOW cm/s
LENGTH M	DROP M	GRADIENT %				1/4 way	1/2 way	3/4 way	CENTIMETERS	METERS (m)			1/4 way	1/2 way	3/4 way	AVERAGE	

Formula (CMS) = W (m) x D (m) x A x L (m) / T (sec) Where: W = width, D = depth, L = length, A is a coefficient for the stream bottom (A= 0.8 for rough bottom; 0.9 for smooth)

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   R/B - is a riffle flowing over & through large substrates (e.g. rock and /or boulder), some of which protrudes the surface
3. Side channels - treat as a separate stream type
4. Undercut Bank - % of bank overhang (above water edge for stream type. Specify left (L) or right (R)
5. Over-hanging Bank Vegetation - % of vegetation overhang for stream type. Specify L or R
6. Visual Embeddedness - % of sands or fines surrounding the larger substrates, up to 100%
7. Woody Debris - total width should be >10 cm in diameter

C 1340-1195

11-06

DNR&E / DFO - NEW BRUNSWICK
STREAM SURVEY and HABITAT ASSESSMENT

Start Point: WPT 171 End Point: WPT 195

__of__

River:
Date: 24-Aug-10
Personnel:

Stream / River No.
Stream Order No.

Unit No.	Stream Type	Channel Type	WPT at end	Length (m)	Ave Width (m)		Substrate (%)							Ave Depth – Wet Width (cm)	Undercut Bank 0-50%		Over-Hanging Bank Vegetation 0-50%		Large Woody Debris In-Stream (m)	Embedded (Criteria) 1: < 20% 2: 20 - 35% 3: 35 - 50% 4: > 50%	In-Stream Vegetation	Comments
					Wet	Bank Channel	Bedrock	Boulder	Rock	Rubble	Gravel	Sand	Fines		L	R	L	R				
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a		n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a		n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a		n/a

STREAM TYPE						CHANNEL TYPE	SUBSTRATE	FLOW TYPE	POOL RATING (reverse side)	
FASTWATER		POOLS							CRITERIA (NO.)	% OF POOLS IN SITE (LETTER)
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2. Cascade	7. Chute	11. Convergence	15. Plunge	19. Gabion	23. Man-Made Dam	* 2. Side Channel (water diverted by islands)		2. Spring		
3. Riffle (GR/RB)	8. Run	12. Lateral	16.	20. Log Structure	24. Natural Deadwater	* 3. Split (if river is split into various different stream types)		3. Brook/River Tributary	Pool Depth .5 to 1.5m 3 - Instream Cover 5 - 30% 4 - Instream Cover > 30%	a - > 50% b - < 50%
4. Riffle (R/B)	9. Rapid	13. Beaver	17. Bogan	21. Road Crossing		* 4. Bogan		4. Spring Seep		
5. Riffle (Sand)						*- Specify Left (L), Right (R) or Middle (M)				

River:

Valley Slope L/ M/ H	Bank Height (m)	Flood Plain Width (m)	Shade (%)	Stream Banks									0^2 (Mg/ L)	pH	Water Temperature (°C)	Fish Species	Pool Rating		Pool Tail			Turbulence (%)
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				Bare	Grasses	Shrubs	Trees	Left Bank (0-50%)			Right Bank (0-50%)							No.	Letter				
								Stable	Bare Stable	Eroding	Stable	Bare Stable	Eroding										
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

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WATER FLOW MEASUREMENT

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LENGTH M	DROP M	GRADIENT %				1/4 way	1/2 way	3/4 way	CENTIMETERS	METERS (m)			1/4 way	1/2 way	3/4 way	AVERAGE	

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6. Visual Embeddedness - % of sands or fines surrounding the larger substrates, up to 100%
7. Woody Debris - total width should be >10 cm in diameter

Appendix D.2

Watercourse Photos

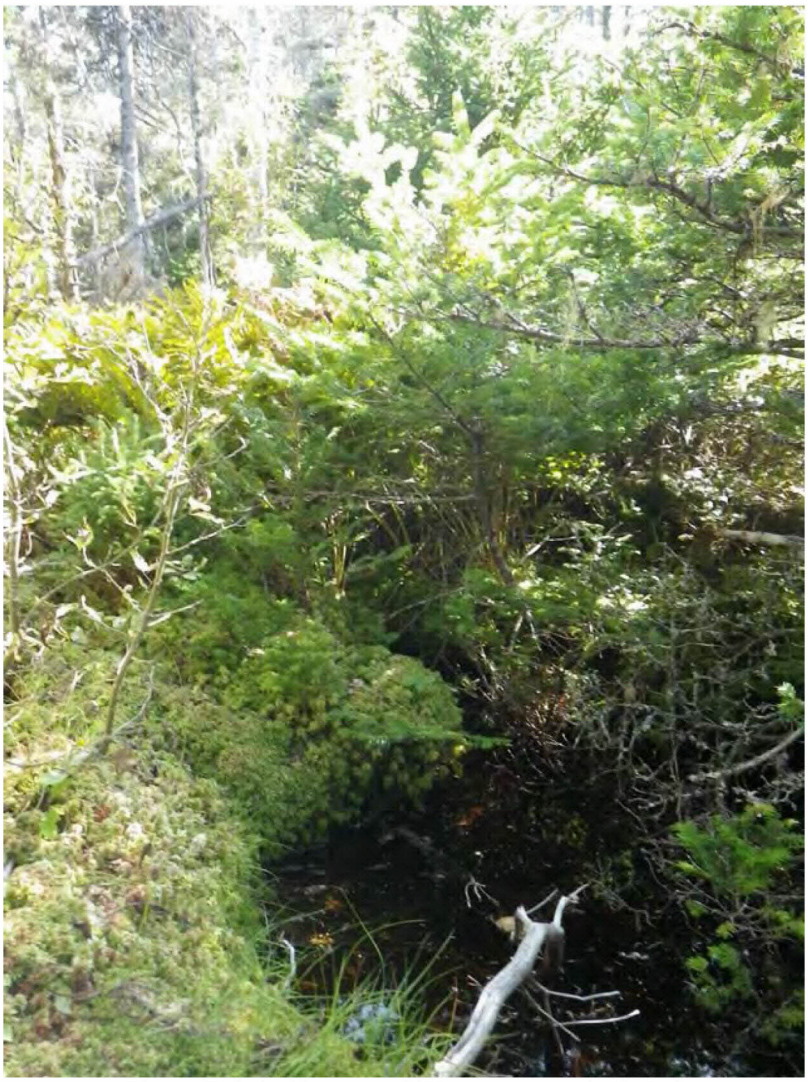

Photo D.2-1. Unnamed Watercourse 2, Unit 2

Photo D.2-2. Unnamed Watercourse 2, Unit 2

Photo D.2-3. Unnamed Watercourse 2, Unit 3

Photo D.2-4. Unnamed Watercourse 2, Unit 3

Photo D.2-5. Unnamed Watercourse 1, Unit 1

Photo D.2-6. Unnamed Watercourse 1, Unit 1

Photo D.2-7. Unnamed Watercourse 1, Unit 1

Photo D.2-8. Unnamed Watercourse 1, Unit 1

Photo D.2-9. Unnamed Watercourse 1, Unit 1

Photo D.2-10. Unnamed Watercourse 1, Unit 2

Photo D.2-11. Unnamed Watercourse 1, Unit 2

Photo D.2-12. Unnamed Watercourse 1, Unit 3

Photo D.2-13. Unnamed Watercourse 1, Unit 3

Photo D.2-14. Unnamed Watercourse 1, Unit 4

Photo D.2-15. Unnamed Watercourse 1, Unit 4

Photo D.2-16. Unnamed Watercourse 1, start of steep dropoff

Photo D.2-17. Unnamed Watercourse 1, start of steep dropoff

Photo D.2-18. Unnamed Watercourse 3, Unit 2

Photo D.2-19. Unnamed Watercourse 3, Unit 2

Photo D.2-20. Unnamed Watercourse 3, Unit 3

Photo D.2-21. Unnamed Watercourse 3, Unit 3

Photo D.2-22. Unnamed Watercourse 3, Unit 4

Photo D.2-23. Unnamed Watercourse 3, Unit 4

Appendix D.3

Water Quality Results

Table D.3-1. Analytical Results of Water Quality, Three Unnamed Watercourses and Fogherty Lake, 2010.

Sample Name				GRQ-1	GRQ-2	GRQ-3	GRQ-4
Location			CCME FWAL	Unnamed Watercourse 3 East stream	Fogherty Lake	Unnamed Watercourse 2 North stream	Unnamed Watercourse 1 Fogherty Lake outflow
Parameter	Unit	RDL	Guideline	24-Aug-10	27-Aug-10	22-Sep-10	22-Sep-10
Field Parameters							
pH			6.5-9	**3.41**	**2.94**	**3.15**	**2.95**
Water Temperature	ºC			21.4	22.7	14.9	16
Conductivity	µS/cm			62	43	91	53
% Dissolved Oxygen	%			79.2	100.6	79.8	47
Dissolved Oxygen	mg/L			6.67	8.67	8.47	4.52
General Chemistry							
pH			6.5-9	**4.3**	**4.3**	**3.9**	**4.2**
Reactive Silica as SiO2	mg/L	0.5		7.2	0.9	10.2	1.8
Chloride	mg/L	1		14	10	18	13
Fluoride	mg/L	0.1	0.12	<0.1	<0.1	**0.4**	<0.1
Sulphate	mg/L	2		<2	<2	<2	<2
Alkalinity	mg/L	5		<5	<5	<5	<5
True Color	TCU	5	Narrative	395	198	411	195
Turbidity	NTU	0.1	Narrative	1	0.7	2.8	0.7
Electrical Conductivity	umho/cm	1		59	52	102	61
Nitrate + Nitrite as N	mg/L	0.05		<0.05	<0.05	0.24	<0.05
Nitrate as N	mg/L	0.05	2.9	<0.05	<0.05	0.24	<0.05
Nitrite as N	mg/L	0.05	0.06	<0.05	<0.05	<0.05	<0.05
Ammonia as N	mg/L	0.03	Fact Sheet	<0.03	0.03	0.06	0.11
Total Organic Carbon	mg/L	0.5		35.6	15.4	46.6	17.5
Ortho-Phosphate as P	mg/L	0.01		<0.01	<0.01	0.02	<0.01
Total Sodium	mg/L	0.1		8.8	6.8	10	6.8
Total Potassium	mg/L	0.1		0.3	0.4	0.4	0.5
Total Calcium	mg/L	0.1		0.5	0.3	0.5	0.4
Total Magnesium	mg/L	0.1		0.7	0.6	1.1	0.6
Bicarb. Alkalinity (as CaCO3)	mg/L	5		<5	<5	<5	<5
Carb. Alkalinity (as CaCO3)	mg/L	10		<10	<10	<10	<10
Hydroxide	mg/L	5		<5	<5	<5	<5
Calculated TDS	mg/L	1		26	19	33	22
Hardness	mg/L			4.1	3.2	5.8	3.5
Langelier Index (@20C)	NA			-6.84	-7.05	-7.25	-7.03
Langelier Index (@ 4C)	NA			-7.16	-7.37	-7.57	-7.35
Saturation pH (@ 20C)	NA			11.1	11.3	11.1	11.2
Saturation pH (@ 4C)	NA			11.5	11.7	11.5	11.5
Anion Sum	me/L			0.39	0.28	0.52	0.37
Cation sum	me/L			0.68	0.47	0.84	0.49
% Difference/ Ion Balance (NS)	%			26.2	25.2	23.3	14.8
Total Suspended Solids	mg/L	5	Narrative	n/a	n/a	<5	<5
Total Phosphorous as P	mg/L	0.002	Fact Sheet	0.157	0.035	0.03	0.012

Table D.3-1. Analytical Results of Water Quality, Three Unnamed Watercourses and Fogherty Lake, 2010.

Sample Name				GRQ-1	GRQ-2	GRQ-3	GRQ-4
Location			CCME FWAL	Unnamed Watercourse 3 East stream	Fogherty Lake	Unnamed Watercourse 2 North stream	Unnamed Watercourse 1 Fogherty Lake outflow
Total Metals							
Total Aluminum	ug/L	5	5.0	**1050**	**335**	**1050**	**272**
Total Antimony	ug/L	2		<2	<2	<2	<2
Total Arsenic	ug/L	2	5.0	<2	<2	5	<2
Total Barium	ug/L	5		<5	<5	16	<5
Total Beryllium	ug/L	2		<2	<2	<2	<2
Total Bismuth	ug/L	2		<2	<2	<2	<2
Total Boron	ug/L	5		14	11	20	14
Total Cadmium	ug/L	0.017	0.017	**0.025**	**0.023**	**0.102**	<0.017
Total Chromium	ug/L	1		4	<1	<1	<1
Total Cobalt	ug/L	1		<1	<1	<1	<1
Total Copper	ug/L	2	2	<2	<2	<2	<2
Total Iron	ug/L	50	300	**976**	**319**	**936**	**415**
Total Lead	ug/L	0.5	1	**3.1**	**2.6**	**2.2**	0.7
Total Manganese	ug/L	2		37	16	87	15
Total Molybdenum	ug/L	2	73	<2	<2	<2	<2
Total Nickel	ug/L	2	25	<2	<2	<2	<2
Total Selenium	ug/L	1	1.0	1	<1	<1	<1
Total Silver	ug/L	0.1	0.1	<0.1	<0.1	<0.1	<0.1
Total Strontium	ug/L	5		<5	<5	9	<5
Total Thallium	ug/L	0.1	0.8	<0.1	<0.1	<0.1	<0.1
Total Tin	ug/L	2		<2	<2	<2	<2
Total Titanium	ug/L	2		5	2	5	<2
Total Uranium	ug/L	0.1		0.3	0.1	0.3	<0.1
Total Vanadium	ug/L	2		<2	<2	<2	<2
Total Zinc	ug/L	5	30	9	26	20	10
Mercury	mg/L	0.00005	0.000026	<0.00005	<0.00005	<0.00005	<0.00005

Appendix D.4.

AGAT QA/QC Forms for Freshwater Samples

AGAT Laboratories

11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
http://www.agatlabs.com

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL
580 MAIN STREET, SUITE 105
SAINT JOHN, NB E2K1J5

ATTENTION TO: CHYANN KIRBY

PROJECT NO: GRQ

AGAT WORK ORDER: 10X432414

WATER ANALYSIS REVIEWED BY: Mike Earp, Operations Manager

DATE REPORTED: Sep 10, 2010

PAGES (INCLUDING COVER): 8

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (902) 468-8718, or at 1-888-468-8718

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

Member of: Association of Professional Engineers, Geologists and Geophysicists of Alberta (APEGGA)
Western Enviro-Agricultural Laboratory Association (WEALA)
Environmental Services Association of Alberta (ESAA)

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Results relate only to the items tested

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Certificate of Analysis

AGAT WORK ORDER: 10X432414
PROJECT NO: GRQ

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: CHYANN KIRBY

Standard Water Analysis + FWAL Metals (Total), Hg

DATE SAMPLED: Aug 24, 2010 | DATE RECEIVED: Sep 02, 2010 | DATE REPORTED: Sep 10, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	GRQ-1 1970509	GRQ-2 1970510
pH				4.3	4.3
Reactive Silica as SiO2	mg/L		0.5	7.2	0.9
Chloride	mg/L		1	14	10
Fluoride	mg/L		0.1	<0.1	<0.1
Sulphate	mg/L		2	<2	<2
Alkalinity	mg/L		5	<5	<5
True Color	TCU		5	395	198
Turbidity	NTU		0.1	1.0	0.7
Electrical Conductivity	umho/cm		1	59	52
Nitrate + Nitrite as N	mg/L		0.05	<0.05	<0.05
Nitrate as N	mg/L		0.05	<0.05	<0.05
Nitrite as N	mg/L		0.05	<0.05	<0.05
Ammonia as N	mg/L		0.03	<0.03	0.03
Total Organic Carbon	mg/L		0.5	35.6	15.4
Ortho-Phosphate as P	mg/L		0.01	<0.01	<0.01
Total Sodium	mg/L		0.1	8.8	6.8
Total Potassium	mg/L		0.1	0.3	0.4
Total Calcium	mg/L		0.1	0.5	0.3
Total Magnesium	mg/L		0.1	0.7	0.6
Bicarb. Alkalinity (as CaCO3)	mg/L		5	<5	<5
Carb. Alkalinity (as CaCO3)	mg/L		10	<10	<10
Hydroxide	mg/L		5	<5	<5
Calculated TDS	mg/L		1	26	19
Hardness	mg/L			4.1	3.2
Langelier Index (@20C)	NA			-6.84	-7.05
Langelier Index (@ 4C)	NA			-7.16	-7.37
Saturation pH (@ 20C)	NA			11.1	11.3
Saturation pH (@ 4C)	NA			11.5	11.7
Anion Sum	me/L			0.39	0.28
Cation sum	me/L			0.68	0.47
% Difference/ Ion Balance (NS)	%			26.2	25.2
Total Aluminum	ug/L		5	1050	335
Total Antimony	ug/L		2	<2	<2

Certified By:

Results relate only to the items tested

AGAT Laboratories

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FAX (902)468-8924
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 10X432414
PROJECT NO: GRQ

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: CHYANN KIRBY

Standard Water Analysis + FWAL Metals (Total), Hg

DATE SAMPLED: Aug 24, 2010 | DATE RECEIVED: Sep 02, 2010 | DATE REPORTED: Sep 10, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	GRQ-1 1970509	GRQ-2 1970510
Total Arsenic	ug/L		2	<2	<2
Total Barium	ug/L		5	<5	<5
Total Beryllium	ug/L		2	<2	<2
Total Bismuth	ug/L		2	<2	<2
Total Boron	ug/L		5	14	11
Total Cadmium	ug/L		0.017	0.025	0.023
Total Chromium	ug/L		1	4	<1
Total Cobalt	ug/L		1	<1	<1
Total Copper	ug/L		2	<2	<2
Total Iron	ug/L		50	976	319
Total Lead	ug/L		0.5	3.1	2.6
Total Manganese	ug/L		2	37	16
Total Molybdenum	ug/L		2	<2	<2
Total Nickel	ug/L		2	<2	<2
Total Selenium	ug/L		1	1	<1
Total Silver	ug/L		0.1	<0.1	<0.1
Total Strontium	ug/L		5	<5	<5
Total Thallium	ug/L		0.1	<0.1	<0.1
Total Tin	ug/L		2	<2	<2
Total Titanium	ug/L		2	5	2
Total Uranium	ug/L		0.1	0.3	0.1
Total Vanadium	ug/L		2	<2	<2
Total Zinc	ug/L		5	9	26
Mercury	mg/L		0.00005	<0.00005	<0.00005

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

Results relate only to the items tested

C 1340-1224

AGAT Laboratories

11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 10X432414
PROJECT NO: GRQ

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: CHYANN KIRBY

Total Phosphorus (Low Level)

DATE SAMPLED: Aug 24, 2010 | DATE RECEIVED: Sep 02, 2010 | DATE REPORTED: Sep 10, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	GRQ-1 1970509	GRQ-2 1970510
Total Phosphorus	mg/L		0.002	0.157	0.035

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

Results relate only to the items tested

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Quality Assurance

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

AGAT WORK ORDER: 10X432414

PROJECT NO: GRQ

ATTENTION TO: CHYANN KIRBY

Water Analysis

RPT Date: Sep 10, 2010			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Standard Water Analysis + FWAL Metals (Total), Hg															
pH	1	1965945	6.9	7.0	1.4%	<	100%	80%	120%		80%	120%		80%	120%
Reactive Silica as SiO2	1	1976151	13.2	13.1	0.8%	< 0.5	103%	80%	120%		80%	120%	102%	80%	120%
Chloride	1	1962422	10	10	0.0%	< 1	94%	80%	120%		80%	120%	100%	80%	120%
Fluoride	1	1962422	< 0.1	< 0.1	0.0%	< 0.1	98%	80%	120%		80%	120%	87%	80%	120%
Sulphate	1	1962422	5	5	0.0%	< 2	100%	80%	120%		80%	120%	102%	80%	120%
Alkalinity	1	1965945	8	8	0.0%	< 5	99%	80%	120%		80%	120%	97%	80%	120%
True Color	1	1965027	< 5	< 5	0.0%	< 5	95%	80%	120%		80%	120%		80%	120%
Turbidity	1	1965027	0.3	0.3	0.0%	< 0.1	88%	80%	120%		80%	120%		80%	120%
Electrical Conductivity	1	1965945	184	187	1.6%	< 1	99%	80%	120%		80%	120%		80%	120%
Nitrate as N	1	1962422	0.08	0.09	11.8%	< 0.05	104%	80%	120%		80%	120%	83%	80%	120%
Nitrite as N	1	1962422	< 0.05	< 0.05	0.0%	< 0.05	110%	80%	120%		80%	120%	101%	80%	120%
Total Organic Carbon	1	1976101	2.4	2.1	13.3%	< 0.5	103%	80%	120%		80%	120%	93%	80%	120%
Ortho-Phosphate as P	1	1976151	<0.01	0.01		< 0.01	99%	80%	120%		80%	120%	94%	80%	120%
Total Sodium	90810	1977594	32.5	31.2	4.1%	< 0.1	115%	80%	120%	108%	90%	110%	97%	80%	120%
Total Potassium	90810	1977594	1.4	1.5	6.9%	< 0.1	103%	90%	110%	103%	90%	110%	82%	80%	120%
Total Calcium	90810	1977594	10.3	10.5	1.9%	< 0.1	102%	90%	110%	103%	90%	110%	117%	80%	120%
Total Magnesium	90810	1977594	1.7	1.6	6.1%	< 0.1	113%	80%	120%	104%	90%	110%	91%	80%	120%
Total Aluminum	90810	1977594	288	294	2.1%	< 5	117%	80%	120%	108%	90%	110%	114%	80%	120%
Total Antimony	90810	1977594	< 2	< 2	0.0%	< 2	83%	80%	120%	110%	90%	110%	98%	80%	120%
Total Arsenic	90810	1977594	74	73	1.4%	< 2	98%	90%	110%	95%	90%	110%	92%	80%	120%
Total Barium	90810	1977594	22	22	0.0%	< 5	99%	90%	110%	98%	90%	110%	83%	80%	120%
Total Beryllium	90810	1977594	< 2	< 2	0.0%	< 2	109%	90%	110%	106%	90%	110%	100%	80%	120%
Total Bismuth	90810	1977594	< 2	< 2	0.0%	< 2	95%	90%	110%	93%	90%	110%	93%	70%	130%
Total Boron	90810	1977594	53	53	0.0%	< 5	110%	90%	110%	110%	90%	110%	103%	80%	120%
Total Cadmium	90810	1977594	0.156	0.157	0.6%	< 0.017	97%	90%	110%	102%	90%	110%	98%	80%	120%
Total Chromium	90810	1977594	< 1	< 1	0.0%	< 1	105%	90%	110%	104%	90%	110%	87%	80%	120%
Total Cobalt	90810	1977594	< 1	< 1	0.0%	< 1	109%	90%	110%	103%	90%	110%	80%	80%	120%
Total Copper	90810	1977594	4	4	0.0%	< 2	105%	90%	110%	102%	90%	110%	84%	80%	120%
Total Iron	90810	1977594	282	274	2.9%	< 50	100%	90%	110%	100%	90%	110%	80%	80%	120%
Total Lead	90810	1977594	5.5	6.3	13.6%	< 0.5	100%	90%	110%	103%	90%	110%	104%	80%	120%
Total Manganese	90810	1977594	33	34	3.0%	< 2	104%	90%	110%	102%	90%	110%	85%	80%	120%
Total Molybdenum	90810	1977594	32	32	0.0%	< 2	93%	90%	110%	101%	90%	110%	103%	70%	130%
Total Nickel	90810	1977594	< 2	< 2	0.0%	< 2	106%	90%	110%	104%	90%	110%	85%	80%	120%
Total Selenium	90810	1977594	< 1	< 1	0.0%	< 1	97%	90%	110%	98%	90%	110%	90%	80%	120%
Total Silver	90810	1977594	< 0.1	< 0.1	0.0%	< 0.1	99%	90%	110%	90%	90%	110%	85%	80%	120%
Total Strontium	90810	1977594	74	73	1.4%	< 5	94%	90%	110%	97%	90%	110%	85%	80%	120%
Total Thallium	90810	1977594	< 0.1	< 0.1	0.0%	< 0.1	102%	90%	110%	104%	90%	110%	99%	80%	120%
Total Tin	90810	1977594	< 2	< 2	0.0%	< 2	91%	90%	110%	101%	90%	110%	98%	80%	120%
Total Titanium	90810	1977594	19	15	23.5%	< 2	104%	90%	110%	100%	90%	110%	91%	80%	120%

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Results relate only to the items tested

AGAT Laboratories

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Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

AGAT WORK ORDER: 10X432414

PROJECT NO: GRQ

ATTENTION TO: CHYANN KIRBY

Water Analysis (Continued)

RPT Date: Sep 10, 2010			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Total Uranium	90810	1977594	16.9	17.0	0.6%	< 0.1	102%	90%	110%	106%	90%	110%	100%	80%	120%
Total Vanadium	90810	1977594	< 2	< 2	0.0%	< 2	104%	90%	110%	99%	90%	110%	80%	80%	120%
Total Zinc	90810	1977594	19	19	0.0%	< 5	103%	90%	110%	102%	90%	110%	84%	80%	120%
Mercury	1	1968366	< 0.00005	< 0.00005	0.0%	< 0.00005	103%	80%	120%		80%	120%	89%	80%	120%
Standard Water Analysis + FWAL Metals (Total), Hg															
Ammonia as N	1	1965026	<0.05	<0.05	0.0%	< 0.03	92%	80%	120%		80%	120%	102%	80%	120%
Total Phosphorus (Low Level)															
Total Phosphorus	1	1970509	0.157	0.136	14.3%	< 0.006	93%	90%	110%	96%	90%	110%	87%	80%	120%

Certified By:

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Method Summary

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

AGAT WORK ORDER: 10X432414

PROJECT NO: GRQ

ATTENTION TO: CHYANN KIRBY

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
pH	INOR-121-6001	SM 4500 H+B	PC-TITRATE
Reactive Silica as SiO2	INORG-121-6028	SM 4110 B	COLORIMETER
Chloride	INORG-121-6005	SM 4110 B	IC
Fluoride	INORG-121-6005	SM 4110 B	IC
Sulphate	INORG-121-6005	SM 4110 B	IC
Alkalinity	INORG-121-6001	SM 2320 B	PC-TITRATE
True Color	INORG-121-6014	EPA 110.2	NEPHELOMETER
Turbidity	INORG-121-6022	SM 2130 B	NEPHELOMETER
Electrical Conductivity	INOR-121-6001	SM 2510 B	PC-TITRATE
Nitrate + Nitrite as N	INORG-121-6005	SM 4110 B	IC
Nitrate as N	INORG-121-6005	SM 4110 B	IC
Nitrite as N	INORG-121-6005	SM 4110 B	IC
Ammonia as N	INORG-121-6003	SM 4500-NH3 G	COLORIMETER
Total Organic Carbon	INORG-121-6026	SM 5310 B	TOC ANALYZER
Ortho-Phosphate as P	INORG-121-6005	SM 4110 B	COLORIMETER
Total Sodium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Potassium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Calcium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Magnesium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Bicarb. Alkalinity (as CaCO3)	INORG-121-6001	SM 2320 B	PC-TITRATE
Carb. Alkalinity (as CaCO3)	INORG-121-6001	SM 2320 B	PC-TITRATE
Hydroxide	INORG-121-6001	SM 2320 B	PC-TITRATE
Calculated TDS			
Hardness			
Langelier Index (@20C)			CALCULATION
Langelier Index (@ 4C)			CALCULATION
Saturation pH (@ 20C)			CALCULATION
Saturation pH (@ 4C)			CALCULATION
Anion Sum			
Cation sum			
% Difference/ Ion Balance (NS)			
Total Aluminum	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Antimony	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Arsenic	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Barium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Beryllium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Bismuth	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Boron	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Cadmium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS

Results relate only to the items tested

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Method Summary

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

AGAT WORK ORDER: 10X432414

PROJECT NO: GRQ

ATTENTION TO: CHYANN KIRBY

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Total Chromium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Cobalt	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Copper	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Iron	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Lead	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Manganese	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Molybdenum	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Nickel	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Selenium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Silver	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Strontium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Thallium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Tin	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Titanium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Uranium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Vanadium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Zinc	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Mercury	INOR-121-6100 & INOR-121-6107	SM 3112 B	CVAAS
Total Phosphorus	INOR-93-1022	SM 4500-P B&E	SPECTROPHOTOMETER

Results relate only to the items tested

AGAT Laboratories

Unit 122 - 11 Morris Dr.
Dartmouth, NS B3B 1M2
Phone: 902-468-8718 • Fax: 902-468-8924
www.agatlabs.com
http://webearth.agatlabs.com

Arrival Condition: 15°C ✓Good ☐ Poor (complete 'notes')
Arrival Temperature: 15°C AGAT Job Number: 10X432414
Notes:
Drinking Water Sample (y/n): Reg. No.
Waterworks Number:

CHAIN OF CUSTODY RECORD

Report To:
Company: AMEC
Contact: Chyann Kirby
Address: Saint John, NB
Phone: (506) 652-9497 FAX:
PO#:
AGAT Quotation:
Client Project Name/ #: GRQ

Invoice To: Same (Y) / N) Circle
Company:
Contact:
Address:
Phone: FAX:
PO#/Credit Card #:

Report Information
1. Name: Chyann Kirby
Email: chyann.kirby@amec.com
2. Name: Maureen Cameron-MacMillan
Email: maureen.cameron@amec.com

Regulatory Requirements (Check)
✓List Guidelines on Report ☐ Do Not List Guidelines on Report
☐ PIRI
☐ Tier 1 ☐ Res.
☐ Tier 2 ☐ Com
☐ Gas ☐ Fuel ☐ Lube
☐ CCME ☐ CDWQ
☐ Ind ☐ NSDFOSP
☐ Com ☐ HRM 101 Storm Water
☐ Res/p
☐ Ag ☐ HRM 101 Waste Water
✓ WAL
☐ Sediment
☐ Other

Site Info (check all that apply):
☐ Pot. ☐ Coarse
☐ N/Pot. ☐ Fine

Report Format
☐ Single PDF sample per page
☐ Multiple PDF samples per page
✓ Excel format included

Turnaround Time (TAT) Business Days
Regular TAT:
✓ 5 - 7 days
Rush TAT:
☐ 1 day ☐ 2 days
☐ 3 - 4 days
Date Required:
Time Required:

Sample Identification	Date/Time Sampled	Sample Matrix	# of Containers	Comments - Site/Sample Info/Containment	Lab Filtration Required	Standard Water Analysis + MS	Metals	(circle - Total, Diss or Available)	Mercury	BOD	pH	TSS	TKN	Anions	Total Phosphorus	Phenols	TPH/BTEX (PIRI) Tier 1	TPH/BTEX - Fractionation Tier 2	VOC	THM	PAH	PCB	Other: Low-level phosphorus	Other:	Hazardous (Y/N)	Lab Sample #
GRQ-1	24 Aug	SW	6			✓	✓	✓	✓			✓											✓		N	
GRQ-2	27 Aug	SW	6			✓	✓	✓	✓			✓											✓		N	

Sample Relinquished by (print name): Maureen Cameron-MacMillan
Date/Time: 01 Sept.
Sample Received by (print name): A. Carmichael
Date/Time: Sept 2
Sample Relinquished by (sign):
Date/Time:
Sample Received by (sign):
Date/Time:

White Copy - AGAT
Yellow Copy - AGAT
Pink Copy - Client

PAGE 1 of 1
NO: 19868

C 1340-1230

AGAT Laboratories

11 Morris Drive, Unit 122
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CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
http://www.agatlabs.com

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL
580 MAIN STREET, SUITE 105
SAINT JOHN, NB E2K1J5

ATTENTION TO: CHYANN KIRBY

PROJECT NO: GRQ

AGAT WORK ORDER: 10X438935

WATER ANALYSIS REVIEWED BY: Jason Coughtrey, Inorganic Supervisor

DATE REPORTED: Oct 06, 2010

PAGES (INCLUDING COVER): 9

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (902) 468-8718, or at 1-888-468-8718

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

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Western Enviro-Agricultural Laboratory Association (WEALA)
Environmental Services Association of Alberta (ESAA)

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Results relate only to the items tested

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Certificate of Analysis

AGAT WORK ORDER: 10X438935
PROJECT NO: GRQ

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: CHYANN KIRBY

Standard Water Analysis + Metals (Total)

DATE SAMPLED: Sep 22, 2010 | DATE RECEIVED: Sep 28, 2010 | DATE REPORTED: Oct 06, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	GRQ-3 2018956	GRQ-4 2018959
pH		6.5-9		3.9	4.2
Reactive Silica as SiO2	mg/L		0.5	10.2	1.8
Chloride	mg/L		1	18	13
Fluoride	mg/L	0.12	0.1	0.4	<0.1
Sulphate	mg/L		2	<2	<2
Alkalinity	mg/L		5	<5	<5
True Color	TCU	Narrative	5	411	195
Turbidity	NTU	Narrative	0.1	2.8	0.7
Electrical Conductivity	umho/cm		1	102	61
Nitrate + Nitrite as N	mg/L		0.05	0.24	<0.05
Nitrate as N	mg/L	2.9	0.05	0.24	<0.05
Nitrite as N	mg/L	0.06	0.05	<0.05	<0.05
Ammonia as N	mg/L	Fact Sheet	0.03	0.06	0.11
Total Organic Carbon	mg/L		0.5	46.6	17.5
Ortho-Phosphate as P	mg/L		0.01	0.02	<0.01
Total Sodium	mg/L		0.1	10.0	6.8
Total Potassium	mg/L		0.1	0.4	0.5
Total Calcium	mg/L		0.1	0.5	0.4
Total Magnesium	mg/L		0.1	1.1	0.6
Bicarb. Alkalinity (as CaCO3)	mg/L		5	<5	<5
Carb. Alkalinity (as CaCO3)	mg/L		10	<10	<10
Hydroxide	mg/L		5	<5	<5
Calculated TDS	mg/L		1	33	22
Hardness	mg/L			5.8	3.5
Langelier Index (@20C)	NA			-7.25	-7.03
Langelier Index (@ 4C)	NA			-7.57	-7.35
Saturation pH (@ 20C)	NA			11.1	11.2
Saturation pH (@ 4C)	NA			11.5	11.5
Anion Sum	me/L			0.52	0.37
Cation sum	me/L			0.84	0.49
% Difference/ Ion Balance (NS)	%			23.3	14.8
Total Aluminum	ug/L	5.0	5	1050	272
Total Antimony	ug/L		2	<2	<2

Certified By: Jason Coughtrey

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Certificate of Analysis

AGAT WORK ORDER: 10X438935
PROJECT NO: GRQ

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: CHYANN KIRBY

Standard Water Analysis + Metals (Total)

DATE SAMPLED: Sep 22, 2010 | DATE RECEIVED: Sep 28, 2010 | DATE REPORTED: Oct 06, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	GRQ-3 2018956	GRQ-4 2018959
Total Arsenic	ug/L	5.0	2	5	<2
Total Barium	ug/L		5	16	<5
Total Beryllium	ug/L		2	<2	<2
Total Bismuth	ug/L		2	<2	<2
Total Boron	ug/L		5	20	14
Total Cadmium	ug/L	0.017	0.017	0.102	<0.017
Total Chromium	ug/L		1	<1	<1
Total Cobalt	ug/L		1	<1	<1
Total Copper	ug/L	2	2	<2	<2
Total Iron	ug/L	300	50	936	415
Total Lead	ug/L	1	0.5	2.2	0.7
Total Manganese	ug/L		2	87	15
Total Molybdenum	ug/L	73	2	<2	<2
Total Nickel	ug/L	25	2	<2	<2
Total Selenium	ug/L	1.0	1	<1	<1
Total Silver	ug/L	0.1	0.1	<0.1	<0.1
Total Strontium	ug/L		5	9	<5
Total Thallium	ug/L	0.8	0.1	<0.1	<0.1
Total Tin	ug/L		2	<2	<2
Total Titanium	ug/L		2	5	<2
Total Uranium	ug/L		0.1	0.3	<0.1
Total Vanadium	ug/L		2	<2	<2
Total Zinc	ug/L	30	5	20	10
Mercury	mg/L	0.026	0.00005	<0.00005	<0.00005

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to NS - FWAL(ug/L)

Certified By:

Results relate only to the items tested

C 1340-1233

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Certificate of Analysis

AGAT WORK ORDER: 10X438935
PROJECT NO: GRQ

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: CHYANN KIRBY

Water Analysis - Various Inorganics

DATE SAMPLED: Sep 22, 2010 | DATE RECEIVED: Sep 28, 2010 | DATE REPORTED: Oct 06, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	GRQ-3 2018956	GRQ-4 2018959
Total Suspended Solids	mg/L	Narrative	5	<5	<5
Total Phosphorous as P	mg/L	Fact Sheet	0.002	0.030	0.012

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to NS-FWAL(mg/L)

Certified By: Jason Coughtrey

Results relate only to the items tested

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Guideline Violation

AGAT WORK ORDER: 10X438935

PROJECT NO: GRQ

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: CHYANN KIRBY

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	GUIDEVALUE	RESULT
2018956	GRQ-3	NS - FWAL(ug/L)	Standard Water Analysis + Metals (Total)	Fluoride	0.12	0.4
2018956	GRQ-3	NS - FWAL(ug/L)	Standard Water Analysis + Metals (Total)	Total Aluminum	5.0	1050
2018956	GRQ-3	NS - FWAL(ug/L)	Standard Water Analysis + Metals (Total)	Total Cadmium	0.017	0.102
2018956	GRQ-3	NS - FWAL(ug/L)	Standard Water Analysis + Metals (Total)	Total Iron	300	936
2018956	GRQ-3	NS - FWAL(ug/L)	Standard Water Analysis + Metals (Total)	Total Lead	1	2.2
2018956	GRQ-3	NS - FWAL(ug/L)	Standard Water Analysis + Metals (Total)	pH	6.5-9	3.9
2018959	GRQ-4	NS - FWAL(ug/L)	Standard Water Analysis + Metals (Total)	Total Aluminum	5.0	272
2018959	GRQ-4	NS - FWAL(ug/L)	Standard Water Analysis + Metals (Total)	Total Iron	300	415
2018959	GRQ-4	NS - FWAL(ug/L)	Standard Water Analysis + Metals (Total)	pH	6.5-9	4.2

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Quality Assurance

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

AGAT WORK ORDER: 10X438935

PROJECT NO: GRQ

ATTENTION TO: CHYANN KIRBY

Water Analysis

RPT Date: Oct 06, 2010			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Standard Water Analysis + Metals (Total)															
pH	1	2017954	7.4	7.4	0.0%		100%	80%	120%		80%	120%		80%	120%
Reactive Silica as SiO2	1	2014611	13.4	13.3	0.7%	< 0.5	99%	80%	120%		80%	120%	102%	80%	120%
Chloride	1	2021445	8	7	13.3%	< 1	102%	80%	120%		80%	120%	106%	80%	120%
Fluoride	1	2021445	< 0.1	< 0.1	0.0%	< 0.1	94%	80%	120%		80%	120%	94%	80%	120%
Sulphate	1	2021445	14	15	6.9%	< 2	108%	80%	120%		80%	120%	105%	80%	120%
Alkalinity	1	2017954	18	17	5.7%	< 5	101%	80%	120%		80%	120%	95%	80%	120%
True Color	1	2016154	30	28	6.9%	< 5	90%	80%	120%		80%	120%		80%	120%
Turbidity	1	2016154	7.6	7.5	1.3%	< 0.1	87%	80%	120%		80%	120%		80%	120%
Electrical Conductivity	1	2017954	93	93	0.0%	< 1	98%	80%	120%		80%	120%		80%	120%
Nitrate as N	1	2021445	2.63	2.67	1.5%	< 0.05	110%	80%	120%		80%	120%	102%	80%	120%
Nitrite as N	1	2021445	< 0.05	< 0.05	0.0%	< 0.05	118%	80%	120%		80%	120%	105%	80%	120%
Ammonia as N	1	2023292	<0.05	<0.05	0.0%	< 0.05	98%	80%	120%		80%	120%	97%	80%	120%
Ortho-Phosphate as P	1	2016250	<0.01	<0.01	0.0%	< 0.01	97%	80%	120%		80%	120%	104%	80%	120%
Total Sodium	92920	2018917	6.0	6.3	4.9%	< 0.1	102%	90%	110%	92%	90%	110%	113%	80%	120%
Total Potassium	92920	2018917	1.4	1.3	7.4%	< 0.1	105%	90%	110%	103%	90%	110%	89%	80%	1020
Total Calcium	92920	2018917	481	427	11.9%	< 0.1	104%	90%	110%	103%	90%	110%	90%	80%	120%
Total Magnesium	92920	2018917	15.7	16.6	5.6%	< 0.1	100%	90%	110%	99%	90%	110%	117%	80%	120%
Total Aluminum	92920	2018917	206	212	2.9%	< 10	100%	90%	110%	100%	90%	110%	106%	80%	120%
Total Antimony	92920	2018917	< 2	< 2	0.0%	< 2	97%	90%	110%	104%	90%	110%	109%	80%	120%
Total Arsenic	92920	2018917	14	14	0.0%	< 2	97%	90%	110%	97%	90%	110%	113%	80%	120%
Total Barium	92920	2018917	13	11	16.7%	< 5	97%	90%	110%	100%	90%	110%	106%	80%	120%
Total Beryllium	92920	2018917	< 2	< 2	0.0%	< 2	103%	90%	110%	102%	90%	110%	110%	80%	120%
Total Bismuth	92920	2018917	< 2	< 2	0.0%	< 2	102%	90%	110%	87%	80%	120%	84%	80%	120%
Total Boron	92920	2018917	79	77	2.6%	< 5	102%	90%	110%	94%	90%	110%	120%	80%	120%
Total Cadmium	92920	2018917	< 0.3	< 0.3	0.0%	< 0.3	98%	90%	110%	100%	90%	110%	101%	80%	120%
Total Chromium	92920	2018917	< 2	< 2	0.0%	< 2	105%	90%	110%	104%	90%	110%	80%	80%	120%
Total Cobalt	92920	2018917	< 1	< 1	0.0%	< 1	105%	90%	110%	103%	90%	110%	91%	80%	120%
Total Copper	92920	2018917	3	3	0.0%	< 2	108%	90%	110%	106%	90%	110%	107%	80%	120%
Total Iron	92920	2018917	2270	2000	12.6%	< 50	106%	90%	110%	105%	90%	110%	89%	80%	120%
Total Lead	92920	2018917	< 0.5	< 0.5	0.0%	< 0.5	102%	90%	110%	100%	90%	110%	86%	80%	120%
Total Manganese	92920	2018917	105	91	14.3%	< 2	105%	90%	110%	104%	90%	110%	80%	80%	120%
Total Molybdenum	92920	2018917	5	5	0.0%	< 2	99%	90%	110%	92%	90%	110%	86%	80%	120%
Total Nickel	92920	2018917	< 2	< 2	0.0%	< 2	107%	90%	110%	106%	90%	110%	90%	80%	120%
Total Selenium	92920	2018917	< 2	< 2	0.0%	< 2	99%	90%	110%	99%	90%	110%	111%	80%	120%
Total Silver	92920	2018917	< 0.5	< 0.5	0.0%	< 0.5	98%	90%	110%	105%	90%	110%	98%	80%	120%
Total Strontium	92920	2018917	7750	7650	1.3%	< 5	98%	90%	110%	98%	90%	110%	96%	80%	120%
Total Thallium	92920	2018917	< 0.1	< 0.1	0.0%	< 0.1	101%	90%	110%	100%	90%	110%	90%	80%	120%
Total Tin	92920	2018917	< 2	< 2	0.0%	< 2	96%	90%	110%	100%	90%	110%	115%	80%	120%
Total Titanium	92920	2018917	20	21	4.9%	< 2	103%	90%	110%	100%	90%	110%	106%	80%	120%

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Quality Assurance

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

AGAT WORK ORDER: 10X438935

PROJECT NO: GRQ

ATTENTION TO: CHYANN KIRBY

Water Analysis (Continued)

RPT Date: Oct 06, 2010			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Total Uranium	92920	2018917	0.5	0.5	0.0%	< 0.1	102%	90%	110%	98%	90%	110%	84%	80%	120%
Total Vanadium	92920	2018917	< 2	< 2	0.0%	< 2	105%	90%	110%	98%	90%	110%	91%	80%	120%
Total Zinc	92920	2018917	< 5	< 5	0.0%	< 5	103%	90%	110%	103%	90%	110%	104%	80%	120%
Mercury	1	2016154	< 0.00005	< 0.00005	0.0%	< 0.00005	103%	80%	120%		80%	120%	96%	80%	120%
Water Analysis - Various Inorganics															
Total Suspended Solids	1	2020180	<5	<5	0.0%	< 5	100%	80%	120%		80%	120%	102%	80%	120%
Total Phosphorous as P	1		0.055	0.051	7.5%	< 0.002	90%	80%	120%	95%	80%	120%	94%	80%	120%

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Method Summary

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

AGAT WORK ORDER: 10X438935

PROJECT NO: GRQ

ATTENTION TO: CHYANN KIRBY

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
pH	INOR-121-6001	SM 4500 H+B	PC-TITRATE
Reactive Silica as SiO2	INORG-121-6028	SM 4110 B	COLORIMETER
Chloride	INORG-121-6005	SM 4110 B	IC
Fluoride	INORG-121-6005	SM 4110 B	IC
Sulphate	INORG-121-6005	SM 4110 B	IC
Alkalinity	INORG-121-6001	SM 2320 B	PC-TITRATE
True Color	INORG-121-6014	EPA 110.2	NEPHELOMETER
Turbidity	INORG-121-6022	SM 2130 B	NEPHELOMETER
Electrical Conductivity	INOR-121-6001	SM 2510 B	PC-TITRATE
Nitrate + Nitrite as N	INORG-121-6005	SM 4110 B	IC
Nitrate as N	INORG-121-6005	SM 4110 B	IC
Nitrite as N	INORG-121-6005	SM 4110 B	IC
Ammonia as N	INORG-121-6003	SM 4500-NH3 G	COLORIMETER
Total Organic Carbon	INORG-121-6026	SM 5310 B	TOC ANALYZER
Ortho-Phosphate as P	INORG-121-6005	SM 4110 B	COLORIMETER
Total Sodium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Potassium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Calcium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Magnesium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Bicarb. Alkalinity (as CaCO3)	INORG-121-6001	SM 2320 B	PC-TITRATE
Carb. Alkalinity (as CaCO3)	INORG-121-6001	SM 2320 B	PC-TITRATE
Hydroxide	INORG-121-6001	SM 2320 B	PC-TITRATE
Calculated TDS			
Hardness			
Langelier Index (@20C)			CALCULATION
Langelier Index (@ 4C)			CALCULATION
Saturation pH (@ 20C)			CALCULATION
Saturation pH (@ 4C)			CALCULATION
Anion Sum			
Cation sum			
% Difference/ Ion Balance (NS)			
Total Aluminum	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Antimony	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Arsenic	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Barium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Beryllium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Bismuth	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Boron	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Cadmium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS

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Method Summary

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

AGAT WORK ORDER: 10X438935

PROJECT NO: GRQ

ATTENTION TO: CHYANN KIRBY

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Total Chromium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Cobalt	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Copper	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Iron	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Lead	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Manganese	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Molybdenum	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Nickel	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Selenium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Silver	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Strontium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Thallium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Tin	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Titanium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Uranium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Vanadium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Zinc	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Mercury	INOR-121-6100 & INOR-121-6107	SM 3112 B	CVAAS
Total Suspended Solids	INOR-121-6024, 6025	SM 2540C, D	GRAVIMETRIC
Total Phosphorous as P	INORG-121-6009	SM 365.2	COLORIMETER

Results relate only to the items tested

C 1340-1240

AGAT Laboratories

Unit 122 - 11 Morris Dr.
Dartmouth, NS B3B 1M2
Phone: 902-468-8718 • Fax: 902-468-8924
www.agatlabs.com
http://webearth.agatlabs.com

Arrival Condition: 10°C ☑ Good ☐ Poor (complete notes)
Arrival Temperature: 10°C AGAT Job Number: 10x432045
Notes:

Drinking Water Sample (y/n): _____ Reg. No. _____
Waterworks Number: _____

CHAIN OF CUSTODY RECORD

Report To:
Company: AMEC
Contact: Chyann Kirby
Address: Saint John, NB
Phone: (506)652-9497 FAX: _____
PO#: _____
AGAT Quotation: _____
Client Project Name/ #: GRQ

Invoice To: Same (Y) N) Circle
Company: _____
Contact: _____
Address: _____
Phone: _____ FAX: _____
PO#/Credit Card #: _____

Report Information
1. Name: Chyann Kirby
Email: chyann.kirby@amec.com
2. Name: Maureen Cameron-MacMillan
Email: maureen.cameron@amec.com

Regulatory Requirements (Check)
☑ List Guidelines on Report ☐ Do Not List Guidelines on Report
☐ PIRI
☐ Tier 1 ☐ Res. ☐ Pot. ☐ Coarse
☐ Tier 2 ☐ Com ☐ N/Pot. ☐ Fine
☐ Gas ☐ Fuel ☐ Lube
☑ CCME ☐ CDWQ
☐ Ind ☐ NSDFOSP
☐ Com ☐ HRM 101
☐ Res/p Storm Water
☐ Ag ☐ HRM 101
☑ FWAL Waste Water
☐ Sediment
☐ Other _____
Site Info (check all that apply):

Report Format
☐ Single PDF sample per page
☐ Multiple PDF samples per page
☑ Excel format included

Turnaround Time (TAT) Business Days
Regular TAT:
☑ 5 - 7 days
Rush TAT:
☐ 1 day ☐ 2 days
☐ 3 - 4 days
Date Required: _____
Time Required: _____

Sample Identification	Date/Time Sampled	Sample Matrix	# of Containers	Comments - Site/Sample Info/Containment	Lab Filtration Required	Standard Water Analysis + MS	Metals	(circle Total / Dissolved or Available)	Mercury	BOD	pH	TSS	TKN	Anions	Total Phosphorus	Phenols	TPH/BTEX (PIRI) Tier 1	TPH/BTEX Fractionation Tier 2	VOC	THM	PAH	PCB	Other: Lower level phosphorus	Other:	Hazardous (Y/N)	Lab Sample #
GRQ-3	22 Sept	SW	6			✓	✓	✓	✓			✓											✓		N	
GRQ-4	22 Sept	SW	6			✓	✓	✓	✓			✓											✓		N	

Sample Relinquished by (print name): Maureen Cameron-MacMillan
Sample Relinquished by (sign):
Date/Time: 27 Sept
Date/Time:
Sample Received by (print name): A. Carmichael
Sample Received by (sign):
Date/Time: Sept 29, 10
Date/Time: 3:15

White Copy - AGAT
Yellow Copy - AGAT
Pink Copy - Client

PAGE 1 of _____
NO: 19869

Appendix E: Marine Habitat

Appendix E.1: Video Transect Results

Appendix E.2: Benthic Invertebrate Sample Results

Appendix E.3: Marine Sediment Results

Appendix E.4: AGAT Quality Assurance/Quality Control and Certificates of Analyses for Marine Sediment Samples

Appendix E.1

Video Transect Results

Table E.1-1. 250m Transect – Transect T1, August 31-September 3, 2010

Transect Distance (m)	Transect Tag Numbers	Substrate (% Coverage)	Macrofaunal Life Observed (Estimated Abundances*)	Macrofloral Life Observed (% Coverage)
0-5	0-5	Sand (75%); Cobble (20%); Silt (5%)	Shell Hash	-----
5-10	5-10	Cobble (80%); Sand (10%); Silt (10%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Encrusting Red Alga (*Leptophyllum* sp.) (5%)
10-15	10-15	Cobble (80%); Sand (10%); Silt (10%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Waved Whelk (*Buccinum undatum*) (**U: 1 individual**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%)
15-20	15-20	Cobble (80%); Sand (10%); Silt (10%)	Waved Whelk (*Buccinum undatum*) (**O: 5-10 individuals**); Sea Cucumber (*Cucumaria frondosa*) (**U: 1 individual**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
20-25	20-25	Cobble (80%); Sand (10%); Silt (10%)	Deep Sea Scallop (*Placopecten magellanicus*) (**U: 2 individuals**); Sea Star (*Asterias* sp.) (**U: 1 individual**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Bladderwrack (*Fucus* sp.) (5%)
25-30	25-30	Cobble (65%); Sand (25%); Silt (10%)	Periwinkle (*Littorina* sp.) (**C**); Waved Whelk (*Buccinum undatum*) (**U: 2 individuals**); Blue Mussel (*Mytilus edulis*) (**U: 2 individuals**); American Oyster (*Crassostrea virginica*) (**U: 1 individual**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (15%); Sea Colander (*Agarum clathratum*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
30-35	30-35	Cobble (65%); Sand (25%); Silt (10%)	Blue Mussel (*Mytilus edulis*) (**O: 10-15 individuals**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
35-40	35-40	Cobble (65%); Sand (25%); Silt (10%)	Waved Whelk (*Buccinum undatum*) (**O: 10-15 individuals**); Deep Sea Scallop (*Placopecten magellanicus*) (**U: 1 individual**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%); Sea Colander (*Agarum clathratum*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
40-45	40-45	Cobble (65%); Sand (25%); Silt (10%)	Waved Whelk (*Buccinum undatum*) (**O: 10-15 individuals**); Sea Star (*Asterias* sp.) (**U: 1 individual**); Sea Cucumber (*Cucumaria frondosa*) (**U: 1 individual**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%); Sea Colander (*Agarum clathratum*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%); Bladderwrack (*Fucus* sp.) (5%)
45-50	45-50	Cobble (65%); Sand (25%); Silt (10%)	Periwinkle (*Littorina* sp.) (**C**); Lobster (*Homarus americanus*) (**U: 1 individual**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%)
50-55	50-55	Cobble (65%); Sand (25%); Silt (10%)	Barnacle (*Semibalanus balanoides*) (**C**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%)
55-60	55-60	Cobble (65%); Sand (25%); Silt (10%)	Barnacle (*Semibalanus balanoides*) (**C**); Shell Hash	Bladderwrack (*Fucus* sp.) (5%)
60-65	60-65	Cobble (65%); Sand (25%); Silt (10%)	Barnacle (*Semibalanus balanoides*) (**C**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%); Bladderwrack (*Fucus* sp.) (5%)
65-70	65-70	Cobble (65%); Sand (25%); Silt (10%)	Waved Whelk (*Buccinum undatum*) (U: **1 individual**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
70-75	70-75	Cobble (65%); Sand (25%); Silt (10%)	Lobster (*Homarus americanus*) (**U: 1 individual**); Shell Hash	Sea Colander (*Agarum clathratum*) (20%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
75-80	75-80	Cobble (65%); Sand (25%); Silt (10%)	Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%); Sea Colander (*Agarum clathratum*) (5%)
80-85	80-85	Cobble (75%); Sand (20%); Silt (5%)	Blue Mussel (*Mytilus edulis*) (**U: 1 individual**); Shell Hash	Encrusting Red Alga (*Leptophyllum* sp.) (5%); Bladderwrack (*Fucus* sp.) (5%)
85-90	85-90	Cobble (75%); Sand (20%); Silt (5%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O:5-10 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (20%)
90-95	90-95	Cobble (75%); Sand (20%); Silt (5%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O:5-10 individuals**); Lobster (*Homarus americanus*) (**U: 1 individual**); Shell Hash	Sea Colander (*Agarum clathratum*) (10%); Black Whip Weed (*Chordaria flagelliformis*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
95-100	95-100	Cobble (75%); Sand (20%); Silt (5%)	Blue Mussel (*Mytilus edulis*) (**O 15-20 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
100-105	100-105	Cobble (75%); Sand (20%); Silt (5%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O:5-10 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
105-110	105-110	Cobble (75%); Sand (20%); Silt (5%)	Barnacle (*Semibalanus balanoides*) (**C**); Deep Sea Scallop (*Placopecten magellanicus*) (**O:5-10 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (10%); Encrusting Red Alga (*Leptophyllum* sp.) (5%); Bladderwrack (*Fucus* sp.) (5%)
110-115	110-115	Cobble (75%); Sand (20%); Silt (5%)	Barnacle (*Semibalanus balanoides*) (**C**); Deep Sea Scallop (*Placopecten magellanicus*) (**O:5-10 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (10%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
115-120	115-120	Cobble (75%); Sand (20%); Silt (5%)	Shell Hash	Sea Colander (*Agarum clathratum*) (15%)
120-125	120-125	Cobble (75%); Sand (15%); Rock (5%); Silt (5%)	Barnacle (*Semibalanus balanoides*) (**C**); Shell Hash	Sea Colander (*Agarum clathratum*) (10%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)

Table E.1-1. 250m Transect – Transect T1, August 31-September 3, 2010

Transect Distance (m)	Transect Tag Numbers	Substrate (% Coverage)	Macrofaunal Life Observed (Estimated Abundances*)	Macrofloral Life Observed (% Coverage)
125-130	125-130	Cobble (90%); Sand (5%); Silt (5%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O:5-10 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%); Bladderwrack (*Fucus* sp.) (5%)
130-135	130-135	Cobble (90%); Sand (5%); Silt (5%)	Not visible	Sea Colander (*Agarum clathratum*) (5%)
135-140	135-140	Cobble (90%); Sand (5%); Silt (5%)	Not visible	Not visible
140-145	140-145	Cobble (85%); Boulder (5%); Sand (5%); Silt (5%)	Not visible	Not visible
145-150	145-150	Boulder (50%); Cobble (40%); Sand (5%); Silt (5%)	Frilled Anemone (*Metridium senile*) (**O:5-10 individuals**); Bowerbank's Halichonidria (*Halichondria bowerbanki*) (**O:5-10 individuals**)	Not visible
150-155	150-155	Boulder (75%); Cobble (20%); Sand (5%)	Not visible	Not visible
155-160	155-160	Boulder (50%); Cobble (40%); Sand (5%); Silt (5%)	Not visible	Black Whip Weed (*Chordaria flagelliformis*) (5%)
160-165	160-165	Cobble (85%); Sand (10%); Silt (5%)	Not visible	Black Whip Weed (*Chordaria flagelliformis*) (5%)
165-170	165-170	Cobble (85%); Sand (10%); Silt (5%)	Not visible	Black Whip Weed (*Chordaria flagelliformis*) (5%)
170-175	170-175	Cobble (85%); Sand (10%); Silt (5%)	-----	Black Whip Weed (*Chordaria flagelliformis*) (5%)
175-180	175-180	Cobble (85%); Sand (10%); Silt (5%)	Lobster (*Homarus americanus*) (**U: 1 individual**)	Black Whip Weed (*Chordaria flagelliformis*) (5%)
180-185	180-185	Cobble (85%); Sand (10%); Silt (5%)	Lobster (*Homarus americanus*) (**U: 1 individual**)	Black Whip Weed (*Chordaria flagelliformis*) (5%)
185-190	185-190	Cobble (85%); Sand (10%); Silt (5%)	-----	Black Whip Weed (*Chordaria flagelliformis*) (5%)
190-195	190-195	Cobble (85%); Sand (10%); Silt (5%)	-----	Black Whip Weed (*Chordaria flagelliformis*) (5%)
195-200	195-200	Cobble (85%); Sand (10%); Silt (5%)	-----	Black Whip Weed (*Chordaria flagelliformis*) (5%)
200-205	200-205	Cobble (85%); Sand (10%); Silt (5%)	-----	Black Whip Weed (*Chordaria flagelliformis*) (5%); Bladderwrack (*Fucus* sp.) (5%)
205-210	205-210	Cobble (85%); Sand (10%); Silt (5%)	-----	Black Whip Weed (*Chordaria flagelliformis*) (5%)
210-215	210-215	Cobble (85%); Sand (10%); Silt (5%)	-----	Black Whip Weed (*Chordaria flagelliformis*) (5%)
215-220	215-220	Cobble (85%); Sand (10%); Silt (5%)	Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%)
220-225	220-225	Cobble (80%); Boulder (5%); Sand (5%); Silt (5%)	-----	Bladderwrack (*Fucus* sp.) (5%)
225-230	225-230	Cobble (80%); Boulder (5%); Sand (5%); Silt (5%)	Waved Whelk (*Buccinum undatum*) (**U: 1 individual**)	Black Whip Weed (*Chordaria flagelliformis*) (5%)
230-235	230-235	Boulder (45%); Cobble (40%); Sand (10%); Silt (5%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%)
235-240	235-240	Boulder (45%); Cobble (40%); Sand (10%); Silt (5%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%)
240-245	240-245	Boulder (45%); Cobble (40%); Sand (10%); Silt (5%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Cunner (*Tautogolabrus adspersus*) (**U: 2 individuals**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%)
245-250	245-250	Boulder (45%); Cobble (40%); Sand (10%); Silt (5%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Sea Peach (*Holacynthia pyriformis*) (**O:5-10 individuals**); Bowerbank's Halichonidria (*Halichondria bowerbanki*) (**O:5-10 individuals**)	Black Whip Weed (*Chordaria flagelliformis*) (5%)

*Definitions:

A = Abundant (Numerous (not quantifiable) observations made throughout the entire 5 m segment)

C = Common (Numerous (not quantifiable) observations made intermittently along the 5 m segment)

= Occasional (Quantifiable observations made intermittently along the 5 m segment)

U = Uncommon (Quantifiable observations made infrequently along the 5 m segment)

----- denotes "no life observed".

Table E.1-2. 250m Transect – Transect T2, August 31-September 3, 2010

Transect Distance (m)	Transect Tag Numbers	Substrate (% Coverage)	Macrofaunal Life Observed (Estimated Abundances*)	Macrofloral Life Observed (% Coverage)
0-5	0-5	Cobble (85%); Sand (10%); Silt (5%)	Shorthorn Sculpin (*Myoxocephalus scorpius*) (**U: 1 individual**); American Oyster (*Crassostrea virginica*) (**U: 1 individual**); Shell Hash	-----
5-10	5-10	Cobble (85%); Sand (10%); Silt (5%)	Blue Mussel (*Mytilus edulis*) (**U: 1 individual**); Lobster (*Homarus americanus*) (**U: 1 individual**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%)
10-15	10-15	Cobble (85%); Sand (10%); Silt (5%)	Shell Hash	Sea Colander (*Agarum clathratum*) (5%)
15-20	15-20	Cobble (85%); Sand (10%); Silt (5%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%)
20-25	20-25	Cobble (85%); Sand (10%); Silt (5%)	Blue Mussel (*Mytilus edulis*) (**O: 5-10 individuals**)	Sea Colander (*Agarum clathratum*) (5%)
25-30	25-30	Cobble (85%); Sand (10%); Silt (5%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**)	Black Whip Weed (*Chordaria flagelliformis*) (5%)
30-35	30-35	Cobble (85%); Sand (10%); Silt (5%)	Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
35-40	35-40	Cobble (85%); Sand (10%); Silt (5%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Unidentified Fish Species (**U: 1 individual**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
40-45	40-45	Cobble (65%); Sand (30%); Silt (5%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Lobster (*Homarus americanus*) (**U: 1 individual**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
45-50	45-50	Cobble (65%); Sand (30%); Silt (5%)	Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
50-55	50-55	Cobble (65%); Sand (30%); Silt (5%)	Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
55-60	55-60	Cobble (65%); Sand (30%); Silt (5%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
60-65	60-65	Cobble (65%); Sand (30%); Silt (5%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
65-70	65-70	Cobble (90%); Sand (10%)	Shell Hash	-----
70-75	70-75	Cobble (90%); Sand (10%)	Deep Sea Scallop (*Placopecten magellanicus*) (**U: 2 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%)
75-80	75-80	Cobble (90%); Sand (10%)	Shell Hash	Sea Colander (*Agarum clathratum*) (10%)
80-85	80-85	Cobble (90%); Sand (10%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (10%)
85-90	85-90	Cobble (90%); Sand (10%)	Shell Hash	Sea Colander (*Agarum clathratum*) (10%)
90-95	90-95	Cobble (90%); Sand (10%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%); Kelp (*Laminaria saccharina*) (5%)
95-100	95-100	Cobble (90%); Sand (10%)	Shell Hash	Sea Colander (*Agarum clathratum*) (5%)
100-105	100-105	Cobble (90%); Sand (10%)	Blue Mussel (*Mytilus edulis*) (**U:1 individual**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%)
105-110	105-110	Cobble (90%); Sand (10%)	Shell Hash	Sea Colander (*Agarum clathratum*) (10%)
110-115	110-115	Cobble (90%); Sand (10%)	Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Bladderwrack (*Fucus* sp.) (5%)
115-120	115-120	Cobble (90%); Sand (10%)	Shell Hash	Sea Colander (*Agarum clathratum*) (20%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
120-125	120-125	Cobble (90%); Sand (10%)	Barnacle (*Semibalanus balanoides*) (**C**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
125-130	125-130	Cobble (90%); Sand (10%)	Shell Hash	Sea Colander (*Agarum clathratum*) (5%)
130-135	130-135	Cobble (90%); Sand (10%)	Shorthorn Sculpin (*Myoxocephalus scorpius*) (**U: 1 individual**); Shell Hash	Sea Colander (*Agarum clathratum*) (15%); Bladderwrack (*Fucus* sp.) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)

Table E.1-2. 250m Transect – Transect T2, August 31-September 3, 2010

Transect Distance (m)	Transect Tag Numbers	Substrate (% Coverage)	Macrofaunal Life Observed (Estimated Abundances*)	Macrofloral Life Observed (% Coverage)
135-140	135-140	Cobble (90%); Sand (10%)	Shell Hash	Sea Colander (*Agarum clathratum*) (15%); Bladderwrack (*Fucus* sp.) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
140-145	140-145	Cobble (90%); Sand (10%)	Shell Hash	Sea Colander (*Agarum clathratum*) (15%); Bladderwrack (*Fucus* sp.) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
145-150	145-150	Cobble (90%); Sand (10%)	Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (15%); Sea Colander (*Agarum clathratum*) (10%)
150-155	150-155	Cobble (90%); Sand (10%)	Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (15%); Sea Colander (*Agarum clathratum*) (10%)
155-160	155-160	Boulder (45%); Cobble (40%); Sand (5%); Silt (5%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Blue Mussel (*Mytilus edulis*) (**C**);	Sea Colander (*Agarum clathratum*) (5%)
160-165	160-165	Boulder (75%); Cobble (20%); Sand (5%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Blue Mussel (*Mytilus edulis*) (**C**); Lobster (*Homarus americanus*) (**U: 1 individual**)	-----
165-170	165-170	Cobble (90%); Sand (5%); Silt (5%)	Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
170-175	170-175	Cobble (90%); Sand (5%); Silt (5%)	Lobster (*Homarus americanus*) (**U: 2 individuals**)	Sea Colander (*Agarum clathratum*) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
175-180	175-180	Cobble (90%); Sand (5%); Silt (5%)	Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
180-185	180-185	Cobble (90%); Sand (5%); Silt (5%)	Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
185-190	185-190	Cobble (90%); Sand (5%); Silt (5%)	Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (15%); Sea Colander (*Agarum clathratum*) (5%)
190-195	190-195	Cobble (90%); Sand (5%); Silt (5%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5 individuals**)	Black Whip Weed (*Chordaria flagelliformis*) (5%); Sea Colander (*Agarum clathratum*) (5%)
195-200	195-200	Cobble (90%); Sand (5%); Silt (5%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5 individuals**)	Black Whip Weed (*Chordaria flagelliformis*) (5%); Sea Colander (*Agarum clathratum*) (5%)
200-205	200-205	Cobble (90%); Sand (5%); Silt (5%)	Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%); Sea Colander (*Agarum clathratum*) (5%)
205-210	205-210	Cobble (90%); Sand (5%); Silt (5%)	Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%); Sea Colander (*Agarum clathratum*) (5%)
210-215	210-215	Cobble (90%); Sand (5%); Silt (5%)	Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%); Sea Colander (*Agarum clathratum*) (5%)
215-220	215-220	Cobble (90%); Sand (5%); Silt (5%)	Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%); Sea Colander (*Agarum clathratum*) (5%)
220-225	220-225	Cobble (90%); Sand (5%); Silt (5%)	Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%); Sea Colander (*Agarum clathratum*) (5%)
225-230	225-230	Cobble (60%); Boulder (30%); Sand (5%); Silt (5%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**)	Green Fleece (*Codium fragile*) (5%)
230-235	230-235	Cobble (60%); Boulder (30%); Sand (5%); Silt (5%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**)	-----
235-240	235-240	Boulder (75%); Cobble (20%); Sand (5%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Lobster (*Homarus americanus*) (**U: 1 individual**)	-----
240-245	240-245	Boulder (75%); Cobble (20%); Sand (5%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Blue Mussel (*Mytilus edulis*) (**O: 5 individuals**); Deep Sea Scallop (*Placopecten magellanicus*) (**U: 1 individual**)	-----
245-250	245-250	Boulder (75%); Cobble (20%); Sand (5%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**)	-----

*Definitions:

A = Abundant (Numerous (not quantifiable) observations made throughout the entire 5 m segment)

C = Common (Numerous (not quantifiable) observations made intermittently along the 5 m segment)

= Occasional (Quantifiable observations made intermittently along the 5 m segment)

U = Uncommon (Quantifiable observations made infrequently along the 5 m segment)

----- denotes "no life observed".

Table E.1-3. 250m Transect – Transect T3, August 31-September 3, 2010

Transect Distance (m)	Transect Tag Numbers	Substrate (% Coverage)	Macrofaunal Life Observed (Estimated Abundances*)	Macrofloral Life Observed (% Coverage)
0-5	0-5	Cobble (90%); Sand (10%)	Barnacle (*Semibalanus balanoides*) (**A**)	-----
5-10	5-10	Cobble (65%); Rock (30%); Sand (10%)	Barnacle (*Semibalanus balanoides*) (**A**); ShellHash	Sea Colander (*Agarum clathratum*) (20%)
10-15	10-15	Rock (50%); Cobble (30%); Boulder (15%); Sand (5%)	Barnacle (*Semibalanus balanoides*) (**A**); Blue Mussel (*Mytilus edulis*) (**C**); Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**O: 5-10 individuals**); Sea Star (*Asterias* sp.) (**U: 1 individual**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Bladderwrack (*Fucus* sp.) (5%)
15-20	15-20	Rock (50%); Cobble (30%); Boulder (15%); Sand (5%)	Barnacle (*Semibalanus balanoides*) (**C**); Blue Mussel (*Mytilus edulis*) (**C**); Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%)
20-25	20-25	Rock (50%); Cobble (30%); Boulder (15%); Sand (5%)	Barnacle (*Semibalanus balanoides*) (**C**); Blue Mussel (*Mytilus edulis*) (**C**); Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%)
25-30	25-30	Rock (50%); Cobble (30%); Boulder (15%); Sand (5%)	Barnacle (*Semibalanus balanoides*) (**C**); Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Lobster (*Homarus americanus*) (**U: 1 individual**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%)
30-35	30-35	Rock (50%); Cobble (30%); Boulder (15%); Sand (5%)	Barnacle (*Semibalanus balanoides*) (**C**); Blue Mussel (*Mytilus edulis*) (**C**); Unidentified Fish Species (**U: 1 individual**)	Bladderwrack (*Fucus* sp.) (15%)
35-40	35-40	Cobble (90%); Sand (10%)	Barnacle (*Semibalanus balanoides*) (**C**); Lobster (*Homarus americanus*) (**U: 1 individual**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Bladderwrack (*Fucus* sp.) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
40-45	40-45	Cobble (90%); Sand (10%)	Barnacle (*Semibalanus balanoides*) (**C**)	Bladderwrack (*Fucus* sp.) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
45-50	45-50	Cobble (90%); Sand (10%)	Barnacle (*Semibalanus balanoides*) (**C**); American Oyster (*Crassostrea virginica*) (**U: 1 individual**)	Bladderwrack (*Fucus* sp.) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
50-55	50-55	Cobble (85%); Sand (10%); Rock (5%)	Barnacle (*Semibalanus balanoides*) (**C**)	Bladderwrack (*Fucus* sp.) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
55-60	55-60	Cobble (90%); Sand (10%)	Barnacle (*Semibalanus balanoides*) (**C**)	Black Whip Weed (*Chordaria flagelliformis*) (15%); Sea Colander (*Agarum clathratum*) (5%)
60-65	60-65	Cobble (75%); Boulder (15%); Rock (5%); Sand (5%)	Barnacle (*Semibalanus balanoides*) (**C**)	Black Whip Weed (*Chordaria flagelliformis*) (5%)
65-70	65-70	Boulder (60%); Cobble (30%); Sand (10%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Sea Star (*Asterias* sp.) (**U: 2 individuals**); Lobster (*Homarus americanus*) (**U: 1 individual**)	-----
70-75	70-75	Boulder (80%); Cobble (15%); Sand (5%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Lobster (*Homarus americanus*) (**U: 1 individual**)	-----
75-80	75-80	Boulder (100%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%)
80-85	80-85	Boulder (80%); Rock (10%); Cobble (10%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Sea Star (*Asterias* sp.) (**U: 1 individual**)	-----
85-90	85-90	Boulder (80%); Rock (10%); Cobble (10%)	Barnacle (*Semibalanus balanoides*) (**C**); Blue Mussel (*Mytilus edulis*) (**C**); Sea Star (*Asterias* sp.) (**U: 1 individual**)	-----
90-95	90-95	Boulder (50%); Cobble (30%); Rock (20%)	Blue Mussel (*Mytilus edulis*) (**C**); Shell Hash	Bladderwrack (*Fucus* sp.) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
95-100	95-100	Boulder (50%); Cobble (30%); Rock (20%)	Barnacle (*Semibalanus balanoides*) (**C**); Cunner (*Tautogolabrus adspersus*) (**U: 1 individual**); Lobster (*Homarus americanus*) (**U: 1 individual**)	Bladderwrack (*Fucus* sp.) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%); Sea Colander (*Agarum clathratum*) (5%)
100-105	100-105	Cobble (100%)	Sea Star (*Asterias* sp.) (**U: 1 individual**)	Black Whip Weed (*Chordaria flagelliformis*) (20%)
105-110	105-110	Cobble (100%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Unidentified Fish Species (**U: 1 individual**)	Black Whip Weed (*Chordaria flagelliformis*) (60%); Bladderwrack (*Fucus* sp.) (10%)

Table E.1-3. 250m Transect – Transect T3, August 31-September 3, 2010

Transect Distance (m)	Transect Tag Numbers	Substrate (% Coverage)	Macrofaunal Life Observed (Estimated Abundances*)	Macrofloral Life Observed (% Coverage)
110-115	110-115	Cobble (100%)	-----	Black Whip Weed (*Chordaria flagelliformis*) (60%); Bladderwrack (*Fucus* sp.) (5%); Sea Colander (*Agarum clathratum*) (5%); Tube Weed (*Polysiphonia lanosa*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
115-120	115-120	Cobble (100%)	Cunner (*Tautogolabrus adspersus*) (**U: 3 individuals**)	Black Whip Weed (*Chordaria flagelliformis*) (40%); Bladderwrack (*Fucus* sp.) (25%); Tube Weed (*Polysiphonia lanosa*) (10%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
120-125	120-125	Boulder (100%)	Cunner (*Tautogolabrus adspersus*) (**U: 4 individuals**)	Bladderwrack (*Fucus* sp.) (50%); Black Whip Weed (*Chordaria flagelliformis*) (20%); Tube Weed (*Polysiphonia lanosa*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
125-130	125-130	Boulder (100%)	Unidentified Fish Species (**U: 1 individual**)	Bladderwrack (*Fucus* sp.) (40%); Black Whip Weed (*Chordaria flagelliformis*) (25%); Tube Weed (*Polysiphonia lanosa*) (10%)
130-135	130-135	Boulder (50%); Cobble (50%)	-----	Bladderwrack (*Fucus* sp.) (25%); Black Whip Weed (*Chordaria flagelliformis*) (25%); Tube Weed (*Polysiphonia lanosa*) (5%)
135-140	135-140	Boulder (50%); Cobble (50%)	-----	Bladderwrack (*Fucus* sp.) (60%); Kelp (*Laminaria saccharina*) (15%); Black Whip Weed (*Chordaria flagelliformis*) (10%)
140-145	140-145	Boulder (50%); Cobble (50%)	Cunner (*Tautogolabrus adspersus*) (**U: 3 individuals**); Sea Star (*Asterias* sp.) (**U: 4 individuals**)	Bladderwrack (*Fucus* sp.) (75%); Black Whip Weed (*Chordaria flagelliformis*) (10%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
145-150	145-150	Boulder (75%); Cobble (25%)	-----	Bladderwrack (*Fucus* sp.) (60%); Black Whip Weed (*Chordaria flagelliformis*) (20%); Tube Weed (*Polysiphonia lanosa*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
150-155	150-155	Boulder (75%); Cobble (25%)	-----	Bladderwrack (*Fucus* sp.) (60%); Black Whip Weed (*Chordaria flagelliformis*) (20%); Tube Weed (*Polysiphonia lanosa*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
155-160	155-160	Boulder (75%); Cobble (25%)	Unidentified Fish Species (**U: 2 individuals**)	Bladderwrack (*Fucus* sp.) (60%); Black Whip Weed (*Chordaria flagelliformis*) (20%); Tube Weed (*Polysiphonia lanosa*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
160-165	160-165	Boulder (75%); Cobble (25%)	Cunner (*Tautogolabrus adspersus*) (**O: 5-10 individuals**)	Bladderwrack (*Fucus* sp.) (60%); Black Whip Weed (*Chordaria flagelliformis*) (20%); Tube Weed (*Polysiphonia lanosa*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
165-170	165-170	Boulder (75%); Cobble (25%)	Unidentified Fish Species (**O: 5-10 individuals**)	Black Whip Weed (*Chordaria flagelliformis*) (45%); Bladderwrack (*Fucus* sp.) (25%); Tube Weed (*Polysiphonia lanosa*) (5%)
170-175	170-175	Boulder (75%); Cobble (25%)	Sea Star (*Asterias* sp.) (**U: 1 individual**)	Bladderwrack (*Fucus* sp.) (25%); Black Whip Weed (*Chordaria flagelliformis*) (15%)
175-180	175-180	Boulder (75%); Cobble (25%)	-----	Bladderwrack (*Fucus* sp.) (30%); Black Whip Weed (*Chordaria flagelliformis*) (5%); Tube Weed (*Polysiphonia lanosa*) (5%); Kelp (*Laminaria saccharina*) (15%); Irish Moss (*Chondrus crispus*) (5%)
180-185	180-185	Boulder (75%); Cobble (25%)	Cunner (*Tautogolabrus adspersus*) (**U: 2 individuals**)	Bladderwrack (*Fucus* sp.) (65%); Black Whip Weed (*Chordaria flagelliformis*) (15%); Tube Weed (*Polysiphonia lanosa*) (10%)
185-190	185-190	Boulder (75%); Cobble (25%)	Cunner (*Tautogolabrus adspersus*) (**U: 1 individual**); Lobster (*Homarus americanus*) (**U: 1 individual**)	Bladderwrack (*Fucus* sp.) (80%); Black Whip Weed (*Chordaria flagelliformis*) (5%); Tube Weed (*Polysiphonia lanosa*) (5%); Irish Moss (*Chondrus crispus*) (5%)
190-195	190-195	Boulder (75%); Cobble (25%)	Cunner (*Tautogolabrus adspersus*) (**U: 1 individual**)	Bladderwrack (*Fucus* sp.) (40%); Black Whip Weed (*Chordaria flagelliformis*) (10%); Tube Weed (*Polysiphonia lanosa*) (5%); Irish Moss (*Chondrus crispus*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
195-200	195-200	Cobble (80%); Boulder (20%)	-----	Black Whip Weed (*Chordaria flagelliformis*) (25%); Bladderwrack (*Fucus* sp.) (15%); Tube Weed (*Polysiphonia lanosa*) (5%); Brown alga (*Pilayella littoralis*) (5%)
200-205	200-205	Cobble (100%)	Deep Sea Scallop (*Placopecten magellanicus*); (**O: 5-10 individuals**)	Bladderwrack (*Fucus* sp.) (25%); Brown alga (*Pilayella littoralis*) (10%); Black Whip Weed (*Chordaria flagelliformis*) (5%)

Table E.1-3. 250m Transect – Transect T3, August 31-September 3, 2010

Transect Distance (m)	Transect Tag Numbers	Substrate (% Coverage)	Macrofaunal Life Observed (Estimated Abundances*)	Macrofloral Life Observed (% Coverage)
205-210	205-210	Cobble (80%); Boulder (20%)	Unidentified Fish Species (**U: 1 individual**); Sea Star (*Asterias* sp.) (**U: 1 individual**)	Bladderwrack (*Fucus* sp.) (20%); Black Whip Weed (*Chordaria flagelliformis*) (10%); Irish Moss (*Chondrus crispus*) (10%); Tube Weed (*Polysiphonia lanosa*) (5%); Brown alga (*Pilayella littoralis*) (5%)
210-215	210-215	Cobble (65%); Boulder (35%)	-----	Bladderwrack (*Fucus* sp.) (20%); Black Whip Weed (*Chordaria flagelliformis*) (10%); Irish Moss (*Chondrus crispus*) (10%); Tube Weed (*Polysiphonia lanosa*) (5%); Brown alga (*Pilayella littoralis*) (5%)
215-220	215-220	Cobble (100%)	-----	Bladderwrack (*Fucus* sp.) (20%); Black Whip Weed (*Chordaria flagelliformis*) (10%); Irish Moss (*Chondrus crispus*) (10%); Tube Weed (*Polysiphonia lanosa*) (5%); Brown alga (*Pilayella littoralis*) (5%)
220-225	220-225	Cobble (65%); Boulder (35%)	-----	Bladderwrack (*Fucus* sp.) (35%); Black Whip Weed (*Chordaria flagelliformis*) (10%); Irish Moss (*Chondrus crispus*) (10%); Brown alga (*Pilayella littoralis*) (10%); Tube Weed (*Polysiphonia lanosa*) (5%)
225-230	225-230	Cobble (65%); Boulder (35%)	Unidentified Fish Species (**U: 1 individual**)	Bladderwrack (*Fucus* sp.) (35%); Black Whip Weed (*Chordaria flagelliformis*) (10%); Irish Moss (*Chondrus crispus*) (10%); Brown alga (*Pilayella littoralis*) (10%); Tube Weed (*Polysiphonia lanosa*) (5%)
230-235	230-235	Cobble (65%); Boulder (35%)	-----	Bladderwrack (*Fucus* sp.) (35%); Black Whip Weed (*Chordaria flagelliformis*) (10%); Irish Moss (*Chondrus crispus*) (10%); Brown alga (*Pilayella littoralis*) (10%); Tube Weed (*Polysiphonia lanosa*) (5%)
235-240	235-240	Cobble (65%); Boulder (35%)	Cunner (*Tautogolabrus adspersus*) (**U: 1 individual**); Sea Star (*Asterias* sp.) (**U: 1 individual**); Deep Sea Scallop (*Placopecten magellanicus*); (**U: 1 individual**)	Bladderwrack (*Fucus* sp.) (35%); Black Whip Weed (*Chordaria flagelliformis*) (10%); Irish Moss (*Chondrus crispus*) (10%); Brown alga (*Pilayella littoralis*) (10%); Tube Weed (*Polysiphonia lanosa*) (5%)
240-245	240-245	Cobble (65%); Boulder (35%)	-----	Bladderwrack (*Fucus* sp.) (35%); Black Whip Weed (*Chordaria flagelliformis*) (10%); Irish Moss (*Chondrus crispus*) (10%); Brown alga (*Pilayella littoralis*) (10%); Tube Weed (*Polysiphonia lanosa*) (5%)
245-250	245-250	Cobble (65%); Boulder (35%)	Cunner (*Tautogolabrus adspersus*) (**O: 5-10 individuals**)	Bladderwrack (*Fucus* sp.) (35%); Black Whip Weed (*Chordaria flagelliformis*) (10%); Irish Moss (*Chondrus crispus*) (10%); Brown alga (*Pilayella littoralis*) (10%); Tube Weed (*Polysiphonia lanosa*) (5%)

*Definitions:

A = Abundant (Numerous (not quantifiable) observations made throughout the entire 5 m segment)

C = Common (Numerous (not quantifiable) observations made intermittently along the 5 m segment)

= Occasional (Quantifiable observations made intermittently along the 5 m segment)

U = Uncommon (Quantifiable observations made infrequently along the 5 m segment)

----- denotes “no life observed”.

Table E.1-4. 150m Transect – Transect T4, August 31-September 3, 2010

Transect Distance (m)	Transect Tag Numbers	Substrate (% Coverage)	Macrofaunal Life Observed (Estimated Abundances*)	Macrofloral Life Observed (% Coverage)
0-5	0-5	Cobble (70%); Sand (25%); Silt (5%)	Barnacle (*Semibalanus balanoides*) (**C**); Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Encrusting Red Alga (*Leptophyllum* sp.) (5%)
5-10	5-10	Cobble (70%); Sand (25%); Silt (5%)	Barnacle (*Semibalanus balanoides*) (**C**); Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Encrusting Red Alga (*Leptophyllum* sp.) (5%); Bladderwrack (*Fucus* sp.) (5%)
10-15	10-15	Cobble (70%); Sand (25%); Silt (5%)	Barnacle (*Semibalanus balanoides*) (**C**); Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%); Bladderwrack (*Fucus* sp.) (5%)
15-20	15-20	Cobble (70%); Sand (25%); Silt (5%)	Barnacle (*Semibalanus balanoides*) (**C**); Waved Whelk (*Buccinum undatum*) (**U: 1 individual**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%)
20-25	20-25	Cobble (70%); Sand (25%); Silt (5%)	Barnacle (*Semibalanus balanoides*) (**C**); Waved Whelk (*Buccinum undatum*) (**O: 5-10 individuals**); Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**)	-----
25-30	25-30	Cobble (70%); Sand (25%); Silt (5%)	Barnacle (*Semibalanus balanoides*) (**C**); Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%); Sea Colander (*Agarum clathratum*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
30-35	30-35	Cobble (70%); Sand (25%); Silt (5%)	Barnacle (*Semibalanus balanoides*) (**C**); Waved Whelk (*Buccinum undatum*) (**U: 1 individual**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (10%); Sea Colander (*Agarum clathratum*) (5%)
35-40	35-40	Cobble (70%); Sand (25%); Silt (5%)	Barnacle (*Semibalanus balanoides*) (**C**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
40-45	40-45	Cobble (70%); Sand (25%); Silt (5%)	Barnacle (*Semibalanus balanoides*) (**C**); Waved Whelk (*Buccinum undatum*) (**U: 1 individual**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
45-50	45-50	Cobble (70%); Sand (25%); Silt (5%)	Barnacle (*Semibalanus balanoides*) (**C**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
50-55	50-55	Cobble (70%); Sand (25%); Silt (5%)	Barnacle (*Semibalanus balanoides*) (**C**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%)
55-60	55-60	Cobble (70%); Sand (25%); Silt (5%)	Barnacle (*Semibalanus balanoides*) (**C**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%)
60-65	60-65	Cobble (70%); Sand (25%); Silt (5%)	Lobster (*Homarus americanus*) (**U: 1 individual**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%)
65-70	65-70	Cobble (70%); Sand (25%); Silt (5%)	Waved Whelk (*Buccinum undatum*) (**O: 5-10 individuals**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%)
70-75	70-75	Cobble (70%); Sand (25%); Silt (5%)	Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%)
75-80	75-80	Cobble (70%); Sand (25%); Silt (5%)	Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (10%)
80-85	80-85	Cobble (70%); Sand (25%); Silt (5%)	Shell Hash	Bladderwrack (*Fucus* sp.) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
85-90	85-90	Cobble (90%); Sand (10%)	Lobster (*Homarus americanus*) (**U: 1 individual**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%)
90-95	90-95	Cobble (60%); Boulder (30%); Sand (10%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**)	Green Alga (*Acrosiphonia arcta*) (5%); Red Alga (*Plumaria plumosa*) (5%)
95-100	95-100	Boulder (70%); Cobble (25%); Sand (5%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Blue Mussel (*Mytilus edulis*) (**O: 15-20 individuals**); Lobster (*Homarus americanus*) (**U: 1 individual**)	Green Alga (*Acrosiphonia arcta*) (5%); Red Alga (*Plumaria plumosa*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
100-105	100-105	Boulder (70%); Cobble (25%); Sand (5%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Sea Star (*Asterias* sp.) (**U: 1 individual**)	Green Alga (*Acrosiphonia arcta*) (5%); Red Alga (*Plumaria plumosa*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
105-110	105-110	Boulder (85%); Cobble (10%); Sand (5%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Lobster (*Homarus americanus*) (**U: 1 individual**); Shell Hash	Green Alga (*Acrosiphonia arcta*) (5%); Red Alga (*Plumaria plumosa*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
110-115	110-115	Boulder (90%); Sand (10%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Blue Mussel (*Mytilus edulis*) (**O: 25-30 individuals**); Sea Star (*Asterias* sp.) (**U: 1 individual**)	-----
115-120	115-120	Boulder (90%); Sand (10%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**)	Bladderwrack (*Fucus* sp.) (5%)

Table E.1-4. 150m Transect – Transect T4, August 31-September 3, 2010

Transect Distance (m)	Transect Tag Numbers	Substrate (% Coverage)	Macrofaunal Life Observed (Estimated Abundances*)	Macrofloral Life Observed (% Coverage)
120-125	120-125	Boulder (90%); Sand (10%)	Bowerbank's Halichonidria (*Halichondria bowerbanki*) (**O:5-10 individuals**); Cunner (*Tautogolabrus adspersus*) (**O: 10-15 individuals**)	Bladderwrack (*Fucus* sp.) (15%); Sea Colander (*Agarum clathratum*) (5%)
125-130	125-130	Boulder (90%); Sand (10%)	Sea Star (*Asterias* sp.) (**U: 1 individual**)	Bladderwrack (*Fucus* sp.) (15%); Green Alga (*Acrosiphonia arcta*) (5%); Red Alga (*Plumaria plumosa*) (5%)
130-135	130-135	Boulder (90%); Sand (10%)	Unidentified Fish Species (**U: 1 individual**)	Bladderwrack (*Fucus* sp.) (25%); Green Alga (*Acrosiphonia arcta*) (5%); Red Alga (*Plumaria plumosa*) (5%); Tube Weed (*Polysiphonia lanosa*) (10%); Irish Moss (*Chondrus crispus*) (5%)
135-140	135-140	Boulder (90%); Sand (10%)	Unidentified Fish Species (**O: 5-10 individuals**)	Bladderwrack (*Fucus* sp.) (60%); Black Whip Weed (*Chordaria flagelliformis*) (10%); Tube Weed (*Polysiphonia lanosa*) (5%)
140-145	140-145	Boulder (90%); Sand (10%)	Cunner (*Tautogolabrus adspersus*) (**O: 5-10 individuals**); Lobster (*Homarus americanus*) (**U: 1 individual**)	Bladderwrack (*Fucus* sp.) (75%); Irish Moss (*Chondrus crispus*) (10%); Tube Weed (*Polysiphonia lanosa*) (10%)
145-150	145-150	Boulder (90%); Sand (10%)	-----	Bladderwrack (*Fucus* sp.) (85%); Black Whip Weed (*Chordaria flagelliformis*) (10%); Kelp (*Laminaria saccharina*) (5%)

*Definitions:

A = Abundant (Numerous (not quantifiable) observations made throughout the entire 5 m segment)

C = Common (Numerous (not quantifiable) observations made intermittently along the 5 m segment)

= Occasional (Quantifiable observations made intermittently along the 5 m segment)

U = Uncommon (Quantifiable observations made infrequently along the 5 m segment)

----- denotes "no life observed".

Table E.1-5. 150m Transect – Transect T5, August 31-September 3, 2010

Transect Distance (m)	Transect Tag Numbers	Substrate (% Coverage)	Macrofaunal Life Observed (Estimated Abundances*)	Macrofloral Life Observed (% Coverage)
0-5	0-5	Not visible	Not visible	Not visible
5-10	5-10	Not visible	Not visible	Not visible
10-15	10-15	Cobble (80%); Sand (20%)	Shell Hash	-----
15-20	15-20	Cobble (80%); Sand (20%)	Shell Hash	Bladderwrack (*Fucus* sp.) (5%)
20-25	20-25	Cobble (80%); Sand (20%)	Shell Hash	Bladderwrack (*Fucus* sp.) (5%)
25-30	25-30	Cobble (90%); Sand (10%)	Deep Sea Scallop (*Placopecten magellanicus*) (**U: 2 individuals**); Shell Hash	-----
30-35	30-35	Cobble (90%); Sand (10%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	-----
35-40	35-40	Cobble (90%); Sand (10%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Sea Star (*Asterias* sp.) (**U: 1 individual**);Shell Hash	-----
40-45	40-45	Cobble (90%); Sand (10%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	-----
45-50	45-50	Cobble (90%); Sand (10%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Green Alga (*Acrosiphonia arcta*) (10%); Red Alga (*Plumaria plumosa*) (10%)
50-55	50-55	Cobble (90%); Sand (10%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Green Alga (*Acrosiphonia arcta*) (10%); Red Alga (*Plumaria plumosa*) (10%)
55-60	55-60	Cobble (90%); Sand (10%)	Shell Hash	Green Alga (*Acrosiphonia arcta*) (30%); Red Alga (*Plumaria plumosa*) (30%); Sea Colander (*Agarum clathratum*) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
60-65	60-65	Cobble (90%); Sand (10%)	Shell Hash	Green Alga (*Acrosiphonia arcta*) (20%); Red Alga (*Plumaria plumosa*) (20%); Sea Colander (*Agarum clathratum*) (5%)
65-70	65-70	Cobble (90%); Sand (10%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Green Alga (*Acrosiphonia arcta*) (20%); Red Alga (*Plumaria plumosa*) (20%)
70-75	70-75	Cobble (90%); Sand (10%)	Deep Sea Scallop (*Placopecten magellanicus*) (**U: 1 individual**); Shell Hash	Green Alga (*Acrosiphonia arcta*) (10%); Red Alga (*Plumaria plumosa*) (10%); Sea Colander (*Agarum clathratum*) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
75-80	75-80	Cobble (80%); Sand (20%)	Blue Mussel (*Mytilus edulis*) (**O: 15-20 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Bladderwrack (*Fucus* sp.) (5%); Kelp (*Laminaria saccharina*) (5%)
80-85	80-85	Cobble (80%); Sand (20%)	Shell Hash	Green Alga (*Acrosiphonia arcta*) (20%); Red Alga (*Plumaria plumosa*) (20%); Sea Colander (*Agarum clathratum*) (5%)
85-90	85-90	Cobble (80%); Sand (20%)	Shell Hash	Green Alga (*Acrosiphonia arcta*) (20%); Red Alga (*Plumaria plumosa*) (20%); Sea Colander (*Agarum clathratum*) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
90-95	90-95	Cobble (80%); Sand (20%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Green Alga (*Acrosiphonia arcta*) (15%); Red Alga (*Plumaria plumosa*) (15%); Sea Colander (*Agarum clathratum*) (5%); Kelp (*Laminaria saccharina*) (5%)
95-100	95-100	Cobble (90%); Sand (10%)	Shell Hash	Sea Colander (*Agarum clathratum*) (25%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
100-105	100-105	Cobble (90%); Sand (10%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (20%); Bladderwrack (*Fucus* sp.) (5%)
105-110	105-110	Cobble (90%); Sand (10%)	Shell Hash	Sea Colander (*Agarum clathratum*) (10%); Bladderwrack (*Fucus* sp.) (5%)
110-115	110-115	Cobble (90%); Sand (10%)	Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Bladderwrack (*Fucus* sp.) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
115-120	115-120	Cobble (90%); Sand (10%)	Shell Hash	Bladderwrack (*Fucus* sp.) (5%)
120-125	120-125	Cobble (90%); Sand (10%)	Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
125-130	125-130	Cobble (90%); Sand (10%)	Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (10%); Sea Colander (*Agarum clathratum*) (5%)

Table E.1-5. 150m Transect – Transect T5, August 31-September 3, 2010

Transect Distance (m)	Transect Tag Numbers	Substrate (% Coverage)	Macrofaunal Life Observed (Estimated Abundances*)	Macrofloral Life Observed (% Coverage)
130-135	130-135	Cobble (75%); Rock (20%); Sand (5%)	Bowerbank's Halichonidria (*Halichondria bowerbanki*) (**C**); Blue Mussel (*Mytilus edulis*) (**U: 1 individual**); Lobster (*Homarus americanus*) (**U: 1 individual**); Unidentified Fish Species (**U: 1 individual**)	Black Whip Weed (*Chordaria flagelliformis*) (35%); Bladderwrack (*Fucus* sp.) (15%)
135-140	135-140	Boulder (75%); Cobble (20%); Sand (5%)	Bowerbank's Halichonidria (*Halichondria bowerbanki*) (**C**); Unidentified Fish Species (**U: 1 individual**)	Black Whip Weed (*Chordaria flagelliformis*) (10%); Bladderwrack (*Fucus* sp.) (10%)
140-145	140-145	Boulder (100%)	Bowerbank's Halichonidria (*Halichondria bowerbanki*) (**C**)	Green Alga (*Acrosiphonia arcta*) (5%); Red Alga (*Plumaria plumosa*) (5%); Bladderwrack (*Fucus* sp.) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
145-150	145-150	Boulder (100%)	Bowerbank's Halichonidria (*Halichondria bowerbanki*) (**C**); Unidentified Fish Species (**U: 1 individual**)	Bladderwrack (*Fucus* sp.) (75%); Black Whip Weed (*Chordaria flagelliformis*) (5%); Tube Weed (*Polysiphonia lanosa*) (5%)

*Definitions:

A = Abundant (Numerous (not quantifiable) observations made throughout the entire 5 m segment)
C = Common (Numerous (not quantifiable) observations made intermittently along the 5 m segment)
= Occasional (Quantifiable observations made intermittently along the 5 m segment)
U = Uncommon (Quantifiable observations made infrequently along the 5 m segment)
----- denotes "no life observed".

Table E.1-6. 150m Transect – Transect T6, August 31-September 3, 2010

Transect Distance (m)	Transect Tag Numbers	Substrate (% Coverage)	Macrofaunal Life Observed (Estimated Abundances*)	Macrofloral Life Observed (% Coverage)
0-5	0-5	Cobble (65%); Sand (35%)	Deep Sea Scallop (*Placopecten magellanicus*) (**U: 1 individual**); Shell Hash	-----
5-10	5-10	Cobble (65%); Sand (35%)	Deep Sea Scallop (*Placopecten magellanicus*) (**U: 2 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Bladderwrack (*Fucus* sp.) (5%)
10-15	10-15	Cobble (65%); Sand (35%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%)
15-20	15-20	Cobble (65%); Sand (35%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**)	-----
20-25	20-25	Cobble (75%); Sand (25%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%)
25-30	25-30	Cobble (65%); Sand (35%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	-----
30-35	30-35	Cobble (65%); Sand (35%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	-----
35-40	35-40	Cobble (65%); Sand (35%)	Shell Hash	-----
40-45	40-45	Cobble (65%); Sand (35%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%);
45-50	45-50	Cobble (75%); Sand (25%)	Shell Hash	-----
50-55	50-55	Cobble (75%); Sand (25%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (15%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
55-60	55-60	Cobble (75%); Sand (25%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (15%); Black Whip Weed (*Chordaria flagelliformis*) (5%); Kelp (*Laminaria saccharina*) (5%)
60-65	60-65	Cobble (90%); Sand (10%)	Shell Hash	Sea Colander (*Agarum clathratum*) (15%); Green Alga (*Acrosiphonia arcta*) (10%); Red Alga (*Plumaria plumosa*) (10%)
65-70	65-70	Cobble (90%); Sand (10%)	Bowerbank's Halichonidria (*Halichondria bowerbanki*) (**C**); Shell Hash	Sea Colander (*Agarum clathratum*) (15%); Green Alga (*Acrosiphonia arcta*) (15%); Red Alga (*Plumaria plumosa*) (10%)
70-75	70-75	Cobble (70%); Rock (25%); Sand (5%)	Bowerbank's Halichonidria (*Halichondria bowerbanki*) (**C**); Shell Hash	Sea Colander (*Agarum clathratum*) (20%);
75-80	75-80	Cobble (85%); Sand (10%); Rock (5%)	Shell Hash	Green Alga (*Acrosiphonia arcta*) (10%); Red Alga (*Plumaria plumosa*) (10%); Sea Colander (*Agarum clathratum*) (5%); Bladderwrack (*Fucus* sp.) (5%)
80-85	80-85	Cobble (75%); Sand (25%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Deep Sea Scallop (*Placopecten magellanicus*) (**U: 1 individual**); Shell Hash	Sea Colander (*Agarum clathratum*) (15%); Black Whip Weed (*Chordaria flagelliformis*) (5%); Bladderwrack (*Fucus* sp.) (5%)
85-90	85-90	Rock (90%); Cobble (10%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**)	Bladderwrack (*Fucus* sp.) (5%)
90-95	90-95	Rock (90%); Cobble (5%); Sand (5%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Blue Mussel (*Mytilus edulis*) (**O: 5-10 individuals**)	-----
95-100	95-100	Rock (100%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**)	-----
100-105	100-105	Rock (100%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Blue Mussel (*Mytilus edulis*) (**O: 5-10 individuals**); Unidentified Fish Species (**U: 1 individual**)	-----
105-110	105-110	Rock (100%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Unidentified Fish Species (**U: 1 individual**)	Green Alga (*Acrosiphonia arcta*) (5%); Red Alga (*Plumaria plumosa*) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%); Kelp (*Laminaria saccharina*) (5%)
110-115	110-115	Rock (100%)	Bowerbank's Halichonidria (*Halichondria bowerbanki*) (**C**); Fish (**O: 5-10 individuals**)	Black Whip Weed (*Chordaria flagelliformis*) (25%); Bladderwrack (*Fucus* sp.) (15%); Green Alga (*Acrosiphonia arcta*) (5%); Red Alga (*Plumaria plumosa*) (5%)

Table E.1-6. 150m Transect – Transect T6, August 31-September 3, 2010

Transect Distance (m)	Transect Tag Numbers	Substrate (% Coverage)	Macrofaunal Life Observed (Estimated Abundances*)	Macrofloral Life Observed (% Coverage)
115-120	115-120	Rock (100%)	-----	Kelp (*Laminaria saccharina*) (5 Bladderwrack (*Fucus* sp.) (25%); %); Green Alga (*Acrosiphonia arcta*) (5%); Red Alga (*Plumaria plumosa*) (5%)
120-125	120-125	Rock (100%)	Unidentified Fish Species (**U: 1 individual**)	Bladderwrack (*Fucus* sp.) (75%); Tube Weed (*Polysiphonia lanosa*) (15%); Kelp (*Laminaria saccharina*) (5%)
125-130	125-130	Rock (90%); Cobble (10%)	Barnacle (*Semibalanus balanoides*) (**C**)	Bladderwrack (*Fucus* sp.) (75%); Irish Moss (*Chondrus crispus*) (15%); Tube Weed (*Polysiphonia lanosa*) (10%)
130-135	130-135	Rock (100%)	Barnacle (*Semibalanus balanoides*) (**C**)	Bladderwrack (*Fucus* sp.) (85%); Kelp (*Laminaria saccharina*) (15%)
135-140	135-140	Rock (100%)	Sea Star (*Asterias* sp.) (**U: 1 individual**)	Bladderwrack (*Fucus* sp.) (85%); Kelp (*Laminaria saccharina*) (5%); Tube Weed (*Polysiphonia lanosa*) (5%); Sea Lettuce (*Ulva* sp.) (5%)
140-145	140-145	Rock (85%); Cobble (15%)	Sea Star (*Asterias* sp.) (**U: 1 individual**)	Bladderwrack (*Fucus* sp.) (85%); Tube Weed (*Polysiphonia lanosa*) (5%); Dulse (*Palmaria palmata*) (5%)
145-150	145-150	Rock (80%); Cobble (20%)	-----	Bladderwrack (*Fucus* sp.) (85%); Tube Weed (*Polysiphonia lanosa*) (5%)

*Definitions:

A = Abundant (Numerous (not quantifiable) observations made throughout the entire 5 m segment)

C = Common (Numerous (not quantifiable) observations made intermittently along the 5 m segment)

= Occasional (Quantifiable observations made intermittently along the 5 m segment)

U = Uncommon (Quantifiable observations made infrequently along the 5 m segment)

----- denotes "no life observed".

Table E.1-7. List of Species Observed during Video Transect Survey of Benthic Habitat off Black Point, September 2010.

Marine Fauna	
American Oyster	*Crassostrea virginica*
Barnacle	*Semibalanus balanoides*
Blue Mussel	*Mytilus edulis*
Bowerbank's Halichonidria	*Halichondria bowerbanki*
Cunner	*Tautogolabrus adspersus*
Frilled Anemone	*Metridium senile*
Green Sea Urchin	*Strongylocentrotus droebachiensis*
Lobster	*Homarus americanus*
Periwinkle	*Littorina sp.*
Scallop	*Placopecten magellanicus*
Sea Cucumber	*Cucumaria frondosa*
Sea Peach	*Holacynthia pyriformis*
Sea Star	*Asterias sp.*
Shorthorn Sculpin	*Myoxocephalus scorpius*
Waved Whelk	*Buccinum undatum*
Marine Flora	
Black Whip Weed	*Chordaria flagelliformis*
Bladderwrack	*Fucus sp.*
Brown alga	*Pilayella littoralis*
Encrusting Red Alga	*Leptophyllum sp.*
Green Alga	*Acrosiphonia arcta*
Green Fleece	*Codium fragile*
Irish Moss	*Chondrus crispus*
Kelp	*Laminaria saccharina*
Red Alga	*Plumaria plumosa*
Sea Colander	*Agarum clathratum*
Tube Weed	*Polysiphonia lanosa*

Appendix E.2

Benthic Invertebrate Sample Results

Table E.2-1. Species Presence and Abundance within Benthic Invertebrate Samples Collected off Black Point, September 2010.

PHYLUM	SPECIES	Abundance (# of individuals per sample)					
		GQ 02	GQ 25	GQ 27	GQ 31	GQ 47	GQ 50
CNIDARIA	*Metridium senile*	1	0	0	0	0	0
	Sertularia sp.	5	0	0	0	0	0
NEMERTEA	*Cerebratulus lacteus*	0	0	0	0	0	1
OLIGOCHAETA	*Peloscolex benedeni*	0	4	0	1	0	1
	Other Tubificidae	0	0	0	0	1	2
POLYCHAETA	*Acmira catherinae*	0	40	1	0	6	3
	Amphitrite johnstoni	0	0	0	0	0	1
	Anaitides groenlandica	1	0	0	0	0	0
	Anaitides maculata	0	5	0	0	0	2
	Capitella capitata	0	5	3	0	0	0
	Dexiospira spirillum	29	0	0	0	0	0
	Eualia bilineata	1	0	0	0	0	0
	Exogone sp.	0	2	2	1	0	0
	Glycera dibranchiata	2	10	1	6	2	2
	Harmothoe extenuata	2	7	0	2	0	6
	Harmothoe imbricata	1	1	3	0	2	2
	Lepidonotus squamatus	0	1	0	0	0	0
	Lumbrineris fragilis	5	4	2	13	5	1
	Micropthalamus sp.	0	0	1	0	0	0
	Naineris quadricuspida	1	0	0	0	0	1
	Neanthes virens	1	0	1	0	0	1
	Nephtys caeca	1	0	0	0	0	0
	Pectenaria granulata	0	2	5	1	5	0
	Pherusa sp.	0	0	0	0	1	0
	Pholoe minuta	1	8	9	0	3	1
	Polycirrus sp.	0	0	3	0	0	1
	Prionospio steenstrupi	0	0	1	0	0	0
	Schistomeringus caeca	0	0	4	3	0	0
	Scoloplos sp.	1	0	0	0	0	0
	Spio filicornis	0	0	0	0	0	1
	Spirorbis borealis	48	0	0	0	0	0
	Syllis cornuta	0	2	2	0	0	5
	Tharyx sp.	1	7	9	34	14	5
BRYOZOA	*Dendrobeania murryana*	2	0	0	0	0	0
	Electra pilosa	0	0	0	0	0	1
	Membranipora membranacea	0	0	0	8	0	0
POLYPLACOPHORA	*Ischnochiton albus*	2	0	0	0	0	0
	Ischnochiton rubra	4	2	0	1	8	0

Table E.2-1. Species Presence and Abundance within Benthic Invertebrate Samples Collected off Black Point, September 2010.

PHYLUM	SPECIES	Abundance (# of individuals per sample)					
		GQ 02	GQ 25	GQ 27	GQ 31	GQ 47	GQ 50
GASTROPODA	*Bittium alternatum*	7	0	0	0	0	0
	Euspira triseriata	0	0	0	0	1	0
	Lacuna vincta	0	2	1	0	3	3
	Margarites groenlandicus	2	0	0	0	0	0
	Moelleria costulata	2	0	0	0	0	0
	Nassarius trivittatus	1	4	3	0	8	0
	Oenopota sp.	5	0	1	0	0	0
	Onoba aculeus	2	2	2	0	3	2
	Tectura testudinalis	13	44	49	21	34	35
	Trichtropis borealis	1	0	0	0	0	0
	Turbonilla interrupta	4	4	73	10	6	2
BIVALVIA	*Anomia simplex*	1	0	2	1	1	0
	Arctica islandica	1	0	0	0	0	0
	Astarte undata	13	0	1	2	0	0
	Cerastoderma pinnulatum	6	0	2	0	1	2
	Clinocardium ciliatum	2	0	0	0	0	0
	Crenella glandula	9	0	0	0	1	0
	Hiatella arctica	2	2	0	0	1	0
	Modiolus modiolus	3	1	0	3	4	53
	Mysella planulata	0	0	1	0	0	4
	Mytilus edulis	2	0	0	0	0	0
	Nucula delphinodonta	3	0	0	0	0	0
	Thyasira gouldii	9	0	0	0	0	0
CIRRIPEDIA	*Semibalanus balanoides*	3	0	2	0	0	0
ISOPODA	*Idotea phosphorea*	0	0	0	0	0	2
AMPHIPODA	*Corophium sp.*	0	0	1	0	4	0
	Caprella linearis	0	0	0	0	0	3
	Caprella septentrionalis	5	2	0	0	16	5
	Dexamine thea	0	0	0	0	1	0
	Gammarus oceanicus	0	2	0	0	0	0
	Melita dentata	1	0	0	0	0	0
	Unciola irrorata	0	53	0	1	1	17
DECAPODA	*Cancer irroratus*	0	0	0	0	0	1
	Pagurus acadianus	0	3	2	0	4	0
INSECTA	Chironomidae	0	0	0	0	0	1
ASTEROIDEA	*Asterias* sp.	2	3	0	0	0	2
OPHIUROIDEA	*Amphipholis squamatus*	4	1	1	1	3	1
	Ophiopholis aculeata	2	1	1	0	6	1
ECHINOIDEA	*Echinarachnius parma*	2	0	0	0	0	0
	Strongylocentrotus droebachiensis	3	94	8	0	21	11
ASCIDIACEA	*Molgula sp.*	0	0	0	0	0	1
Total # individuals		**219**	**318**	**197**	**109**	**166**	**183**
Number of Taxa		**47**	**30**	**31**	**17**	**30**	**36**
Wet weight g.		**10.14**	**1.45**	**1.74**	**0.81**	**19.82**	**5.82**

Appendix E.3

Marine Sediment Results

Table E.3-1. PAH Results of the Sediment Samples Collected for Black Point Quarry Project

Parameter	Units	Sample Identification and Date			CEPA Ocean Disposal Guidelines - Atlantic Region	CCME Probable Effects Levels, Rev. 2002[1]	CCME Soil Quality Guidelines, Rev. 2008[2]				
							Human Health	Environmental Health			
							Potable Water	Soil Contact		Soil and Food Ingestion	Freshwater Life
		GQ 02	GQ 25	GQ 50		Marine / Estuarine Sediment	Agricultural, Residential / Parkland, Commercial, and Industrial Land Uses	Agricultural, Residential / Parkland Land Uses	Commercial / Industrial Land Uses	Agricultural, Residential / Parkland Land Uses	Agricultural, Residential / Parkland, Commercial, and Industrial Land Uses
		September 1, 2010									
Polycyclic Aromatic Hydrocarbons (PAH) Results											
2-Methylnapthalene	mg/kg	<0.02	<0.02	<0.02	-	0.201	-	-	-	-	-
Acenaphthene	mg/kg	<0.005	<0.005	<0.005	-	0.0889	-	-	-	-	0.28
Acenaphthylene	mg/kg	<0.005	<0.005	<0.005	-	0.128	-	-	-	21.5	320
Anthracene	mg/kg	<0.04	<0.04	<0.04	-	0.245	-	2.5	32	61.5	-
Benz(a)anthracene	mg/kg	<0.01	<0.01	<0.01	-	0.693	0.33	-	-	6.2	-
Benzo(a)pyrene	mg/kg	<0.01	<0.01	<0.01	-	0.763	0.37	20	72	0.6	8800
Benzo(b)fluoranthene	mg/kg	<0.05	<0.05	<0.05	-	-	-	-	-	-	-
Benzo(b+j)fluoranthene	mg/kg	<0.01	<0.01	<0.01	-	-	0.16	-	-	6.2	-
Benzo(g,h,i)perylene	mg/kg	<0.01	<0.01	<0.01	-	-	6.8	-	-	-	-
Benzo(k)fluoranthene	mg/kg	<0.01	<0.01	<0.01	-	-	0.034	-	-	6.2	-
Chrysene	mg/kg	<0.01	<0.01	<0.01	-	0.846	2.1	-	-	6.2	-
Dibenz(a,h)anthracene	mg/kg	<0.006	<0.006	<0.006	-	0.135	0.23	-	-	-	-
Fluoranthene	mg/kg	<0.05	<0.05	<0.05	-	1.494	-	50	180	15.4	-
Fluorene	mg/kg	<0.02	<0.02	<0.02	-	0.144	-	-	-	15.4	0.25
Indeno(1,2,3-cd)pyrene	mg/kg	<0.01	<0.01	<0.01	-	-	2.7	-	-	-	-
Naphthalene	mg/kg	<0.01	<0.01	<0.01	-	0.391	-	-	-	8.8	0.013
Phenanthrene	mg/kg	<0.04	<0.04	<0.04	-	0.544	-	-	-	43.0	0.046
Pyrene	mg/kg	<0.05	<0.05	<0.05	-	1.398	-	-	-	7.7	-
Total PAH[3]	mg/kg	0.168	0.168	0.168	2.5	-	-	-	-	-	-
IACR (Protection of Potable Water)[4]	-	0.225	0.225	0.225	-	-	1	-	-	-	-

[1] denotes Canadian Council of Ministers for the Environment (CCME) Canadian Environmental Quality Guidelines - Sediment Quality Guidelines, revised 2002.

[2] denotes Canadian Council of Ministers for the Environment (CCME) Canadian Environmental Quality Guidelines - Soil Quality Guidelines, revised 2008.

[3] Total PAH calculation based on the sum of 16 PAH compounds (acenapthene, acenapthylene, anthracene, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluorene, fluoranthene, ideno(1,2,3-cd)pyrene, napthalene, phenanthrene, and pyrene) as per guidance from Environment Canada, 2009.

[4] denotes Index of Additive Cancer Risk (IACR) = ([Benz(a)anthracene]/0.33mg/kg) + ([Chrysene]/2.1mg/kg) + ([Benzo(b+j)fluoranthene]/0.16mg/kg) + ([Benzo(k)fluoranthene]/0.034) + ([Benzo(a)pyrene]/0.37mg/kg) + ([Indeno(1,2,3-c,d)pyrene]/2.7mg/kg) + ([Dibenz(a,h)anthracene]/0.23mg/kg) + ([Benzo(g,h,i)perylene]/6.8mg/kg).

[5] denotes Total Potency Equivalent (TPE) SQG based on an incremental lifetime cancer risk (ILCR) of 1 in 100,000 (10^{-5}).

[6] "NA" denotes the Benzo(a)pyrene TPE has not been multiplied by an uncertainty factor (UF) of 3 as results from the lab indicate there is no evidence of creosote in the sample.

NOTE: All results below the laboratory detection limit were divided by 2 prior to further calculations.

Table E.3-2. PAH Results of the Sediment Samples Collected for Black Point Quarry Project, with Application of Benzo(a)pyrene Potency Equivalency Factors

Parameter	Units	Sample Identification and Date			Benzo(a)pyrene Potency Equivalency Factors	CCME Soil Quality Guidelines, Rev. 2008[1]
						Human Health
						Direct Contact
						Agricultural, Residential / Parkland, Commercial, and Industrial Land Uses
		GQ 02	GQ 25	GQ 50		
		July 22, 2010				
Polycyclic Aromatic Hydrocarbons (PAH) Results (with application of Benzo(a)pyrene Potency Equivalency Factors)						
Benz(a)anthracene	mg/kg	0.000500	0.000500	0.000500	0.1	-
Benzo(a)pyrene	mg/kg	0.005000	0.005000	0.005000	1	-
Benzo(b+j)fluoranthene	mg/kg	0.000500	0.000500	0.000500	0.1	-
Benzo(g,h,i)perylene	mg/kg	0.000050	0.000050	0.000050	0.01	-
Benzo(k)fluoranthene	mg/kg	0.000500	0.000500	0.000500	0.1	-
Chrysene	mg/kg	0.000050	0.000050	0.000050	0.01	-
Dibenz(a,h)anthracene	mg/kg	0.003000	0.003000	0.003000	1	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.000500	0.000500	0.000500	0.1	-
Benzo(a)pyrene TPE (10^{-5})[5]	mg/kg	0.010100	0.010100	0.010100	-	5.3
Benzo(a)pyrene TPE (10^{-5}) with UF[6]	mg/kg	NA	NA	NA		

[1] denotes Canadian Council of Ministers for the Environment (CCME) Canadian Environmental Quality Guidelines - Sediment Quality Guidelines, revised 2002.

[5] denotes Total Potency Equivalent (TPE) SQG based on an incremental lifetime cancer risk (ILCR) of 1 in 100,000 (10^{-5}).

Table E.3-3. Metal Concentrations in the Sediment Samples Collected for Black Point Quarry Project

Metals	Units	Sample Identification and Date			CEPA Ocean Disposal Guidelines-Atlantic Region	CCME Probable Effects Levels, Rev. 2002[1]	CCME Soil Quality Guidelines, Rev. 2008[2]		
		GQ 02	GQ 25	GQ 50			Agricultural	Residential/ Parkland	Commercial/ Industrial
		September 1, 2010				Marine / Estuarine Sediment			
Antimony	mg/kg	<2	<2	<2	-	-	20	20	40
Arsenic	mg/kg	3	<2	3	-	41.6	12	12	12
Barium	mg/kg	18	6	<5	-	-	750	500	2000
Beryllium	mg/kg	<2	<2	<2	-	-	4	4	8
Cadmium	mg/kg	<0.3	<0.3	<0.3	0.6	4.2	1.4	10	22
Chromium +6	mg/kg	<0.5	<0.5	<0.5	-	-	0.4	0.4	1.4
Chromium (Total)	mg/kg	10	11	11	-	160	64	64	87
Cobalt	mg/kg	3	3	3	-	-	40	50	300
Copper	mg/kg	4	4	4	81*	108	63	63	91
Lead	mg/kg	5.5	3.1	3	66*	112	70	140	260 / 600
Mercury	mg/kg	<0.05	<0.05	<0.05	0.75	0.7	6.6	6.6	24 / 50
Molybdenum	mg/kg	<2	<2	<2	-	-	5	10	40
Nickel	mg/kg	9	10	10	-	-	50	50	50
Selenium	mg/kg	<1	<1	<1	-	-	1	1	2.9
Silver	mg/kg	<0.5	<0.5	<0.5	-	-	20	20	40
Thallium	mg/kg	<0.1	<0.1	<0.1	-	-	1	1	1
Tin	mg/kg	<2	<2	<2	-	-	5	50	300
Uranium	mg/kg	0.6	0.5	0.3			23	23	33 / 300
Vanadium	mg/kg	12	12	12	-	-	130	130	130
Zinc	mg/kg	29	25	20	160*	271	200	200	360

*Former Interim Rejection Limits (1991) which are not currently used to screen for ocean based disposal permitting but may be considered in terms of further investigation prior to issuance of an Ocean Disposal Permit (Victor Li, Environment Canada, pers. comm., June 2002).

[1] denotes Canadian Council of Ministers for the Environment (CCME) Canadian Environmental Quality Guidelines - Sediment Quality Guidelines, revised 2002.

[2] denotes Canadian Council of Ministers for the Environment (CCME) Canadian Environmental Quality Guidelines - Soil Quality Guidelines, revised 2008.

Table E.3-4. Results Table for BTEX Compounds (mg/kg) and Individual TPH Carbon Segments (mg/kg) in the Sediment Samples Collected for Black Point Quarry Project

Sample Identification	Date	Benzene	Toluene	Ethylbenzene	Xylene (Total)	C_6-C_{10} Less BTEX	C_{10}-C_{16}	C_{16}-C_{21}	C_{21}-C_{32}	C_6-C_{10} Less BTEX	Modified TPH	Resemblance*
GQ 02	Sept 1, 2010	<0.005	<0.04	<0.01	<0.05	<3	<15	<15	<15	<3	<20	No resemblance to fuel products.
GQ 25		<0.005	<0.04	<0.01	<0.05	<3	<15	<15	<15	<3	<20	No resemblance to fuel products.
GQ 50		<0.005	<0.04	<0.01	<0.05	<3	<15	<15	<15	<3	<20	No resemblance to fuel products.

Atlantic RBCA Version 2.0 and CCME SQGs for Comparison with the Above Analytical Results (mg/kg)

Atlantic RBCA Tier I Risk-Based Screening Levels**			Benzene	Toluene	Ethylbenzene	Xylenes	Gasoline	Diesel #2	#6 Oil
Residential	Potable	Coarse-grained	0.03	0.38	0.08	11	39	140	690
		Fine-grained	0.01	0.08	0.02	2.3	140	220	970
	Non-Potable	Coarse-grained	0.16	14	58	17	39	140	690
		Fine-grained	1.5	120	430	160	330	4,400	8,300
Commercial	Potable	Coarse-grained	0.03	0.38	0.08	11	450	7,400	10,000
		Fine-grained	0.01	0.08	0.02	2.3	520	840	4,700
	Non-Potable	Coarse-grained	1.8	160	430	200	450	7,400	10,000
		Fine-grained	11	680	430	650	10,000	7,700	10,000
CCME SQGs for Surface Soils* **									
Agricultural		Coarse-grained	0.03[1] (0.0095[2])	0.37	0.082	11.0	-	-	-
		Fine-grained	0.0068[1,2]	0.08	0.018	2.4	-	-	-
Residential/Parkland		Coarse-grained	0.03[1] (0.0095[2])	0.37	0.082	11.0	-	-	-
		Fine-grained	0.0068[1,2]	0.08	0.018	2.4	-	-	-
Commercial		Coarse-grained	0.03[1,2]	0.37	0.082	11.0	-	-	-
		Fine-grained	0.0068[1,2]	0.08	0.018	2.4	-	-	-
Industrial		Coarse-grained	0.03[1,2]	0.37	0.082	11.0	-	-	-
		Fine-grained	0.0068[1,2]	0.08	0.018	2.4	-	-	-

*Modified TPH values reflect the sum of the individual carbon fractions that resembles gasoline, diesel #2, and lube oil. No guideline comparison required as results indicate no resemblance to fuel products observed in the samples.

**Atlantic RBCA Version 2.0 Reference Document for Petroleum Impacted Sites (2003, updated March 2007).

***A Protocol for the Derivation of Environmental and Human Health Soil Quality Guidelines. Report CCME-EPC-101E, March 1997 with updates to 2004.

"-" denotes no guideline available.

1 denotes guideline value based on "10-5 Incremental Risk". For the purposes of this report, an incremental risk of 10-5 is used.

2 denotes guideline value based on "10-6 Incremental Risk".

Table E.3-5. Analytical Results of the Sediment Samples Collected for Black Point Quarry Project

Parameter	Units	Sample Identification and Date			CEPA Ocean Disposal Guidelines- Atlantic Region	CCME Probable Effects Levels, Rev. 2002[1] Marine / Estuarine Sediment	CCME Soil Quality Guidelines, Rev. 2008[2]		
		GQ 02	GQ 25	GQ 50			Agricultural	Residential / Parkland	Commercial / Industrial
		September 1, 2010							
Polychlorinated Biphenyl (PCB) Results*									
Aroclor 1254	mg/kg	<0.1	<1.0	<1.0	-	0.709	-	-	-
Total PCB Concentration	mg/kg	<0.05	<0.5	<0.5	0.1	0.189	0.5	1.3	33
Dichloro-Diphenyl-Trichloroethane (DDT) Results*									
2,4' - DDD + 4,4' - DDD	mg/kg	<0.0015	<0.015	<0.015	-	0.00781	-	-	-
2,4' - DDE + 4,4' - DDE	mg/kg	<0.001	<0.010	<0.010	-	0.37400	-	-	-
2,4' - DDT + 4,4' - DDT	mg/kg	<0.001	<0.010	<0.010	-	0.00477	-	-	-
Total DDT	mg/kg	<0.0035	<0.035	<0.035	-	-	0.7	0.7	12
Grain Size Results									
<PHI -4.00 (12.5 mm)	%	100	100	100	-	-	-	-	-
<PHI -3.00 (9.5 mm)	%	87.3	86.3	100	-	-	-	-	-
<PHI -2.00 (4.75 mm)	%	53.4	46.6	34.3	-	-	-	-	-
<PHI -1.00 (2.00 mm)	%	48.9	23.6	17.6	-	-	-	-	-
<PHI 0.00 (1.00 mm)	%	45.9	16.5	13	-	-	-	-	-
<PHI +1.0 (0.50 mm)	%	40.5	11.1	7.6	-	-	-	-	-
<PHI +2.0 (0.25 mm)	%	28	7	3.6	-	-	-	-	-
<PHI +3.0 (0.125 mm)	%	12	5.3	2.3	-	-	-	-	-
<PHI +4.0 (0.0625 mm)	%	7.3	4.4	1.9	-	-	-	-	-
<PHI +5.0 (0.031 mm)	%	6.4	3.4	1.8	-	-	-	-	-
<PHI +6.0 (0.0156 mm)	%	5.1	2.5	1.2	-	-	-	-	-
<PHI +7.0 (0.0078 mm)	%	3.3	1.4	0.9	-	-	-	-	-
<PHI +8.0 (0.0039 mm)	%	2.8	1.2	0.6	-	-	-	-	-
<PHI +9.0 (0.002 mm)	%	1.9	0.6	<0.1	-	-	-	-	-
Gravel	%	51	76	82	-	-	-	-	-
Sand	%	42	19	16	-	-	-	-	-
Silt	%	5	3	1	-	-	-	-	-
Clay	%	3	1	<1	-	-	-	-	-
Carbon and Moisture Results									
Total Carbon	g/kg	1.62	0.60	1.10	-	-	-	-	-
Total Organic Carbon	g/kg	0.17	0.25	0.55	-	-	-	-	-
Total Inorganic Carbon	g/kg	1.45	0.35	0.55	-	-	-	-	-
Moisture	%	17	14	13	-	-	-	-	-

[1] denotes Canadian Council of Ministers for the Environment (CCME) Canadian Environmental Quality Guidelines - Sediment Quality Guidelines, revised 2002.

[2] denotes Canadian Council of Ministers for the Environment (CCME) Canadian Environmental Quality Guidelines - Soil Quality Guidelines, revised 2008.

*Standard laboratory detection limits were increased for samples GQ 25 and GQ 50 due to chromatographic interference.

NOTE: All results below the laboratory detection limit were divided by 2 prior to further calculations.

Appendix E.4

AGAT Quality Assurance/Quality Control and Certificates of Analyses for Marine Sediment Samples

AGAT Laboratories

11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
http://www.agatlabs.com

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL
580 MAIN STREET, SUITE 105
SAINT JOHN, NB E2K1J5

ATTENTION TO: CHYANN KIRBY

PROJECT NO: GRQ - Marine

AGAT WORK ORDER: 10X432562

SOIL ANALYSIS REVIEWED BY: Jason Coughtrey, Inorganic Supervisor

TRACE ORGANICS REVIEWED BY: Kelly Hogue, Senior Organic Chemist

DATE REPORTED: Sep 15, 2010

PAGES (INCLUDING COVER): 16

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (902) 468-8718, or at 1-888-468-8718

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

Member of: Association of Professional Engineers, Geologists and Geophysicists of Alberta (APEGGA)
Western Enviro-Agricultural Laboratory Association (WEALA)
Environmental Services Association of Alberta (ESAA)

AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation.

Results relate only to the items tested

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Certificate of Analysis

AGAT WORK ORDER: 10X432562
PROJECT NO: GRQ - Marine

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: CHYANN KIRBY

Available Metals in Soil

DATE SAMPLED: Sep 01, 2010 | DATE RECEIVED: Sep 02, 2010 | DATE REPORTED: Sep 15, 2010 | SAMPLE TYPE: Soil

Parameter	Unit	G / S	RDL	GQ 02 1971606	GQ 25 1971621	GQ 50 1971639
Aluminum	mg/kg		10	5550	4760	4300
Antimony	mg/kg		2	<2	<2	<2
Arsenic	mg/kg		2	3	<2	3
Barium	mg/kg		5	18	6	<5
Beryllium	mg/kg		2	<2	<2	<2
Boron	mg/kg		5	<5	<5	<5
Cadmium	mg/kg		0.3	<0.3	<0.3	<0.3
Chromium	mg/kg		2	10	11	11
Cobalt	mg/kg		1	3	3	3
Copper	mg/kg		2	4	4	4
Iron	mg/kg		50	14100	12100	11600
Lead	mg/kg		0.5	5.5	3.1	2.9
Manganese	mg/kg		2	413	267	213
Molybdenum	mg/kg		2	<2	<2	<2
Nickel	mg/kg		2	9	10	10
Selenium	mg/kg		1	<1	<1	<1
Silver	mg/kg		0.5	<0.5	<0.5	<0.5
Strontium	mg/kg		5	60	69	155
Thallium	mg/kg		0.1	<0.1	<0.1	<0.1
Tin	mg/kg		2	<2	<2	<2
Uranium	mg/kg		0.1	0.6	0.5	0.3
Vanadium	mg/kg		2	12	12	12
Zinc	mg/kg		5	29	25	20

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard
1971606-1971639 Results are based on the dry weight of the sample.

Certified By:

Results relate only to the items tested

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AGAT WORK ORDER: 10X432562

PROJECT NO: GRQ - Marine

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: CHYANN KIRBY

Grain Size Analysis (Sieve & Pipette)

DATE SAMPLED: Sep 01, 2010 | DATE RECEIVED: Sep 02, 2010 | DATE REPORTED: Sep 15, 2010 | SAMPLE TYPE: Soil

Parameter	Unit	G / S	RDL	GQ 02 1971606	GQ 25 1971621	GQ 50 1971639
Particle Size Distribution (<12.5mm, -4 PHI)	%		0.1	100.0	100.0	100.0
Particle Size Distribution (<9.5mm, -3 PHI)	%		0.1	87.3	86.3	100.0
Particle Size Distribution (<4.75mm, -2 PHI	%		0.1	53.4	46.6	34.3
Particle Size Distribution (<2mm, -1 PHI)	%		0.1	48.9	23.6	17.6
Particle Size Distribution (<1mm, 0 PHI)	%		0.1	45.9	16.5	13.0
Particle Size Distribution (<1/2mm, 1 PHI)	%		0.1	40.5	11.1	7.6
Particle Size Distribution (<1/4mm, 2 PHI)	%		0.1	28.0	7.0	3.6
Particle Size Distribution (<1/8mm, 3 PHI)	%		0.1	12.0	5.3	2.3
Particle Size Distribution (<1/16mm, 4 PHI)	%		0.1	7.3	4.4	1.9
Particle Size Distribution (<1/32mm, 5 PHI)	%		0.1	6.4	3.4	1.8
Particle Size Distribution (<1/64mm, 6 PHI)	%		0.1	5.1	2.5	1.2
Particle Size Distribution (<1/128mm, 7 PHI)	%		0.1	3.3	1.4	0.9
Particle Size Distribution (<1/256mm, 8 PHI)	%		0.1	2.8	1.2	0.6
Particle Size Distribution (<1/512mm, 9 PHI)	%		0.1	1.9	0.6	<0.1
Particle Size Distribution (Gravel)	%		1	51	76	82
Particle Size Distribution (Sand)	%		1	42	19	16
Particle Size Distribution (Silt)	%		1	5	3	1
Particle Size Distribution (Clay)	%		1	3	1	<1
Particles >75um	%		1	92	95	98
Classification	Coarse/Fine			Coarse	Coarse	Coarse

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By: Jason Coughtrey

Results relate only to the items tested

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AGAT WORK ORDER: 10X432562

PROJECT NO: GRQ - Marine

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: CHYANN KIRBY

Mercury and Hexavalent Chromium Analysis in Soil

DATE SAMPLED: Sep 01, 2010 | DATE RECEIVED: Sep 02, 2010 | DATE REPORTED: Sep 15, 2010 | SAMPLE TYPE: Soil

Parameter	Unit	G / S	RDL	GQ 02 1971606	GQ 25 1971621	GQ 50 1971639
Mercury	mg/kg		0.05	<0.05	<0.05	<0.05
Chromium, Hexavalent	mg/kg		0.5	<0.5	<0.5	<0.5

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

1971606-1971639 Results are based on the dry weight of the soil.

Certified By:

Results relate only to the items tested

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Certificate of Analysis

AGAT WORK ORDER: 10X432562

PROJECT NO: GRQ - Marine

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: CHYANN KIRBY

Soil Analysis - Total Organic Carbon (W-B Wet Oxidation)

DATE SAMPLED: Sep 01, 2010 | DATE RECEIVED: Sep 02, 2010 | DATE REPORTED: Sep 15, 2010 | SAMPLE TYPE: Soil

Parameter	Unit	G / S	RDL	GQ 02 1971606	GQ 25 1971621	GQ 50 1971639
Total Organic Carbon	%		0.15	0.17	0.25	0.55
Total Inorganic Carbon	%		0.01	1.45	0.35	0.55

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

Results relate only to the items tested

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Certificate of Analysis

AGAT WORK ORDER: 10X432562
PROJECT NO: GRQ - Marine

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: CHYANN KIRBY

Atlantic RBCA Tier 1 Hydrocarbons in Soil - Low Level HC (Version 3.0)

DATE SAMPLED: Sep 01, 2010 | DATE RECEIVED: Sep 02, 2010 | DATE REPORTED: Sep 15, 2010 | SAMPLE TYPE: Soil

Parameter	Unit	G / S	RDL	GQ 02 1971606	GQ 25 1971621	GQ 50 1971639
Benzene	mg/kg		0.005	<0.005	<0.005	<0.005
Ethylbenzene	mg/kg		0.01	<0.01	<0.01	<0.01
Toluene	mg/kg		0.04	<0.04	<0.04	<0.04
Xylene (Total)	mg/kg		0.05	<0.05	<0.05	<0.05
C6-C10 (less BTEX)	mg/kg		3	<3	<3	<3
>C10-C16 Hydrocarbons	mg/kg		15	<15	<15	<15
>C16-C21 Hydrocarbons	mg/kg		15	<15	<15	<15
>C21-C32 Hydrocarbons	mg/kg		15	<15	<15	<15
Modified TPH (Tier 1)	mg/kg		20	<20	<20	<20
Return to Baseline at C32				Y	Y	Y
% Moisture	%		1	17	14	13
Surrogate	**Unit**	**Acceptable Limits**				
Isobutylbenzene - EPH	%	60-140		99	92	95
Isobutylbenzene - VPH	%	60-140		113	112	111
n-Dotriacontane - EPH	%	60-140		112	94	102

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

1971606-1971639 Results are based on the dry weight of the soil.
Resemblance: No resemblance.

Certified By: Kelly Hogue

Results relate only to the items tested

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Dartmouth, Nova Scotia
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Certificate of Analysis

AGAT WORK ORDER: 10X432562
PROJECT NO: GRQ - Marine

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: CHYANN KIRBY

OC Pesticides and PCBs in Soil

DATE SAMPLED: Sep 01, 2010 | DATE RECEIVED: Sep 02, 2010 | DATE REPORTED: Sep 15, 2010 | SAMPLE TYPE: Soil

Parameter	Unit	G / S	RDL	GQ 02 1971606	RDL	GQ 25 1971621	GQ 50 1971639
alpha-BHC	mg/Kg		0.005	<0.005	0.050	<0.050	<0.050
beta-BHC	mg/Kg		0.005	<0.005	0.050	<0.050	<0.050
Gamma-BHC (Lindane)	mg/Kg		0.0003	<0.0003	0.0030	<0.0030	<0.0030
delta-BHC	mg/Kg		0.005	<0.005	0.050	<0.050	<0.050
Heptachlor	mg/Kg		0.005	<0.005	0.050	<0.050	<0.050
Aldrin	mg/Kg		0.005	<0.005	0.050	<0.050	<0.050
Heptachlor Epoxide	mg/Kg		0.0006	<0.0006	0.0060	<0.0060	<0.0060
Alpha-Chlordane	mg/Kg		0.002	<0.002	0.020	<0.020	<0.020
Gamma-Chlordane	mg/Kg		0.002	<0.002	0.020	<0.020	<0.020
Endosulfan I	mg/Kg		0.005	<0.005	0.050	<0.050	<0.050
Endosulfan II	mg/Kg		0.005	<0.005	0.050	<0.050	<0.050
Endosulfan Sulfate	mg/Kg		0.005	<0.005	0.050	<0.050	<0.050
Dieldrin	mg/Kg		0.0007	<0.0007	0.0070	<0.0070	<0.0070
p,p'-DDE	mg/Kg		0.001	<0.001	0.010	<0.010	<0.010
o,p'-DDE	mg/Kg		0.001	<0.001	0.010	<0.010	<0.010
Endrin	mg/Kg		0.002	<0.002	0.020	<0.020	<0.020
DDD (o,p')	mg/Kg		0.002	<0.002	0.020	<0.020	<0.020
p,p'-DDD	mg/Kg		0.001	<0.001	0.010	<0.010	<0.010
p,p'- DDT	mg/Kg		0.001	<0.001	0.010	<0.010	<0.010
o,p'-DDT	mg/Kg		0.001	<0.001	0.010	<0.010	<0.010
Endrin Aldehyde	mg/Kg		0.005	<0.005	0.050	<0.050	<0.050
Endrin ketone	mg/Kg		0.005	<0.005	0.050	<0.050	<0.050
Methoxychlor	mg/Kg		0.005	<0.005	0.050	<0.050	<0.050
Mirex	mg/Kg		0.005	<0.005	0.050	<0.050	<0.050
Hexachlorobenzene	mg/Kg		0.05	<0.05	0.50	<0.50	<0.50
PCBs	mg/Kg		0.05	<0.05	0.50	<0.50	<0.50
Aroclor 1254	mg/Kg		0.1	<0.1	1.0	<1.0	<1.0
Surrogate	Unit	Acceptable Limits					
Decachlorobiphenyl	%	50-130		100		89	101

Certified By: Kelly Hogue

Results relate only to the items tested

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AGAT WORK ORDER: 10X432562
PROJECT NO: GRQ - Marine

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: CHYANN KIRBY

OC Pesticides and PCBs in Soil

DATE SAMPLED: Sep 01, 2010	DATE RECEIVED: Sep 02, 2010	DATE REPORTED: Sep 15, 2010	SAMPLE TYPE: Soil

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

1971606 Results are based on the dry weight of the soil.
Due to the high moisture content the sample was air dried prior to extraction.

1971621-1971639 Results are based on the dry weight of the soil.
Due to the high moisture content the sample was air dried prior to extraction.
Sample was diluted and Reporting Detection Limit raised due to chromatographic interference.

Certified By: Kelly Hogue

Results relate only to the items tested

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AGAT WORK ORDER: 10X432562

PROJECT NO: GRQ - Marine

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: CHYANN KIRBY

Polycyclic Aromatic Hydrocarbons in Soil (CCME)

DATE SAMPLED: Sep 01, 2010 | DATE RECEIVED: Sep 02, 2010 | DATE REPORTED: Sep 15, 2010 | SAMPLE TYPE: Soil

Parameter	Unit	G / S	RDL	GQ 02 1971606	GQ 25 1971621	GQ 50 1971639
1-Methylnaphthalene	mg/kg		0.05	<0.05	<0.05	<0.05
2-Methylnaphthalene	mg/kg		0.02	<0.02	<0.02	<0.02
Acenaphthene	mg/kg		0.005	<0.005	<0.005	<0.005
Acenaphthylene	mg/kg		0.005	<0.005	<0.005	<0.005
Acridine	mg/Kg		0.05	<0.05	<0.05	<0.05
Anthracene	mg/kg		0.04	<0.04	<0.04	<0.04
Benzo(a)anthracene	mg/kg		0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene	mg/kg		0.01	<0.01	<0.01	<0.01
Benzo(b)fluoranthene	mg/kg		0.05	<0.05	<0.05	<0.05
Benzo(b+j)fluoranthene	mg/kg		0.01	<0.01	<0.01	<0.01
Benzo(e)pyrene	mg/kg		0.05	<0.05	<0.05	<0.05
Benzo(ghi)perylene	mg/kg		0.01	<0.01	<0.01	<0.01
Benzo(k)fluoranthene	mg/kg		0.01	<0.01	<0.01	<0.01
Chrysene	mg/kg		0.01	<0.01	<0.01	<0.01
Dibenzo(a,h)anthracene	mg/kg		0.006	<0.006	<0.006	<0.006
Fluoranthene	mg/kg		0.05	<0.05	<0.05	<0.05
Fluorene	mg/kg		0.02	<0.02	<0.02	<0.02
Indeno(1,2,3)pyrene	mg/kg		0.01	<0.01	<0.01	<0.01
Naphthalene	mg/kg		0.01	<0.01	<0.01	<0.01
Perylene	mg/kg		0.05	<0.05	<0.05	<0.05
Phenanthrene	mg/kg		0.04	<0.04	<0.04	<0.04
Pyrene	mg/kg		0.05	<0.05	<0.05	<0.05
Quinoline	mg/Kg		0.05	<0.05	<0.05	<0.05
% Moisture	%			17	14	13
Surrogate	**Unit**	**Acceptable Limits**				
Nitrobenzene-d5	%	50-140		101	113	106
2-Fluorobiphenyl	%	50-140		85	90	83
Terphenyl-d14	%	50-140		94	101	93

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

1971606-1971639 Results are based on the dry weight of the soil.

Certified By: Kelly Hogue

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Quality Assurance

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

AGAT WORK ORDER: 10X432562

PROJECT NO: GRQ - Marine

ATTENTION TO: CHYANN KIRBY

Soil Analysis

RPT Date: Sep 15, 2010			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Available Metals in Soil															
Aluminum	90920	1964787	4770	5070	6.1%	< 10	101%	90%	110%	96%	90%	110%	106%	70%	130%
Antimony	90920	1964787	< 2	< 2	0.0%	< 2	100%	90%	110%	99%	90%	110%	86%	70%	130%
Arsenic	90920	1964787	7	8	13.3%	< 2	97%	90%	110%	96%	90%	110%	111%	70%	130%
Barium	90920	1964787	18	18	0.0%	< 5	96%	90%	110%	103%	90%	110%	107%	70%	130%
Beryllium	90920	1964787	< 2	< 2	0.0%	< 2	99%	90%	110%	102%	90%	110%	99%	70%	130%
Boron	90920	1964787	16	20	22.2%	< 5	102%	90%	110%	91%	90%	110%	88%	70%	130%
Cadmium	90920	1964787	0.8	0.8	0.0%	< 0.3	98%	90%	110%	102%	90%	110%	103%	70%	130%
Chromium	90920	1964787	11	12	8.7%	< 2	104%	90%	110%	108%	90%	110%	97%	70%	130%
Cobalt	90920	1964787	3	4	28.6%	< 1	108%	90%	110%	104%	90%	110%	92%	70%	130%
Copper	90920	1964787	36	42	15.4%	< 2	107%	90%	110%	103%	90%	110%	91%	70%	130%
Iron	90920	1964787	12500	16400	27.0%	< 50	105%	90%	110%	104%	90%	110%	99%	70%	130%
Lead	90920	1964787	749	624	18.2%	< 0.5	99%	90%	110%	102%	90%	110%	102%	70%	130%
Manganese	90920	1964787	813	763	6.3%	< 2	108%	90%	110%	108%	90%	110%	106%	70%	130%
Molybdenum	90920	1964787	< 2	< 2	0.0%	< 2	98%	90%	110%	87%	80%	120%	94%	70%	130%
Nickel	90920	1964787	9	11	20.0%	< 2	108%	90%	110%	109%	90%	110%	95%	70%	130%
Selenium	90920	1964787	< 1	< 1	0.0%	< 1	101%	90%	110%	97%	90%	110%	99%	70%	130%
Silver	90920	1964787	< 0.5	< 0.5	0.0%	< 0.5	100%	90%	110%	88%	80%	120%	101%	70%	130%
Strontium	90920	1964787	16	15	6.5%	< 5	96%	90%	110%	98%	90%	110%	105%	70%	130%
Thallium	90920	1964787	0.1	0.1	0.0%	< 0.1	100%	90%	110%	103%	90%	110%	104%	70%	130%
Tin	90920	1964787	13	15	14.3%	< 2	95%	90%	110%	100%	90%	110%	97%	70%	130%
Uranium	90920	1964787	1.0	1.0	0.0%	< 0.1	95%	90%	110%	104%	90%	110%	117%	70%	130%
Vanadium	90920	1964787	11	12	8.7%	< 2	99%	90%	110%	102%	90%	110%	97%	70%	130%
Zinc	90920	1964781	33	32	3.1%	< 5	109%	90%	110%	110%	90%	110%	98%	70%	130%
Mercury and Hexavalent Chromium Analysis in Soil															
Mercury	1	1971606	<0.05	<0.05	0.0%	< 0.05	113%	70%	130%		70%	130%	93%	70%	130%
Chromium, Hexavalent	1	1965291	<0.5	<0.5	0.0%	< 0.5	96%	80%	120%	93%	80%	120%		80%	120%
Soil Analysis - Total Organic Carbon (W-B Wet Oxidation)															
Total Organic Carbon	6159	1606	0.17	0.15	12.5%	< 0.15	100%	90%	110%				106%	90%	110%

Certified By:

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Quality Assurance

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

AGAT WORK ORDER: 10X432562

PROJECT NO: GRQ - Marine

ATTENTION TO: CHYANN KIRBY

Trace Organics Analysis

RPT Date: Sep 15, 2010			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Atlantic RBCA Tier 1 Hydrocarbons in Soil - Low Level HC (Version 3.0)															
Benzene	1	1971639	< 0.005	<0.005	0.0%	< 0.005	87%	60%	140%	76%	60%	140%	92%	30%	130%
Ethylbenzene	1	1971639	< 0.01	<0.01	0.0%	< 0.01	83%	60%	140%	83%	60%	140%	95%	30%	130%
Toluene	1	1971639	< 0.04	< 0.04	0.0%	< 0.04	83%	60%	140%	80%	60%	140%	94%	30%	130%
Xylene (Total)	1	1971639	< 0.05	< 0.05	0.0%	< 0.05	85%	60%	140%	85%	60%	140%	96%	30%	130%
C6-C10 (less BTEX)	1	1971639	< 3	< 3	0.0%	< 3	94%	60%	140%	88%	60%	140%	74%	30%	130%
>C10-C16 Hydrocarbons	1		<15	<15	0.0%	< 15	101%	70%	130%	102%	60%	140%	122%	30%	130%
>C16-C21 Hydrocarbons	1		<15	<15	0.0%	< 15	87%	70%	130%	102%	60%	140%	122%	30%	130%
>C21-C32 Hydrocarbons	1		<15	<15	0.0%	< 15	86%	60%	140%	102%	60%	140%	122%	30%	130%
Polycyclic Aromatic Hydrocarbons in Soil (CCME)															
1-Methylnaphthalene	1	1971621	< 0.05	< 0.05	0.0%	< 0.05	76%	50%	140%	83%	50%	140%	78%	50%	140%
2-Methylnaphthalene	1	1971621	< 0.02	< 0.02	0.0%	< 0.02	102%	50%	140%	84%	50%	140%	75%	50%	140%
Acenaphthene	1	1971621	< 0.005	< 0.005	0.0%	< 0.005	103%	50%	140%	97%	50%	140%	96%	50%	140%
Acenaphthylene	1	1971621	< 0.005	< 0.005	0.0%	< 0.005	104%	50%	140%	91%	50%	140%	93%	50%	140%
Acridine	1	1971621	< 0.05	< 0.05	0.0%	< 0.05	118%	50%	140%	68%	50%	140%	70%	50%	140%
Anthracene	1	1971621	< 0.04	< 0.04	0.0%	< 0.04	90%	50%	140%	84%	50%	140%	82%	50%	140%
Benzo(a)anthracene	1	1971621	< 0.01	< 0.01	0.0%	< 0.01	93%	50%	140%	82%	50%	140%	79%	50%	140%
Benzo(a)pyrene	1	1971621	< 0.01	< 0.01	0.0%	< 0.01	94%	50%	140%	109%	50%	140%	83%	50%	140%
Benzo(b)fluoranthene	1	1971621	< 0.05	< 0.05	0.0%	< 0.05	79%	50%	140%	80%	50%	140%	96%	50%	140%
Benzo(b+j)fluoranthene	1	1971621	< 0.01	< 0.01	0.0%	< 0.01	87%	50%	140%	87%	50%	140%	91%	50%	140%
Benzo(e)pyrene	1	1971621	< 0.05	< 0.05	0.0%	< 0.05	113%	50%	140%	66%	50%	140%	64%	50%	140%
Benzo(ghi)perylene	1	1971621	< 0.01	< 0.01	0.0%	< 0.01	115%	50%	140%	107%	50%	140%	105%	50%	140%
Benzo(k)fluoranthene	1	1971621	< 0.01	< 0.01	0.0%	< 0.01	102%	50%	140%	69%	50%	140%	112%	50%	140%
Chrysene	1	1971621	< 0.01	< 0.01	0.0%	< 0.01	92%	50%	140%	117%	50%	140%	87%	50%	140%
Dibenzo(a,h)anthracene	1	1971621	< 0.006	< 0.006	0.0%	< 0.006	106%	50%	140%	96%	50%	140%	95%	50%	140%
Fluoranthene	1	1971621	< 0.05	< 0.05	0.0%	< 0.05	96%	50%	140%	86%	50%	140%	87%	50%	140%
Fluorene	1	1971621	< 0.02	< 0.02	0.0%	< 0.02	106%	50%	140%	101%	50%	140%	103%	50%	140%
Indeno(1,2,3)pyrene	1	1971621	< 0.01	< 0.01	0.0%	< 0.01	114%	50%	140%	108%	50%	140%	81%	50%	140%
Naphthalene	1	1971621	< 0.01	< 0.01	0.0%	< 0.01	107%	50%	140%	104%	50%	140%	96%	50%	140%
Perylene	1	1971621	< 0.05	< 0.05	0.0%	< 0.05	85%	50%	140%	80%	50%	140%	76%	50%	140%
Phenanthrene	1	1971621	< 0.04	< 0.04	0.0%	< 0.04	110%	50%	140%	87%	50%	140%	87%	50%	140%
Pyrene	1	1971621	< 0.05	< 0.05	0.0%	< 0.05	105%	50%	140%	92%	50%	140%	86%	50%	140%
Quinoline	1	1971621	< 0.05	< 0.05	0.0%	< 0.05	87%	50%	140%	105%	50%	140%	85%	50%	140%
OC Pesticides and PCBs in Soil															
alpha-BHC	1		< 0.050	< 0.050	0.0%	< 0.050	101%	60%	140%	102%	60%	140%	102%	60%	140%
beta-BHC	1		< 0.050	< 0.050	0.0%	< 0.050	96%	90%	110%	90%	80%	120%	112%	80%	120%
Gamma-BHC (Lindane)	1		< 0.0030	< 0.0030	0.0%	< 0.0030	98%	60%	140%	91%	60%	140%	114%	60%	140%
delta-BHC	1		< 0.050	< 0.050	0.0%	< 0.050	104%	80%	120%	85%	80%	120%	112%	80%	120%
Heptachlor	1		< 0.050	< 0.050	0.0%	< 0.050	102%	60%	140%	82%	60%	140%	96%	60%	140%

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Quality Assurance

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

AGAT WORK ORDER: 10X432562

PROJECT NO: GRQ - Marine

ATTENTION TO: CHYANN KIRBY

Trace Organics Analysis (Continued)

RPT Date: Sep 15, 2010			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Aldrin	1		< 0.050	< 0.050	0.0%	< 0.050	97%	60%	140%	97%	60%	140%	97%	60%	140%
Heptachlor Epoxide	1		< 0.0060	< 0.0060	0.0%	< 0.0060	98%	60%	140%	89%	60%	140%	112%	60%	140%
Alpha-Chlordane	1		< 0.020	< 0.020	0.0%	< 0.020	104%	60%	140%	90%	60%	140%	114%	60%	140%
Gamma-Chlordane	1		< 0.020	< 0.020	0.0%	< 0.020	96%	60%	140%	104%	60%	140%	97%	60%	140%
Endosulfan I	1		< 0.050	< 0.050	0.0%	< 0.050	98%	90%	110%	102%	90%	110%	96%	80%	120%
Endosulfan II	1		< 0.050	< 0.050	0.0%	< 0.050	104%	60%	140%	90%	60%	140%	97%	60%	140%
Endosulfan Sulfate	1		< 0.050	< 0.050	0.0%	< 0.050	104%	80%	120%	86%	80%	120%	114%	80%	120%
Dieldrin	1		< 0.0070	< 0.0070	0.0%	< 0.0070	97%	60%	140%	85%	60%	140%	114%	60%	140%
p,p'-DDE	1		< 0.010	< 0.010	0.0%	< 0.010	96%	60%	140%	97%	60%	140%	120%	60%	140%
o,p'-DDE	1		< 0.010	< 0.010	0.0%	< 0.010	120%	60%	140%	92%	60%	140%	114%	60%	140%
Endrin	1		< 0.020	< 0.020	0.0%	< 0.020	112%	60%	140%	91%	60%	140%	98%	60%	140%
DDD (o,p')	1		< 0.020	< 0.020	0.0%	< 0.020	102%	90%	110%	90%	90%	110%	96%	60%	140%
p,p'-DDD	1		< 0.010	< 0.010	0.0%	< 0.010	97%	60%	140%	87%	60%	140%	97%	60%	140%
p,p'- DDT	1		< 0.010	< 0.010	0.0%	< 0.010	97%	60%	130%	90%	60%	130%	96%	60%	130%
o,p'-DDT	1		< 0.010	< 0.010	0.0%	< 0.010	96%	60%	140%	85%	60%	140%	112%	60%	140%
Endrin Aldehyde	1		< 0.050	< 0.050	0.0%	< 0.050	104%	80%	120%	87%	80%	120%	114%	80%	120%
Endrin ketone	1		< 0.050	< 0.050	0.0%	< 0.050	102%	80%	120%	90%	80%	120%	120%	80%	120%
Methoxychlor	1		< 0.050	< 0.050	0.0%	< 0.050	96%	60%	140%	91%	60%	140%	120%	60%	140%
Mirex	1		< 0.050	< 0.050	0.0%	< 0.050	97%	70%	130%	92%	70%	130%	104%	70%	130%
Hexachlorobenzene	1		< 0.50	< 0.50	0.0%	< 0.50	104%	60%	140%	90%	60%	140%	102%	60%	140%
PCBs	1		< 0.50	< 0.50	0.0%	< 0.50	96%	60%	140%	112%	60%	140%		60%	140%

Certified By: Kelly Hogue

AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation.

Results relate only to the items tested

AGAT Laboratories

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http://www.agatlabs.com

Method Summary

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

AGAT WORK ORDER: 10X432562

PROJECT NO: GRQ - Marine

ATTENTION TO: CHYANN KIRBY

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Aluminum	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Antimony	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Arsenic	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Barium	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Beryllium	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Boron	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Cadmium	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Chromium	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Cobalt	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Copper	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Iron	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Lead	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP-MS
Manganese	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Molybdenum	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Nickel	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Selenium	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Silver	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Strontium	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Thallium	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Tin	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Uranium	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Vanadium	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Zinc	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Particle Size Distribution (<12.5mm, -4 PHI)	INOR-121-6034	ASTM D-422-63 & ODCA, 1976	SIEVE & PIPETTE
Particle Size Distribution (<9.5mm, -3 PHI)	INOR-121-6034	ASTM D-422-63 & ODCA, 1976	SIEVE & PIPETTE
Particle Size Distribution (<4.75mm, -2 PHI	INOR-121-6034	ASTM D-422-63 & ODCA, 1976	SIEVE & PIPETTE
Particle Size Distribution (<2mm, -1 PHI)	INOR-121-6034	ASTM D-422-63 & ODCA, 1976	SIEVE & PIPETTE
Particle Size Distribution (<1mm, 0 PHI)	INOR-121-6034	ASTM D-422-63 & ODCA, 1976	SIEVE & PIPETTE
Particle Size Distribution (<1/2mm, 1 PHI)	INOR-121-6034	ASTM D-422-63 & ODCA, 1976	SIEVE & PIPETTE
Particle Size Distribution (<1/4mm, 2 PHI)	INOR-121-6034	ASTM D-422-63 & ODCA, 1976	SIEVE & PIPETTE
Particle Size Distribution (<1/8mm, 3 PHI)	INOR-121-6034	ASTM D-422-63 & ODCA, 1976	SIEVE & PIPETTE

Results relate only to the items tested

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Method Summary

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AGAT WORK ORDER: 10X432562

PROJECT NO: GRQ - Marine

ATTENTION TO: CHYANN KIRBY

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Particle Size Distribution (<1/16mm, 4 PHI)	INOR-121-6034	ASTM D-422-63 & ODCA, 1976	SIEVE & PIPETTE
Particle Size Distribution (<1/32mm, 5 PHI)	INOR-121-6034	ASTM D-422-63 & ODCA, 1976	SIEVE & PIPETTE
Particle Size Distribution (<1/64mm, 6 PHI)	INOR-121-6034	ASTM D-422-63 & ODCA, 1976	SIEVE & PIPETTE
Particle Size Distribution (<1/128mm, 7 PHI)	INOR-121-6034	ASTM D-422-63 & ODCA, 1976	SIEVE & PIPETTE
Particle Size Distribution (<1/256mm, 8 PHI)	INOR-121-6034	ASTM D-422-63 & ODCA, 1976	SIEVE & PIPETTE
Particle Size Distribution (<1/512mm, 9 PHI)	INOR-121-6034	ASTM D-422-63 & ODCA, 1976	SIEVE & PIPETTE
Particle Size Distribution (Gravel)	INOR-121-6031	Canadian Society of Soil Science - SSMA	HYDROMETER
Particle Size Distribution (Sand)	INOR-121-6031	Canadian Society of Soil Science - SSMA	HYDROMETER
Particle Size Distribution (Silt)	INOR-121-6031	Canadian Society of Soil Science - SSMA	HYDROMETER
Particle Size Distribution (Clay)	INOR-121-6031	Canadian Society of Soil Science - SSMA	HYDROMETER
Particles >75um	INOR-121-6031, INOR-121-6034	ASTM D-422-63 & ODCA, 1976, SSMA	CALCULATED
Classification	INOR-121-6031, INOR-121-6031	Atlantic RBCA	CALCULATED
Mercury	INOR-121-6101 & INOR-121-6107	Based on EPA 245.5 & SM 3112B	CV/AA
Chromium, Hexavalent	INOR-121-6029	SSSA 5;25 p. 683	SPECTROPHOTOMETER
Total Organic Carbon	SOIL 0480; SOIL 0110; SOIL 0120	NELSON 1996; SHEPPARD 2007	COLOR
Total Inorganic Carbon		ASA 11 - 2.2	CVAAS

Results relate only to the items tested

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Method Summary

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AGAT WORK ORDER: 10X432562

PROJECT NO: GRQ - Marine

ATTENTION TO: CHYANN KIRBY

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Trace Organics Analysis			
Benzene	VOL-120-5013	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/MS
Ethylbenzene	VOL-120-5013	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/MS
Toluene	VOL-120-5013	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/MS
Xylene (Total)	VOL-120-5013	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/MS
C6-C10 (less BTEX)	VOL-120-5013	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/MS/FID
>C10-C16 Hydrocarbons	ORG-120-5007	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/FID
>C16-C21 Hydrocarbons	ORG-120-5007	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/MS/FID
>C21-C32 Hydrocarbons	VOL-120-5007	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/FID
Modified TPH (Tier 1)	ORG-120-5007	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/MS/FID
Return to Baseline at C32	ORG-120-5007	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/FID
% Moisture	LAB-131-4024	Topp, G.C. 1993. Soil Water Content. CSSS	GRAVIMETRIC
Isobutylbenzene - EPH	VOL-120-5007	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/FID
Isobutylbenzene - VPH	VOL-120-5013	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/MS
n-Dotriacontane - EPH	VOL-120-5007	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/FID
alpha-BHC	ORG 5513	EPA SW-846 3541,3550B, 3620B,8081A,8082	GC/ECD
beta-BHC	ORG 5508	EPA SW-846 3541 & 8081A	GC/ECD
Gamma-BHC (Lindane)	ORG 5513	EPA SW-846 3541,3550B, 3620B,8081A,8082	GC/ECD
delta-BHC	TO 0110	EPA SW-846 355	GC/ECD
Heptachlor	ORG 5513	EPA SW-846 3541,3550B, 3620B,8081A,8082	GC/ECD
Aldrin	ORG 5513	EPA SW-846 3541,3550B, 3620B,8081A,8082	GC/ECD
Heptachlor Epoxide	ORG 5513	EPA SW-846 3541,3550B, 3620B,8081A,8082	GC/ECD
Alpha-Chlordane	ORG 5513	EPA SW-846 3541,3550B, 3620B,8081A,8082	GC/ECD
Gamma-Chlordane	ORG 5513	EPA SW-846 3541,3550B, 3620B,8081A,8082	GC/ECD
Endosulfan I	TO 0110	EPA SW-846 355	GC/ECD
Endosulfan II	ORG 5009	EPA SW-846 3550 & 8081	GC/MS & GC/ECD
Endosulfan Sulfate	TO 0110	EPA SW-846 355	GC/ECD
Dieldrin	ORG 5513	EPA SW-846 3541,3550B, 3620B,8081A,8082	GC/ECD
p,p'-DDE	ORG 5513	EPA SW-846 3541,3550B, 3620B,8081A,8082	GC/ECD
o,p'-DDE	ORG 5513	EPA SW-846 3541,3550B, 3620B,8081A,8082	GC/ECD
Endrin	ORG 5513	EPA SW-846 3541,3550B, 3620B,8081A,8082	GC/ECD

Results relate only to the items tested

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Method Summary

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

AGAT WORK ORDER: 10X432562

PROJECT NO: GRQ - Marine

ATTENTION TO: CHYANN KIRBY

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
DDD (o,p')	ORG-91-5113	EPA SW - 846 3541/8081	GC/ECD
p,p'-DDD	ORG 5513	EPA SW-846 3541,3550B, 3620B,8081A,8082	GC/ECD
p,p'- DDT	ORG 5513	EPA SW-846 3541,3550B, 3620B,8081A,8082	GC/ECD
o,p'-DDT	ORG 5513	EPA SW-846 3541,3550B, 3620B,8081A,8082	GC/ECD
Endrin Aldehyde	TO 0110	EPA SW-846 355	GC/ECD
Endrin ketone	TO 0110	EPA SW-846 355	GC/ECD
Methoxychlor	ORG 5513	EPA SW-846 3541,3550B, 3620B,8081A,8082	GC/ECD
Mirex	ORG 5009	EPA SW-846 3550 & 8081	GC/ECD
Hexachlorobenzene	ORG 5508	EPA SW-846 3510C & 8270	GC/MS
Decachlorobiphenyl	ORG-120-5106, ORG-120-5108	EPA SW846 3510C/8080/8010, 8081A	GC/ECD
PCBs	ORG-120-5107	EPA SW-846 8081A & 8082	GC/ECD
Aroclor 1254	ORG-91-5113	EPA SW-846 3541 & 8082	GC/ECD
1-Methylnaphthalene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
2-Methylnaphthalene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Acenaphthene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Acenaphthylene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Acridine	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Anthracene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Benzo(a)anthracene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Benzo(a)pyrene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Benzo(b)fluoranthene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Benzo(b+j)fluoranthene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Benzo(e)pyrene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Benzo(ghi)perylene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Benzo(k)fluoranthene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Chrysene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Dibenzo(a,h)anthracene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Fluoranthene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Fluorene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Indeno(1,2,3)pyrene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Naphthalene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Perylene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Phenanthrene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Pyrene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Quinoline	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
% Moisture			GRAVIMETRIC
Nitrobenzene-d5	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
2-Fluorobiphenyl	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Terphenyl-d14	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS

Results relate only to the items tested

AGAT Laboratories

Unit 122 - 11 Morris Dr.
Dartmouth, Nova Scotia
B3B 1M2
http://webearth.agatlabs.com

Phone: 902-468-8718
Fax: 902-468-8924
www.agatlabs.com

Laboratory use Only
Arrival Condition: ☑ Good ☐ Poor (complete 'notes')
Arrival Temperature: 7 C AGAT Job Number: 10-4325602
Notes:

Drinking Water Sample (y/n): No Reg. No.
Waterworks Number:

Report To:
Company: AMEC Earth & Environmental
Contact: Chyann Kirby
Address: 580 Main Street, Suite 105, Hilyard Place,
Building B, Saint John, New Brunswick E2K 1J5
Phone: 506.652.9497 FAX: 506.652.9517
PO#: TV01017
AGAT Quotation: 10 -192
Client Project #: GRQ - Marine

Invoice to: Same (Y/N) - Circle
Company:
Contact:
Address:
Phone: Fax:
PO#/Credit Card #:

Report Information
1. Name: Chyann Kirby
Email: chyann.kirby@amec.com
2. Name:
Email:

Regulatory Requirements (Check):
☐ List Guidelines on Report ■ Do Not List Guidelines on Report
■ PIRI Site Info (check all that apply):
■ Tier 1 ■ Res ☐ Pot ☐ Coarse
☐ Tier 2 ■ Com ☐ N/Pot ☐ Fine
■ Gas ■ Fuel ■ Lube
■ CCME ☐ CDWQ
■ Ind ☐ NSDFOSP
■ Com ☐ HRM 101
■ Res/P Storm Water
■ Ag ☐ HRM 101
■ FWAL Waste Water
■ Sediment
☐ Other

Report Format
☐ Single PDF sample per page
■ Multiple PDF samples per page
■ Excel Format Included

Turnaround Time (TAT) Business Days
Regular TAT:
■ 5 - 7 days
Rush TAT:
☐ 1 day ☐ 2 days
☐ 3 - 4 days
Date Required:
Time Required:

SAMPLE IDENTIFICATION	DATE / TIME SAMPLED	SAMPLE MATRIX	# OF CONTAINERS	COMMENTS - Site/Sample Info, Sample Containment	Metals (Code 121-349)	Hexavalent Chromium (Code 93-021)	Mercury (Code 121-325)	TPH/BTEX (PIRI) Tier 1 (Code 120-104)	PAH (low-level (CCME) Code 120-127)	PCB (Code 120-131)	Particle Size (Code 121-337)	TIC/TOC (Codes 121-376 and 58-109)				EXTRACT AND HOLD FOR THE FOLLOWING (ARCHIVE)	Metals (Code 121-349)	Hexavalent Chromium (Code 93-021)	Mercury (Code 121-325)	TPH/BTEX (PIRI) Tier 1 (Code 120-104)	Particle Size (Code 121-337)	TIC/TOC (Codes 121-376 and 58-109)		Hazardous (Y/N)	Lab Sample #
GQ 02	1-Sep-10	sed./soi	2 x 250mL	Sample jars labelled "A" and "B" for each sample.	√	√	√	√	√	√	√	√													N	
GQ 25	1-Sep-10	sed./soi	2 x 250mL		√	√	√	√	√	√	√	√													N	
GQ 27	1-Sep-10	sed./soi	2 x 250mL														√	√	√	√	√	√			N	
GQ 31	1-Sep-10	sed./soi	2 x 250mL														√	√	√	√	√	√			N	
GQ 47	1-Sep-10	sed./soi	2 x 250mL														√	√	√	√	√	√			N	
GQ 50	1-Sep-10	sed./soi	2 x 250mL		√	√	√	√	√	√	√	√													N	
					*SEE QUOTATION FOR SPECIFICS ON SEDIMENT ANALYSES REQUESTED																						

Sample Relinquished By (print name & sign)	Date/Time	Samples Received By (print name and sign)	Date/Time	Special Instructions
Beth Cameron	2-Sep-10	A. Cole-Yemen	02-Sep-10	
Sample Relinquished By (print name & sign)	Date/Time	Samples Received By (print name and sign)	Date/Time	
			17:15	Page 1 of 1

C 1340-1294

APPENDIX F1
AMEC 2010 and 2014 Wetland Baseline Survey Report

Attachment A – Wetland Delineation Data Sheets and Habitat Assessment Forms

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

2010 / 2011 / 2014 WETLAND FIELD SURVEY, DELINEATION AND FUNCTIONAL ASSESSMENT REPORT

BLACK POINT QUARRY
GUYSBOROUGH COUNTY

Submitted to:
Morien Resources Corp. (Morien)
Metropolitan Place
Suite 1480, 99 Wyse Road
Dartmouth, Nova Scotia,
Canada, B3A 4S5

Submitted By:

AMEC Environment & Infrastructure,
A division of AMEC Americas Limited
50 Troop Avenue
Dartmouth, NS
B3B 1Z1

September 2014

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Appendix E Additional Wetland Delineation Data Sheets

1.0 INTRODUCTION

Vulcan Materials Company and Morien Resources Corp. (the Proponent) proposes the development, operation, decommissioning and abandonment of a granite quarry and marine terminal at Black Point in Guysborough County, Nova Scotia. The Black Point Quarry Project consists of aggregate production (drilling, blasting, processing and stockpiling) on a 354.5 ha property, along with the construction and operation of a 200 m long marine terminal adjacent to the quarry in Chedabucto Bay. The aggregate will be loaded into bulk carriers up to 70,000 DWT and transported to ports along the US eastern and Gulf coasts and potentially to markets in Canada and the Caribbean.

1.1 Project Area

The Black Point Quarry Project (the Project) is located on the south shore of Chedabucto Bay in the District of Guysborough, Nova Scotia. The proposed Project Site is approximately 2 and 2.5 km from the communities of Half Island Cove in the west, and Fox Island Main in the east, respectively. The Project is situated between Highway 16 and the Atlantic coast in an area dominated by coniferous forests, coastal barrens, as well as various types of wetlands including, bog, fen, swamp and marsh. A power transmission line corridor runs along the south end of the property and with the exception of a few ATV trails, skidder tracks and property cut lines, the area is relatively undisturbed.

1.2 Scope of Work

In preparation for construction activities planned within the Black Point Quarry Project boundary, wetlands located within the Project area must be identified, delineated and assessed in terms of ecological functions they provide. This work is required to determine the potential impacts the Project may have on wetland habitat. The information will also be used to prepare wetland alteration applications to NSE and associated plans for wetland compensation. The following activities were conducted to identify and delineate wetland habitat present:

- Review aerial photographs and existing maps to identify location of wetlands;
- Determine wetlands in the field using three parameter approach (soil, vegetation, and hydrology);
- Mark wetland boundaries with physical markers and GPS;
- Conduct wetland habitat and functional assessments; and
- Reporting including photographs and field data sheets.

2.0 WETLANDS REGULATORY REQUIREMENT AND DEFINITIONS

Several definitions of "wetland" exist in literature:

- Lands that are seasonally or permanently covered by shallow water, including lands where the water table is at or close to the surface. The presence of abundant water causes the formation of hydric soils and favours the dominance of either hydrophytic or water-tolerant plants. The five major types of wetlands are: marshes, swamps, bogs, fens and shallow open waters (Environment Canada, 2013);
- A wetland is land "where the water table is at, near, or above the surface or which is saturated for a long enough period to promote such features as wet-altered soils and water tolerant vegetation" (Environment Canada, 1996);
- A wetland is land that is "saturated with water long enough to promote wetland or aquatic processes as indicated by poorly drained soils, hydrophytic (i.e., water-loving) vegetation and various kinds of biological activity which are adapted to a wet environment" (Government of Canada, 1991); and
- Wetlands are areas of "marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters" (UNESCO, 1987).

Although each definition is slightly different, the relevant common aspects adopted for the purpose of this report that define a wetland are:

- Land that is saturated or covered by water for some time during the growing season;
- Poorly drained soils; and
- Predominantly, hydrophytic vegetation.

From these features that define a wetland, it is clear that preserving wetland habitat is dependent on maintaining existing soil, vegetation, and hydrologic conditions at a site.

Wetlands are environmentally significant for several reasons, including: water filtration; water storage (water recharge); flood reduction and control; carbon absorption; erosion control; and wildlife habitat (Nova Scotia Museum, 1996). Loss of wetlands has resulted, to some degree, in increased flooding, decreased water quality, desertification, and declines of fish and wildlife (Lynch-Stewart, 1992).

2.1 Federal Policy on Wetland Conservation

The *Federal Policy on Wetland Conservation* (Government of Canada, 1991) directs all federal government departments to conserve or sustain wetland functions during delivery of their programs. One of the main considerations in developing the Policy was Canada's membership in the Ramsar Convention on Wetlands (Revised 1987), signed by Canada in 1981. The Ramsar Convention is a global conservation treaty specifically dealing with wetland loss and sustainable use.

Another consideration in developing the Policy was Canada's commitments under the North American Waterfowl Management Plan and the potentially beneficial influences of land use decisions by federal departments and agencies (Lynch-Stewart *et al.*, 1999).

The two key commitments in the federal wetland policy include:

- No net loss of wetland functions on federal lands through mitigation; and
- Enhancement and rehabilitation of wetlands in areas where wetland loss has reached critical levels.

Implementation of strategies contained in the Federal Policy on Wetland Conservation is outlined in the *Implementation Guide for Federal Land Managers* (Lynch-Stewart *et al.*, 1996). The Guide also outlines the hierarchy for mitigation alternatives for meeting the goal of no net loss of wetland function:

- First – Avoid impacts;
- Second – Minimize unavoidable impacts; and
- Third, and last – Compensate for residual impacts that cannot be minimized.

In addition, the Guide provides advice on integrating wetlands into the project planning process, and details on the related process under the *Canadian Environmental Assessment Act 1992*.

2.2 Nova Scotia Wetland Policy

The *Nova Scotia Wetland Conservation Policy* (NSE, 2011) provides direction with respect to conservation, alteration or infilling of wetlands in Nova Scotia. The guiding principle is to achieve no loss in Wetlands of Special Significance and prevent net loss of wetland function in other wetlands. The Department designates infilling or alteration of wetlands as an "activity" under the NS *Environment Act* (Government of Nova Scotia, 1995) and requires approval of such activities prior to the occurrence.

This Policy recognizes that freshwater wetlands and salt marshes are critical ecosystems that provide a suite of environmental and societal services including:

- Maintaining watershed health;
- Maintaining and improving water quality and quantity (surface and groundwater);
- Reducing impacts and damage due to flooding and storm surges;
- Providing habitat for wildlife and other wetland dependent species; and
- Providing opportunities for recreation and education.

Nova Scotia Environment (NSE) recognizes that wetlands are a particularly sensitive habitat and that alteration of wetlands can cause significant adverse environmental effects. The policy guides departmental decision making with respect to wetlands.

3.0 METHODOLOGY

3.1 Desktop Review

All wetlands noted to occur within the Project footprint from previous reports and databases, were mapped, and information on the location, size and type of these wetlands were extracted. This information has been augmented by information obtained from review of:

- NS Wetlands Atlas
- Aerial photos;
- Topographical maps;
- NSDNR Wet Areas Mapping (WAM); and
- Information collected during field work.

All known wetland locations as well as high potential areas identified during the desk top review were visited in the field to confirm the presence of wetland habitat within the Project area.

3.2 Wetland Delineation

Wetland delineations were conducted by trained wetland biologists according to standard methodologies approved by NSE (NSE, 2013). The determination of wetland habitat in the field was based largely on the Corps of Engineers Wetland Delineation Manual (the Manual) (Environmental Laboratory, 1987) and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual (USACE, 2012). Wetland areas within the Project area were identified and mapped using wetland indicators and definitions from the delineation approach approved by NSE (NSE, 2013). This consisted of using representative "paired data points" (i.e., one sample point in the wetland habitat and one sample point in the adjacent upland habitat) as described in the US Army Corps of Engineers Manual.

Wetland data were recorded on Wetland Delineation Data Sheets developed by the Maritimes College of Forestry Technology for the province of Nova Scotia (Appendix A). *Munsell Soil Color Charts* were used to aid in identifying hydric soils in the field. The *Canadian System of Soil Classification* (SCWG, 1998) was used to aid in description of soil characteristics. The *Roland's Flora of Nova Scotia* (Zinc, 1998) and *Flora of New Brunswick* (Hinds, 2000) aided with plant nomenclature and identification. The location of data points and selected wetland boundary points were recorded by Global Positioning System (GPS) using a TRIMBLE Geo-XH GPS receiver capable of sub-metre accuracy. Accuracy of all saved data points were estimated by the receiver to be <1m.

At each sample site, two sample points were chosen; which represent wetland and upland habitat at the wetland boundary. The location of each sample point was recorded with the GPS and marked using pink flagging tape with a unique GPS waypoint name (See Appendix B). The identified vegetation communities were then used to delineate the wetland boundary. Wetland boundary locations were recorded with the GPS and used to prepare individual wetland figures located at the end of this report. Representative site photos of wetland areas, adjacent upland areas, and soil pit exposures were also collected (Appendix C).

3.3 Wetland Determination

To be determined a wetland; the following three criteria should be met:

- Majority of dominant vegetation species are wetland associated species;
- Hydrologic conditions exist that result in periods of flooding, ponding, or saturation during the growing season; and
- Hydric soils are present.

3.3.1 Vegetation

Hydrophytic vegetation is defined as the sum total of macrophytic plant life that occurs in areas where the frequency and duration of inundation or soil saturation produce permanent or periodically saturated soils of sufficient duration to exert a controlling influence on the plant species present (Environmental Laboratory 1987). The definition of wetlands includes the phrase "sustains aquatic processes as indicated by the presence of hydric soils, hydrophytic vegetation and biological activities adapted to wet conditions." Hydrophytic vegetation should be the dominant plant type and is characterized by the dominant plant species comprising the plant community (Environmental Laboratory 1987).

Dominant plant species observed at each data point were classified according to their Indicator Status Group (probability of occurrence in wetlands) (Table 3.1), in accordance with the Nova Scotia Wetland Indicator Plant List developed by Sean Blaney at the Atlantic Canada Conservation Data Center (ACCDC, 2011). This classification of plants follows methods developed by the US fish and Wildlife Service (Reed 1988). Further relevant information was reviewed in Roland's *Flora of Nova Scotia* 3rd Ed. (Zinc, 1998) and *Flora of New Brunswick* 2nd Ed. (Hinds, 2000).

Table 3.1: Classification of Wetland-Associated Plant Species

Plant Species Classification	Abbreviation	Probability of Occurring in Wetland
Obligate	OBL	>99%
Facultative Wetland	FACW	66-99%
Facultative	FAC	33-66%
Facultative Upland	FACU	1-33%
Upland	UPL	<1%
No indicator status	NI	Insufficient information to determine status
Plants That Are Not Listed (assumed upland species)	NL	Does not occur in wetlands in any region.

Source: USFWS 1988.

The Prevalence Index (PI) was the main indicator used to assess the dominance of hydrophytic vegetation at each data point location. The PI method assigns weighted values to each dominant species according to their Indicator Status Group. The total cover (% area) of species

in each group is then multiplied by the weighted values and the product is divided by the sum of the unweighted total cover, yielding a value between 1 and 5. If the majority of the dominant vegetation on a site are classified as obligate (OBL), facultative wetland (FACW), or facultative (FAC) then the PI will be equal to or less than 3, and the site is considered to be dominated by hydrophytic vegetation.

3.3.2 Soils

A hydric soil is defined as a soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (USDA-NRCS, 2007). Indicators of hydric soil include; soil color (gleyed soils and soils with bright mottles and/or low matrix chroma), aquic or preaquic moisture regime, reducing soil conditions, sulfidic material (odour), soils listed on hydric soils list, iron and manganese concretions, organic soils (Histosols), histic epipedon, high organic content in surface layer in sandy soils, and organic streaking in sandy soils.

A soil pit was excavated to a minimum depth of 40 centimetres or refusal at each data point. The soil was then examined for hydric soil indicators. The matrix color and mottle color (if present) of the soil was determined using the Munsell Soil Color Charts.

3.3.3 Hydrology

Wetlands, by definition, either periodically or permanently have a water table at, near or above the land's surface or are saturated with water. To be classified as a wetland, a site should have at least one primary indicator or two secondary indicators of wetland hydrology. Primary indicators of wetland hydrology may include, but are not limited to: water marks, drift lines, sediment deposition, drainage patterns, visual observation of saturated soils, and visual observation of inundation. In addition to the primary indicators, there is a variety of secondary wetland hydrology indicators. Secondary indicators include, but are not limited to: oxidized root channels in the upper 12 inches (30.5 centimetres), stunted vegetation, and local soil survey data. When no primary indicators of wetland hydrology are observed at a data point, two or more secondary indicators are required to confirm wetland hydrology.

3.3.4 Regional Supplement

There are a number of uncommon situations, often regional in nature that may cause difficulty in interpreting wetland indicators at a site. Some examples include recent disturbance (e.g. vegetation clearing, infilling), past land use (e.g. agricultural tillage or ditch drainage), recent extreme flooding (e.g. sediment deposits, hanging debris), and problematic soils (e.g. fluvial deposits, red parent material). The Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual (USACE, 2012) contains specific guidance for use in these situations. Although there was some minor disturbance noted in some of the wetlands assessed within the Project area, none were considered to be problematic in terms of interpreting wetland indicators.

3.4 Functional Assessment Method

Environment Canada and the US Army Corps of Engineers both describe wetland ecological functions as the natural processes (physical, chemical, biological) that a wetland provides that is independent from the benefits these processes provide to humans (Hanson et al., 2008; USACE, 1999). This is differentiated from wetland values which reflect the ecosystem services wetlands provide to humans and the associated societal value. These "values" are a product of the ecological function a wetland may provide, but may change depending on individual or community preference (Hanson et al., 2008).

NSE has developed the Nova Scotia Wetland Evaluation Technique (NovaWET) which is designed to assess the condition and functions of wetlands specifically in Nova Scotia (NSE 2014). This technique has been adapted using aspects of various methods successfully employed in other regions, in particular the US. This method uses a combination of landscape level information and site-specific characteristics of the wetland to determine the most significant wetland functions.

NovaWET consists of 11 major sections associated with key wetland functions. Each section contains a number of questions that pertain to that function which provide details that enable the assessor to determine to what degree the wetland provides significant functions (SF). This method identifies a total of 29 significant functions a wetland may provide depending on the specific characteristics of the wetland and surrounding landscape. The 11 major sections and associated 29 significant functions are as follows:

- Section 1 – Watershed Characteristics
    - SF1 – Watershed condition
    - SF2 – Proportion of wetland area in watershed & opportunity for floodwater detention
- Section 2 – Wetland Characteristics
    - SF3 – General wetland condition/integrity
- Section 3 – Adjacent Land Condition and Integrity
    - SF4 – Overall condition and integrity of adjacent land to wetland
- Section 4 – Documented Important Features
    - SF5 – Wetland is a WSS
    - SF6 – Wetland support commercial/recreational fish/shellfish
    - SF7 – Wetland contains/ is utilized by species of concern
    - SF8 – Wetland has conservation/compensation agreement/activity
    - SF9 – Wetland is calcareous fen, black ash or cedar swamp
    - SF10 – Wetland is situated within Drinking Water Protected Area (designated watershed/wellfield)

- SF11 –Wetland is situated within a floodplain and upstream or within a populated area
- SF12 – Wetland is situated within Fed/Prov/Municipal area of interest

- Section 5 – Hydrologic Condition and Integrity
  - SF13 – Wetland hydrologic condition
  - SF14 – Wetland importance for maintaining stream flow
  - SF15 – Wetland ability to detain surface water
- Section 6 – Water Quality
  - SF16 – Wetland improves water quality
  - SF17 – Evidence of excess nutrient loading/contamination
  - SF18 – Wetland contributes to water quality in downstream resources
- Section 7 – Groundwater Interactions
  - SF19 – Wetland likely a recharge site
  - SF20 – Wetland likely a discharge site
- Section 8 – Shoreline Stabilization and Integrity
  - SF21 – Wetland ability to stabilize shoreline
- Section 9 – Plant Community
  - SF22 – Plant community unique or rare regionally or provincially
  - SF23 – Wetland contains a diversity of plant communities
  - SF24 – Overall integrity of the wetland's plant community
  - SF25 – Presence of rare or endangered plant species
- Section 10 – Fish and Wildlife Habitat and Integrity
  - SF26 – Wetland supports fish/fish habitat
  - SF27 – Presence of rare or endangered fish/wildlife
  - SF28 – Wetland's overall fish and wildlife habitat quality
- Section 11 – Community Use/Value
  - SF29 – Wetland's community use/value

NovaWET goes further to identify critical wetland functions (SF rating highlighted in red on the data sheets) that are often unique or rare or associated with high risk to the watershed if lost and as such minimizing or compensating for this loss may be difficult. In many cases the rating of significant functions determines whether the wetland provides a critical function or if this function is just merely present. For example a wetland is considered to provide a critical function as fish and wildlife habitat if that significant function is assessed to be of high quality.

Alternatively, if habitat quality is determined to be low or moderate, the wetland is still considered to offer that function, however it is not considered critical. Other significant functions only need to be present in order to be considered critical for example the presence of a rare or endangered species constitutes a critical function for that wetland. NSE should be consulted should a wetland be determined to provide a critical wetland function prior to Project implementation.

Functional Assessments of all wetlands encountered within the Project area were conducted using the NovaWET method. Appendix D provides the completed NovaWET evaluation forms for the 22 wetlands assessed within the Project area.

4.0 RESULTS

Preliminary field surveys were conducted between August 31st and September 8th, 2010 by AMEC Wetland Biologists, Scott Burley (M.Sc.) and Marion Sensen (Ph.D.). During this initial round of surveys, wetland habitat occurring within the Project Area was identified in the field, approximate boundaries were determined and habitat assessments were conducted. The purpose of this round of surveys was to provide an overview of the amount and type of wetland habitat present on the Project Site to aid in planning and design of specific Project components.

A second round of wetland surveys was conducted in July of 2011 by Pinchin LeBlanc Wetland Biologist, Theo Popma. During this second survey, wetland delineations were conducted following standardized methodologies described above (Sections 3.2 and 3.3).

A third and final round of field surveys was conducted by Scott Burley and Marion Sensen between August 18th and August 22nd, 2014. The weather during these surveys was a mix of sun and cloud with rain on the 18th. Wetland delineations were verified in the field and additional field data was recorded for each wetland to be used during the functional assessments.

A total of 22 wetlands were identified within the Project footprint and/or determined to be hydrologically connected downstream. The majority of wetland habitat identified consists of open bogs and riparian fens which range in size from approximately 16.5 ha to <0.5 ha. Other wetland types identified include swamp and marsh as well as complexes including a combination of a number of these wetland types. The total area of wetland habitat identified within the Project Study Area is approximately 57 ha.

Individual wetlands identified during the initial 2010 surveys were given a unique wetland indentifying number. These wetland numbers were recorded on all data sheets completed during the 2010 and 2011 surveys. Over the course of the next two field survey events, wetland boundaries were refined and verified and as such some wetlands identified as individual wetlands in 2010 were subsequently found to be connected, forming larger wetland complexes. In these instances data collected for each wetland component were combined and the wetland complex was assigned a new wetland identifying number that fits chronologically with the actual number of wetlands occurring within the Project Area. Table 4.1 below presents the updated

wetland numbering system along with the corresponding initial numbering system that is reflected in the field data sheets. Note that the functional assessment forms in Appendix D reflect the updated numbering system.

Table 4.1: Updated Wetland Identification Number

Updated Wetland # for Current Report	Initial Wetland # Reflected in Field Data Sheets
WL1	WL1, WL17, WL18
WL2	WL2
WL3	WL3
WL4	WL4
WL5	WL5
WL6	WL6
WL7	WL7
WL8	WL8, WL9
WL9	WL10
WL10	WL11
WL11	WL12
WL12	WL13
WL13	WL14
WL14	WL15
WL15	WL16
WL16	WL19, WL20
WL17	WL21
WL18	WL22
WL19	WL23
WL20	WL24
WL21	WL25
WL22	WL26

Twelve (12) of the 22 wetlands surveyed were found to occur directly within the proposed footprint of the pit, fill areas and plant location (WL1, WL3 – WL7 and WL11-WL15 inclusive in Table 4.2). Four (4) wetlands surveyed occur within the proposed footprint of the access road (WL12- WL20 inclusive). Six (6) wetlands surveyed (WL8-WL10, WL16, WL21 and WL2) are situated outside the proposed footprint of all Project components however these wetlands may be indirectly impacted by the project and as such were included in the surveys. Complete wetland delineation, habitat assessments and functional assessments were conducted for all 22 wetlands surveyed.

Table 4.2 provides a summary of all wetlands assessed along with their general characteristics and corresponding coordinates (UTM Zone 20, NAD 83).

Table 4.2: Wetland Locations and Characterization

Wetland #	Coordinates		Type	Size (Ha)	Landscape Position	Water Flow Path	Landform
	Easting	Northing					

1	645437	5022529	Bog/Swamp Complex	16.5	Lotic Stream	Throughflow	Basin
2	645430	5024058	Fen/Swamp/Marsh Complex	6	Lotic Pond	Inflow	Basin
3	645076	5024059	Riparian Fen	0.5	Lotic Stream	Throughflow	Slope
4	645076	5024059	Bog	0.2	Terrene	Isolated	Basin
5	644431	5024129	Riparian Fen	0.5	Lotic Stream	Throughflow	Slope
6	644737	5024077	Bog	0.3	Terrene	Outflow	Basin
7	644845	5024349	Riparian Treed Swamp	0.5	Lotic Stream	Throughflow	Slope
8	644009	5023134	Swamp/Bog/Fen Complex	10.3	Lotic Stream	Throughflow	Flat
9	643617	5023397	Bog	4.6	Terrene	Isolated	Flat
10	643857	5023694	Riparian Treed Swamp	0.1	Lotic Stream	Throughflow	Slope
11	644458	5023456	Bog	9.0	Terrene	Isolated	Flat
12	644737	5024077	Bog/Fen Complex	0.3	Terrene	Outflow	Basin
13	644860	5023362	Treed Swamp	0.6	Terrene	Isolated	Slope
14	645506	5023190	Fen/Bog Complex	6.2	Lotic Stream	Throughflow	Slope
15	645265	5023544	Riparian Fen	0.07	Lotic Stream	Throughflow	Slope
16	645920	5022505	Bog	0.45	Terrene	Isolated	Basin
17	644193	5021827	Bog/Swamp Complex	0.74	Terrene	Outflow	Basin
18	644396	5022050	Bog	0.07	Terrene	Isolated	Basin
19	644440	5022148	Bog	0.04	Terrene	Isolated	Basin
20	644447	5022225	Bog	0.15	Terrene	Isolated	Basin
21	645820	5023684	Fen	0.19	Lotic Stream	Inflow	Slope
22	645630	5023728	Riparian Fen	0.1	Lotic Stream	Throughflow	Slope
Total Wetland Area (ha)				57.3			

4.1 Wetland Delineation

The following descriptions of sample test points are summarized from field data sheets presented in Appendix A. Site photos are included in Appendix C. The following description refers to GPS points in Appendix B and figures located at the end of this report. In addition to the sample test pit locations summarized below, additional supplemental test pits were completed and summarized on Appendix E.

4.1.1 Wetland 1 (WL1)

WL1 (Figure 3) is a fen/bog/swamp wetland complex approximately 16.5 ha in total area located in the southeast end of the Project Area (Figure 2). This wetland was originally identified as

three separate wetlands (WL1, WL17 and WL18) however further field investigations identified that these areas are in fact connected to form one large complex.One paired sampling site was recorded (labeled as WL17 on data sheets in Appendix A). The wetland was determined to contain normal site conditions however the vegetation along the southern boundary is slightly influenced by maintenance activities within the power transmission line corridor. The upland area around surrounding the wetland consists of a mix of shrub barren and coniferous forest.

The dominant vegetation at Data Point "WL1-WP1" in the overstory is Black Spruce (*Picea mariana*) with Mountain Holy (*Nemopanthes muronata*) and Wild Raisin (*Vibirnum nudum*) dominating the shrub layer. The understory is dominated by a thick layer of sphagnum moss with Leather Leaf (*Chamaedaphne calyculata*) and Common Juniper (*Juniperus communis*) as the dominant understory (Photo 1; Appendix C). The PI was observed to be 2.4. The soil was determined to be a Balck Histic (A3) as there was 20 cm of organic matter accumulated over a loamy sand layer with color of 10YR 3/2 (Photo 2; Appendix C). Soil saturation was found to be at 3cm (A3) while no surface water or water table was detected.

The dominant vegetation at Data Point "WL1-UP1' in the overstory is Balsam Fir (*Abies balsamea*), Red Maple (*Acer rubrum*) and Black Spruce. Mountain Holy was found to be dominant in the understorey while Lambkill (*Kalmia angustifolia*) and Labrador Tea (*Ledum groenlandicum*) dominated the understory (Photo 3; Appendix C). The PI was observed to be 2.7. The substrate was found to consist of a 14 cm organic layer over rock (Photo 4, Appendix C). The soil appeared to be well drained with no presence of saturation. Although the sample point has hydrophytic vegetation, the lack of hydric soil and wetland hydrology identifies this site as upland.

Changes in topographic relief and vegetation were the main criteria utilized in delineating the wetland boundary. Along the northern, eastern and southern boundaries of the wetland there is a noticeable transition in elevation (~15% slope) and vegetation.

4.1.2 Wetland 2 (WL2)

WL2 (Figure 4) is a Marsh/fen/Swamp wetland complex approximately 6.0 ha in total area located in the northwest end of the Project area (Figure 2). One paired sampling site was recorded. The wetland was determined to contain normal site conditions however the vegetation in southern end of the site has been disturbed and is now an early successional forest. The upland area surrounding the south, east and west sides of the wetland are composed of a coniferous forest while the northern side is bordered by a cobble/boulder/sand beach.

The dominant vegetation at Data Point "WL2-WP1" in the overstory and subcanopy is Balsam Fir along with Lambkill and Mountain Holy dominating the shrub layer. The understory is dominated by a thick layer of sphagnum moss with Three-seeded Sedge (*Carex trisperma*), Creeping Snowberry (*Gaultheria hispidula*) and Three-leaved False Solomon's Seal (*Mainanthemum trifolium*) as the dominant understory (Photo 5; Appendix C). The PI was

observed to be 2.6. The soil was determined to be a histosol (A1) as there was more than 40 cm of organic matter accumulated (Photo 6; Appendix C). Although surface water or the water table was not present at the sample point, soil saturation was at 15cm (A3) and a strong Hydrogen Sulfide ordor was detected (C1).

Balsam fir and White Birch (*Betula papyrifera*) is the dominant vegetation at Data Point "WL2-UP1', in the overstory while Balsam Fir, Lambkill and Mountain Ash (*Sorbus americana*) is also dominant in the subcanopy. Bunchberry (*Cornus canadensis*) and Wild Sarsaparilla (*Aralia* nudicaulis) were found to dominate the understory (Photo 7; Appendix C). The PI was observed to be 3.0 although all dominant species were found to have an indicator status of FAC. The substrate was found to consist of a 10 cm duff layer over a 7cm silt loam Ae layer (2.5YR 5/1) (Photo 8, Appendix C). The soil appeared to be well drained with no presence of saturation. Although the sample point has hydrophytic vegetation, the lack of hydric soil and wetland hydrology identifies this site as upland.

Delineation of WL2 relied primarily on an abrupt change in elevation and shift in vegetation composition. The wetland is located in a basin where the land slopes inward essentially on all sides. A small stream provides an inlet to the wetland on the southwest end.

4.1.3 Wetland 3 (WL3)

WL3 (Figure 5) is a riparian fen wetland approximately 0.5 ha in total area located in the northern end of the Project area (Figure 2). One paired sampling site was recorded. The wetland was determined to contain normal site conditions. The upland area surrounding the entire wetland is composed of a coniferous forest.

The dominant vegetation at Data Point "WL3-WP1" in the understory is Black Spruce and Larch (*Larix laracina*). The ground layer is dominated by a thick layer of sphagnum moss with Swamp-Pink (*Arethusa bulbosa*) and White Beak-rush (*Rhynchospora alba*) as the dominant species (Photo 9; Appendix C). The PI was observed to be 2.2. The soil was determined to be a histosol (A1) as there was more than 40 cm of organic matter accumulated (Photo 10; Appendix C). Although surface water was not present at the sample point, soil saturation was at surface (A3) and the water table was to 15 cm from surface (A2).

White Spruce (*Picea glauca*) is the dominant species at Data Point "WL3-UP1" in the overstory while Black Holly (*Ilex verticillata*) and Balsam Fir dominate the understorey. Wild lily-of-the-valley (*Mainanthemum canadensis*), Star Flower (*Triantalis borealis*) and Mountain Cranberry (*Vaccinium vitis-idea*) was found to dominate the understory (Photo 11; Appendix C). The PI was observed to be 2.8 although all but one species recorded has an indicator status of FAC. The substrate was found to consist of a 15 cm duff layer over a sand silt Ae horizon (5Y 5/1) (Photo 12, Appendix C). The soil appeared to be well drained with no presence of saturation. Although the sample point has hydrophytic vegetation, the lack of hydric soil and wetland hydrology identifies this site as upland.

WL3 is located in a steep sided basin where boundary delineation was determined primarily by the abrupt change in elevation and associated shift in plant species composition.

4.1.4 Wetland 4 (WL4)

WL4 (Figure 6) is a bog wetland approximately 0.2 ha in total area located in the northern end of the Project area (Figure 2). One paired sampling site was recorded. The wetland was determined to contain normal site conditions. The upland area along the perimeter of this wetland consists of coniferous forest.

The dominant vegetation at Data Point "WL4-WP1" is Black Spruce in the canopy and subcanopy while Three-leaved False Solomon's Seal and Three-seeded Sedge are the dominant species in the understory (Photo 13; Appendix C). The PI was observed to be 1.9. The soil was determined to be a histosol (A1) as there was more than 40 cm of organic matter accumulated (Photo 14; Appendix C). Surface water was not found to be present at the sample point however soil saturation was at 5 cm (A3) and there was a strong Hydrogen Sulfide odor detected (C1).

Black Spruce is the dominant species at Data Point "WL4-UP1" in the overstory. Mountain Holly and Black Spruce dominated the understorey while Three-seeded Sedge and Lambkill were found to dominate the understory (Photo 15; Appendix C). The PI was observed to be 2.3. The substrate was found to consist of a 15 cm duff layer over a 9 cm silt Ae layer (2.5YR 7/1) (Photo 16, Appendix C). The soil appeared to be well drained with no presence of saturation. Although the sample point has hydrophytic vegetation, the lack of hydric soil and wetland hydrology identifies this site as upland.

WL4 is located in a steep sided basin where boundary delineation was determined primarily by the abrupt change in elevation and associated shift in plant species composition.

4.1.5 Wetland 5 (WL5)

WL5 (Figure 7) is a riparian fen wetland approximately 0.5 ha in total area located in the southern end of the Project area (Figure 2). One paired sampling site was recorded. The wetland was determined to contain normal site conditions. The upland area along the south, east and north boundaries is composed of a confierous forest while a cobble/boulder/sand beach is located at the west boundary.

The dominant vegetation at Data Point "WL5-WP1" is located in the understorey including Large Cranberry (*Vaccinium macrocarpon*), Tussock Cotton-grass (*Eriophorum vaginatum*) and Bog Aster (*Oclemena nemoralis*) (Photo 17; Appendix C). The PI was observed to be 2.2. The soil was determined to be a histosol (A1) as there was more than 40 cm of organic matter accumulated (Photo 18; Appendix C). Surface water was found to be present at the sample point (A1), soil saturation was at surface (A3) and the water table was to 5 cm from surface (A2).

Balsam Fir and White Spruce are the dominant species at Data Point "WL5-UP1" in the canopy. Speckled Alder (*Alnus incana*) is dominant in the understorey while Bunchberry and Spinulous Woodfern (*Dryopteris carthusiana*) was found to dominate the understory (Photo 19; Appendix C). The PI was observed to be 3.1. The substrate was found to consist of a 2 cm duff layer over a 35 cm sand loam B horizon (7.5YR 4/4) (Photo 20, Appendix C). The soil appeared to

be well drained with no presence of saturation. The lack of hydric vegetation, hydric soil and wetland hydrology identifies this site as upland.

Wetland boundaries along the north and south sides were determined by an abrupt change in elevation. The boundary along the eastern end of this wetland consists of a more gradual change in elevation which creates a wider transition from wetland to upland in this area. Wetland boundary in this area was determined by a shift in dominance of sphagnum moss in the wetland to feather moss in the upland. Wetland boundary in the west end was determined by the beach.

4.1.6 Wetland 6 (WL6)

WL6 (Figure 8) is a bog wetland approximately 0.3 ha in total area located in the northern end of the Project area (Figure 2). One paired sampling site was recorded. The wetland was determined to contain normal site conditions. The upland area surrounding this wetland consists of coniferous forest.

The dominant vegetation at Data Point "WL6-WP1" is Black Spruce and Balsam Fir in the canopy with Black Spruce, Huckleberry (*Gaylussacia baccata*) and Sweet Gale (*Myrica gale*) dominating the understorey. Three-leaved False Solomon's Seal and Tussock Cotton-grass are the dominant species in the understory (Photo 17; Appendix C). The PI was observed to be 2.1. The soil was determined to be a histosol (A1) as there was 30 cm of organic matter overtop of bedrock (Photo 18; Appendix C). Although no surface water was found at the sample point, soil saturation was at surface (A3) and the water table was at 20 cm from surface (A2).

Balsam Fir is the dominant species at Data Point "WL6-UP1', in the canopy and subcanopy while Wild Lily-of-the-valley, Mountain Cranberry, Twin Flower (*Linnaea borealis*) and Partridge Berry (*Mitchella repens*) dominate the understory (Photo 19; Appendix C). The PI was observed to be 3.0. The substrate was found to consist of a 5 cm duff layer over a sandy loam Ae layer (7.5YR 6/1) over a clay loam Bf horizon (7.5YR 4/6) (Photo 20, Appendix C). The soil appeared to be well drained with no presence of saturation. Although the sample point has hydrophytic vegetation, the lack of hydric soil and wetland hydrology identifies this site as upland.

Wetland boundaries along the north and south sides were determined by an abrupt change in elevation. The boundaries along the eastern and western end of this wetland consist of a more gradual change in elevation which creates a wider transition from wetland to upland in this area. Wetland boundary in this area was determined by a shift in dominance of sphagnum moss in the wetland to feather moss in the upland.

4.1.7 Wetland 7 (WL7)

WL7 (Figure 9) is a Riparian treed swamp wetland approximately 0.5 ha in total area located at the northern end of the Project area (Figure 2). One paired sampling site was recorded. The wetland was determined to contain normal site conditions. The upland area along the western

boundary is a rock cliff leading the ocean while coniferous forest surrounds the remainder of the wetland.

The dominant vegetation at Data Point "WL7-WP1" is Black Spruce in the canopy and (Photo 21; Appendix C). The PI was observed to be 2.0. The soil was determined to be a histosol (A1) as there was more than 40 cm of accumulated organic matter (Photo 22; Appendix C). Surface water was not found to be present however a strong Hydrogen Sulfide odor was detected (C1) and soil saturation was at 5 cm (A3).

White Spruce is the dominant species at Data Point "WL7-UP1" in the canopy while Lambkill, White Spruce and Green Alder (*Alnus crispa*) is the dominant species in the subcanopy while Bunchberry dominates the understory (Photo 23; Appendix C). The PI was observed to be 3.1. The substrate was found to consist of a 15 cm duff layer over rock (Photo 24, Appendix C). The soil appeared to be well drained with no presence of saturation. The lack of all three wetland indicators identifies this site as upland.

Wetland boundaries of WL7 were determined by an abrupt change in elevation and vegetation composition.

4.1.8 Wetland 8 (WL8)

WL8 (Figure 10) is a riparian swamp/bog/fen wetland complex approximately 10.3 ha in total area located in the western side of the Project area (Figure 2). One paired sampling site was recorded. This wetland was originally identified as two separate wetlands (WL8 and WL9 on data sheets on Appendix A) however further field investigations identified that these areas are in fact connected to form one large complex. The wetland was determined to contain normal site conditions. The upland habitat surrounding this wetland consists of a mix of barren vegetation, coniferous forest and mixed forest.

The dominant vegetation at Data Point "WL8-WP1" in the canopy is Balsam Fir and Red Maple. The subcanopy is dominated by Cinnamon Fern while Three-seeded Sedge dominates the understorey (Photo 25; Appendix C). The PI was observed to be 1.5. The soil was determined to be a histosol (A1) as there was more than 40 cm of accumulated organic matter (Photo 26; Appendix C). Surface water was not found to be present however a strong Hydrogen Sulfide odor was detected (C1) and soil saturation was at 5 cm (A3).

The dominant species at Data Point "WL8-UP1" in the canopy is Balsam Fir and Red Maple. Dominant species in the subcanopy include Mountain Holy, Wild Raisin and Lambkill while Wild Sarsaparilla and Star Flower dominate the understory (Photo 27; Appendix C). The PI was observed to be 2.9. The substrate was found to consist of a 20 cm duff layer over 10 cm silt-loam Ae layer (2.5YR 5/1), over rock (Photo 28, Appendix C). The soil appeared to be well drained with no presence of saturation. Although the sample point has hydrophytic vegetation, the lack of hydric soil and wetland hydrology identifies this site as upland.

Wetland boundaries along the bog portion of WL8 were determined by an abrupt change in elevation and associated shift in dominant plant species. The boundary of the riparian swamp portion of this wetland consists of a more gradual shift in elevation and dominant plant species. Wetland boundary in this area was determined by a shift in dominance of sphagnum moss in the wetland to feather moss in the upland.

4.1.9 Wetland 9 (WL9)

WL9 (Figure 11) is an open bog wetland approximately 4.6 ha in total area located along the western property boundary of the Project area (Figure 2). One paired sampling site was recorded (labeled as WL10 on data sheets in Appendix A). The wetland was determined to contain normal site conditions. The upland habitat surrounding this wetland consists of a mix of barren vegetation and coniferous forest.

The dominant vegetation at Data Point "WL9-WP1" in the subcanopy is Black Spruce and Huckleberry while Common Juniper, Bog Laurel (*Kalmia polifolia*), Pitcher Plant (*Sarracenia purperea*) and Deer Grass (*Trichophorum caespitosus*) dominates the understory (Photo 29; Appendix C). The PI was observed to be 2.5. The soil was determined to be a histosol (A1) as there was more than 40 cm of accumulated organic matter (Photo 30; Appendix C). Surface water was not found to be present however a strong water stained leaves (B9), sparsely vegetated concave surface (B8) and thin muck surface were all noted (C7).

The dominant species at Data Point "WL9-UP1" in the canopy is Black Spruce. Dominate species in the subcanopy include Black Spruce and Huckleberry while Lambkill and Star Flower dominate the understory (Photo 31; Appendix C). The PI was observed to be 2.7. The substrate was found to consist of a 20 cm duff layer over rock (Photo 32, Appendix C). The soil appeared to be well drained with no presence of saturation. Although the sample point has hydrophytic vegetation, the lack of hydric soil and wetland hydrology identifies this site as upland.

4.1.10 Wetland 10 (WL10)

WL10 (Figure 12) is a small riparian treed swamp located along an unnamed stream at the western side of the Project Area. The upland habitat surrounding this wetland consists primarily of coniferous forest. One paired sampling site was recorded (labeled as WL11 on data sheets in Appendix A). The wetland was determined to contain normal site conditions.

The dominant vegetation at Data Point "WL10-WP1" in the canopy is Balsam Fir. Cinnamon Fern is the dominant species in the subcanopy while Three-seeded Sedge dominates the understory (Photo 33; Appendix C). The PI was observed to be 2.4. The soil was determined to be a histosol (A1) as there was more than 40 cm of accumulated organic matter (Photo 34; Appendix C). Surface water was found to be present (A1) and soil saturation was at 5 cm (A3).

The dominant species at Data Point "WL10-UP1" in the canopy is Black Spruce and Balsam Fir. Dominant species in the subcanopy include Balsam Fir and Mountain Ash while Wild

Sarsaparilla and Star Flower dominate the understory (Photo 35; Appendix C). The PI was observed to be 2.9. The substrate was found to consist of a 10 cm duff layer over rock (Photo 36, Appendix C). The soil appeared to be well drained with no presence of saturation. Although the sample point has hydrophytic vegetation, the lack of hydric soil and wetland hydrology identifies this site as upland.

4.1.11 Wetland 11 (WL11)

WL11 (Figure 13) is a large open bog located in the center of the Project Area on the east side of Fogherty Lake. The wetland is bordered on three sides by a shrub barren while Fogherty Lake borders the western boundary. One paired sampling site was recorded (labeled as WL12 on data sheets in Appendix A). The wetland was determined to contain normal site conditions.

The dominant vegetation at Data Point "WL11-WP1" is Larch in the canopy; Rhodora (*Rhododendron canadensis*), Mountain Holy and Huckleberry in the subcanopy; and Labrador Tea, Pitcher Plant and Three-leaved False Solomon's Seal in the understory (Photo 37; Appendix C). The PI was observed to be 2.6. The soil was determined to be a histosol (A1) as there was more than 40 cm of accumulated organic matter (Photo 38; Appendix C). Although surface water was not detected in the plot, soil saturation was at surface 5 cm (A3).

Larch, Red Maple and Black Spruce are the dominant species in the canopy at Data Point "WL11-UP1". Huckleberry dominates the subcanopy while Bunchberry and Black Crowberry (*Empetrum nigrum*) dominated the understory (Photo 39; Appendix C). The PI was observed to be 3.0. The substrate was found to consist of a 11 cm duff layer over rock (Photo 40, Appendix C). The area appeared to be well drained with no presence of saturation. Although the sample point has hydrophytic vegetation, the lack of hydric soil and wetland hydrology identifies this site as upland.

Wetland boundaries along the south, and north sides of WL11 were determined by an abrupt change in elevation. The boundary along the eastern and western ends of this wetland consists of a more gradual change in elevation however a distinct change in dominant vegetation and soil characteristics determined the boundary.

4.1.12 Wetland 12 (WL12)

WL12 (Figure 14) is an open bog/fen wetland approximately 0.3 ha in total area located in the central portion of the Project Area (Figure 2). One paired sampling site was recorded (labeled as WL13 on data sheets in Appendix A). The wetland was determined to contain normal site conditions although a skidder trail was noted to pass through the wetland. Upland habitat surrounding this wetland is primarily shrub barren with patches of coniferous forest.

The dominant vegetation at Data Point "WL12-WP1" cinnamon Fern in the subcanopy and Three-seeded Sedge in the understory (Photo 41; Appendix C). The PI was observed to be 2.7. The soil was determined to be a histosol (A1) as there was more than 40 cm of accumulated

organic matter (Photo 42; Appendix C). Surface water was not found to be present in the plot however the water table was at 10cm (A2), while soil saturation was at surface (A3).

The dominant species at Data Point "WL12-UP1" is Huckleberry in the subcanopy (Photo 43; Appendix C). The PI was observed to be 2.7. The substrate was found to consist of a 5 cm duff layer over rock (Photo 44, Appendix C). The area appeared to be well drained with no presence of saturation. Although the sample point has hydrophytic vegetation, the lack of hydric soil and wetland hydrology identifies this site as upland.

Wetland boundaries along the south, and north sides of WL12 were determined by an abrupt change in elevation. The boundary along the eastern and western ends of this wetland consisted of a more gradual change in elevation however a distinct change in dominant vegetation and soil characteristics determined the boundary.

4.1.13 Wetland 13 (WL13)

WL13 (Figure 15) is a treed swamp wetland approximately 0.6 ha in total area located in a depression in the landscape in the central portion of the Project Area (Figure 2). One paired sampling site was recorded (labeled as WL14 on data sheets in Appendix A). The wetland was determined to contain normal site conditions. Upland habitat surrounding this wetland consists primarily of shrub barren with patches of coniferous forest.

The dominant vegetation at Data Point "WL13-WP1" is Black Spruce and Red maple in the canopy and Mountain Holy, Wild Raisin and Cinnamon Fern in the subcanopy. Three-seeded Sedge and Wild Lily-of-the-valley dominate the understorey (Photo 45; Appendix C). The PI was observed to be 1.9. The soil was determined to be a histic epipedon (A2) as there was 20 cm of accumulated organic matter over a silt layer with a colour of 5YR 2.5/1 (Photo 46; Appendix C). Soil saturation was at surface (A3) and a strong Hydrogen Sulfide odor was detected (C1).

Black Spruce was the dominant species at Data Point "WL13-UP1' in the canopy while Green Alder, Huckleberry, Mountain Holy and Black Spruce dominate the subcanopy. Bunch Berry and Black Crowberry dominate the understory (Photo 47; Appendix C). The PI was observed to be 2.8. The substrate was found to consist of a 5 cm duff layer over rock (Photo 48, Appendix C). The area appeared to be well drained with no presence of saturation. Although the sample point has hydrophytic vegetation, the lack of hydric soil and wetland hydrology identifies this site as upland.

Wetland boundaries along all sides of WL13 were determined by an abrupt change in elevation.

4.1.14 Wetland 14 (WL14)

WL14 (Figure 16) is a fen/bog wetland complex approximately 6.2 ha in total area located along an unnamed stream in the eastern side of the Project Area (Figure 2). One paired sampling

site was recorded (labeled as WL15 on data sheets in Appendix A). The wetland was determined to contain normal site conditions. Upland habitat surrounding this wetland consists primarily of coniferous forest intermixed with shrub barren.

The dominant vegetation at Data Point "WL14-WP1" is Black Spruce and Balsam Fir in the canopy and Sweet Gale and Huckleberry in the subcanopy. Three-leaved False Solomon's Seal dominates the understorey (Photo 49; Appendix C). The PI was observed to be 2.6. The soil was determined to be a histosol (A1) as there was more than 40 cm of accumulated organic matter (Photo 50; Appendix C). Surface water was present (A1), the water table was at 5 cm (A2) and soil saturation was at surface (A3).

Black Spruce was the dominant species at Data Point "WL14-UP1' in the canopy while Black Spruce, Huckleberry and Lambkill dominate the subcanopy. Lambkill and Black Crowberry dominate the understory (Photo 51; Appendix C). The PI was observed to be 2.8. The substrate was found to consist of an 8 cm duff layer over rock (Photo 52, Appendix C). The area appeared to be well drained with no presence of saturation. Although the sample point has hydrophytic vegetation, the lack of hydric soil and wetland hydrology identifies this site as upland.

Wetland boundaries along the south, and north sides of WL14 were determined by an abrupt change in elevation. The boundary along the eastern and western ends of this wetland consisted of a more gradual change in elevation however a distinct change in dominant vegetation and soil characteristics determined the boundary.

4.1.15 Wetland 15 (WL15)

WL15 (Figure 17) is a riparian fen wetland approximately 0.07 ha in total area located along an unnamed stream in the center of the Project Area (Figure 2). One paired sampling site was recorded (labeled as WL16 on data sheets in Appendix A). The wetland was determined to contain normal site conditions. Upland habitat surrounding this wetland consists primarily of coniferous forest intermixed with shrub barren.

The dominant species at Data Point "WL15-WP1" is Black Spruce in the canopy and Sweet Gale, Cinnamon Fern and Mountain Holy in the subcanopy. Three-seeded sedge dominates the understorey (Photo 53; Appendix C). The PI was observed to be 2.7. The soil was determined to be a histosol (A1) as there was more than 40 cm of accumulated organic matter (Photo 54; Appendix C). Surface water was not present however the water table was at 10 cm (A2) and soil saturation was at surface (A3).

Black Spruce and Balsam Fir were the dominant species at Data Point "WL15-UP1' in the canopy while Lambkill is dominant in the subcanopy. Late Low-bush Blueberry (*Vaccinium angustifolium*), Bunchberry and Blackberry (*Rubus allegheniensis*) dominate the understory (Photo 55; Appendix C). The PI was observed to be 3.0. The substrate was found to consist of a 10 cm duff layer over rock (Photo 56, Appendix C). The area appeared to be well drained with

no presence of saturation. Although the sample point has hydrophytic vegetation, the lack of hydric soil and wetland hydrology identifies this site as upland.

Wetland boundaries along all sides of WL15 were determined by an abrupt change in elevation.

4.1.16 Wetland 16 (WL16)

WL16 (Figure 18) is a bog wetland approximately 0.45 ha in total area located along an unnamed stream in the center of the Project Area (Figure 2). This wetland was originally identified as two separate wetlands (WL19 and WL20 on data sheets on Appendix A) however further field investigations identified that these areas are in fact connected to form one contiguous wetland. One paired sampling site was recorded. The wetland was determined to contain normal site conditions. Upland habitat surrounding this wetland consists primarily of coniferous forest.

The dominant species at Data Point "WL16-WP1" is Black Spruce and Larch in the canopy and Lambkill and Balsam Fir in the subcanopy. Three-seeded sedge and Three-leaved False Solomon's Seal dominates the understorey (Photo 57; Appendix C). The PI was observed to be 2.6. The soil was determined to be a histosol (A1) as there was more than 40 cm of accumulated organic matter (Photo 58; Appendix C). Surface water was not present however soil saturation was at 5 cm (A3) and a strong Hydrogen Sulfide odor was detected.

Black Spruce, Red Maple and Balsam Fir were the dominant species at Data Point "WL16-UP1' in the canopy while Balsam Fir is dominant in the subcanopy. Wild Lily-of-the-valley is dominant in the understory (Photo 59; Appendix C). The PI was observed to be 2.9. The substrate was found to consist of a 16 cm duff layer over a 3 cm sand Ae horizon with a colour of 10YR 5/2, over rock (Photo 60, Appendix C). The area appeared to be well drained with no presence of saturation. Although the sample point has hydrophytic vegetation, the lack of hydric soil and wetland hydrology identifies this site as upland.

Wetland boundaries along the north and south sides of WL16 were determined by an abrupt change in elevation. The boundary along the eastern and western ends of this wetland consisted of a more gradual change in elevation however a distinct change in dominant vegetation and soil characteristics determined the boundary.

4.1.17 Wetland 17 (WL17)

WL17 (Figure 19) is a bog/Swamp wetland complex approximately 0.74 ha in total area located along the proposed access road to the Site (Figure 2). One paired sampling site was recorded (labeled as WL21 on the data sheets in Appendix A). The wetland was determined to contain normal site conditions. Upland habitat surrounding this wetland consists primarily of coniferous forest.

The dominant species at Data Point "WL17-WP1" is Black Spruce in the canopy. Leatherleaf, Rhodora, Balsam Fir and Black Spruce dominate the subcanopy. White-beaked Rush and

Three-leaved False Solomon's Seal dominate the understorey (Photo 61; Appendix C). The PI was observed to be 1.6. The soil was determined to be a histosol (A1) as there was more than 40 cm of accumulated organic matter (Photo 62; Appendix C). Surface water was not present however soil saturation was at surface (A3) and the water table was at 10cm (A2).

Black Spruce and Balsam Fir were the dominant species at Data Point "WL17-UP1' in the canopy and subcanopy. Lambkill is dominant in the understory (Photo 63; Appendix C). The PI was observed to be 2.6. The substrate was found to consist of a 10 cm duff layer over a 6 cm silt loam Ae horizon with a colour of 10YR 6/2, overtop a 5 cm clay loam B horizon with a colour of 7.5YR 5/4, over rock (Photo 64, Appendix C). The area appeared to be well drained with no presence of saturation. Although the sample point has hydrophytic vegetation, the lack of hydric soil and wetland hydrology identifies this site as upland.

Wetland boundaries along the north and south sides of WL17 were determined by an abrupt change in elevation. The boundary along the eastern and western ends of this wetland consisted of a more gradual change in elevation however a distinct change in dominant vegetation and soil characteristics determined the boundary.

4.1.18 Wetland 18 (WL18)

WL18 (Figure 20) is a bog wetland approximately 0.07 ha in total area located along the proposed access road to the Site (Figure 2). One paired sampling site was recorded (labeled as WL22 on the data sheets in Appendix A). The wetland was determined to contain normal site conditions. Upland habitat surrounding this wetland consists primarily of coniferous forest.

The dominant species at Data Point "WL18-WP1" is Black Spruce in the canopy and subcanopy. Three-leaved False Solomon's Seal, Bunchberry, Three-seeded Sedge and Cinnamon Fern dominate the understorey (Photo 65; Appendix C). The PI was calculated to be 2.3. The soil was determined to be a histosol (A1) as there was more than 40 cm of accumulated organic matter (Photo 66; Appendix C). Surface water was not present however soil saturation was at surface (A3) and the water table was at 10cm (A2).

Black Spruce was the dominant species at Data Point "WL18-UP1" in the canopy while Lambkill and Huckleberry dominate the subcanopy. Bunchberry is dominant in the understory (Photo 67; Appendix C). The PI was observed to be 2.9. The substrate was found to consist of a 10 cm duff layer over a 5 cm silt loam Ae horizon with a colour of 10YR 5/2, over rock (Photo 68, Appendix C). The area appeared to be well drained with no presence of saturation. Although the sample point has hydrophytic vegetation, the lack of hydric soil and wetland hydrology identifies this site as upland.

Wetland boundaries along the north, east and south sides of WL18 were determined by an abrupt change in elevation. The boundary along the western ends of this wetland consisted of a more gradual change in elevation however a distinct change in dominant vegetation and soil characteristics determined the boundary.

4.1.19 Wetland 19 (WL19)

WL19 (Figure 21) is a bog wetland approximately 0.04 ha in total area located along the proposed access road to the Site (Figure 2). One paired sampling site was recorded (labeled as WL23 on the data sheets in Appendix A). The wetland was determined to contain normal site conditions. Upland habitat surrounding this wetland consists primarily of coniferous forest.

The dominant species at Data Point "WL19-WP1" is Larch in the canopy. The dominant species in the subcanopy include Huckleberry, Mountain Holy and Baltic Rush (*Juncus arcticus*). Deer Grass, White-beaked Rush and Pitcher Plant dominate the understorey (Photo 69; Appendix C). The PI was calculated to be 1.3. The soil was determined to be a histosol (A1) as there was more than 40 cm of accumulated organic matter (Photo 70; Appendix C). Surface water was not present however soil saturation was at surface (A3) and the water table was at 10cm (A2).

Huckleberry was the dominant species at Data Point "WL19-UP1" in the subcanopy while Lambkill and Black Crowberry is dominant in the understory (Photo 71; Appendix C). The PI was observed to be 3.0. The substrate was found to consist of a 5 cm duff layer over rock (Photo 72, Appendix C). The area appeared to be well drained with no presence of saturation. Although the sample point has hydrophytic vegetation, the lack of hydric soil and wetland hydrology identifies this site as upland.

Wetland boundaries along the north, east and south sides of WL19 were determined by an abrupt change in elevation. The boundary along the western ends of this wetland consisted of a more gradual change in elevation however a distinct change in dominant vegetation and soil characteristics determined the boundary.

4.1.20 Wetland 20 (WL20)

WL20 (Figure 22) is a bog wetland approximately 0.15 ha in total area located along the proposed access road to the Site (Figure 2). One paired sampling site was recorded (labeled as WL24 on the data sheets in Appendix A). The wetland was determined to contain normal site conditions. Upland habitat surrounding this wetland consists primarily of coniferous forest.

The dominant species at Data Point "WL20-WP1" is Larch in the canopy. The dominant species in the subcanopy include Huckleberry, Mountain Holy, Sweet Gale and Wild Raisin. Deer Grass and Pitcher Plant dominate the understorey (Photo 73; Appendix C). The PI was calculated to be 2.0. The soil was determined to be a Black Histic (A3) as there was 20 cm of accumulated organic matter accumulated over a 10 cm loam sand horizon with a colour of 10YR 5/2 (Photo 74; Appendix C). Surface water was not present however soil saturation was at surface (A3).

Larch and Black Spruce were the dominant species at Data Point "WL20-UP1" in the canopy. Huckleberry, Wild Raisin and Rhodora were dominants in the subcanopy while Late Low-bush Blueberry is dominant in the understory (Photo 75; Appendix C). The PI was observed to be 3.0. The substrate was found to consist of a 10 cm duff layer over rock (Photo 76, Appendix C).

The area appeared to be well drained with no presence of saturation. Although the sample point has hydrophytic vegetation, the lack of hydric soil and wetland hydrology identifies this site as upland.

Wetland boundaries along the north and south sides of WL20 were determined by an abrupt change in elevation. The boundary along the western ends of this wetland consisted of a more gradual change in elevation however a distinct change in dominant vegetation and soil characteristics determined the boundary.

4.1.21 Wetland 21 (WL21)

WL21 (Figure 23) is a Fen wetland approximately 0.19 ha in total area located close the coast at the northeast end of the Project Area (Figure 2). One paired sampling site was recorded (labeled as WL25 on the data sheets in Appendix A). The wetland was determined to contain normal site conditions. Upland habitat surrounding this wetland consists primarily of coniferous forest to the south and cobble/gravel/sand beach to the north.

Balsam Fir, White Spruce and Red Maple are the dominant species at Data Point "WL21-WP1" in the canopy. The dominant species in the subcanopy include Black Choke Berry and Lambkill. Bunchberry, Tawny Cotton-grass (*Eriophorum virgincum*), Bog Aster, and Soft Rush (*Juncus effuses*) dominate the understorey (Photo 77; Appendix C). The PI was calculated to be 2.5. The soil was determined to be a Histosol (A1) as there was 30 cm of accumulated organic matter accumulated over bedrock (Photo 78; Appendix C). Surface water was not present however soil saturation was at 5 cm (A3).

Balsam Fir and White Spruce were the dominant species at Data Point "WL21-UP1" in the canopy. Balsam Fir, Mountain Ash, Green Alder, and White Birch were dominants in the subcanopy while Bunchberry, Mountain Woodfern, Blackberry, and Mountain Cranberry are dominant in the understory (Photo 79; Appendix C). The PI was observed to be 3.1. The substrate was found to consist of a 10 cm duff layer over a 20 cm sand loam B horizon (10YR 3/6), over rock (Photo 80, Appendix C). The area appeared to be well drained with no presence of saturation. The lack of hydophytic vegetation, hydric soil and wetland hydrology identifies this site as upland.

Wetland boundaries along the west, east and south sides of WL21 were determined by an abrupt change in elevation. The boundary along the northern side of this wetland was determined by the presence of the beach.

4.1.22 Wetland 22 (WL22)

WL22 (Figure 24) is a Fen wetland approximately 0.1 ha in total area located along an unnamed stream in the northeast end of the Project Area (Figure 2). One paired sampling site was recorded (labeled as WL26 on the data sheets in Appendix A). The wetland was determined to contain normal site conditions. Upland habitat surrounding this wetland consists primarily of coniferous forest.

Balsam Fir and White Spruce are the dominant species at Data Point "WL22-WP1" in the canopy. The dominant species in the subcanopy include Black Choke Berry, Green Alder and Leatherleaf. Bog Aster, Canada Bluejoint (*Calamagrostis canadensis*) and Swamp Loosestrife (*Lysmachia terrestris*) dominate the understorey (Photo 81; Appendix C). The PI was calculated to be 1.4. The soil was determined to be a Histosol (A1) as there was over 40 cm of accumulated organic matter accumulated (Photo 82; Appendix C). Surface water was not present however soil saturation was at 3 cm (A3) and Hydrogen Sulfide odor was detected (C1).

White Spruce was the dominant species at Data Point "WL22-UP1" in the canopy. Balsam Fir, Mountain Ash and White Birch were determined to be dominants in the subcanopy while Bunchberry and Mountain Woodfern are dominant in the understory (Photo 83; Appendix C). The PI was observed to be 3.1. The substrate was found to consist of a 15 cm duff layer over a 10 cm silt loam B horizon (7.5YR 3/3) (Photo 84, Appendix C). The area appeared to be well drained with no presence of saturation. The lack of hydophytic vegetation, hydric soil and wetland hydrology identifies this site as upland.

Wetland boundaries along all sides of WL22 were determined by an abrupt change in elevation.

4.2 Functional Assessments

The resulting description of wetland functions will provide the baseline for further assessment and monitoring of project impacts. The description of wetland functions is intended to be conservative. Completed assessment forms are located in Appendix D.

4.2.1 Ecological Characterization

The Project occurs with the tertiary watershed (1EQ-SD) within which covers approximately 518 km^2 and encompasses the land east of the Project site to the eastern end of Guysborough County and extends west of the Project site to the community of Goldboro. Land cover within the majority of this watershed is forested and open natural areas (e.g. barrens) with a combined coverage of approximately 86% of tertiary watershed 1EQ-SD. Wetlands also constitute a relatively moderate component of this wetland covering approximately 11% of the total area. Anthropogenic development in this area is relatively low with residential, gravel pits, roads and landfills combining for a total coverage of approximately 7% of the tertiary land cover.

Forestry is the greatest stress within the tertiary watershed where large clear cut and partial cut blocks are noted to occur throughout the area. The overall watershed condition is relatively unaltered with a low percentage of impervious surfaces. The reliance on individual wetlands to contribute to flood water detention is moderate given the proportion of total wetland area in this watershed.

Land cover in the Project area consists primarily of coniferous / mixed forest in various successional stages intermixed with open shrub dominated areas and wetlands. A number of small streams are located within the Project area, the largest occurring in the southwestern end

which flows south through WL1 before connecting to Indian Cove Creek. Fish surveys conducted within the small streams in the Project Area as well as Fogherty Lake (also occurring on the Project Area) found no fish species present which may be attributed to the very low pH of the surface water present onsite.

Vegetation surveys conducted during previous years and supplemented during the 2014 field surveys indicated that no plant species at risk listed under the federal Species at Risk Act (SARA) or Nova Scotia Endangered Species Act (NSESA) were recorded in the Project area. One plant species of conservation concern, Northern Comandra (*Geocaulon lividum* – ACCDC rank; S3) was recorded in wetland 22 (WL22). Southern Twayblade (*Listera australis* – ACCDC rank; S2) was also found along two watercourses in the west side of the Project Area. three lichen species of conservation concern were also noted in many of the wetlands within the Project Area including; Black-footed Reindeer Lichen (*Cladonia stygia* – Canada General Status rank; 3: ACCDC rank; S2S3), Naked Kidney Lichen (*Nephroma bellum* – Canada General Status rank; 3: ACCDC rank; S3?) and Coastal Bushy Beard Lichen (*Usnea flammea* – Canada General Status rank; 3: ACCDC rank; S2S3).

Surface hydrology in the area flows in two major directions on the property. The western and northern portion of the site drains in a northerly direction towards the ocean, while the central and southeastern section of the site flows in a southeast direction into Indian Cove Creek. A small portion of the eastern edge of the Project Area also flows in an easterly direction towards Murphy's Lake and eventually to the ocean.

Groundwater flow is inferred to follow similar directional flow as surface drainage patterns. Based on various characteristics such as wetland soils, land use in the subwatershed upstream, topographic relief surrounding wetlands and hydroperiod of wetland, 16 of the 22 wetlands assessed are likely groundwater discharge sites. Wetlands 9, 11, 16, 19 and 20 were found to potentially serve as groundwater recharge sites. Wetland 9 and 10 are relatively large in size however the groundwater flow path originating from these wetlands flows toward the ocean with no downstream users identified. A total of 16 wells are recorded in the NS well log database, however given the relative small size of wetlands 16, 19 and 20, the location of wetlands 9 and 11 relative to potable water wells and since the remaining wetlands in the Project area are likely discharge wetlands, it is unlikely that the Project impacts on wetlands will have any significant impact on the ground water flow regime and potable water wells of the area.

4.2.2 Significant Wetland Functions

The functional assessments conducted for the 22 wetlands located within the Project site determined that the overall watershed condition within which these wetlands are located is in a relatively unaltered state with wetland habitat covering approximately 11% of the total land area of the watershed. The buffer area surrounding these wetlands is fully vegetated and relatively unaltered providing high quality wildlife habitat and water quality functions. All wetlands assessed were determined to provide high floristic quality where the plant community is composed of native species characteristic of the wetland type with a very minor component of non-native species. Table 4.3 presents and summary of the various significant functions each

wetland was assessed to provide (see Appendix D for more details regarding the functional assessments).

Table 4.3: Wetland Functional Assessment Summary

Significant Function	WL1	WL2	WL3	WL4	WL5	WL6	WL7	WL8	WL9	WL10	WL11	WL12	WL13	WL14	WL15	WL16	WL17	WL18	WL19	WL20	WL21	WL22
SF1-Watershed condition (H-Significantly modified, M-Modified, L-Relatively unaltered)	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
SF2-Proportion of WL area in watershed & opportunity for floodwater detention (H,M,L)	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
SF3-Rate the general wetland condition/integrity (H,M,L)	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
SF4-Rate the overall condition and integrity land adjacent to wetland (H,M,L)	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
SF5-Is the WL a WSS? (Y/N)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF6-Does the WL support commercial/recreational fish/shellfish? (Y/N)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
**SF7-Species of concern (Fed/Prov)? Specify.*	S2	N	N	N	N	N	N	S2	N	S3	S2	S2	N	N	N	N	S2	S2,S3	S2	S2	N	N
SF8-Wetland has conservation/ compensation agreements/activity? (Y/N)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF9-Wetland is calcerous fen, black ash or cedar swamp? (Y/N)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF10-Within Drinking Water Protected Area (designated watershed/wellfield) (Y/N)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF11-WL within a floodplain and upstream of or within of a populated area? (Y/N)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF12-Fed/Prov/Municipal area of interest? (Y/N)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF13-WL hydrologic condition	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT
SF14-WL important for maintaining stream flow? (Y/N)	Y	N	Y	N	N	Y	N	Y	N	N	N	N	N	Y	N	N	Y	N	N	N	N	N
SF15-WL ability to detain surface water (H,M,L)	M	H	M	M	M	M	M	M	M	M	M	M	M	H	M	M	H	M	M	M	M	M
SF16-Wetland improves water quality? (Y/N)	Y	Y	Y	N	N	Y	Y	Y	N	Y	N	N	N	Y	Y	N	Y	N	N	N	Y	Y
SF17-Evidence of excess nutrient loading/ contamination? (H,M,L)	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
SF18-WL contributes to water quality in downstream resources (H,M,L)	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
SF19-WL serves as a recharge site (Y/N)	N	N	N	N	N	N	N	N	Y	N	Y	N	N	N	N	Y	N	Y	Y	Y	N	N

Significant Function	WL1	WL2	WL3	WL4	WL5	WL6	WL7	WL8	WL9	WL10	WL11	WL12	WL13	WL14	WL15	WL16	WL17	WL18	WL19	WL20	WL21	WL22
SF20-WL serves as a discharge site (Y/N)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SF21-WL ability to stabilize shoreline (H,M,L)	M	H	L	L	L	L	M	M	L	M	L	L	L	M	M	L	L	L	L	L	L	M
SF22-Is the plant community unique or rare regionally or provincially? (Y/N)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF23-Does the WL contain a diversity of plant communities (H,M,L)	H	H	L	L	M	L	L	H	M	L	M	L	L	M	L	L	M	M	M	M	L	L
SF24-Rate the overall integrity/quality of plant community? (H,M,L)	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
**SF25-Are there any observed rare or endangered plant species? Specify.*	S2	N	N	N	N	N	N	S2	N	S3	S2	S2	N	N	N	N	S2	S2,S3	S2	S2	N	N
SF26-Does wetland support fish/fish habitat? (Y/N)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
**SF27-Rare or endangered fish/wildlife species found in the wetland?*	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF28-Overall fish and wildlife habitat quality (H,M,L)	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
SF29-Rate the wetland's community use/ value (H,M,L)	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L

Notes:

* SF7/SF25/SF27 is considered a red rated function if a species present is listed by SARA or NSESA as Endangered/Threatened/Special Concern; NSDNR - Red listed; or Ranked by ACCDC as S1

Cells highlighted in red indicate this function is considered to be critical to the watershed or represent a highly degraded watershed. These functions are typically unique or rare or associated with a high risk to the watershed if lost (NSE 2014).

Unless otherwise stated: H=High; M=Moderate/Medium; L=Low; Y=Yes; N=No; NAT=Natural

4.2.2.1 Wetland 1 (WL1)

WL1 is characterized as a wetland complex comprised of a mix of bog and swamp types. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated (SF3 and SF4). The buffer zone surrounding the wetland provides high quality wildlife habitat and water quality function.

This wetland is important in maintaining stream flow of the unnamed stream that flows along the east side of the Project area (SF14). The hydrologic condition of this wetland is considered natural with a moderate ability to detain surface water (SF15). The wetland was also determined to improve water quality (SF16) with little evidence of excess nutrient loading or contamination (SF17).

The plant community in this wetland was determined to be relatively intact with high species diversity and little to no influence of invasive/non-native species. This complex consists of a number of different wetland types and as such it is considered to have a high diversity of high quality vegetation communities (SF23 and SF24). One lichen species of conservation concern, Black-footed Reindeer Lichen (*Cladonia stygia* – ACCDC rank; S2S3) was recorded in WL1.

The wetland may provide moderate habitat to amphibians, reptiles and mammals. This wetland may provide open aesthetic functions as well as berry picking and plant gathering opportunities as it is somewhat accessible to the public via the power line transmission corridor (SF29).

Red rated significant functions provided by this wetland includes maintaining stream flow in a first/second order stream.

4.2.2.2 Wetland 2 (WL2)

WL2 is characterized as a wetland complex comprised of marsh, fen and swamp wetland types. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated (SF3 and SF4). The buffer zone surrounding the wetland provides high quality wildlife habitat and water quality function. This wetland borders a small pond at the northern boundary located behind a barrier beach. This area does receive periodic salt water influx during storm events, however the vegetation present in this wetland indicate that this is a fresh water pond.

The hydrologic condition of this wetland is considered natural with a high ability to detain surface water (SF15). The wetland was also determined to improve water quality (SF16) with little evidence of excess nutrient loading or contamination (SF17). Given the location of this wetland within the landscape, it provides a high ability to stabilize the shoreline (SF21) in particular during storm events.

The plant community in this wetland was determined to be relatively intact with high species diversity and little to no influence of invasive/non-native species. This complex consists of a number of different wetland types and as such it is considered to have a high diversity of high quality vegetation communities (SF23 and SF24).

The wetland may provide moderate habitat to amphibians, reptiles and mammals (SF28). This wetland may provide open aesthetic functions however since this wetland is not readily accessible by the public, community use functions are assessed as low (SF29).

Red rated significant functions provided by this wetland include stabilizing the shoreline (SF21).

4.2.2.3 Wetland 3 (WL3)

WL3 is characterized as a sloped throughflow fen wetland. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated (SF3 and SF4). The buffer zone surrounding the wetland provides high quality wildlife habitat and water quality function.

This wetland is important in maintaining stream flow of the unnamed stream that flows through this wetland (SF14). The hydrologic condition of this wetland is considered natural with a moderate ability to detain surface water (SF15). The wetland was also determined to improve water quality (SF16) with little evidence of excess nutrient loading or contamination (SF17).

The plant community in this wetland was determined to be relatively intact with moderate species diversity and little to no influence of invasive/non-native species. Although this wetland contains low diversity of plant communities, the community present is of high quality (SF23 and SF24).

The wetland may provide moderate habitat to amphibians, reptiles and mammals (SF28). This wetland may provide open aesthetic functions however since this wetland is not readily accessible by the public, community use functions are assessed as low (SF29).

Red rated significant functions provided by this wetland includes maintaining stream flow in a first/second order stream.

4.2.2.4 Wetland 4 (WL4)

WL4 is characterized as an isolated treed bog wetland. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated (SF3 and SF4). The buffer zone surrounding the wetland provides high quality wildlife habitat and water quality function.

The hydrologic condition of this wetland is considered natural (SF13) with little evidence of excess nutrient loading or contamination (SF17).

The plant community in this wetland was determined to be relatively intact with low species diversity but little to no influence of invasive/non-native species. This wetland is considered to have a low diversity of plant communities, however the vegetation community present is considered of high quality (SF23 and SF24).

The wetland may provide moderate habitat to amphibians, reptiles and mammals. This wetland is not readily available to the public and as such provides low community use value (SF29).

No red rated significant functions were assessed for this wetland.

4.2.2.5 Wetland 5 (WL5)

WL5 is characterized as a sloped throughflow fen wetland. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated (SF3 and SF4). The buffer zone surrounding the wetland provides high quality wildlife habitat and water quality function.

The hydrologic condition of this wetland is considered natural with a moderate ability to detain surface water (SF15). The wetland was also determined to improve water quality (SF16) with little evidence of excess nutrient loading or contamination (SF17).

The plant community in this wetland was determined to be relatively intact with moderate species diversity and little to no influence of invasive/non-native species. Although this wetland contains low diversity of plant communities, the community present is of high quality (SF23 and SF24).

The wetland may provide moderate habitat to amphibians, reptiles and mammals (SF28). This wetland may provide open aesthetic functions however since this wetland is not readily accessible by the public, community use functions are assessed as low (SF29).

No red rated functions were assessed for this wetland.

4.2.2.6 Wetland 6 (WL6)

WL6 is characterized as an outflow bog wetland. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated (SF3 and SF4). The buffer zone surrounding the wetland provides high quality wildlife habitat and water quality function.

This wetland is important in maintaining stream flow of the unnamed stream that originates from the west and east ends of this wetland (SF14). The hydrologic condition of this wetland is

considered natural with a moderate ability to detain surface water (SF15). The wetland was also determined to improve water quality (SF16) with little evidence of excess nutrient loading or contamination (SF17).

The plant community in this wetland was determined to be relatively intact with moderate species diversity and little to no influence of invasive/non-native species. Although this wetland contains low diversity of plant communities, the community present is of high quality (SF23 and SF24).

The wetland may provide moderate habitat to amphibians, reptiles and mammals (SF28). This wetland is not readily available to the public and as such provides low community use value (SF29).

Red rated significant functions provided by this wetland includes maintaining stream flow in a first/second order stream.

4.2.2.7 Wetland 7 (WL7)

WL7 is characterized as a throughflow swamp wetland. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated (SF3 and SF4). The buffer zone surrounding the wetland provides high quality wildlife habitat and water quality function.

The hydrologic condition of this wetland is considered natural with a moderate ability to detain surface water (SF15). The wetland was also determined to improve water quality (SF16) with little evidence of excess nutrient loading or contamination (SF17).

The plant community in this wetland was determined to be relatively intact with low species diversity and little to no influence of invasive/non-native species. Although this wetland contains low diversity of plant communities, the community present is of high quality (SF23 and SF24).

The wetland may provide moderate habitat to amphibians, reptiles and mammals (SF28). This wetland is not readily available to the public and as such provides low community use value (SF29).

No red rated significant functions were assessed for this wetland.

4.2.2.8 Wetland 8 (WL8)

WL8 is characterized as a wetland complex comprised of a mix of bog, fen and swamp types. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated (SF3 and SF4). The buffer zone surrounding the wetland provides high quality wildlife habitat and water quality function.

This wetland is important in maintaining stream flow of the unnamed stream that flows along the east side of the Project area (SF14). The hydrologic condition of this wetland is considered natural with a moderate ability to detain surface water (SF15). The wetland was also determined to improve water quality (SF16) with little evidence of excess nutrient loading or contamination (SF17).

The plant community in this wetland was determined to be relatively intact with high species diversity and little to no influence of invasive/non-native species. This complex consists of a number of different wetland types and as such it is considered to have a high diversity of high quality vegetation communities (SF23 and SF24). Two lichen species of conservation concern, Black-footed Reindeer Lichen (*Cladonia stygia* – ACCDC rank; S2S3) and Coastal Bushy Heard Lichen (*Usnea flammea* – ACCDC rank; S2S3) were recorded in WL8.

The wetland may provide moderate habitat to amphibians, reptiles and mammals. This wetland may provide open aesthetic functions as well as berry picking and plant gathering opportunities however since this wetland is not readily accessible by the public, community use functions are assessed as low (SF29).

Red rated significant functions provided by this wetland includes maintaining stream flow in a first/second order stream (SF14). The Bog Portion of this wetland may also serve as a groundwater recharge site (SF19).

4.2.2.9 Wetland 9 (WL9)

WL9 is characterized as an isolated domed bog wetland. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated (SF3 and SF4). The buffer zone surrounding the wetland provides high quality wildlife habitat and water quality function.

The hydrologic condition of this wetland is considered natural (SF13) with little evidence of excess nutrient loading or contamination (SF17). Where this wetland is a large isolated bog with no visible inlet or outlet it may serve as a groundwater recharge site (SF19).

The plant community in this wetland was determined to be relatively intact with moderate species diversity and little to no influence of invasive/non-native species. This wetland is considered to have a moderate diversity of high quality plant communities (SF23 and SF24). One lichen species of conservation concern, Black-footed Reindeer Lichen (*Cladonia stygia* – ACCDC rank; S2S3) was recorded in WL9.

The wetland may provide moderate habitat to amphibians, reptiles and mammals. This wetland may provide open aesthetic functions as well as berry picking and plant gathering opportunities however since this wetland is not readily accessible by the public, community use functions are assessed as low (SF29).

Red rated significant functions provided by this wetland includes potentially serving as a groundwater recharge site (SF19).

4.2.2.10 Wetland 10 (WL10)

WL10 is characterized as a throughflow treed swamp wetland. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated (SF3 and SF4). The buffer zone surrounding the wetland provides high quality wildlife habitat and water quality function.

The hydrologic condition of this wetland is considered natural with a moderate ability to detain surface water (SF15). The wetland was also determined to improve water quality (SF16) with little evidence of excess nutrient loading or contamination (SF17).

The plant community in this wetland was determined to be relatively intact with low species diversity and little to no influence of invasive/non-native species. Although this wetland contains low diversity of plant communities, the community present is of high quality (SF23 and SF24). One lichen species of conservation concern, Naked Kidney Lichen (*Nephroma bellum* – ACCDC rank; S3?) was recorded in WL10.

The wetland may provide moderate habitat to amphibians, reptiles and mammals (SF28). This wetland is not readily available to the public and as such provides low community use value (SF29).

No red rated significant functions were assessed for this wetland.

4.2.2.11 Wetland 11 (WL11)

WL11 is characterized as an isolated domed bog wetland. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated (SF3 and SF4). The buffer zone surrounding the wetland provides high quality wildlife habitat and water quality function.

The hydrologic condition of this wetland is considered natural (SF13) with little evidence of excess nutrient loading or contamination (SF17). Since this wetland is a large isolated bog with no visible inlet or outlet it may serve as a groundwater recharge site (SF19).

The plant community in this wetland was determined to be relatively intact with moderate species diversity and little to no influence of invasive/non-native species. This wetland is considered to have a moderate diversity of high quality plant communities (SF23 and SF24). One lichen species of conservation concern, Black-footed Reindeer Lichen (*Cladonia stygia* – ACCDC rank; S2S3) was recorded in WL11.

The wetland may provide moderate habitat to amphibians, reptiles and mammals. This wetland may provide open aesthetic functions as well as berry picking and plant gathering opportunities however since this wetland is not readily accessible by the public, community use functions are assessed as low (SF29).

Red rated significant functions provided by this wetland includes potentially serving as a groundwater recharge site (SF19).

4.2.2.12 Wetland 12 (WL12)

WL12 is characterized as an outflow bog / fen wetland. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated (SF3 and SF4). The buffer zone surrounding the wetland provides high quality wildlife habitat and water quality function.

The hydrologic condition of this wetland is considered natural with a moderate ability to detain surface water (SF15). The wetland was also determined to improve water quality (SF16) with little evidence of excess nutrient loading or contamination (SF17).

The plant community in this wetland was determined to be relatively intact with moderate species diversity and little to no influence of invasive/non-native species. Although this wetland contains low diversity of plant communities, the community present is of high quality (SF23 and SF24). One lichen species of conservation concern, Coastal Bushy Beard Lichen (*Usnea flammea* – ACCDC rank; S2S3) was recorded in WL12.

The wetland may provide moderate habitat to amphibians, reptiles and mammals (SF28). This wetland is not readily available to the public and as such provides low community use value (SF29).

No red rated significant functions were assessed for this wetland.

4.2.2.13 Wetland 13 (WL13)

WL13 is characterized as an isolated treed swamp wetland. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated (SF3 and SF4). The buffer zone surrounding the wetland provides high quality wildlife habitat and water quality function.

The hydrologic condition of this wetland is considered natural (SF13) with little evidence of excess nutrient loading or contamination (SF17).

The plant community in this wetland was determined to be relatively intact with low species diversity but little to no influence of invasive/non-native species. This wetland is considered to have a low diversity of plant communities, however the vegetation community present is considered of high quality (SF23 and SF24).

The wetland may provide moderate habitat to amphibians, reptiles and mammals. This wetland is not readily available to the public and as such provides low community use value (SF29).

No red rated significant functions were assessed for this wetland.

4.2.2.14 Wetland 14 (WL14)

WL14 is characterized as a wetland complex comprised of a mix of bog and fen types. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated (SF3 and SF4). The buffer zone surrounding the wetland provides high quality wildlife habitat and water quality function.

This wetland is important in maintaining stream flow of the unnamed stream that flows through the wetland to the southeast (SF14). The hydrologic condition of this wetland is considered natural with a high ability to detain surface water (SF15). The wetland was also determined to improve water quality (SF16) with little evidence of excess nutrient loading or contamination (SF17). The wetland also provides a significant flood/stormwater attenuation function for the surrounding landscape.

The plant community in this wetland was determined to be relatively intact with moderate species diversity and little to no influence of invasive/non-native species. This complex consists of a number of different wetland types and as such it is considered to have a moderate diversity of high quality vegetation communities (SF23 and SF24).

The wetland may provide moderate habitat to amphibians, reptiles and mammals. This wetland is not readily available to the public and as such provides low community use value (SF29).

Red rated significant functions provided by this wetland includes maintaining stream flow in a first/second order stream.

4.2.2.15 Wetland 15 (WL15)

WL15 is characterized as a sloped throughflow fen wetland. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated (SF3 and SF4). The buffer zone surrounding the wetland provides high quality wildlife habitat and water quality function.

The hydrologic condition of this wetland is considered natural with a moderate ability to detain surface water (SF15). The wetland was also determined to improve water quality (SF16) with little evidence of excess nutrient loading or contamination (SF17).

The plant community in this wetland was determined to be relatively intact with moderate species diversity and little to no influence of invasive/non-native species. Although this wetland contains low diversity of plant communities, the community present is of high quality (SF23 and SF24).

The wetland may provide moderate habitat to amphibians, reptiles and mammals (SF28). This wetland is not readily available to the public and as such provides low community use value (SF29).

No red rated significant functions were assessed for this wetland.

4.2.2.16 Wetland 16 (WL16)

WL16 is characterized as an isolated bog wetland. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated (SF3 and SF4). The buffer zone surrounding the wetland provides high quality wildlife habitat and water quality function.

The hydrologic condition of this wetland is considered natural (SF13) with little evidence of excess nutrient loading or contamination (SF17). Since this wetland is an isolated bog with no visible inlet or outlet it may serve as a groundwater recharge site (SF19).

The plant community in this wetland was determined to be relatively intact with moderate species diversity and little to no influence of invasive/non-native species. This wetland is considered to have a low diversity of plant communities, however the vegetation community present is considered to be of high quality (SF23 and SF24).

The wetland may provide moderate habitat to amphibians, reptiles and mammals. This wetland is not readily available to the public and as such provides low community use value (SF29).

Red rated significant functions provided by this wetland includes potentially serving as a groundwater recharge site (SF19).

4.2.2.17 Wetland 17 (WL17)

WL17 is characterized as an outflow bog / swamp wetland complex. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated (SF3 and SF4). The buffer zone surrounding the wetland provides high quality wildlife habitat and water quality function.

This wetland is important in maintaining stream flow of the unnamed stream that flows of the wetland at the southwest end (SF14). The hydrologic condition of this wetland is considered natural with a high ability to detain surface water (SF15). The wetland was also determined to improve water quality (SF16) with little evidence of excess nutrient loading or contamination (SF17).

The plant community in this wetland was determined to be relatively intact with moderate species diversity and little to no influence of invasive/non-native species. This wetland contains a moderate diversity of high quality plant communities (SF23 and SF24). Two lichen species of conservation concern, Coastal Bushy Beard Lichen (*Usnea flammea* – ACCDC rank; S2S3) and Naked Kidney Lichen (*Nephroma bellum* – ACCDC rank S3?) was recorded in WL17.

The wetland may provide moderate habitat to amphibians, reptiles and mammals (SF28). This wetland is not readily available to the public and as such provides low community use value (SF29).

Red rated significant functions provided by this wetland includes maintaining stream flow in a first/second order stream.

4.2.2.18 Wetland 18 (WL18)

WL18 is characterized as an isolated bog wetland. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated (SF3 and SF4). The buffer zone surrounding the wetland provides high quality wildlife habitat and water quality function.

The hydrologic condition of this wetland is considered natural (SF13) with little evidence of excess nutrient loading or contamination (SF17). Since this wetland is an isolated bog with no visible inlet or outlet it may serve as a groundwater recharge site (SF19).

The plant community in this wetland was determined to be relatively intact with moderate species diversity and little to no influence of invasive/non-native species. This wetland contains a moderate diversity of high quality plant communities (SF23 and SF24). One plant species of conservation concern, Northern Comandra (*Geocaulon lividum* – ACCDC rank; S3) was recorded in WL18. One lichen species of conservation concern, Black-footed Reindeer Lichen (*Cladonia stygia* – ACCDC rank; S2S3) was also recorded in WL18.

The wetland may provide moderate habitat to amphibians, reptiles and mammals. This wetland is not readily available to the public and as such provides low community use value (SF29).

Red rated significant functions provided by this wetland includes potentially serving as a groundwater recharge site (SF19).

4.2.2.19 Wetland 19 (WL19)

WL19 is characterized as an isolated bog wetland. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated (SF3 and SF4). The buffer zone surrounding the wetland provides high quality wildlife habitat and water quality function.

The hydrologic condition of this wetland is considered natural (SF13) with little evidence of excess nutrient loading or contamination (SF17). Since this wetland is an isolated bog with no visible inlet or outlet it may serve as a groundwater recharge site (SF19).

The plant community in this wetland was determined to be relatively intact with moderate species diversity and little to no influence of invasive/non-native species. This wetland contains a moderate diversity of high quality plant communities (SF23 and SF24). One lichen species of conservation concern, Black-footed Reindeer Lichen (*Cladonia stygia* – ACCDC rank; S2S3) was recorded in WL19.

The wetland may provide moderate habitat to amphibians, reptiles and mammals. This wetland is not readily available to the public and as such provides low community use value (SF29).

Red rated significant functions provided by this wetland includes potentially serving as a groundwater recharge site (SF19).

4.2.2.20 Wetland 20 (WL20)

WL20 is characterized as an isolated bog wetland. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated (SF3 and SF4). The buffer zone surrounding the wetland provides high quality wildlife habitat and water quality function.

The hydrologic condition of this wetland is considered natural (SF13) with little evidence of excess nutrient loading or contamination (SF17). Since this wetland is an isolated bog with no visible inlet or outlet it may serve as a groundwater recharge site (SF19).

The plant community in this wetland was determined to be relatively intact with moderate species diversity and little to no influence of invasive/non-native species. This wetland contains a moderate diversity of high quality plant communities (SF23 and SF24). One lichen species of conservation concern, Black-footed Reindeer Lichen (*Cladonia stygia* – ACCDC rank; S2S3) was recorded in WL20.

The wetland may provide moderate habitat to amphibians, reptiles and mammals. This wetland is not readily available to the public and as such provides low community use value (SF29).

Red rated significant functions provided by this wetland includes potentially serving as a groundwater recharge site (SF19).

4.2.2.21 Wetland 21 (WL21)

WL21 is characterized as a sloped inflow fen wetland. Although there is no outflow channel present, outflow from this wetland likely occurs under/through the boulder cobble beach located along the northern boundary of this wetland. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated (SF3 and SF4). The buffer zone surrounding the wetland provides high quality wildlife habitat and water quality function.

The hydrologic condition of this wetland is considered natural with a moderate ability to detain surface water (SF15). The wetland was also determined to improve water quality (SF16) with little evidence of excess nutrient loading or contamination (SF17).

The plant community in this wetland was determined to be relatively intact with moderate species diversity and little to no influence of invasive/non-native species. Although this wetland contains low diversity of plant communities, the community present is of high quality (SF23 and SF24).

The wetland may provide moderate habitat to amphibians, reptiles and mammals (SF28). This wetland is not readily available to the public and as such provides low community use value (SF29).

No red rated significant functions were assessed for this wetland.

4.2.2.22 Wetland 22 (WL22)

WL22 is characterized as a sloped throughflow fen wetland. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated (SF3 and SF4). The buffer zone surrounding the wetland provides high quality wildlife habitat and water quality function.

The hydrologic condition of this wetland is considered natural with a moderate ability to detain surface water (SF15) and stabilize the shoreline (SF21). The wetland was also determined to improve water quality (SF16) with little evidence of excess nutrient loading or contamination (SF17).

The plant community in this wetland was determined to be relatively intact with moderate species diversity and little to no influence of invasive/non-native species. Although this wetland contains low diversity of plant communities, the community present is of high quality (SF23 and SF24).

The wetland may provide moderate habitat to amphibians, reptiles and mammals (SF28). This wetland is not readily available to the public and as such provides low community use value (SF29).

No red rated significant functions were assessed for this wetland.

5.0 CONCLUSION

A total of 22 wetlands were encountered within the Project study area. Habitat and functional assessments and field delineations were conducted for all wetlands encountered within the Project study area boundary.

The functional assessment indicate that 12 of the 22 wetlands perform red rated significant functions which elevate the relative importance of these wetlands in terms of the functions they provide to the surrounding watershed. Six of the wetlands assessed with red rated significant functions (WL1, 3, 6, 8, 14 and 17) occur along or form the headwater of small watercourses throughout the site and as such are important in maintaining stream flow. Seven of the wetlands assessed as having red rated significant functions (WL 8, 9, 11, 16, 18, 19 and 20) may serve as groundwater recharge sites while one wetland (WL2) provides a red rated significant function of stabilizing the shoreline. Results of this study will be used to assess the potential impacts of the proposed Black Point Quarry on wetland habitat within the Project Study Area.

6.0 REFERENCES

ACCDC 2011. Nova Scotia Wetland Indicator Plant List. Available online at: http://gov.ns.ca/nse/wetland/wetland.assessment.resources.asp. Updated on Mar 27, 2013.

Environment Canada 2013. About Wetlands. Available online at: http://www.ec.gc.ca/tho-wlo/default.asp?lang=En&n=B4669525-1#_definitions. Viewed May 23, 2013.

Environment Canada. 1996. The Federal Policy on Wetland Conservation – Implementation Guide for Federal Land Managers.

Environmental Laboratory. 1987. Corps of Engineers Wetland Delineation Manual. Technical Report Y-87-1. U.S. Army Engineer Waterways Experiment Station. Vicksburg, Mississippi.

Government of Canada. 1991. The Federal Policy on Wetland Conservation.

Government of Nova Scotia. 1995. Environment Act.

Hanson, A., L. Swanson, D. Ewing, G. Grabas, S. Meyer, L. Ross, M. Watmough, and J. Kirkby, 2008. Wetland Ecological Assessment; An Overview of Approaches. Canadian Wildlife Services Technical Report Series No. 497. Atlantic Region. 59 pp.

Hinds, H., 2000. Flora of New Brunswick. Second Ed. University of New Brunswick, Fredericton, New Brunswick.

Lynch-Stewart, P. 1992. No Net Loss: Implementing "No Net Loss" Goals to Conserve Wetlands in Canada. Sustaining Wetlands. North American Wetlands Conservation Council (Canada).

Lynch-Stewart, P., P. Neice, C. Rubec, and I. Kessel-Taylor. 1996. Implementation Guide for Federal Land Managers. North American Wetlands Conservation Council (Canada).

Lynch-Stewart,P., I. Kessel-Taylor, and C. Rubec. 1999. Wetlands and Government, Policy and Legislationfor Wetland Conservation in Canada. North American Wetlands Conservation Council (Canada).

Nova Scotia Department of Natural Resources (NSDNR) 2012. Forest Inventory - Geographic Information Systems. Available online at http://novascotia.ca/natr/forestry/gis/forest-inventory.asp. Accessed on April 13, 2013.

Nova Scotia Environment (NSE) 2011. Nova Scotia Wetlands Conservation Policy.

Nova Scotia Environment (NSE) 2014. Resources for Wetland Assessors. Available online at http://gov.ns.ca/nse/wetland/wetland.assessment.resources.asp. Updated on March 31, 2014. Accessed August 2014.

Nova Scotia Museum. 1996. The Natural History of Nova Scotia. 2 volumes.

Soil Classification Working Group (SCWG), 1998. The Canadian System of Soil Classification. Agric. and Agri-Food Can. Publ. 1646 (Revised) 187 pp. NRC Research Press, Ottawa.

United Nations Educational, Scientific and Cultural Organization (UNESCO) 1987. Ramsar Convention on Wetlands. Available online at: http://www.ramsar.org/cda/en/ramsar-documents-texts-convention-on/main/ramsar/1-31-38%5E20671_4000_0__

US Army Corps of Engineers (USACE), 1999: The Highway Methodology Workbook Supplement: Wetland Functions and Values- a Descriptive Approach. 32 pp.

U.S. Army Corps of Engineers (USACE), 2012. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (Version 2.0).

U.S. Department of Agriculture, Natural Resources Conservation Service (USDA-NRCS), 2007. National Soil Survey Handbook, title 430-VI. [Online] Available: http://soils.usda.gov/technical/handbook/

Reed 1988. National list of vascular plant species that occur in wetlands. U.S. Fish & Wildlife Service Biological Report 88 (26.9). Region 1 (Northeast).

Zinc, M. 1998. Roland's Flora of Nova Scotia.

APPENDIX A
Wetland Delineation Data Sheets and Habitat Assessment Forms

Freshwater Wetland Data Sheet UL-11

Date: Sept. 8/10
Investigator(s): _____
Weather: Sunny
Topographic Sheet: _____
Aerial Photo Number: _____

Wetland Atlas Number : _____
GIS Map / Stand No. : _____
Wetland Form[1]:: Treed Swamp
Wetland size: _____ ha
Associated Watercourse: _____

Wetland Type:
1.Aquatic bed/unconsolidated bottom (AB) ____
2.Bog(BO) ____
3.Fen (FE) ____
4.Emergent wetland (EW) ____
5.Shrub wetland (SB) ____
6.Forested wetland (FW) X

Wetland Class:
1.Open water ___
2.Deep marsh ____
3.Shallow marsh _____
4.Seasonally flooded flats ____
5.Meadow ____
6.Shrub swamp _____
7.Wooded swamp X
8.Bog ____

Wetland Subclass:
1.Vegetated open water ___
2.Non-vegetated OW ___
3.Floating leaved OW ___
4.Rooted floating leaved OW ___
5.Dead woody OW ____
6.Vegetated deep marsh ____
7.Non-vegetated DM ____
8.Dead woody DM ____
9.Sub-shrub DM ____
10.Floating leaved DM ____
11.Rooted floating leaved DM ____
12.Robust DM ____
13.Narrow-leaved DM ____
14.Broad-leaved DM ____
15.Dead woody shallow marsh ____
16.Robust SM _____
17.Narrow leaved SM _____
18.Broad leaved SM ____
19.Floating leaved SM ____
20.Rooted floating leaved SM ____
21.Non-vegetated SM ____
22.Emergent seasonally flooded flats ____
23.Shrubby SFF ____
24.Grazed meadow ____
25.Ungrazed M ____
26.Sedge M ____
27.Sapling shrub swamp ____
28.Bushy SS ____
29.Compact SS _____
30.Low sparse SS ____
31.Deciduous wooded swamp X
32.Evergreen WS X
33.Wooded bog ____
34.Shrubby B _____
35.Open B _____

Water Regime Indicator:
1.Permanently flooded ___
2.Saturated X
3.Seasonally flooded X

Water Depth:
1.0-5 cm X
2.5-20 cm _____
3.20-50 cm ____
4.50-100 cm ____
5.>100 cm ____

Note: 1. Canadian Wetland Classification System (2nd Edition)

Impounded Wetland Type:
1.Beaver Pond X
2.Man-made Impoundment ____
3.Ducks Unlimited Impoundment ____
4. None of the above ____

Percent Vegetation Cover:
1.> 95% X
2.76-95% in peripheral band ___
3.76-96% in patches ___
4.26-75% in peripheral band ____
5.26-75% in patches ____
6. 5-25% in peripheral band ____
7. 5-25% in patches ____
8.< 5% ____

Wetland Site:
1.Lacustrine ____
2.Riverine X
3.Palustrine ____
4.Isolated ____
5.Deltaic ___

Vegetation Types (%):
1.Deciduous trees –
2.Coniferous trees 70% - Fir
3.Dead trees 10%
4.Tall shrubs 2%
5.Low shrubs –
6.Dead shrubs –
7.Herbs 15% - Cornus sti, Cinorrm fern
8.Mosses 100%
9.Narrow-leaved emergents –
10.Broad-leaved emergents –
11.Robust emergents –
12.Free-floating plants –
13.Floating plants (rooted)
14.Submerged plants –
15. Other

Interspersion: 1.Minimal X 2.Low ____ 3.Medium ___ 4.High ____

Conductivity: N/A
Alkalinity: N/A
pH: N/A

Hydrological Classification:
1.Surface water depression ____
2.Ground water depression ____
3.Surface water slope X
4.Ground water slope ____

Inlets/Outlets/water bodies:
Lotic Bidirectional - Beaver Pond

Wildlife: (Observation/Signs/Reports)

Adjacent Wildlife habitat (%):

1.Salt marsh ____
2.Forest Ex 90
3.Dykelands ____
4.Mudflats ____
5.Beach ____
6.River ____
7. Other ~~Ex~~ 90

Description: ~~mixed weeds~~ Beaver Pond

Surrounding Land Use %:

1 Agriculture ____
2.Forestry ____
3 Recreation ____
4.Industrial ____
5.Urban development ____
6.Transportation ____
7.Residential ____
8.Waste Disposal ____
9.Scientific Research ____
10.Trapping ____
11.Education ____
12.Seasonal resident ____

Description: None

Disturbance: 1.Low X 2.Moderate ____ 3.High ____

Description: None

Roads and/or tracks:

1.Private road adjacent ____
2.DOT road adjacent ____
3.Private road within ____
4.DOT road within ____
5.Vehicle tracks ____
6.Other ____

Description: None

Existing Uses of Wetlands:

1.Economic use (e.g. farming) ____
2.Recreational activities ____
3.Aesthetics ____
4.Education & public awareness ____
5. None evident X

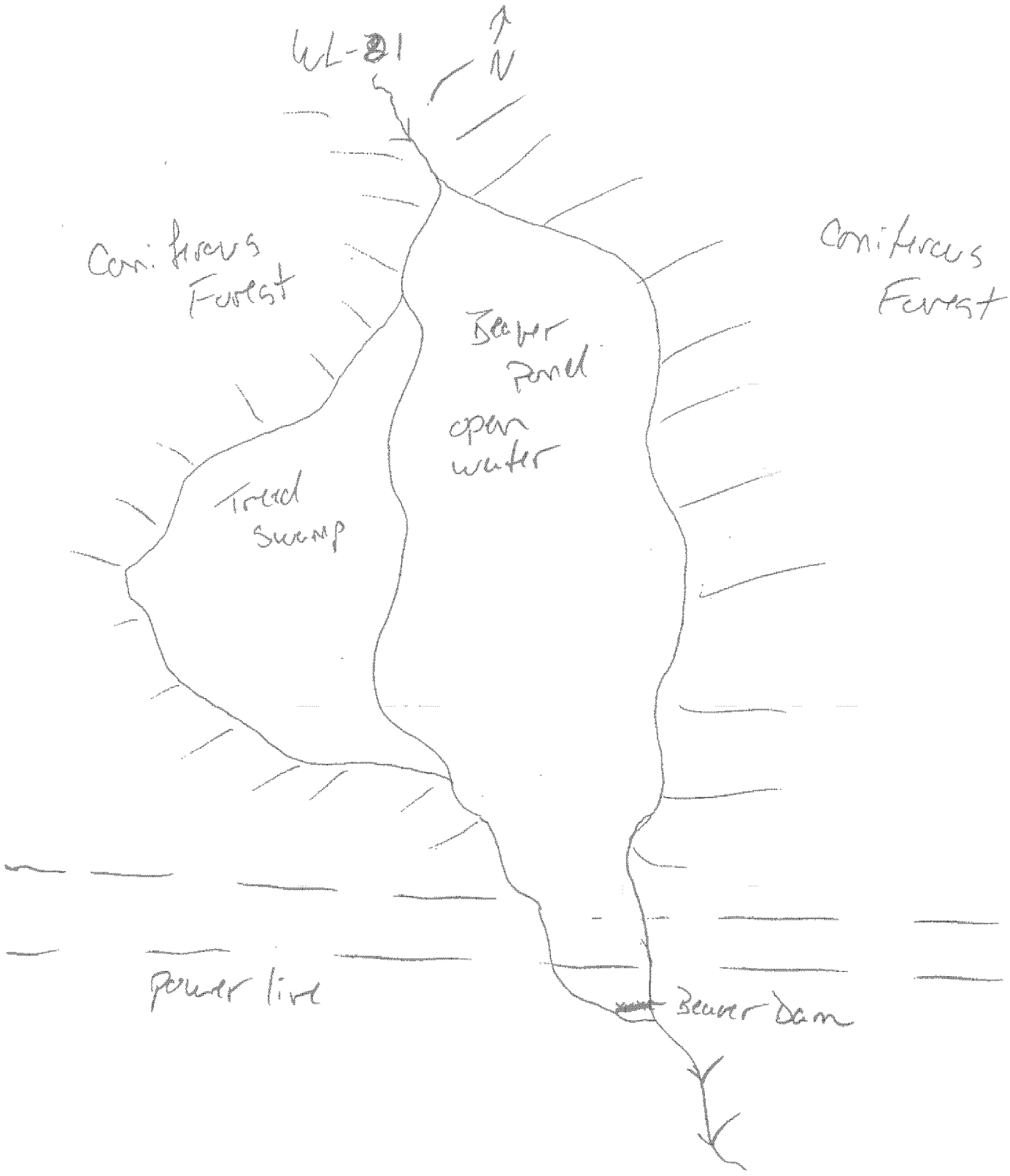
Potential Threats:

Special Features:

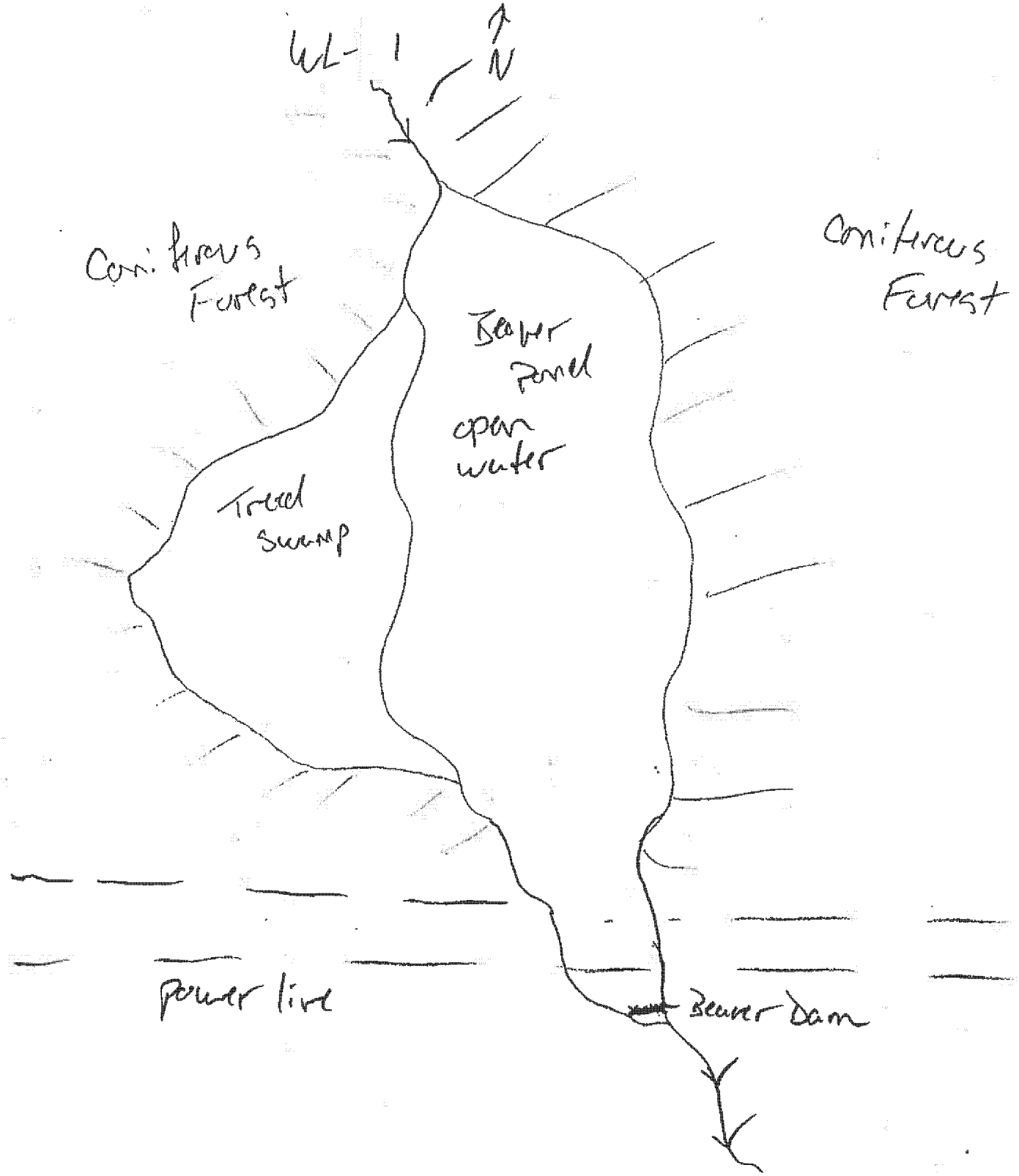
1.Rare wetland type ____
2.Rare animal or plant species ____
3.Habitat of rare species X
4.Nesting site for colonial water birds ____
5.Migration stop-over site ____
6. None evident ____

Description: Potential

Notes:


WL-21
N
Coniferous Forest
Coniferous Forest
Beaver Pond
open water
Treed Swamp
power line
Beaver Dam

C 1340-1349


WL-1
N
Coniferous Forest
Coniferous Forest
Beaver Pond
open water
Treed swamp
power line
Beaver Dam

C 1340-1350

Freshwater Wetland Data Sheet WL 17

Date: Sept. 9/10
Investigator(s): S. Burley
Weather: Sun/cloud
Topographic Sheet: _____
Aerial Photo Number: _____

Wetland Atlas Number : _____
GIS Map / Stand No. : C45306 11 121, 123
Wetland Form[1]:: Bog/Shrub Fen
Wetland size: _____ ha
Associated Watercourse: _____

Wetland Type:
1.Aquatic bed/unconsolidated bottom (AB) ____
2.Bog(BO) X
3.Fen (FE) X
4.Emergent wetland (EW) ____
5.Shrub wetland (SB) X
6.Forested wetland (FW) X

Wetland Class:
1.Open water ___
2.Deep marsh ____
3.Shallow marsh _____
4.Seasonally flooded flats ____
5.Meadow ____
6.Shrub swamp X
7.Wooded swamp X
8.Bog X

Wetland Subclass:
1.Vegetated open water ___
2.Non-vegetated OW ___
3.Floating leaved OW ___
4.Rooted floating leaved OW ___
5.Dead woody OW ____
6.Vegetated deep marsh ____
7.Non-vegetated DM ____
8.Dead woody DM ____
9.Sub-shrub DM ____
10.Floating leaved DM ____
11.Rooted floating leaved DM ____
12.Robust DM ____
13.Narrow-leaved DM ____
14.Broad-leaved DM ____
15.Dead woody shallow marsh ____
16.Robust SM _____
17.Narrow leaved SM _____
18.Broad leaved SM ____
19.Floating leaved SM ____
20.Rooted floating leaved SM ____
21.Non-vegetated SM ____
22.Emergent seasonally flooded flats ____
23.Shrubby SFF ____
24.Grazed meadow ____
25.Ungrazed M ____
26.Sedge M ____
27.Sapling shrub swamp X
28.Bushy SS X
29.Compact SS _____
30.Low sparse SS ____
31.Deciduous wooded swamp X
32.Evergreen WS ____
33.Wooded bog ____
34.Shrubby B X
35.Open B X
Treed Fen X
Shrub Fen X

Water Regime Indicator:
1.Permanently flooded ___
2.Saturated X
3.Seasonally flooded _____

Water Depth:
1.0-5 cm X
2.5-20 cm _____
3.20-50 cm ____
4.50-100 cm X > channel
5.>100 cm ____

Note: 1. Canadian Wetland Classification System (2nd Edition)

Impounded Wetland Type:
1.Beaver Pond ____
2.Man-made Impoundment ____
3.Ducks Unlimited Impoundment ____
4. None of the above X

Percent Vegetation Cover:
1.> 95% X
2.76-95% in peripheral band ___
3.76-96% in patches ___
4.26-75% in peripheral band ____
5.26-75% in patches ____
6. 5-25% in peripheral band ____
7. 5-25% in patches ____
8.< 5% ____

Wetland Site:
1.Lacustrine ____
2.Riverine X
3.Palustrine ____
4.Isolated ____
5.Deltaic ___

Vegetation Types (%):
1.Deciduous trees 2%
2.Coniferous trees 30% - Larch, & Spruce
3.Dead trees 2%
4.Tall shrubs 20% - Alnus, wild Raisin
5.Low shrubs 35% - Ledum, Labrador Tea, Kalmia
6.Dead shrubs – 30% - Cornt, Calamagrostis, False Solomon seal
7.Herbs
8.Mosses 100% - Sphag
9.Narrow-leaved emergents –
10.Broad-leaved emergents –
11.Robust emergents –
12.Free-floating plants –
13.Floating plants (rooted) –
14.Submerged plants –
15. Other –

Interspersion: 1.Minimal ___ 2.Low X 3.Medium ___ 4.High ____

Conductivity: N/A
Alkalinity: N/A
pH: N/A

Hydrological Classification:
1.Surface water depression ____
2.Ground water depression ____
3.Surface water slope X
4.Ground water slope ____

Inlets/Outlets/water bodies:
Stream through Fen Treed Fen / Bog

Wildlife: (Observation/Signs/Reports)
Nut hatch
Dragon flies

Adjacent Wildlife habitat (%):

1.Salt marsh ____
2.Forest 60%
3.Dykelands ____
4.Mudflats ____
5.Beach ____
6.River ____
7. Other 40% - Berries

Description: mixed woods

Surrounding Land Use %:

1 Agriculture ____
2.Forestry ____
3 Recreation ____
4.Industrial 5%
5.Urban development ____
6.Transportation ____
7.Residential ____
8.Waste Disposal ____
9.Scientific Research ____
10.Trapping ____
11.Education ____
12.Seasonal resident ____

Description: Powerline along South side of bog.

Disturbance: 1.Low X 2.Moderate ____ 3.High ____

Description:

Roads and/or tracks:

1.Private road adjacent ____
2.DOT road adjacent ____
3.Private road within ____
4.DOT road within ____
5.Vehicle tracks X
6.Other ____

Description: ATV track through bog

Existing Uses of Wetlands:

1.Economic use (e.g. farming) ____
2.Recreational activities ____
3.Aesthetics ____
4.Education & public awareness ____
5. None evident X

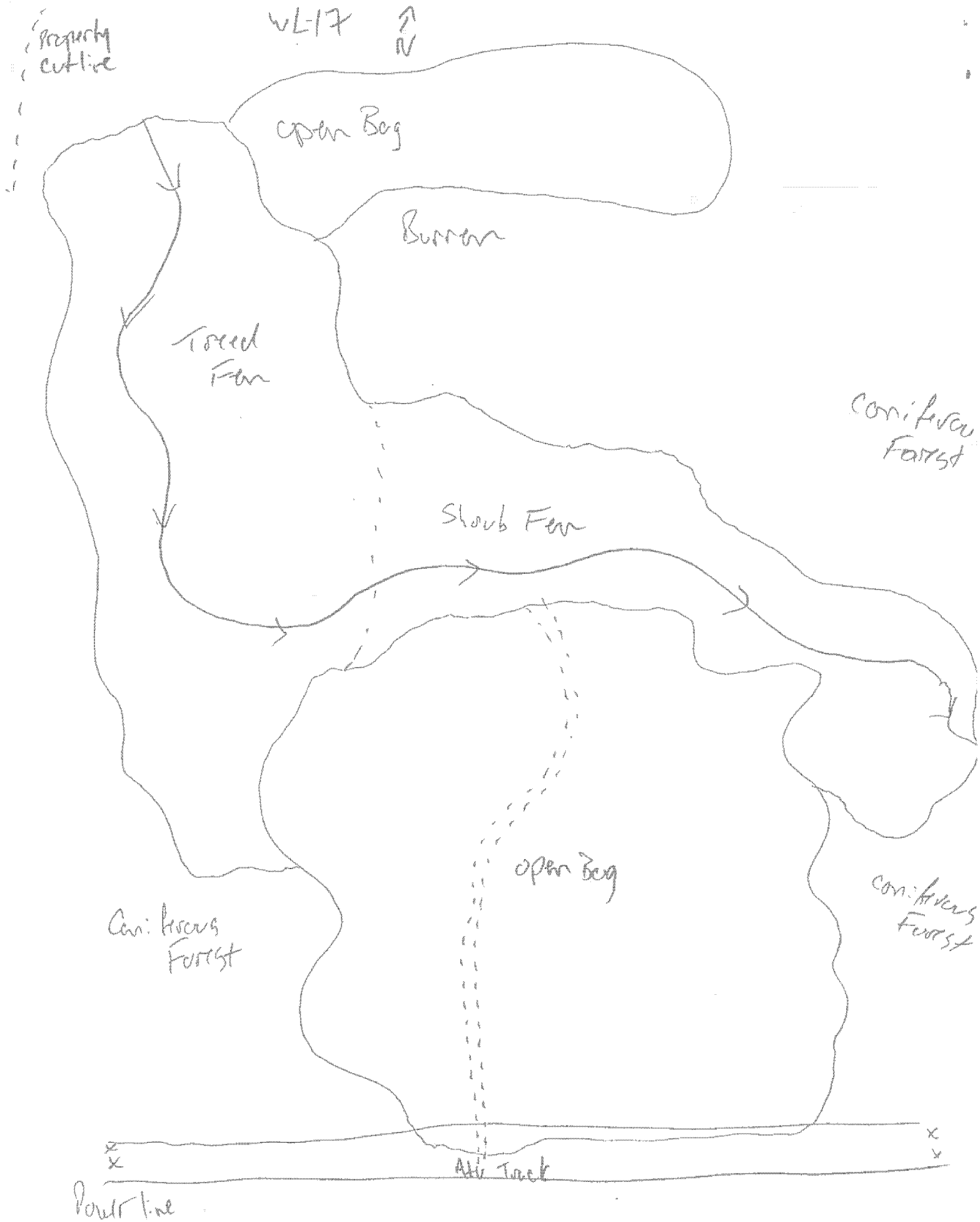
Potential Threats:

Special Features:

1.Rare wetland type ____
2.Rare animal or plant species ____
3.Habitat of rare species X
4.Nesting site for colonial water birds ____
5.Migration stop-over site ____
6. None evident ____

Description: Potential

Notes:


WL-17
N
Property cutline
open Bog
Burrow
Treed Fen
Coniferous Forest
Shrub Fen
open Bog
Coniferous Forest
Coniferous Forest
Air Track
Power line

Freshwater Wetland Data Sheet WL18

Date: Sept. 8/10
Investigator(s): S. Burns
Weather: Cloudy
Topographic Sheet: _____
Aerial Photo Number: _____

Wetland Atlas Number : _____
GIS Map / Stand No. : _____
Wetland Form[1]:: Domed Bog
Wetland size: _____ ha
Associated Watercourse: _____

Wetland Type:
1.Aquatic bed/unconsolidated bottom (AB) ____
2.Bog(BO) X
3.Fen (FE) ____
4.Emergent wetland (EW) ____
5.Shrub wetland (SB) ____
6.Forested wetland (FW) ____

Wetland Class:
1.Open water ___
2.Deep marsh ____
3.Shallow marsh _____
4.Seasonally flooded flats ____
5.Meadow ____
6.Shrub swamp _____
7.Wooded swamp ____
8.Bog X

Wetland Subclass:
1.Vegetated open water ___
2.Non-vegetated OW ___
3.Floating leaved OW ___
4.Rooted floating leaved OW ___
5.Dead woody OW ____
6.Vegetated deep marsh ____
7.Non-vegetated DM ____
8.Dead woody DM ____
9.Sub-shrub DM ____
10.Floating leaved DM ____
11.Rooted floating leaved DM ____
12.Robust DM ____
13.Narrow-leaved DM ____
14.Broad-leaved DM ____
15.Dead woody shallow marsh ____
16.Robust SM _____
17.Narrow leaved SM _____
18.Broad leaved SM ____
19.Floating leaved SM ____
20.Rooted floating leaved SM ____
21.Non-vegetated SM ____
22.Emergent seasonally flooded flats ____
23.Shrubby SFF ____
24.Grazed meadow ____
25.Ungrazed M ____
26.Sedge M ____
27.Sapling shrub swamp ____
28.Bushy SS ____
29.Compact SS _____
30.Low sparse SS ____
31.Deciduous wooded swamp ____
32.Evergreen WS ____
33.Wooded bog X
34.Shrubby B X
35.Open B X

Water Regime Indicator:
1.Permanently flooded ___
2.Saturated X
3.Seasonally flooded _____

Water Depth:
1.0-5 cm X
2.5-20 cm _____
3.20-50 cm ____
4.50-100 cm ____
5.>100 cm ____

Note: 1. Canadian Wetland Classification System (2nd Edition)

Impounded Wetland Type:
1.Beaver Pond _____
2.Man-made Impoundment ____
3.Ducks Unlimited Impoundment ____
4. None of the above X

Percent Vegetation Cover:
1.> 95% X
2.76-95% in peripheral band ___
3.76-96% in patches ___
4.26-75% in peripheral band ____
5.26-75% in patches ____
6. 5-25% in peripheral band ____
7. 5-25% in patches ____
8.< 5% ____

Wetland Site:
1.Lacustrine ____
2.Riverine _____
3.Palustrine X
4.Isolated ____
5.Deltaic ___

Vegetation Types (%):
1.Deciduous trees -
2.Coniferous trees 20% Larch, B. Spruce
3.Dead trees -
4.Tall shrubs 15% MNO, wild rose
5.Low shrubs 40% - Huckleberry, Kalmia, Ledum, Juniper
6.Dead shrubs -
7.Herbs 20% - Scirpus cespitosis, Bunchberry
8.Mosses 100%
9.Narrow-leaved emergents -
10.Broad-leaved emergents -
11.Robust emergents -
12.Free-floating plants -
13.Floating plants (rooted) -
14.Submerged plants -
15. Other

Interspersion: 1.Minimal X 2.Low _____ 3.Medium ___ 4.High ____

Conductivity: N/A
Alkalinity: N/A
pH: N/A

Hydrological Classification:
1.Surface water depression X → near mixed bog
2.Ground water depression _____
3.Surface water slope _____
4.Ground water slope ____

Inlets/Outlets/water bodies:
none observed

Wildlife: (Observation/Signs/Reports)
Moose tracks

Adjacent Wildlife habitat (%):

1.Salt marsh ____
2.Forest 50%
3.Dykelands ____
4.Mudflats ____
5.Beach ____
6.River ____
7. Other 50% Barren

Description: mixed woods

Surrounding Land Use %:

1 Agriculture ____
2.Forestry ____
3 Recreation ____
4.Industrial ____
5.Urban development ____
6.Transportation ____
7.Residential ____
8.Waste Disposal ____
9.Scientific Research ____
10.Trapping ____
11.Education ____
12.Seasonal resident ____

Description: none

Disturbance: 1.Low X 2.Moderate ____ 3.High ____

Description:

Roads and/or tracks:

1.Private road adjacent ____
2.DOT road adjacent ____
3.Private road within ____
4.DOT road within ____
5.Vehicle tracks ____
6.Other ____

Description: none

Existing Uses of Wetlands:

1.Economic use (e.g. farming) ____
2.Recreational activities ____
3.Aesthetics ____
4.Education & public awareness ____
5. None evident X

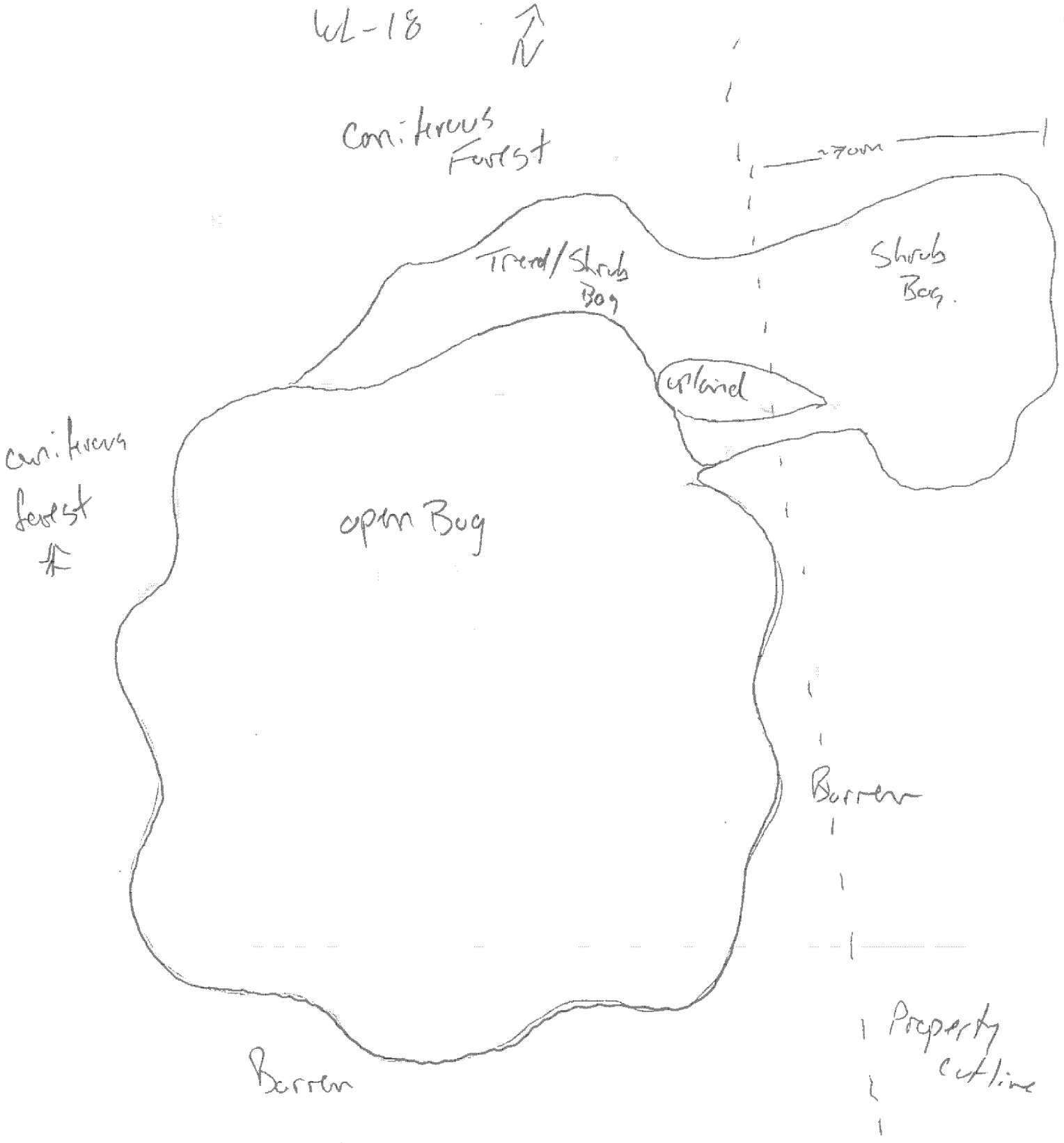
Potential Threats:

Special Features:

1.Rare wetland type ____
2.Rare animal or plant species ____
3.Habitat of rare species X
4.Nesting site for colonial water birds ____
5.Migration stop-over site ____
6. None evident ____

Description: Potential

Notes:


WL-18
N
Coniferous Forest
Tree/Shrub Bog
Shrub Bog
upland
coniferous forest
open Bog
Barren
Barren
Property cutline

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Black Point Municipality/County: Queensborough Sampling Date: Aug. 19/14

Applicant/Owner: Vafeia Sampling Point: WL17 - WP1

Investigator(s): S. Bushby Affiliation: AMEC

Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): Hummocky

Slope (%): 5% Lat: 6453209 Long: 5024432 Datum: NAD 83

Soil Map Unit Name/Type: Parkland Wetland Type: Bog

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	
Wetland Hydrology Present?	Yes ✓	No ____	If yes, optional Wetland Site ID: WL17

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Larix laricina	2		FAC
2. Picea mariana	5	✓	FACW
3.			
4.			
5.			
	7	= Total Cover	

Sapling/Shrub Stratum (Plot size: 5m)			
1. Acer rubrum var. trilobum	30	✓	FAC
2. Viburnum nudum	15	✓	FAC
3. Rhododendron canadense	5		FAC
4. Picea mariana	10		FACW
5. Kalmia angustifolia	2		FAC
	62	= Total Cover	

Herb Stratum (Plot size: 1m)			
1. Trientalis borealis	50	✓	FAC
2. Chamaedaphne calyculata	30	✓	OBL
3. Sarracenia purpurea	15		OBL
4. Vaccinium angustifolium	5		FAC
5. Ledum groenlandicum	10		FACW
6. Cornus canadensis	2		FAC
7.			
8.			
9.			
10.			
	112	= Total Cover	

Woody Vine Stratum (Plot size: ____)

1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	45	x 1 =	45
FACW species	25	x 2 =	50
FAC species	111	x 3 =	333
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	181 (A)		428 (B)

Prevalence Index = B/A = 2.4

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ✓ Dominance Test is >50%
- ✓ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

SOIL

Sampling Point: GL17-UPL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
O 0-20								
B 20-35+	10YR 3/2	100					Loamy Sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ✓ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): _____

Water Table Present? Yes ___ No ✓ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (inches): 3cm

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Block Point Municipality/County: Queensborough Sampling Date: Aug. 19/14
Applicant/Owner: Vulcan Sampling Point: WL17-UP1
Investigator(s): S. Burley Affiliation: AMEC
Landform (hillslope, terrace, etc.): Hill Slope Local relief (concave, convex, none): Hummocky
Slope (%): 25 Lat: 6645303 Long: 5022398 Datum: NAD 83
Soil Map Unit Name/Type: Rockland Wetland Type: Upland
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ____ No ____
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10 m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer rubrum	5	✓	FAC
2. Picea mariana	5	✓	FACW
3. Larix laricina	2		FAC
4. Abies balsamea	5	✓	FAC
5.			
	17	= Total Cover	

Sapling/Shrub Stratum (Plot size: 5 m)			
1. Viburnum nudum	5		FAC
2. Amelanchier laevis	15	✓	FAC
3. Gaylussacia baccata	2		FAC
4. Picea mariana	2		FACW
5. Larix laricina	2		FAC
	26	= Total Cover	

Herb Stratum (Plot size: 1 m)			
1. Calypso augustifolium	15	✓	FAC
2. Cornus canadensis	15	✓	FACW
3. Cornus canadensis	5		FAC
4. Vaccinium angustifolium	2		FAC
5. Coptis trifolia	2		FACW
6. Chamaedaphne calyculata	2		OBL
7. Bracken fern	5		FACU
8.			
9.			
10.			
	46	= Total Cover	

Woody Vine Stratum (Plot size: ____)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 6 (A)
Total Number of Dominant Species Across All Strata: 6 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	2	x 1 =	2
FACW species	24	x 2 =	48
FAC species	43	x 3 =	129
FACU species	5	x 4 =	20
UPL species		x 5 =	
Column Totals:	74 (A)		199 (B)

Prevalence Index = B/A = 2.7

Hydrophytic Vegetation Indicators:
___ Rapid Test for Hydrophytic Vegetation
✓ Dominance Test is >50%
✓ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

C 1340-1362

SOIL

Sampling Point: WL17-SP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-14	Black						Organic	rocks / Peat cover

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Bedrock

Depth (inches): 14 cm

Hydric Soil Present? Yes _____ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

Freshwater Wetland Data Sheet: WL #2

Date: Aug 31/10
Investigator(s): Scott Burley/M. Sensen
Weather: Sunny
Topographic Sheet: _____
Aerial Photo Number: _____

Wetland Atlas Number : 45
GIS Map / Stand No. : C45 35 611
Wetland Form[1]:: Emergent Marsh/Shrub Bog
Wetland size: _____ ha
Associated Watercourse: _____

Wetland Type:
1.Aquatic bed/unconsolidated bottom (AB) ____
2.Bog(BO) ____
3.Fen (FE) X
4.Emergent wetland (EW) X
5.Shrub wetland (SB) X
6.Forested wetland (FW) ____

Wetland Class:
1.Open water ___
2.Deep marsh X
3.Shallow marsh ____
4.Seasonally flooded flats ____
5.Meadow ____
6.Shrub swamp ____
7.Wooded swamp ____
8.Bog X

Wetland Subclass:
1.Vegetated open water ___
2.Non-vegetated OW X
3.Floating leaved OW X
4.Rooted floating leaved OW ___
5.Dead woody OW ____
6.Vegetated deep marsh ____
7.Non-vegetated DM ____
8.Dead woody DM ____
9.Sub-shrub DM ____
10.Floating leaved DM ____
11.Rooted floating leaved DM ____
12.Robust DM X
13.Narrow-leaved DM ____
14.Broad-leaved DM ____
15.Dead woody shallow marsh ____
16.Robust SM ____
17.Narrow leaved SM ____
18.Broad leaved SM ____
19.Floating leaved SM ____
20.Rooted floating leaved SM ____
21.Non-vegetated SM ____
22.Emergent seasonally flooded flats ____
23.Shrubby SFF ____
24.Grazed meadow ____
25.Ungrazed M ____
26.Sedge M ____
27.Sapling shrub swamp ____
28.Bushy SS ____
29.Compact SS ____
30.Low sparse SS ____
31.Deciduous wooded swamp ____
32.Evergreen WS ____
33.Wooded bog ____
34.Shrubby B ____
35.Open B ____
36. Fen X

Water Regime Indicator:
1.Permanently flooded X - Marsh
2.Saturated X - Fen
3.Seasonally flooded ____

Water Depth:
1.0-5 cm X - Fen
2.5-20 cm ____
3.20-50 cm ____
4.50-100 cm ____
5.>100 cm X → pond - Marsh

Note: 1. Canadian Wetland Classification System (2nd Edition)

Impounded Wetland Type:

1.Beaver Pond _____
2.Man-made Impoundment ____
3.Ducks Unlimited Impoundment ____
4. None of the above X

Percent Vegetation Cover:
1.> 95% _____
2.76-95% in peripheral band X
3.76-96% in patches ___
4.26-75% in peripheral band ____
5.26-75% in patches ____
6. 5-25% in peripheral band ____
7. 5-25% in patches ____
8.< 5% ____

Wetland Site:
1.Lacustrine ____
2.Riverine X
3.Palustrine ____
4.Isolated _____
5.Deltaic ___

Vegetation Types (%):
1.Deciduous trees 2% Acer rubrum
2.Coniferous trees 10% > White Spruce, Pinus Marsima
3.Dead trees 5%
4.Tall shrubs -
5.Low shrubs 15% - Myrica gale, Chamaedaphne calyculata,
6.Dead shrubs -
7.Herbs
8.Mosses 30%
9.Narrow-leaved emergents 40% - Eriophorum, Carex, Scirpus
10.Broad-leaved emergents -
11.Robust emergents 50% - Typha
12.Free-floating plants
13.Floating plants (rooted) 2% - Pond lily
14.Submerged plants
15. Other

Interspersion: 1.Minimal ___ 2.Low X 3.Medium ___ 4.High ____

Conductivity: N/A
Alkalinity: N/A
pH: N/A

Hydrological Classification:
1.Surface water depression X
2.Ground water depression ___
3.Surface water slope _____
4.Ground water slope ____

Inlets/Outlets/water bodies:
Pond @ Beach which wetland flows into. Surface Drainage channels inlet wetland @ South side.

Wildlife: (Observation/Signs/Reports)
Dragon fly
Peregrines
Bull Frog
Wood Frog

Adjacent Wildlife habitat (%):

1.Salt marsh ____
2.Forest 90%
3.Dykelands ____
4.Mudflats ____
5.Beach 10%
6.River ____
7. Other ____

Description:

Surrounding Land Use %:

1 Agriculture ____
2.Forestry ____
3 Recreation ____
4.Industrial ____
5.Urban development ____
6.Transportation ____
7.Residential ____
8.Waste Disposal ____
9.Scientific Research ____
10.Trapping ____
11.Education ____
12.Seasonal resident ____

Description: None

Disturbance: 1.Low X 2.Moderate ____ 3.High ____

Description:

Roads and/or tracks:

1.Private road adjacent ____
2.DOT road adjacent ____
3.Private road within ____
4.DOT road within ____
5.Vehicle tracks X
6.Other ____

Description: ATV Truck along beach north wetland

Existing Uses of Wetlands:

1.Economic use (e.g. farming) ____
2.Recreational activities ____
3.Aesthetics ____
4.Education & public awareness ____
5. None evident X

Potential Threats:

Special Features:

1.Rare wetland type ____
2.Rare animal or plant species ____
3.Habitat of rare species X
4.Nesting site for colonial water birds X
5.Migration stop-over site X
6. None evident ____

Description: Potential

Notes:

WL2
N
Beach
Natural Stone Berm
Typha
Pond
Robust Emergent Marsh
Herb
Eriophorum
Tall Shrub Fern
Osmunda cinnamomea
Alnus incana
Treed Patch
Stream
Drainage Channels

C 1340-1367

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Black Point Municipality/County: Guysborough Sampling Date: Aug. 20/14

Applicant/Owner: Vulcan Sampling Point: WL2-UP1

Investigator(s): S. Buckley Affiliation: AMEC

Landform (hillslope, terrace, etc.): depression Local relief (concave, convex, none): Concave

Slope (%): 1-2 Lat: 45 37 8 Long: 502 42 18 Datum: NAD 83

Soil Map Unit Name/Type: Rockland Wetland Type: Shrub Swamp

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	
Wetland Hydrology Present?	Yes ✓	No ____	If yes, optional Wetland Site ID: WL2

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Abies balsamea	30	✓	FAC
2.			
3.			
4.			
5.			
	30 = Total Cover		

Sapling/Shrub Stratum (Plot size: 5m)			
1. Amelanchier laevis	20	✓	FAC
2. Calamagrostis canadensis	10	✓	FAC
3. Picea mariana	7		FAC
4.			
5.			
	37 = Total Cover		

Herb Stratum (Plot size: 1m)			
1. Carex trisperma	10	✓	OBL
2. Gaultheria hispidula	5	✓	FAC
3. Maianthemum stellatum	5	✓	OBL
4. Cornus canadensis	2		FAC
5.			
6.			
7.			
8.			
9.			
10.			
	22 = Total Cover		

Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 6 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	15	x 1 =	15
FACW species	-	x 2 =	
FAC species	69	x 3 =	207
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	84 (A)		222 (B)

Prevalence Index = B/A = 2.6

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

✓ Dominance Test is >50%

✓ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

SOIL

Sampling Point: WL2-UP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-40+							organic	Peat

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ✓ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ✓ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): _____

Water Table Present? Yes ___ No ✓ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (inches): 15cm

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Beckfoot Municipality/County: Guysborough Sampling Date: Aug 20/14
Applicant/Owner: Vulcan Sampling Point: WL2-UP1
Investigator(s): S. Buckley Affiliation: AMEC
Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Hummocky
Slope (%): 0-20 Lat: 645 373 Long: 5224214 Datum: NAD 83
Soil Map Unit Name/Type: Ecklund Wetland Type: Upland
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ✓ No ____
Hydric Soil Present? Yes ____ No ✓
Wetland Hydrology Present? Yes ____ No ✓

Is the Sampled Area within a Wetland? Yes ____ No ✓
If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)
Naturally regenerating Forest.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Abies balsamea	20%	✓	FAC
2. Rhus typhina	10%	✓	FACU
3. Picea rubens	2%		FACU
4.			
5.			
	32	= Total Cover	

Sapling/Shrub Stratum (Plot size: 1m)			
1. Abies balsamea	10	✓	FAC
2. Eurybia radulina	20	✓	FAC
3. Sorbus decora	20	✓	FAC
4.			
5.			
		= Total Cover	

Herb Stratum (Plot size: 1m)			
1. Cornus canadensis	30	✓	FAC
2. Aralia nudicaulis	10	✓	FAC
3. Trientalis borealis	2		FAC
4. Carex disperma	2		OBL
5.			
6.			
7.			
8.			
9.			
10.			
	44	= Total Cover	

Woody Vine Stratum (Plot size: ____)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 6 (A)
Total Number of Dominant Species Across All Strata: 7 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 86 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species 2	x 1 =	2
FACW species 2	x 2 =	4
FAC species 112	x 3 =	336
FACU species 10	x 4 =	40
UPL species ____	x 5 =	____
Column Totals: 126 (A)		382 (B)

Prevalence Index = B/A = 3.0

Hydrophytic Vegetation Indicators:
___ Rapid Test for Hydrophytic Vegetation
✓ Dominance Test is >50%
✓ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

C 1340-1370

SOIL

Sampling Point: WL2-UP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
O 0-10							Organic	Duff
Ae 10-17	2.5YR 5/1	100					Silt loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

Freshwater Wetland Data Sheet: WL #3

Date: Aug 31/10
Investigator(s): Scott Burley/_____
Weather: _____
Topographic Sheet: _____
Aerial Photo Number: _____

Wetland Atlas Number : _____
GIS Map / Stand No. : _____
Wetland Form[1]:: Fen
Wetland size: _____ ha
Associated Watercourse: _____

Wetland Type:
1.Aquatic bed/unconsolidated bottom (AB) ____
2.Bog(BO) ____
3.Fen (FE) X
4.Emergent wetland (EW) ____
5.Shrub wetland (SB) ____
6.Forested wetland (FW) ____

Wetland Class:
1.Open water ___
2.Deep marsh ____
3.Shallow marsh _____
4.Seasonally flooded flats ____
5.Meadow ____
6.Shrub swamp _____
7.Wooded swamp ____
8.Bog ____
9. Fen X

Wetland Subclass:
1.Vegetated open water ___
2.Non-vegetated OW ___
3.Floating leaved OW ___
4.Rooted floating leaved OW ___
5.Dead woody OW ____
6.Vegetated deep marsh ____
7.Non-vegetated DM ____
8.Dead woody DM ____
9.Sub-shrub DM ____
10.Floating leaved DM ____
11.Rooted floating leaved DM ____
12.Robust DM ____
13.Narrow-leaved DM ____
14.Broad-leaved DM ____
15.Dead woody shallow marsh ____
16.Robust SM _____
17.Narrow leaved SM _____
18.Broad leaved SM ____
19.Floating leaved SM ____
20.Rooted floating leaved SM ____
21.Non-vegetated SM ____
22.Emergent seasonally flooded flats ____
23.Shrubby SFF ____
24.Grazed meadow ____
25.Ungrazed M ____
26.Sedge M ____
27.Sapling shrub swamp ____
28.Bushy SS ____
29.Compact SS _____
30.Low sparse SS ____
31.Deciduous wooded swamp ____
32.Evergreen WS ____
33.Wooded bog _____
34.Shrubby B _____
35.Open B _____
36. Fen X

Water Regime Indicator:
1.Permanently flooded ___
2.Saturated X
3.Seasonally flooded _____

Water Depth:
1.0-5 cm X
2.5-20 cm _____
3.20-50 cm ____
4.50-100 cm ____
5.>100 cm ____

Note: 1. Canadian Wetland Classification System (2nd Edition)

Impounded Wetland Type:

1.Beaver Pond _____
2.Man-made Impoundment ____
3.Ducks Unlimited Impoundment ____
4. None of the above X

Percent Vegetation Cover:
1.> 95% X
2.76-95% in peripheral band ___
3.76-96% in patches ___
4.26-75% in peripheral band ____
5.26-75% in patches ____
6. 5-25% in peripheral band ____
7. 5-25% in patches ____
8.< 5% ____

Wetland Site:
1.Lacustrine ____
2.Riverine X
3.Palustrine ____
4.Isolated ____
5.Deltaic ___

Vegetation Types (%):
1.Deciduous trees 5% - Acer rubrum
2.Coniferous trees 10% - Picea mariana
3.Dead trees –
4.Tall shrubs - 25% Alnus, Ilex
5.Low shrubs - 55% - Aronia
6.Dead shrubs –
7.Herbs 10%
8.Mosses
9.Narrow-leaved emergents 70% - Eriophorum, Rhynchospora alba, Carex
10.Broad-leaved emergents –
11.Robust emergents - 25% Iris
12.Free-floating plants –
13.Floating plants (rooted) –
14.Submerged plants –
15. Other - 15% - Osmunda cinnamomea

Interspersion: 1.Minimal X 2.Low _____ 3.Medium ___ 4.High ____

Conductivity: N/A
Alkalinity: N/A
pH: N/A

Hydrological Classification:
1.Surface water depression ____
2.Ground water depression ____
3.Surface water slope X
4.Ground water slope ____

Inlets/Outlets/water bodies:
Lotic Through flow

Wildlife: (Observation/Signs/Reports)
Bull Frog

Adjacent Wildlife habitat (%):

1.Salt marsh ____
2.Forest 1010
3.Dykelands ____
4.Mudflats ____
5.Beach ____
6.River ____
7. Other ____

Description:

Surrounding Land Use %:
1 Agriculture ____
2.Forestry ____
3 Recreation ____
4.Industrial ____
5.Urban development ____
6.Transportation ____
7.Residential ____
8.Waste Disposal ____
9.Scientific Research ____
10.Trapping ____
11.Education ____
12.Seasonal resident ____

Description: none

Disturbance: 1.Low X 2.Moderate ____ 3.High ____

Description:

Roads and/or tracks:
1.Private road adjacent ____
2.DOT road adjacent ____
3.Private road within ____
4.DOT road within ____
5.Vehicle tracks ____
6.Other ~~X~~

Description: none

Existing Uses of Wetlands:
1.Economic use (e.g. farming) ____
2.Recreational activities ____
3.Aesthetics ____
4.Education & public awareness ____
5. None evident X

Potential Threats:

Special Features:
1.Rare wetland type ____
2.Rare animal or plant species ____
3.Habitat of rare species X
4.Nesting site for colonial water birds ____
5.Migration stop-over site ____
6. None evident ____

Description: Potential

Notes:

N
Coniferous Forest
Watercourse
Coniferous Forest
Standing Water

C 1340-1375

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Black Point Municipality/County: Guysborough Sampling Date: July/2011

Applicant/Owner: Uisc m Sampling Point: WL3-UP1

Investigator(s): ~~S. Beaty~~ Theo Pepin Affiliation: AMEC

Landform (hillslope, terrace, etc.): Basin Local relief (concave, convex, none): ~~Con~~ Hummocky

Slope (%): 2 Lat: 645147 Long: 5024038 Datum: NAD 83

Soil Map Unit Name/Type: Rockland Wetland Type: Fen

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	If yes, optional Wetland Site ID: WL3
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 5)			
1. Picea mariana	20	✓	FACW
2. Larix laricina	20	✓	FAC
3.			
4.			
5.			
	40 = Total Cover		
Herb Stratum (Plot size: 1)			
1. Arethusa bulbosa	5	✓	OBL
2. Rhynchospora alba	5	✓	OBL
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	10 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	10	x 1 =	10
FACW species	20	x 2 =	40
FAC species	20	x 3 =	60
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	50 (A)		110 (B)

Prevalence Index = B/A = 2.2

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

✓ Dominance Test is >50%

✓ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

C 1340-1376

SOIL

Sampling Point: WL3-UP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
C 0-40+							organic	Dead

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☒ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No _____

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ☒ High Water Table (A2)
- ☒ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No ☒ Depth (inches): _____

Water Table Present? Yes ✓ No _____ Depth (inches): 5

Saturation Present? (includes capillary fringe) Yes ✓ No _____ Depth (inches): 0

Wetland Hydrology Present? Yes ✓ No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Black Point Municipality/County: Guysborough Sampling Date: Aug. 2014

Applicant/Owner: Vidéotron Sampling Point: WDS-UP1

Investigator(s): S. Burley Affiliation: AMEC

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Hummocky

Slope (%): 25 Lat: 6451416 Long: 502 4032 Datum: NAD 83

Soil Map Unit Name/Type: Rockland Wetland Type: upland upon forest

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Picea glauca	30	✓	FAC
2. Abies balsamea	5		FAC
3.			
4.			
5.			
	35	= Total Cover	

Sapling/Shrub Stratum (Plot size: 5m)			
1. Abies balsamea	30	✓	FAC
2. Viburnum nudum var. cassinoides	20	✓	FACW
3.			
4.			
5.			
	50	= Total Cover	

Herb Stratum (Plot size: 1m)			
1. Maianthemum canadense	10	✓	FAC
2. Trientalis borealis	5	✓	FAC
3. Vaccinium vitis-idea	5	✓	FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	20	= Total Cover	

Woody Vine Stratum (Plot size: ✓)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 6 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	–	x 1 =	
FACW species	20	x 2 =	40
FAC species	85	x 3 =	255
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	105 (A)		295 (B)

Prevalence Index = B/A = 2.8

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ✓ Dominance Test is >50%
- ✓ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

C 1340-1378

SOIL

Sampling Point: WL3-UP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
O 0-15							Organic Litt	
Ae 15-22	5Y 4/1	100					Sandy Silt	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Root

Depth (inches): 22cm

Hydric Soil Present? Yes _____ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

Freshwater Wetland Data Sheet: WL4

Date: Aug 31/10
Investigator(s): Scott Burley/_____
Weather: Sunny
Topographic Sheet: _____
Aerial Photo Number: _____

Wetland Atlas Number : _____
GIS Map / Stand No. : _____
Wetland Form[1]:: Basin Rex
Wetland size: _____ ha
Associated Watercourse: UA

Wetland Type:
1.Aquatic bed/unconsolidated bottom (AB) ____
2.Bog(BO) X
3.Fen (FE) ____
4.Emergent wetland (EW) ____
5.Shrub wetland (SB) ____
6.Forested wetland (FW) X

Wetland Class:
1.Open water ___
2.Deep marsh ____
3.Shallow marsh _____
4.Seasonally flooded flats ____
5.Meadow ____
6.Shrub swamp _____
7.Wooded swamp ____
8.Bog X

Wetland Subclass:
1.Vegetated open water ___
2.Non-vegetated OW ___
3.Floating leaved OW ___
4.Rooted floating leaved OW ___
5.Dead woody OW ____
6.Vegetated deep marsh ____
7.Non-vegetated DM ____
8.Dead woody DM ____
9.Sub-shrub DM ____
10.Floating leaved DM ____
11.Rooted floating leaved DM ____
12.Robust DM ____
13.Narrow-leaved DM ____
14.Broad-leaved DM ____
15.Dead woody shallow marsh ____
16.Robust SM _____
17.Narrow leaved SM _____
18.Broad leaved SM ____
19.Floating leaved SM ____
20.Rooted floating leaved SM ____
21.Non-vegetated SM ____
22.Emergent seasonally flooded flats ____
23.Shrubby SFF ____
24.Grazed meadow ____
25.Ungrazed M ____
26.Sedge M ____
27.Sapling shrub swamp ____
28.Bushy SS ____
29.Compact SS _____
30.Low sparse SS ____
31.Deciduous wooded swamp ____
32.Evergreen WS ____
33.Wooded bog X
34.Shrubby B X
35.Open B _____

Water Regime Indicator:
1.Permanently flooded ___
2.Saturated X
3.Seasonally flooded _____

Water Depth:
1.0-5 cm X
2.5-20 cm _____
3.20-50 cm ____
4.50-100 cm ____
5.>100 cm ____

Note: 1. Canadian Wetland Classification System (2nd Edition)

Impounded Wetland Type:

1.Beaver Pond _____
2.Man-made Impoundment ____
3.Ducks Unlimited Impoundment ____
4. None of the above ____

Percent Vegetation Cover:
1.> 95% _____
2.76-95% in peripheral band ___
3.76-96% in patches ___
4.26-75% in peripheral band ____
5.26-75% in patches ____
6. 5-25% in peripheral band ____
7. 5-25% in patches ____
8.< 5% ____

Wetland Site:
1.Lacustrine ____
2.Riverine _____
3.Palustrine X
4.Isolated _____
5.Deltaic ___

Vegetation Types (%):
1.Deciduous trees –
2.Coniferous trees 45% – Picea Mariana
3.Dead trees 5%
4.Tall shrubs 10% Alnus incana, Rhamnus frs
5.Low shrubs –
6.Dead shrubs –
7.Herbs 5% – Maianthemum dilatatum,
8.Mosses 10% – Sphagnum
9.Narrow-leaved emergents 5% Carex disperma
10.Broad-leaved emergents –
11.Robust emergents –
12.Free-floating plants –
13.Floating plants (rooted) –
14.Submerged plants –
15. Other –

Interspersion: 1.Minimal X 2.Low _____ 3.Medium ___ 4.High ____

Conductivity: N/A
Alkalinity: N/A
pH: N/A

Hydrological Classification:
1.Surface water depression X
2.Ground water depression _____
3.Surface water slope _____
4.Ground water slope ____

Inlets/Outlets/water bodies:
Underground drainage channel @ North side leading. (Terrene outflow Bog)

Wildlife: (Observation/Signs/Reports)
None observed

Adjacent Wildlife habitat (%):

1.Salt marsh ____
2.Forest 100%
3.Dykelands ____
4.Mudflats ____
5.Beach ____
6.River ____
7. Other ____

Description: Coniferous Forest

Surrounding Land Use %:

1 Agriculture ____
2.Forestry ____
3 Recreation ____
4.Industrial ____
5.Urban development ____
6.Transportation ____
7.Residential ____
8.Waste Disposal ____
9.Scientific Research ____
10.Trapping ____
11.Education ____
12.Seasonal resident ____

Description: None

Disturbance: 1.Low X 2.Moderate ____ 3.High ____

Description:

Roads and/or tracks:

1.Private road adjacent ____
2.DOT road adjacent ____
3.Private road within ____
4.DOT road within ____
5.Vehicle tracks ____
6.Other ____

Description: None

Existing Uses of Wetlands:

1.Economic use (e.g. farming) ____
2.Recreational activities ____
3.Aesthetics ____
4.Education & public awareness ____
5. None evident X

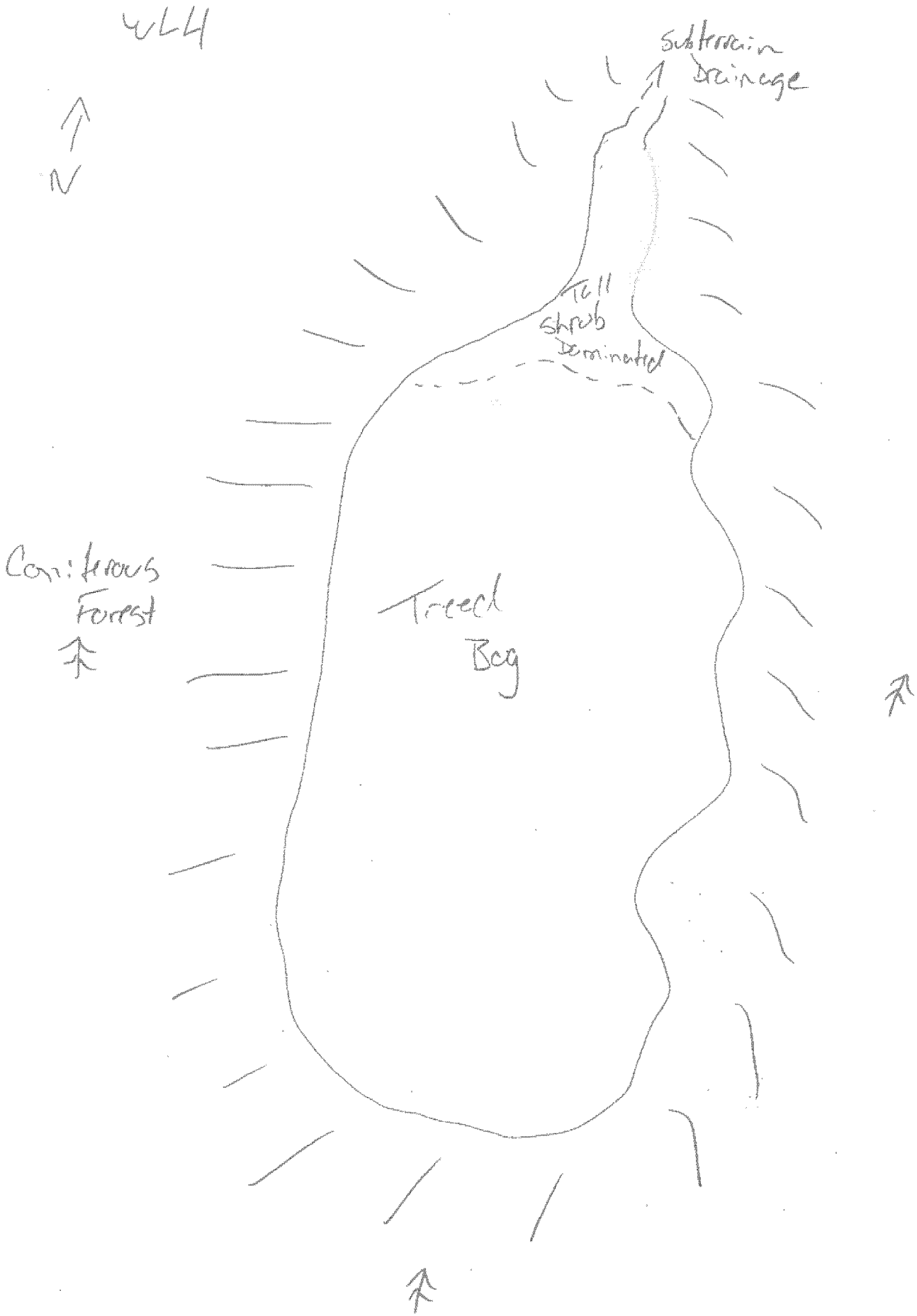
Potential Threats:

Special Features:

1.Rare wetland type ____
2.Rare animal or plant species ____
3.Habitat of rare species X
4.Nesting site for colonial water birds ____
5.Migration stop-over site ____
6. None evident ____

Description: Potential

Notes:


WL4
N
Subterrain
Drainage
Tall
shrub
Dominated
Coniferous
Forest
Treed
Bog

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Black Point Municipality/County: Guysborough Sampling Date: Aug 20/14
Applicant/Owner: Vulcan Sampling Point: WL4-UP1
Investigator(s): S. Burley Affiliation: AMEC
Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): Hummocky
Slope (%): 2% Lat: 45 10 4 Long: 52 44 19 Datum: NAD 83
Soil Map Unit Name/Type: Rockland Wetland Type: Treed Bog
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ✓ No ____
Hydric Soil Present? Yes ✓ No ____
Wetland Hydrology Present? Yes ✓ No ____

Is the Sampled Area within a Wetland? Yes ✓ No ____
If yes, optional Wetland Site ID: WL4

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Picea mariana	45%	✓	FAC
2.			
3.			
4.			
5.			
	45 = Total Cover		

Sapling/Shrub Stratum (Plot size: 5m)			
1. Viburnum nudum	5		FAC
2. Picea mariana	15%	✓	FAC
3. Ledum groenlandicum	5		FACW
4. Kalmia angustifolium	2		FAC
5.			
	27 = Total Cover		

Herb Stratum (Plot size: 1m)			
1. Carex trisperma	40%	✓	OBL
2. Maianthemum trifolia	25%	✓	OBL
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	65 = Total Cover		

Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____ = Total Cover		

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)
Total Number of Dominant Species Across All Strata: 4 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	65	x 1 =	65
FACW species	5	x 2 =	10
FAC species	51	x 3 =	156
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	122 (A)		231 (B)

Prevalence Index = B/A = 231.9

Hydrophytic Vegetation Indicators:
___ Rapid Test for Hydrophytic Vegetation
✓ Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

SOIL

Sampling Point: WL4-WP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-40+							Organic	Peat

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ✓ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ✓ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): _____

Water Table Present? Yes ✓ No ___ Depth (inches): 2 cm

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (inches): 5cm

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Black Point Municipality/County: Guysborough Sampling Date: July 2011

Applicant/Owner: [redacted] Sampling Point: WL4-UP1

Investigator(s): [redacted] Affiliation: AMEC

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Hummocky

Slope (%): 5 Lat: 645041 Long: 5021473 Datum: NAD 83

Soil Map Unit Name/Type: Rockland Wetland Type: upland

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ____	
Wetland Hydrology Present?	Yes ____	No ____	If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10)	Absolute % Cover	Dominant Species?	Indicator Status
1. Picea mariana	30	✓	FACW
2.			
3.			
4.			
5.			
	30	= Total Cover	
Sapling/Shrub Stratum (Plot size: 5)			
1. Picea mariana	15	✓	FACW
2. Abies balsamea	5		FAC
3. Nemopanthus mucronatus	10	✓	FACW
4.			
5.			
	30	= Total Cover	
Herb Stratum (Plot size: 1)			
1. Carex trisperma	5	✓	OBL
2. Kalmia angustifolia	10	✓	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	15	= Total Cover	
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	5	x 1 =	5
FACW species	45	x 2 =	90
FAC species	25	x 3 =	75
FACU species	____	x 4 =	____
UPL species	____	x 5 =	____
Column Totals:	75 (A)		170 (B)

Prevalence Index = B/A = 2.3

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ✓ Dominance Test is >50%
- ✓ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

C 1340-1386

SOIL

Sampling Point: WL4-UP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
O 0-15cm							Cosan.	Duff
AC 15-24	2.5YR 7/1	100					Silt	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Bedrock

Depth (inches): 24cm

Hydric Soil Present? Yes _____ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

Freshwater Wetland Data Sheet: WL5

Date: Sept. 1/10
Investigator(s): Scott Burley/_____
Weather: Sunny
Topographic Sheet: _____
Aerial Photo Number: _____

Wetland Atlas Number : _____
GIS Map / Stand No. : _____
Wetland Form[1]:: Lotic Fen
Wetland size: _____ ha
Associated Watercourse: _____

Wetland Type:
1.Aquatic bed/unconsolidated bottom (AB) ____
2.Bog(BO) ____
3.Fen (FE) X
4.Emergent wetland (EW) ____
5.Shrub wetland (SB) ____
6.Forested wetland (FW) ____

Wetland Class:
1.Open water ___
2.Deep marsh ____
3.Shallow marsh _____
4.Seasonally flooded flats ____
5.Meadow ____
6.Shrub swamp _____
7.Wooded swamp ____
8.Bog ___
Fen X

Wetland Subclass:
1.Vegetated open water ___
2.Non-vegetated OW ___
3.Floating leaved OW ___
4.Rooted floating leaved OW ___
5.Dead woody OW ____
6.Vegetated deep marsh ____
7.Non-vegetated DM ____
8.Dead woody DM ____
9.Sub-shrub DM ____
10.Floating leaved DM ____
11.Rooted floating leaved DM ____
12.Robust DM ____
13.Narrow-leaved DM ____
14.Broad-leaved DM ____
15.Dead woody shallow marsh ____
16.Robust SM _____
17.Narrow leaved SM _____
18.Broad leaved SM ____
19.Floating leaved SM ____
20.Rooted floating leaved SM ____
21.Non-vegetated SM ____
22.Emergent seasonally flooded flats ____
23.Shrubby SFF ____
24.Grazed meadow ____
25.Ungrazed M ____
26.Sedge M ____
27.Sapling shrub swamp ____
28.Bushy SS ____
29.Compact SS _____
30.Low sparse SS ____
31.Deciduous wooded swamp ____
32.Evergreen WS ____
33.Wooded bog _____
34.Shrubby B _____
35.Open B _____
Fen X

Water Regime Indicator:
1.Permanently flooded ___
2.Saturated X
3.Seasonally flooded _____

Water Depth:
1.0-5 cm X
2.5-20 cm X ? in channels
3.20-50 cm ____
4.50-100 cm ____
5.>100 cm ____

Note: 1. Canadian Wetland Classification System (2nd Edition)

Impounded Wetland Type:

1.Beaver Pond _____
2.Man-made Impoundment ____
3.Ducks Unlimited Impoundment ____
4. None of the above X

Percent Vegetation Cover:
1.> 95% X
2.76-95% in peripheral band ___
3.76-96% in patches ___
4.26-75% in peripheral band ____
5.26-75% in patches ____
6. 5-25% in peripheral band ____
7. 5-25% in patches ____
8.< 5% ____

Wetland Site:
1.Lacustrine ____
2.Riverine X
3.Palustrine ____
4.Isolated _____
5.Deltaic ___

Vegetation Types (%):
1.Deciduous trees 2% - Acer rubrum
2.Coniferous trees 10% - Picea mariana
3.Dead trees 2%
4.Tall shrubs 5% - Alnus incana, Cornus sericea
5.Low shrubs 20% - Ilex glabra, Aronia
6.Dead shrubs -
7.Herbs - 20% - Rhododendron, Vaccinium macrocarpon
8.Mosses 95% - Sphagnum
9.Narrow-leaved emergents - 35% - Eriophorum
10.Broad-leaved emergents -
11.Robust emergents - 10% Typha, Iris
12.Free-floating plants -
13.Floating plants (rooted) -
14.Submerged plants -
15. Other -

Interspersion: 1.Minimal ___ 2.Low X 3.Medium ___ 4.High ____

Conductivity: N/A
Alkalinity: N/A
pH: N/A

Hydrological Classification:
1.Surface water depression _____
2.Ground water depression _____
3.Surface water slope X
4.Ground water slope ____

Inlets/Outlets/water bodies:
Stream Through flow from East -> West

Wildlife: (Observation/Signs/Reports)
Passerines
Brown Snake
wood Frog

Adjacent Wildlife habitat (%):

1.Salt marsh ____
2.Forest 50%
3.Dykelands ____
4.Mudflats ____
5.Beach 5%
6.River ____
7. Other 5% – Barren Headland

Description:

Surrounding Land Use %:
1 Agriculture ____
2.Forestry ____
3 Recreation ____
4.Industrial ____
5.Urban development ____
6.Transportation ____
7.Residential ____
8.Waste Disposal ____
9.Scientific Research ____
10.Trapping ____
11.Education ____
12.Seasonal resident ____

Description: None

Disturbance: 1.Low X 2.Moderate ____ 3.High ____

Description:

Roads and/or tracks:
1.Private road adjacent ____
2.DOT road adjacent ____
3.Private road within ____
4.DOT road within ____
5.Vehicle tracks ____
6.Other ____

Description: None

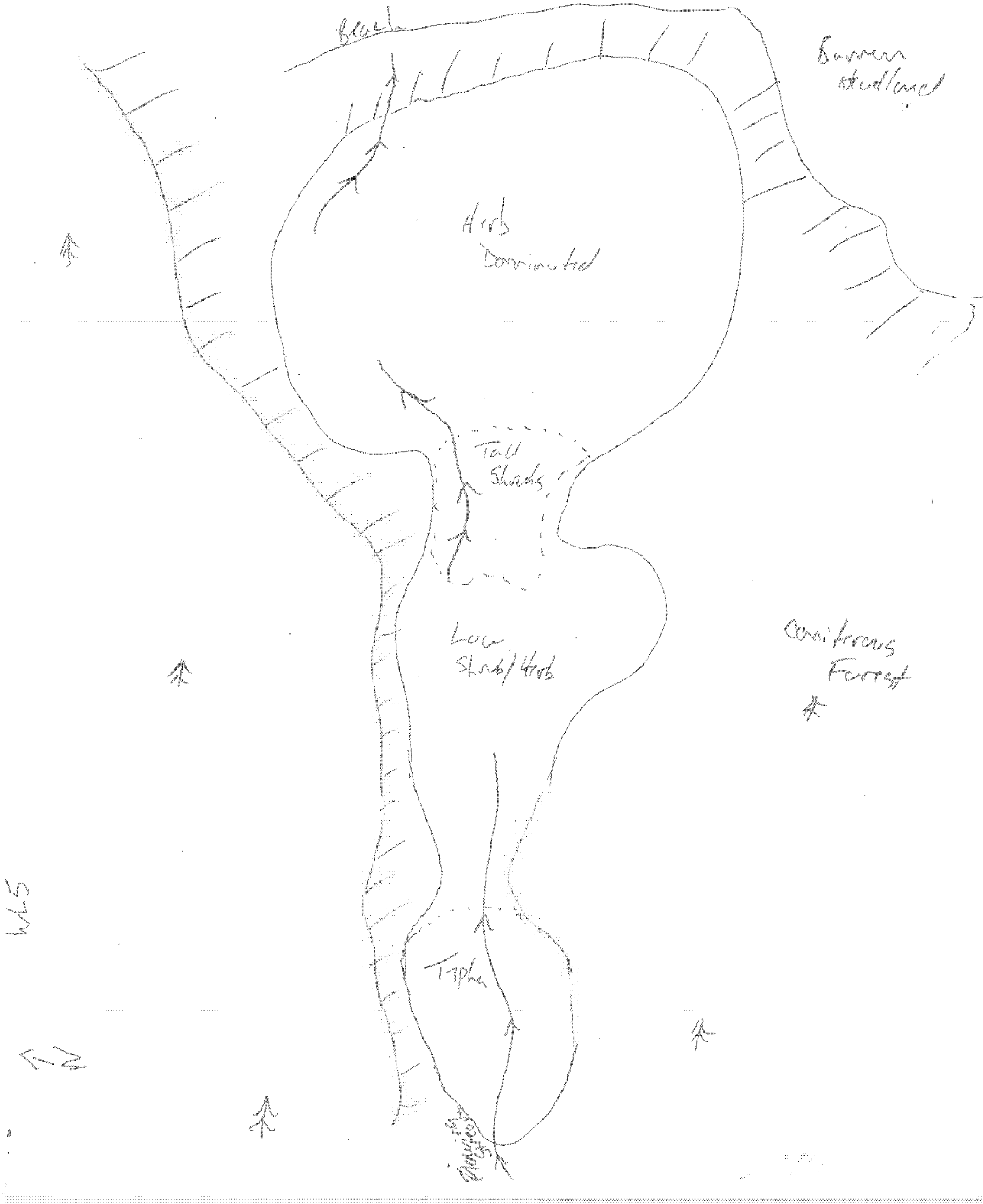
Existing Uses of Wetlands:
1.Economic use (e.g. farming) ____
2.Recreational activities ____
3.Aesthetics ____
4.Education & public awareness ____
5. None evident X

Potential Threats:

Special Features:
1.Rare wetland type ____
2.Rare animal or plant species ____
3.Habitat of rare species X
4.Nesting site for colonial water birds ____
5.Migration stop-over site ____
6. None evident ____

Description: Potential

Notes:


Beach
Barren
Headland
Herb
Dominated
Tall
Shrubs
Low
Shrub/Herb
Coniferous
Forest
Typha
Flowing
Stream
WL5
N

WETLAND DETERMINATION DATA FORM – NOVA SCOTIA

Project/Site: GLQ Municipality/County: Guysborough Sampling Date: Sept 1/10

Applicant/Owner: Eastern Values Sampling Point: WL5-upl

Investigator(s): S. Burley Section, Township, Range: Blacks Point

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): concave

Slope (%): 15% Lat: 644453 Long: 5024118 Datum: NAD 83

Soil Map Unit Name: Rocklond Wetland Type: Herb Fen

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	Is the Sampled Area within a Wetland? Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	
Wetland Hydrology Present?	Yes ✓	No ____	If yes, optional Wetland Site ID: WL5

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10 m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Picea glauca	2%		FAC
2.			
3.			
4.			
5.			
	2	= Total Cover	

Sapling/Shrub Stratum (Plot size: 5 M)			
1. Acer rubrum	2%		FAC
2.			
3.			
4.			
5.			
	2	= Total Cover	

Herb Stratum (Plot size: 1 m)			
1. Vaccinium myrsinites	15%	✓	OBL
2. Eriophorum vaginatum	10%	✓	OBL
3. Aster nemoralis	20%	✓	FACW
4. Iris versicolor	5%		FACW
5. Rubus - Black Berry	5%		FACU
6.			
7.			
8.			
9.			
10.			
	55	= Total Cover	

Woody Vine Stratum (Plot size: —)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	25	x 1 =	25
FACW species	25	x 2 =	50
FAC species	4	x 3 =	12
FACU species	5	x 4 =	20
UPL species		x 5 =	
Column Totals:	59 (A)		131 (B)

Prevalence Index = B/A = 2.2

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ✓ Dominance Test is >50%
- ✓ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2009)

C 1340-1392

Sampling Point: WLS-WP1

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (~~inches~~ cm)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
+40-0							Histosol	Peat

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ✓ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ✓ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Depleted Dark Surface (F7)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Redox Depressions (F8)
- ___ Red Parent Material (TF2)

Indicators for Problematic Hydric Soils[3]:

- ___ Sandy Gleyed Matrix (S4)
- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (~~inches~~ cm): ___

Hydric Soil Present? Yes ✓ No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ✓ No ___ Depth (~~inches~~ cm): 3cm

Water Table Present? Yes ✓ No ___ Depth (~~inches~~ cm): 5cm

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (~~inches~~ cm): 12

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – NOVA SCOTIA

Project/Site: GP Q Municipality/County: Guysborough Sampling Date: Sept 1/10

Applicant/Owner: Ecosystem Unlimited Sampling Point: WL5-UP1

Investigator(s): S. Burley Section, Township, Range: Blocks Point

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Convex

Slope (%): 25% E: 644453 N: 5024120 Datum: NAD 83

Soil Map Unit Name: Rockland Wetland Type: Upland

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No	Is the Sampled Area within a Wetland? Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10 m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Picea glauca	20%	FACU	✓
2. Abies balsamea	5%	FAC	✓
3.			
4.			
5.			
	25	= Total Cover	

Sapling/Shrub Stratum (Plot size: 5 m)			
1. Alnus incana	15%	FACW	✓
2.			
3.			
4.			
5.			
	15	= Total Cover	

Herb Stratum (Plot size: 1 m)			
1. Cornus canadensis	25%	FAC	✓
2. Dryopteris cristata	20%	FAC	✓
3. Solidago rugosa	5%	FAC	
4. Rhodora sp	5%		
5. Rosa sp	5%		
6. Dryopteris/Thelypteris	10%	N/I	
7. Maianthemum canadense	2%	FAC	
8.			
9.			
10.			
	72%	= Total Cover	

Woody Vine Stratum (Plot size: ____)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 80% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	____	x 1 =	____
FACW species	15	x 2 =	30
FAC species	57	x 3 =	171
FACU species	20	x 4 =	80
UPL species	____	x 5 =	____
Column Totals:	92 (A)		281 (B)

Prevalence Index = B/A = 3.1

Hydrophytic Vegetation Indicators:

- ____ Rapid Test for Hydrophytic Vegetation
- ✓ Dominance Test is >50%
- ____ Prevalence Index is ≤3.0[1]
- ____ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Sampling Point: WL5-UP1

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 2-0							Du H	
Bf 0-35	7.5YR 4/4	100					Sandy loam	well drained

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Depleted Dark Surface (F7)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Redox Depressions (F8)
- ___ Red Parent Material (TF2)

Indicators for Problematic Hydric Soils[3]:

- ___ Sandy Gleyed Matrix (S4)
- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (cm): ___

Hydric Soil Present? Yes ___ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ___ Depth (cm): ___

Water Table Present? Yes ___ No ___ Depth (cm): ___

Saturation Present? (includes capillary fringe) Yes ___ No ___ Depth (cm): ___

Wetland Hydrology Present? Yes ___ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Freshwater Wetland Data Sheet: WL 6

Date: Sept. 1/10
Investigator(s): Scott Burley
Weather: Sun
Topographic Sheet: _____
Aerial Photo Number: _____

Wetland Atlas Number : _____
GIS Map / Stand No. : _____
Wetland Form[1]:: Beside Bog
Wetland size: _____ ha
Associated Watercourse: _____

Wetland Type:
1.Aquatic bed/unconsolidated bottom (AB) ____
2.Bog(BO) X
3.Fen (FE) ____
4.Emergent wetland (EW) ____
5.Shrub wetland (SB) ____
6.Forested wetland (FW) X

Wetland Class:
1.Open water ___
2.Deep marsh ____
3.Shallow marsh ____
4.Seasonally flooded flats ____
5.Meadow ____
6.Shrub swamp ____
7.Wooded swamp ____
8.Bog X

Wetland Subclass:
1.Vegetated open water ___
2.Non-vegetated OW ___
3.Floating leaved OW ___
4.Rooted floating leaved OW ___
5.Dead woody OW ____
6.Vegetated deep marsh ____
7.Non-vegetated DM ____
8.Dead woody DM ____
9.Sub-shrub DM ____
10.Floating leaved DM ____
11.Rooted floating leaved DM ____
12.Robust DM ____
13.Narrow-leaved DM ____
14.Broad-leaved DM ____
15.Dead woody shallow marsh ____
16.Robust SM ____
17.Narrow leaved SM ____
18.Broad leaved SM ____
19.Floating leaved SM ____
20.Rooted floating leaved SM ____
21.Non-vegetated SM ____
22.Emergent seasonally flooded flats ____
23.Shrubby SFF ____
24.Grazed meadow ____
25.Ungrazed M ____
26.Sedge M ____
27.Sapling shrub swamp ____
28.Bushy SS ____
29.Compact SS ____
30.Low sparse SS ____
31.Deciduous wooded swamp ____
32.Evergreen WS ____
33.Wooded bog ____
34.Shrubby B X
35.Open B X

Water Regime Indicator:
1.Permanently flooded ___
2.Saturated X
3.Seasonally flooded ____

Water Depth:
1.0-5 cm X
2.5-20 cm ____
3.20-50 cm ____
4.50-100 cm ____
5.>100 cm ____

Note: 1. Canadian Wetland Classification System (2nd Edition)

Impounded Wetland Type:
1.Beaver Pond ____
2.Man-made Impoundment ____
3.Ducks Unlimited Impoundment ____
4. None of the above X

Percent Vegetation Cover:
1.> 95% X
2.76-95% in peripheral band ____
3.76-96% in patches ____
4.26-75% in peripheral band ____
5.26-75% in patches ____
6. 5-25% in peripheral band ____
7. 5-25% in patches ____
8.< 5% ____

Wetland Site:
1.Lacustrine ____
2.Riverine ____
3.Palustrine ____
4.Isolated ____
5.Deltaic ____

Vegetation Types (%):
1.Deciduous trees 5% - Red Maple, Birch
2.Coniferous trees 40% Black Spruce
3.Dead trees 10%
4.Tall shrubs 10% - Bog Rosemary, Meadowsweet
5.Low shrubs 25% - Labrador Tea, Cranberry
6.Dead shrubs -
7.Herbs 25%
8.Mosses 10%
9.Narrow-leaved emergents 10% - Cattail, Sedges, Rushes
10.Broad-leaved emergents -
11.Robust emergents 2% Iris
12.Free-floating plants ____
13.Floating plants (rooted) ____
14.Submerged plants ____
15. Other ____

Interspersion: 1.Minimal ____ 2.Low X 3.Medium ____ 4.High ____

Conductivity: N/A
Alkalinity: N/A
pH: N/A

Hydrological Classification:
1.Surface water depression ____
2.Ground water depression X
3.Surface water slope ____
4.Ground water slope ____

Inlets/Outlets/water bodies:
Treeline outflow Bog @ East westmed

Wildlife: (Observation/Signs/Reports)
Pasture
Frog

Adjacent Wildlife habitat (%):

1.Salt marsh ____
2.Forest 100
3.Dykelands ____
4.Mudflats ____
5.Beach ____
6.River ____
7. Other ____

Description:

Surrounding Land Use %:

1 Agriculture ____
2.Forestry ____
3 Recreation ____
4.Industrial ____
5.Urban development ____
6.Transportation ____
7.Residential ____
8.Waste Disposal ____
9.Scientific Research ____
10.Trapping ____
11.Education ____
12.Seasonal resident ____

Description: None

Disturbance: 1.Low ____ 2.Moderate ____ 3.High ____

Description: None

Roads and/or tracks:

1.Private road adjacent ____
2.DOT road adjacent ____
3.Private road within ____
4.DOT road within ____
5.Vehicle tracks ____
6.Other ____

Description: Property cut line @ East side

Existing Uses of Wetlands:

1.Economic use (e.g. farming) ____
2.Recreational activities ____
3.Aesthetics ____
4.Education & public awareness ____
5. None evident ____

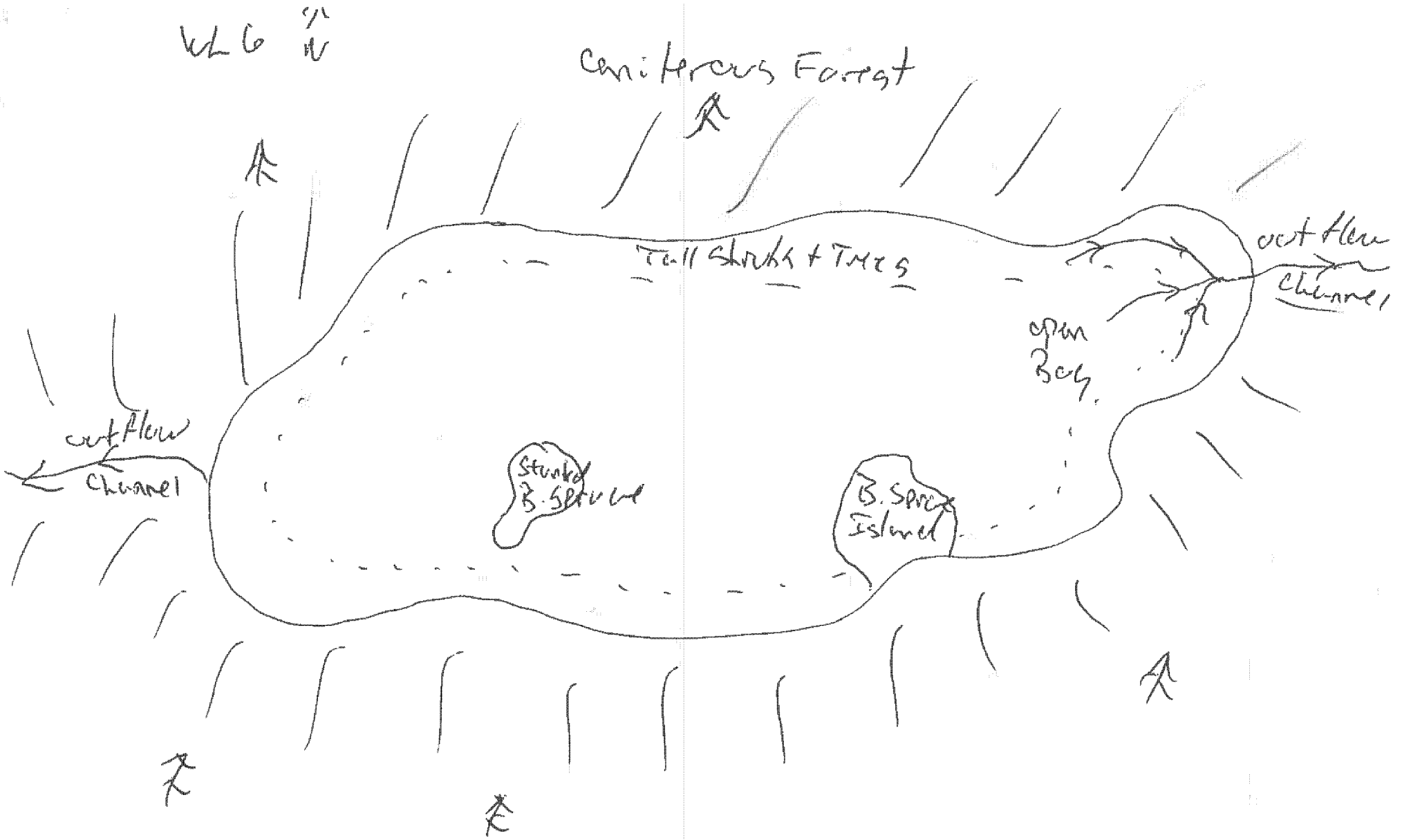
Potential Threats:

Special Features:

1.Rare wetland type ____
2.Rare animal or plant species ____
3.Habitat of rare species X
4.Nesting site for colonial water birds ____
5.Migration stop-over site ____
6. None evident ____

Description: Potential

Notes:


Coniferous Forest
Tall Stumps + Trees
outflow channel
open Bay
outflow channel
Stunted B. Spruce
B. Spruce Island

C 1340-1399

WETLAND DETERMINATION DATA FORM – NOVA SCOTIA

Project/Site: GRQ Municipality/County: Guysborough Sampling Date: Sept. 1/10

Applicant/Owner: Future Wilderness Sampling Point: WL6 - WP1

Investigator(s): S. Burley Section, Township, Range: Blacks Point

Landform (hillslope, terrace, etc.): Flat Local relief (concave, convex, none): Concave

Slope (%): 2% ~~Lat:~~ 6447 45 ~~Long:~~ 5024111 Datum: NAD 83

Soil Map Unit Name: Rockland Wetland Type: Rog

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓ No ____	Is the Sampled Area within a Wetland?	Yes ✓ No ____
Hydric Soil Present?	Yes ✓ No ____		
Wetland Hydrology Present?	Yes ✓ No ____	If yes, optional Wetland Site ID:	WL6

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 12m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer rubrum	2%		FAC
2. Abies balsamea	5%	✓	FAC
3. Picea mariana	5%	✓	FAC
4.			
5.			
	12	= Total Cover	

Sapling/Shrub Stratum (Plot size: 5m)			
1. Acer rubrum	10%		FAC
2. Picea mariana	5%	✓	FACW
3. Alnus incana	2%		FACW
4. Myrica pensylvanica	10%	✓	FAC
5. Eucalyptus bacata	5%	✓	FACU
	23	= Total Cover	

Herb Stratum (Plot size: 1m)			
1. Maianthemum trifolia	20%	✓	ORL
2. Eriophorum virginicum	10%	✓	ORL
3. Onoclea sensibilis	5%		FACW
4. Ledum groenlandicum	5%		ORL
5. Aster acuminatus	2%		FACW
6. Rubus hispidus	2%		FACW
7. Rhynchospora alba	2%		ORL
8.			
9.			
10.			
	46	= Total Cover	

Woody Vine Stratum (Plot size: ____)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 6 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 86 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	57	x 1 =	57
FACW species	11	x 2 =	22
FAC species	23	x 3 =	69
FACU species	10	x 4 =	40
UPL species		x 5 =	
Column Totals:	81 (A)		188 (B)

Prevalence Index = B/A = 2.1

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ✓ Dominance Test is >50%
- ✓ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2009)

C 1340-1400

Sampling Point: WL6-WP1

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (~~inches~~ cm)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
7-40-0							organic	Peat

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ✓ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ✓ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Depleted Dark Surface (F7)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Redox Depressions (F8)
- ___ Red Parent Material (TF2)

Indicators for Problematic Hydric Soils[3]:

- ___ Sandy Gleyed Matrix (S4)
- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (~~inches~~ cm): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (~~inches~~ cm): _____

Water Table Present? Yes ✓ No ___ Depth (~~inches~~ cm): Surface

Saturation Present? (Includes capillary fringe) Yes ✓ No ___ Depth (~~inches~~ cm): 0

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – NOVA SCOTIA

Project/Site: GPA Municipality/County: Guysborough Sampling Date: Sept 1/10
Applicant/Owner: Enbridge Pipelines Sampling Point: WL6-UP1
Investigator(s): S. Burley Section, Township, Range: Blacks Point
Landform (hillslope, terrace, etc.): Local relief (concave, convex, none):
Slope (%): 5% ~~Lat:~~ 6446716 ~~Long:~~ 502 4127 Datum: NAD 83 UTM
Soil Map Unit Name: Rockland Wetland Type: Upland
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ____ No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	Is the Sampled Area within a Wetland? Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer saccharum	15%	✓	FAC
2.			
3.			
4.			
5.			
	15 = Total Cover		

Sapling/Shrub Stratum (Plot size: 5m)			
1. Acer saccharum	15%	✓	FAC
2. Picea rubens	5%		FACW
3. Betula papyrifera	2%		FAC
4.			
5.			
	22 = Total Cover		

Herb Stratum (Plot size: 1m)			
1. Maianthemum canadense	5%	✓	FAC
2. Viburnum nudis-idaea	5%	✓	FAC
3. Linnaea borealis	10%	✓	FAC
4. Mitchella repens	5%	✓	FACW
5. Picea rubens	2%		FACW
6. Acer saccharum	2%		FAC
7.			
8.			
9.			
10.			
	29 = Total Cover		

Woody Vine Stratum (Plot size: ~)			
1.			
2.			
	= Total Cover		

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)
Total Number of Dominant Species Across All Strata: 6 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 83 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	7	x 2 =	14
FAC species	54	x 3 =	162
FACU species	5	x 4 =	20
UPL species		x 5 =	
Column Totals:	66 (A)		196 (B)

Prevalence Index = B/A = 2.97

Hydrophytic Vegetation Indicators:
___ Rapid Test for Hydrophytic Vegetation
___ Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2009)

C 1340-1402

Sampling Point: WL-DP1

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0								duff
0-10	7.5YR 6/1						Sandy loam	
10-30	7.5YR 4/6						Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Depleted Dark Surface (F7)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Redox Depressions (F8)
- ___ Red Parent Material (TF2)

Indicators for Problematic Hydric Soils[3]:

- ___ Sandy Gleyed Matrix (S4)
- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (cm): _____

Hydric Soil Present? Yes _____ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Mart Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (cm): _____

Water Table Present? Yes _____ No _____ Depth (cm): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (cm): _____

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Freshwater Wetland Data Sheet: WL 7

Date: Sept. 1/10
Investigator(s): Scott Burley
Weather: Sun
Topographic Sheet: _____
Aerial Photo Number: _____

Wetland Atlas Number : _____
GIS Map / Stand No. : _____
Wetland Form[1]:: Swamp
Wetland size: _____ ha
Associated Watercourse: _____

Wetland Type:
1.Aquatic bed/unconsolidated bottom (AB) ____
2.Bog(BO) ____
3.Fen (FE) ____
4.Emergent wetland (EW) ____
5.Shrub wetland (SB) ____
6.Forested wetland (FW) ____

Wetland Class:
1.Open water ___
2.Deep marsh ____
3.Shallow marsh _____
4.Seasonally flooded flats ____
5.Meadow ____
6.Shrub swamp ____
7.Wooded swamp ____
8.Bog ____

Wetland Subclass:
1.Vegetated open water ___
2.Non-vegetated OW ___
3.Floating leaved OW ___
4.Rooted floating leaved OW ___
5.Dead woody OW ____
6.Vegetated deep marsh ____
7.Non-vegetated DM ____
8.Dead woody DM ____
9.Sub-shrub DM ____
10.Floating leaved DM ____
11.Rooted floating leaved DM ____
12.Robust DM ____
13.Narrow-leaved DM ____
14.Broad-leaved DM ____
15.Dead woody shallow marsh ____
16.Robust SM _____
17.Narrow leaved SM _____
18.Broad leaved SM ____
19.Floating leaved SM ____
20.Rooted floating leaved SM ____
21.Non-vegetated SM ____
22.Emergent seasonally flooded flats ____
23.Shrubby SFF ____
24.Grazed meadow ____
25.Ungrazed M ____
26.Sedge M ____
27.Sapling shrub swamp ____
28.Bushy SS ____
29.Compact SS _____
30.Low sparse SS ____
31.Deciduous wooded swamp ____
32.Evergreen WS ____
33.Wooded bog ____
34.Shrubby B ____
35.Open B _____

Water Regime Indicator:
1.Permanently flooded ____ - channels
2.Saturated ____
3.Seasonally flooded ____

Water Depth:
1.0-5 cm ____
2.5-20 cm ____ - channels
3.20-50 cm ____
4.50-100 cm ____
5.>100 cm ____

Note: 1. Canadian Wetland Classification System (2nd Edition)

Impounded Wetland Type:
1.Beaver Pond ____
2.Man-made Impoundment ____
3.Ducks Unlimited Impoundment ____
4. None of the above X

Percent Vegetation Cover:
1.> 95% X
2.76-95% in peripheral band ___
3.76-96% in patches ___
4.26-75% in peripheral band ____
5.26-75% in patches ____
6. 5-25% in peripheral band ____
7. 5-25% in patches ____
8.< 5% ____

Wetland Site:
1.Lacustrine ____
2.Riverine X
3.Palustrine ____
4.Isolated ____
5.Deltaic ___

Vegetation Types (%):
1.Deciduous trees
2.Coniferous trees
3.Dead trees
4.Tall shrubs
5.Low shrubs
6.Dead shrubs
7.Herbs
8.Mosses
9.Narrow-leaved emergents
10.Broad-leaved emergents
11.Robust emergents
12.Free-floating plants
13.Floating plants (rooted)
14.Submerged plants
15. Other

Interspersion: 1.Minimal X 2.Low ____ 3.Medium ___ 4.High ____

Conductivity: N/A
pH: N/A
Alkalinity: N/A

Hydrological Classification:
1.Surface water depression ____
2.Ground water depression ____
3.Surface water slope X
4.Ground water slope ____

Inlets/Outlets/water bodies:
Lotic Through flow

Wildlife: (Observation/Signs/Reports)
Passerines
Frog

Adjacent Wildlife habitat (%):

1.Salt marsh ____
2.Forest 90?
3.Dykelands ____
4.Mudflats ____
5.Beach 10
6.River ____
7. Other ____

Description:

Surrounding Land Use %:

1 Agriculture ____
2.Forestry ____
3 Recreation ____
4.Industrial ____
5.Urban development ____
6.Transportation ____
7.Residential ____
8.Waste Disposal ____
9.Scientific Research ____
10.Trapping ____
11.Education ____
12.Seasonal resident ____

Description: None

Disturbance: 1.Low ____ 2.Moderate ____ 3.High ____

Description: None

Roads and/or tracks:

1.Private road adjacent ____
2.DOT road adjacent ____
3.Private road within ____
4.DOT road within ____
5.Vehicle tracks ____
6.Other ____

Description: None

Existing Uses of Wetlands:

1.Economic use (e.g. farming) ____
2.Recreational activities ____
3.Aesthetics ____
4.Education & public awareness ____
5. None evident C

Potential Threats:

Special Features:

1.Rare wetland type ____
2.Rare animal or plant species ____
3.Habitat of rare species C
4.Nesting site for colonial water birds ____
5.Migration stop-over site ____
6. None evident ____

Description: Potential

Notes:

Cliff to Ocean

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Black Point Municipality/County: Guysborough Sampling Date: Aug 20/14
Applicant/Owner: Vulcan Sampling Point: WL7-WP1
Investigator(s): S. Beckley Affiliation: AMEC
Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Hummocky
Slope (%): 1 Lat: 0445669 Long: 5024338 Datum: NAD 83
Soil Map Unit Name/Type: Rockland Wetland Type: Treed Swamp
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ✓ No ____
Hydric Soil Present? Yes ✓ No ____
Wetland Hydrology Present? Yes ✓ No ____
Is the Sampled Area within a Wetland? Yes ✓ No ____
If yes, optional Wetland Site ID: WL 7
Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Picea mariana	60	✓	FACW
2.			
3.			
4.			
5.			
	60 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. Picea mariana	5	✓	FACW
2. Aronia melanocarpa var. melanocarpa	2		FACW
3.			
4.			
5.			
	7 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. Rubus pubescens	2		FAC
2. Lonicera borealis	2		FAC
3. Cornus trispermum	2		OBL
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	= Total Cover		
Woody Vine Stratum (Plot size: ~)			
1.			
2.			
	= Total Cover		

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)
Total Number of Dominant Species Across All Strata: 2 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species 2	x 1 =	2
FACW species 67	x 2 =	134
FAC species 4	x 3 =	12
FACU species	x 4 =	
UPL species	x 5 =	
Column Totals: 73 (A)		148 (B)

Prevalence Index = B/A = 2.0

Hydrophytic Vegetation Indicators:
___ Rapid Test for Hydrophytic Vegetation
✓ Dominance Test is >50%
✓ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

SOIL

Sampling Point: WL7-UP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 0-40+							Organic	Peat

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ✓ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ✓ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): _____

Water Table Present? Yes ___ No ✓ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (inches): 5cm

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Black Point Municipality/County: Guysborough Sampling Date: Aug 20/14

Applicant/Owner: Vulcan Sampling Point: SwL7-UP1

Investigator(s): S. Burley Affiliation: AMEC

Landform (hillslope, terrace, etc.): Hill Slope Local relief (concave, convex, none): Hummocky

Slope (%): 5-9% Lat: 6448741 Long: 5624335 Datum:

Soil Map Unit Name/Type: Rockland Wetland Type: upland open forest

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No ✓	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	If yes, optional Wetland Site ID: ____
Wetland Hydrology Present?	Yes ____	No ✓	

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Picea glauca	30	✓	FAC
2.			
3.			
4.			
5.			
	30 = Total Cover		

Sapling/Shrub Stratum (Plot size: 5m)			
1. Alnus crispa	5	✓	FACU
2. Kalmia angustifolia	10	✓	FAC
3. Picea glauca	5	✓	FAC
4.			
5.			
	20 = Total Cover		

Herb Stratum (Plot size: 1m)			
1. Cornus canadensis	40	✓	FAC
2. Rubus sp.	5		FACU
3. Trientalis borealis	5		FAC
4. Vaccinium vitis-idea	2		FAC
5. Maianthemum canadense	2		FAC
6.			
7.			
8.			
9.			
10.			
	54 = Total Cover		

Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 80 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species	x 1 =	
FACW species	x 2 =	
FAC species 94	x 3 =	282
FACU species 10	x 4 =	40
UPL species	x 5 =	
Column Totals: 104 (A)		322 (B)

Prevalence Index = B/A = 3.1

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No ✓

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WLZ-UP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-15							organic	Root

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Rock

Depth (inches): 15cm

Hydric Soil Present? Yes _____ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

Freshwater Wetland Data Sheet WL 8

Date: Sept. 2/10
Investigator(s): S Bullen
Weather: Sunny
Topographic Sheet: _____
Aerial Photo Number: _____

Wetland Atlas Number : _____
GIS Map / Stand No. : _____
Wetland Form[1]:: Riparian Treed Swamp
Wetland size: _____ ha
Associated Watercourse: _____

Wetland Type:
1.Aquatic bed/unconsolidated bottom (AB) ____
2.Bog(BO) ____
3.Fen (FE) ____
4.Emergent wetland (EW) ____
5.Shrub wetland (SB) ____
6.Forested wetland (FW) X

Wetland Class:
1.Open water ____
2.Deep marsh ____
3.Shallow marsh ____
4.Seasonally flooded flats ____
5.Meadow ____
6.Shrub swamp ____
7.Wooded swamp X
8.Bog ____

Wetland Subclass:
1.Vegetated open water ____
2.Non-vegetated OW ____
3.Floating leaved OW ____
4.Rooted floating leaved OW ____
5.Dead woody OW ____
6.Vegetated deep marsh ____
7.Non-vegetated DM ____
8.Dead woody DM ____
9.Sub-shrub DM ____
10.Floating leaved DM ____
11.Rooted floating leaved DM ____
12.Robust DM ____
13.Narrow-leaved DM ____
14.Broad-leaved DM ____
15.Dead woody shallow marsh ____
16.Robust SM ____
17.Narrow leaved SM ____
18.Broad leaved SM ____
19.Floating leaved SM ____
20.Rooted floating leaved SM ____
21.Non-vegetated SM ____
22.Emergent seasonally flooded flats ____
23.Shrubby SFF ____
24.Grazed meadow ____
25.Ungrazed M ____
26.Sedge M ____
27.Sapling shrub swamp ____
28.Bushy SS ____
29.Compact SS ____
30.Low sparse SS ____
31.Deciduous wooded swamp X
32.Evergreen WS X
33.Wooded bog ____
34.Shrubby B ____
35.Open B ____

Water Regime Indicator:
1.Permanently flooded ____
2.Saturated X
3.Seasonally flooded ____

Water Depth:
1.0-5 cm X
2.5-20 cm ____
3.20-50 cm ____
4.50-100 cm ____
5.>100 cm ____

Note: 1. Canadian Wetland Classification System (2nd Edition)

Impounded Wetland Type:
1.Beaver Pond ____
2.Man-made Impoundment ____
3.Ducks Unlimited Impoundment ____
4. None of the above X

Percent Vegetation Cover:
1.> 95% X
2.76-95% in peripheral band ___
3.76-96% in patches ___
4.26-75% in peripheral band ____
5.26-75% in patches ____
6. 5-25% in peripheral band ____
7. 5-25% in patches ____
8.< 5% ____

Wetland Site:
1.Lacustrine ____
2.Riverine X
3.Palustrine ____
4.Isolated ____
5.Deltaic ___

Vegetation Types (%):
1.Deciduous trees 15% - Acer rubrum
2.Coniferous trees 55% - Abies balsamea
3.Dead trees 5%
4.Tall shrubs 5% -
5.Low shrubs 5% - Kalmia
6.Dead shrubs -
7.Herbs - 60% - Cinnamon fern, Canada trisperma
8.Mosses - 100%
9.Narrow-leaved emergents -
10.Broad-leaved emergents -
11.Robust emergents -
12.Free-floating plants -
13.Floating plants (rooted) -
14.Submerged plants -
15. Other -

Interspersion: 1.Minimal ___ 2.Low X 3.Medium ___ 4.High ____

Conductivity: N/A
Alkalinity: N/A
pH: N/A

Hydrological Classification:
1.Surface water depression X
2.Ground water depression ____
3.Surface water slope ____
4.Ground water slope ____

Inlets/Outlets/water bodies:
Lotic through flow

Wildlife: (Observation/Signs/Reports)
Frogs
Passerines

Adjacent Wildlife habitat (%):

1.Salt marsh ____
2.Forest 10 %
3.Dykelands ____
4.Mudflats ____
5.Beach ____
6.River ____
7. Other 90 - Shrub Barren

Description: ~~mixedwoods~~ Mixed forest

Surrounding Land Use %:

1 Agriculture ____
2.Forestry ____
3 Recreation ____
4.Industrial ____
5.Urban development ____
6.Transportation ____
7.Residential ____
8.Waste Disposal ____
9.Scientific Research ____
10.Trapping ____
11.Education ____
12.Seasonal resident ____

Description: Road

Disturbance: 1.Low X 2.Moderate ____ 3.High ____

Description: road

Roads and/or tracks:

1.Private road adjacent ____
2.DOT road adjacent ____
3.Private road within ____
4.DOT road within ____
5.Vehicle tracks ____
6.Other X

Description: Property cut line along west boundary

Existing Uses of Wetlands:

1.Economic use (e.g. farming) ____
2.Recreational activities ____
3.Aesthetics ____
4.Education & public awareness ____
5. None evident X

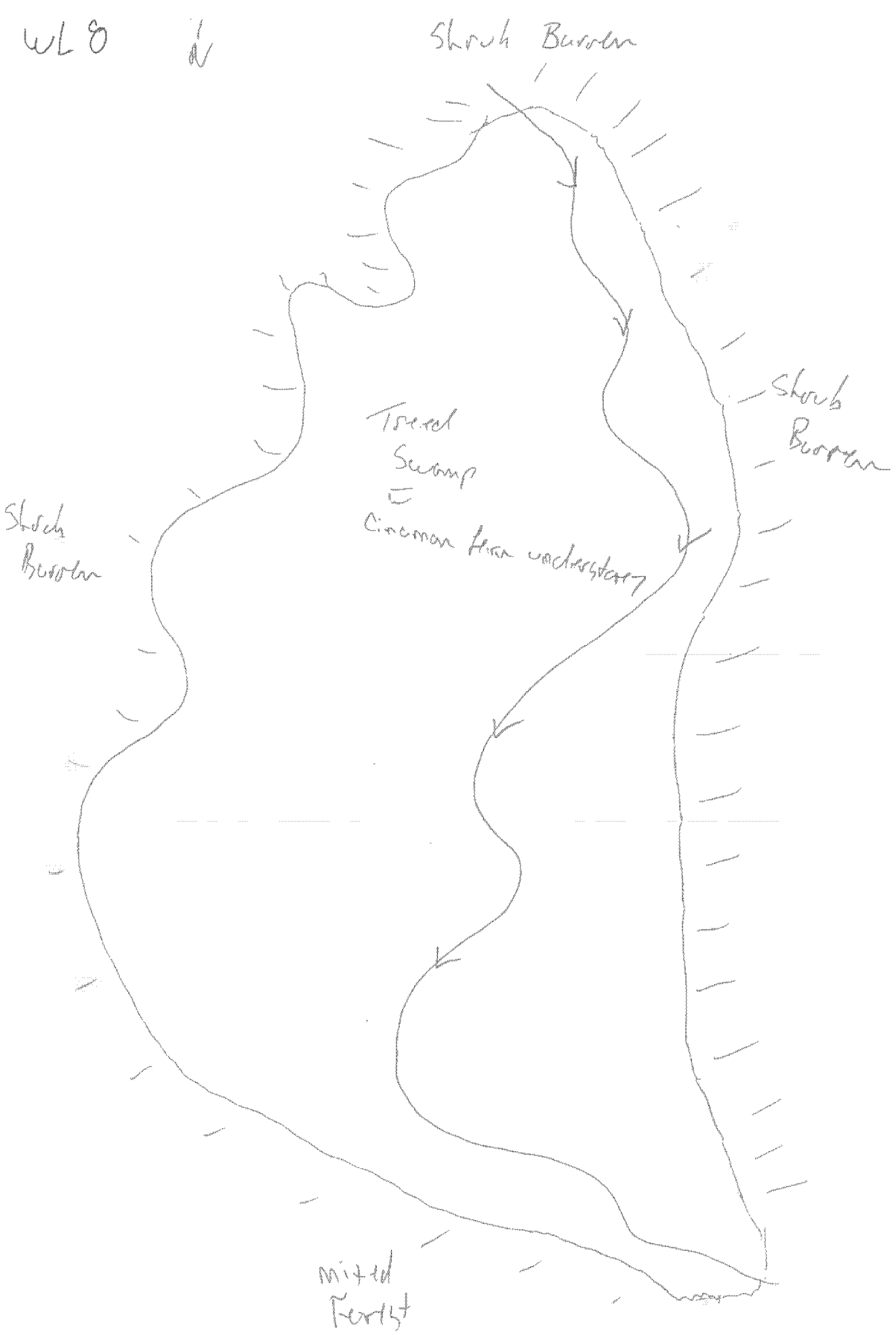
Potential Threats:

Special Features:

1.Rare wetland type ____
2.Rare animal or plant species ____
3.Habitat of rare species X
4.Nesting site for colonial water birds ____
5.Migration stop-over site ____
6. None evident ____

Description: Potential

Notes:


WL 8
Shrub Burrow
Shrub Burrow
Shrub Burrow
Treed Swamp
Cinnamon fern understory
Mixed Forest

C 1340-1415

Freshwater Wetland Data Sheet WL 9

Date: Sept. 2/10
Investigator(s): S. Burke
Weather: Sunny
Topographic Sheet: _____
Aerial Photo Number: _____

Wetland Atlas Number: 91
GIS Map / Stand No.: C45306011
Wetland Form[1]:: Deciduous Bog / Treed / Shrub complex
Wetland size: _____ ha
Associated Watercourse: _____

Wetland Type:
1. Aquatic bed/unconsolidated bottom (AB) ____
2. Bog(BO) X
3. Fen (FE) ____
4. Emergent wetland (EW) ____
5. Shrub wetland (SB) ____
6. Forested wetland (FW) X

Wetland Class:
1. Open water ___
2. Deep marsh ____
3. Shallow marsh ____
4. Seasonally flooded flats ____
5. Meadow ____
6. Shrub swamp ____
7. Wooded swamp X
8. Bog X

Wetland Subclass:
1. Vegetated open water ___
2. Non-vegetated OW ___
3. Floating leaved OW ___
4. Rooted floating leaved OW ___
5. Dead woody OW ____
6. Vegetated deep marsh ____
7. Non-vegetated DM ____
8. Dead woody DM ____
9. Sub-shrub DM ____
10. Floating leaved DM ____
11. Rooted floating leaved DM ____
12. Robust DM ____
13. Narrow-leaved DM ____
14. Broad-leaved DM ____
15. Dead woody shallow marsh ____
16. Robust SM ____
17. Narrow leaved SM ____
18. Broad leaved SM ____
19. Floating leaved SM ____
20. Rooted floating leaved SM ____
21. Non-vegetated SM ____
22. Emergent seasonally flooded flats ____
23. Shrubby SFF ____
24. Grazed meadow ____
25. Ungrazed M ____
26. Sedge M ____
27. Sapling shrub swamp ____
28. Bushy SS ____
29. Compact SS ____
30. Low sparse SS ____
31. Deciduous wooded swamp X
32. Evergreen WS X
33. Wooded bog ____
34. Shrubby B ____
35. Open B X

Water Regime Indicator:
1. Permanently flooded ___
2. Saturated X
3. Seasonally flooded ____

Water Depth:
1. 0-5 cm X
2. 5-20 cm ____
3. 20-50 cm ____
4. 50-100 cm ____
5. >100 cm ____

Note: 1. Canadian Wetland Classification System (2nd Edition)

Impounded Wetland Type:
1.Beaver Pond ____
2.Man-made Impoundment ____
3.Ducks Unlimited Impoundment ____
4. None of the above X

Percent Vegetation Cover:
1.> 95% X
2.76-95% in peripheral band ____
3.76-96% in patches ____
4.26-75% in peripheral band ____
5.26-75% in patches ____
6. 5-25% in peripheral band ____
7. 5-25% in patches ____
8.< 5% ____

Wetland Site:
1.Lacustrine ____
2.Riverine ____
3.Palustrine ____
4.Isolated X
5.Deltaic ____

Vegetation Types (%):
1.Deciduous trees 5% - Acer Rubrum
2.Coniferous trees 15% - Picea mariana
3.Dead trees 10%
4.Tall shrubs - 5% - Alnus, Viburnum nudum, Gaylussacia,
5.Low shrubs - 75% - Ledum, Kalmia angustifolia, Gaylussacia, Chamaedaphne
6.Dead shrubs –
7.Herbs 10% - Cinnamon fern, Sphagnum
8.Mosses - 100% - Sphagnum
9.Narrow-leaved emergents –
10.Broad-leaved emergents –
11.Robust emergents –
12.Free-floating plants –
13.Floating plants (rooted) –
14.Submerged plants –
15. Other –

Interspersion: 1.Minimal X 2.Low ____ 3.Medium ____ 4.High ____

Conductivity: N/A
Alkalinity: N/A
pH: N/A

Hydrological Classification:
1.Surface water depression X
2.Ground water depression ____
3.Surface water slope ____
4.Ground water slope ____

Inlets/Outlets/water bodies:
None observed in Bog - Peripheral THRU Swamp outlets to lake through fen

Wildlife: (Observation/Signs/Reports)
Deer tracks

Adjacent Wildlife habitat (%):

1.Salt marsh ____
2.Forest 50%
3.Dykelands ____
4.Mudflats ____
5.Beach ____
6.River ____
7. Other 10% Lake
other 40% - Shrub barren

Description: mixed woods

Surrounding Land Use %:

1 Agriculture ____
2.Forestry ____
3 Recreation ____
4.Industrial ____
5.Urban development ____
6.Transportation ____
7.Residential ____
8.Waste Disposal ____
9.Scientific Research ____
10.Trapping ____
11.Education ____
12.Seasonal resident ____

Description: none

Disturbance: 1.Low X 2.Moderate ____ 3.High ____

Description: none

Roads and/or tracks:

1.Private road adjacent ____
2.DOT road adjacent ____
3.Private road within ____
4.DOT road within ____
5.Vehicle tracks ____
6.Other ____

Description: none

Existing Uses of Wetlands:

1.Economic use (e.g. farming) ____
2.Recreational activities ____
3.Aesthetics ____
4.Education & public awareness ____
5. None evident X

Potential Threats:

Special Features:

1.Rare wetland type ____
2.Rare animal or plant species ____
3.Habitat of rare species X
4.Nesting site for colonial water birds ____
5.Migration stop-over site ____
6. None evident ____

Description: Potential

Notes: Bog is Isolated. Peripheral swamp [illegible] as [illegible] marsh @ North east end fringe [illegible] which is [illegible] bidirectional, [illegible] is connected to swamp.

N
Lake
Shrub Fen
Burren
coniferous forest
Tall shrub Burren
Mound open Bog
Treed Swamp

C 1340-1419

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Black Point Municipality/County: Guysborough Sampling Date: Aug 22/14

Applicant/Owner: Vulcan Sampling Point: WL8-WP1

Investigator(s): S. Barclay Affiliation: AMEC

Landform (hillslope, terrace, etc.): Flat Local relief (concave, convex, none): Hummocky

Slope (%): 1 Lat: 643967 Long: 5012550 Datum:

Soil Map Unit Name/Type: Pocklmad Wetland Type: Treed Swamp

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ✓ No ____

Hydric Soil Present? Yes ✓ No ____

Wetland Hydrology Present? Yes ✓ No ____

Is the Sampled Area within a Wetland? Yes ✓ No ____

If yes, optional Wetland Site ID: WL8

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

	Tree Stratum (Plot size: 10m)	Absolute % Cover	Dominant Species?	Indicator Status
*	1. Abies balsamea	10	✓	FAC
	2. Acer rubrum	5	✓	FAC
	3.			
	4.			
	5.			
		15	= Total Cover	
	Sapling/Shrub Stratum (Plot size: 5m)			
	1. Abies balsamea	5		FAC
*	2. Viburnum cassinoides	15	✓	FAC
	3. Kalmia angustifolia	5		FAC
	4. Sorbus decora	2		FAC
	5.			
		27	= Total Cover	
	Herb Stratum (Plot size: 1m)			
*	1. Cook trisperma	50	✓	OBL
	2.			
	3.			
	4.			
	5.			
	6.			
	7.			
	8.			
	9.			
	10.			
		50	= Total Cover	
	Woody Vine Stratum (Plot size: ____)			
	1.			
	2.			
			= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	50	x 1 =	50
FACW species	42	x 2 =	84
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	92 (A)		134 (B)

Prevalence Index = B/A = 1.5

Hydrophytic Vegetation Indicators:

__ Rapid Test for Hydrophytic Vegetation

✓ Dominance Test is >50%

✓ Prevalence Index is ≤3.0[1]

__ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

* Dominant in WL

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

SOIL

Sampling Point: WLG-WP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-40+							C&Gsoil	Peat

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ✓ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ✓ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): _____

Water Table Present? Yes ___ No ✓ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (inches): 5 cm

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Black Point Municipality/County: Guysborough Sampling Date: Aug 12/14

Applicant/Owner: Vulcan Sampling Point: WL 8-UP1

Investigator(s): S. Burley Affiliation: AMEC

Landform (hillslope, terrace, etc.): Flat Local relief (concave, convex, none): Hummocky

Slope (%): 2 Lat: 44 39 61 Long: 52 25 87 Datum: WGS83

Soil Map Unit Name/Type: Deckland Wetland Type: Upland - Mixed Forest

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Abies balsamea	15	✓	FAC
2. Acer rubrum	15	✓	FAC
3. Picea mariana	5	____	FACW
4. ____	____	____	____
5. ____	____	____	____
	35	= Total Cover	

Sapling/Shrub Stratum (Plot size: 5m)			
1. Acer Rennsylvanicum Mucronatum	5	✓	FAC
2. Cornus stolonifera	10	✓	FAC
3. Kalmia angustifolia	5	✓	FAC
4. ____	____	____	____
5. ____	____	____	____
	20	= Total Cover	

Herb Stratum (Plot size: 1m)			
1. Aralia nudicaulis	5	✓	FAC
2. Trientalis borealis	5	✓	FAC
3. Vaccinium angustifolium	2	____	FAC
4. Ledum Groenlandicum	2	____	FACW
5. Cephalozia/Lophozia	2	____	FAC
6. ____	____	____	____
7. ____	____	____	____
8. ____	____	____	____
9. ____	____	____	____
10. ____	____	____	____
	16	= Total Cover	

Woody Vine Stratum (Plot size: ____)			
1. ____	____	____	____
2. ____	____	____	____
	____	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 7 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species	—	x 1 = ____
FACW species	7	x 2 = 14
FAC species	64	x 3 = 192
FACU species	____	x 4 = ____
UPL species	____	x 5 = ____
Column Totals:	71 (A)	206 (B)

Prevalence Index = B/A = 2.9

Hydrophytic Vegetation Indicators:

- ____ Rapid Test for Hydrophytic Vegetation
- ✓ Dominance Test is >50%
- ✓ Prevalence Index is ≤3.0[1]
- ____ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

C 1340-1422

SOIL

Sampling Point: WL8-UP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-20							Organic	Duff
20-30	2.5Y 5/1	100					Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

Freshwater Wetland Data Sheet WL 10

Date: Sept 2/10
Investigator(s): S. Burke
Weather: Sunny
Topographic Sheet: _____
Aerial Photo Number: _____

Wetland Atlas Number : 21/90
GIS Map / Stand No. : C4535611 21 / C4530611
Wetland Form[1]:: Mineral Bog
Wetland size: _____ ha
Associated Watercourse: _____

Wetland Type:
1. Aquatic bed/unconsolidated bottom (AB) ____
2. Bog(BO) X
3. Fen (FE) ____
4. Emergent wetland (EW) ____
5. Shrub wetland (SB) ____
6. Forested wetland (FW) ____

Wetland Class:
1. Open water ____
2. Deep marsh ____
3. Shallow marsh ____
4. Seasonally flooded flats ____
5. Meadow ____
6. Shrub swamp ____
7. Wooded swamp ____
8. Bog X

Wetland Subclass:
1. Vegetated open water ____
2. Non-vegetated OW ____
3. Floating leaved OW ____
4. Rooted floating leaved OW ____
5. Dead woody OW ____
6. Vegetated deep marsh ____
7. Non-vegetated DM ____
8. Dead woody DM ____
9. Sub-shrub DM ____
10. Floating leaved DM ____
11. Rooted floating leaved DM ____
12. Robust DM ____
13. Narrow-leaved DM ____
14. Broad-leaved DM ____
15. Dead woody shallow marsh ____
16. Robust SM ____
17. Narrow leaved SM ____
18. Broad leaved SM ____
19. Floating leaved SM ____
20. Rooted floating leaved SM ____
21. Non-vegetated SM ____
22. Emergent seasonally flooded flats ____
23. Shrubby SFF ____
24. Grazed meadow ____
25. Ungrazed M ____
26. Sedge M ____
27. Sapling shrub swamp ____
28. Bushy SS ____
29. Compact SS ____
30. Low sparse SS ____
31. Deciduous wooded swamp ____
32. Evergreen WS ____
33. Wooded bog ____
34. Shrubby B ____
35. Open B X

Water Regime Indicator:
1. Permanently flooded ____
2. Saturated X
3. Seasonally flooded ____

Water Depth:
1. 0-5 cm X
2. 5-20 cm ____
3. 20-50 cm ____
4. 50-100 cm ____
5. >100 cm ____

Note: 1. Canadian Wetland Classification System (2nd Edition)

Impounded Wetland Type:
1.Beaver Pond _____
2.Man-made Impoundment ____
3.Ducks Unlimited Impoundment ____
4. None of the above X

Percent Vegetation Cover:
1.> 95% X
2.76-95% in peripheral band ___
3.76-96% in patches ___
4.26-75% in peripheral band ____
5.26-75% in patches ____
6. 5-25% in peripheral band ____
7. 5-25% in patches ____
8.< 5% ____

Wetland Site:
1.Lacustrine ____
2.Riverine _____
3.Palustrine ____
4.Isolated X
5.Deltaic ___

Vegetation Types (%):
1.Deciduous trees
2.Coniferous trees Same as WL9
3.Dead trees
4.Tall shrubs
5.Low shrubs
6.Dead shrubs
7.Herbs
8.Mosses
9.Narrow-leaved emergents
10.Broad-leaved emergents
11.Robust emergents
12.Free-floating plants
13.Floating plants (rooted)
14.Submerged plants
15. Other

Interspersion: 1.Minimal Y 2.Low _____ 3.Medium ___ 4.High ____

Conductivity: N/A
Alkalinity: N/A
pH: N/A

Hydrological Classification:
1.Surface water depression _____
2.Ground water depression _____
3.Surface water slope _____
4.Ground water slope ____
5. Dowed Bog - Rain water driven

Inlets/Outlets/water bodies:
None observed

Wildlife: (Observation/Signs/Reports)

Deer Signs

Adjacent Wildlife habitat (%):

1.Salt marsh ____
2.Forest 70%
3.Dykelands ____
4.Mudflats ____
5.Beach ____
6.River ____
7. Other 30% Barren

Description: mixed woods

Surrounding Land Use %:

1 Agriculture ____
2.Forestry ____
3 Recreation ____
4.Industrial ____
5.Urban development ____
6.Transportation ____
7.Residential ____
8.Waste Disposal ____
9.Scientific Research ____
10.Trapping ____
11.Education ____
12.Seasonal resident ____

Description: none

Disturbance: 1.Low X 2.Moderate ____ 3.High ____

Description: none

Roads and/or tracks:

1.Private road adjacent ____
2.DOT road adjacent ____
3.Private road within ____
4.DOT road within ____
5.Vehicle tracks ____
6.Other ____

Description: none

Existing Uses of Wetlands:

1.Economic use (e.g. farming) ____
2.Recreational activities ____
3.Aesthetics ____
4.Education & public awareness ____
5. None evident X

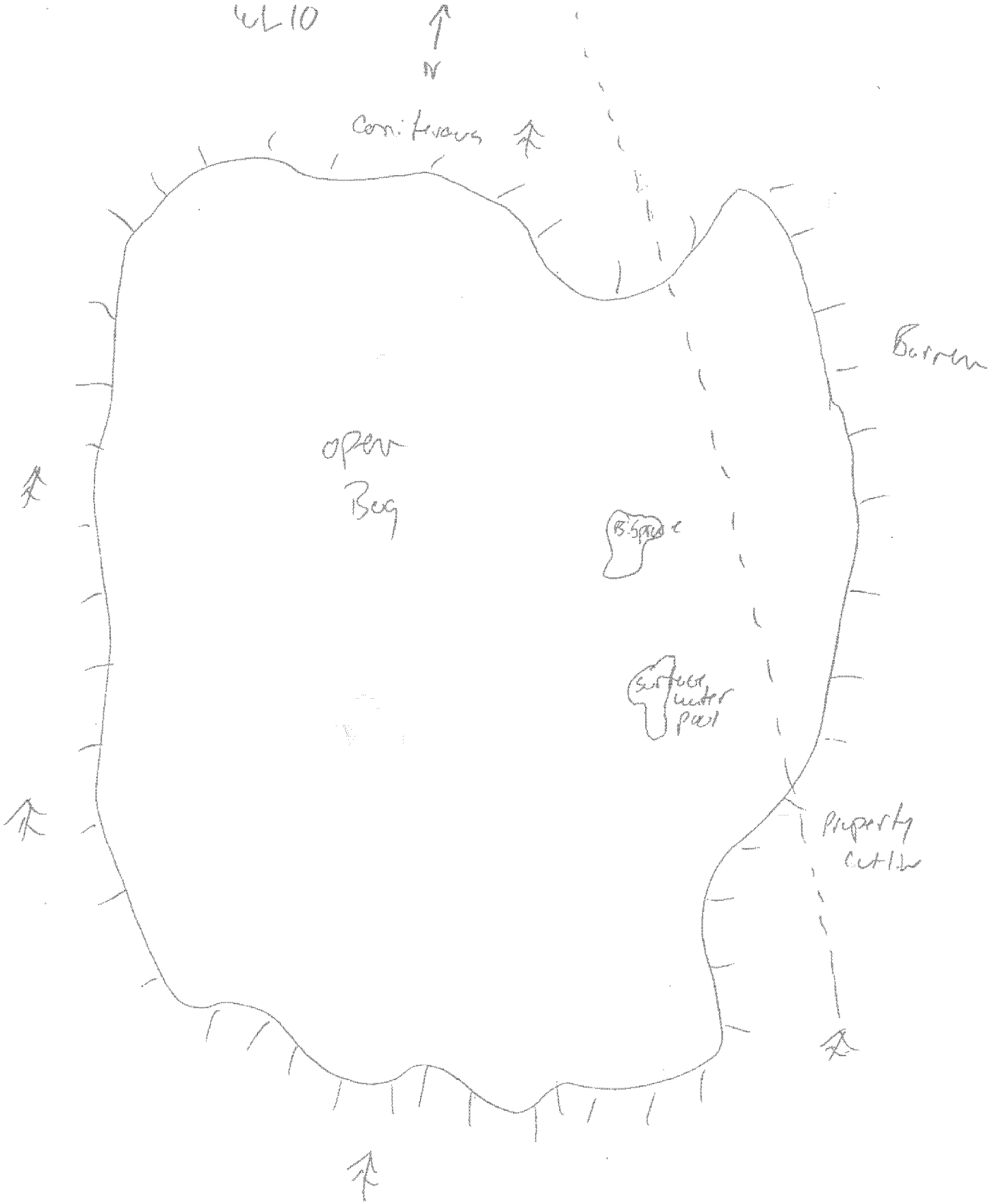
Potential Threats:

Special Features:

1.Rare wetland type ____
2.Rare animal or plant species ____
3.Habitat of rare species X
4.Nesting site for colonial water birds ____
5.Migration stop-over site ____
6. None evident ____

Description: Potential

Notes:



C 1340-1427

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Black Point Municipality/County: Guysborough Sampling Date: Aug. 22/14
Applicant/Owner: Vulcan Sampling Point: WL-10-UP1
Investigator(s): S. Burley Affiliation: AMEC
Landform (hillslope, terrace, etc.): Dented Local relief (concave, convex, none): Concave
Slope (%): 2 Lat: 643751 Long: 5013307 Datum: NAD83
Soil Map Unit Name/Type: Rockland Wetland Type: Domed Bog
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	If yes, optional Wetland Site ID: WL-10
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 10 M)			
1. Larix laricina	3		FAC
2. Picea mariana	4		FACW
3.			
4.			
5.			
	4	= Total Cover	
Sapling/Shrub Stratum (Plot size: 5 M)			
1. Rhododendron groenlandicum	5		FAC
2. Picea mariana	30	✓	FACW
3. Chamaedaphne calyculata	60	✓	FAC
4. Viburnum nudum	5		FAC
5.			
	100	= Total Cover	
Herb Stratum (Plot size: 1 M)			
1. Scirpus cespitosus	5	✓	OBL
2. Eriophorum vaginatum	5	✓	OBL
3. Smilacina trifolia	5	✓	OBL
4. Dryopteris Fern	2		FACW
5. Trientalis Canadensis	5	✓	FAC
6. Cornus Canadensis	2		FAC
7. Myrica gale/Kalmia	2		FAC
8. Acer rubrum	2		FAC
9. Bulk eggplant	5		OBL
10.			
	33	= Total Cover	
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 6 (A)
Total Number of Dominant Species Across All Strata: 6 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	20	x 1 =	20
FACW species	32	x 2 =	64
FAC species	93	x 3 =	249
FACU species	2	x 4 =	8
UPL species		x 5 =	
Column Totals:	137 (A)		341 (B)

Prevalence Index = B/A = 2.5

Hydrophytic Vegetation Indicators:
___ Rapid Test for Hydrophytic Vegetation
✓ Dominance Test is >50%
✓ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

*Rhododendron also dominant as well

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

C 1340-1428

SOIL

Sampling Point: WL10-UP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-40+							Organic	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ✓ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ✓ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ✓ Sparsely Vegetated Concave Surface (B8)
- ✓ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ✓ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): _____

Water Table Present? Yes ___ No ✓ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (inches): 2cm

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Black Point Municipality/County: Guysborough Sampling Date: Aug 22/14

Applicant/Owner: Unicorn Sampling Point: WL-Uc-UP1

Investigator(s): S. Burley Affiliation: AMEC

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Hummocky

Slope (%): 30 Lat: 44°37'57" Long: 62°13'40" Datum: NAD83

Soil Map Unit Name/Type: Rocklend Wetland Type: Upland-Barren

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Picea mariana	10	✓	FACW
2.			
3.			
4.			
5.			
	10 = Total Cover		

Sapling/Shrub Stratum (Plot size: 5m)			
1. Amelanchier laevis	5		FAC
2. Gaylussacia baccata	20	✓	FAC
3. Picea mariana	10	✓	FACW
4. Viburnum nudum	5		FAC
5.			
	40 = Total Cover		

Herb Stratum (Plot size: 1m)			
1. Eriophorum angustifolium	10	✓	FAC
2. Trientalis borealis	10	✓	FAC
3. Maianthemum canadense	5		FAC
4. Vaccinium angustifolium	2		FAC
5.			
6.			
7.			
8.			
9.			
10.			
	27 = Total Cover		

Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species	x 1 =	
FACW species 20	x 2 =	40
FAC species 57	x 3 =	171
FACU species	x 4 =	
UPL species	x 5 =	
Column Totals: 77 (A)		211 (B)

Prevalence Index = B/A = 2.7

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ✓ Dominance Test is >50%
- ✓ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

SOIL

Sampling Point: WHC-P1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-20							Organic	Duff

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Bedrock

Depth (inches): 20cm

Hydric Soil Present? Yes _____ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

WC 11

Freshwater Wetland Data Sheet

Date: Sept 2, 2010
Investigator(s): S. Brady, T. Jones
Weather: Sunny, hot.
Topographic Sheet: _____
Aerial Photo Number: _____

Wetland Atlas Number : _____
GIS Map / Stand No. : _____
Wetland Form[1]:: _____
Wetland size: _____ ha
Associated Watercourse: _____

Wetland Type:
1.Aquatic bed/unconsolidated bottom (AB) ____
2.Bog(BO) ____
3.Fen (FE) ____
4.Emergent wetland (EW) ____
5.Shrub wetland (SB) ____
6.Forested wetland (FW) ✓

Wetland Class:
1.Open water ___
2.Deep marsh ____
3.Shallow marsh _____
4.Seasonally flooded flats ____
5.Meadow ____
6.Shrub swamp _____
7.Wooded swamp ✓
8.Bog ____

Wetland Subclass:
1.Vegetated open water ___
2.Non-vegetated OW ___
3.Floating leaved OW ___
4.Rooted floating leaved OW ___
5.Dead woody OW ____
6.Vegetated deep marsh ____
7.Non-vegetated DM ____
8.Dead woody DM ____
9.Sub-shrub DM ____
10.Floating leaved DM ____
11.Rooted floating leaved DM ____
12.Robust DM ____
13.Narrow-leaved DM ____
14.Broad-leaved DM ____
15.Dead woody shallow marsh ____
16.Robust SM _____
17.Narrow leaved SM _____
18.Broad leaved SM ____
19.Floating leaved SM ____
20.Rooted floating leaved SM ____
21.Non-vegetated SM ____
22.Emergent seasonally flooded flats ____
23.Shrubby SFF ____
24.Grazed meadow ____
25.Ungrazed M ____
26.Sedge M ____
27.Sapling shrub swamp ____
28.Bushy SS ____
29.Compact SS _____
30.Low sparse SS ____
31.Deciduous wooded swamp ____
32.Evergreen WS ✓
33.Wooded bog ____
34.Shrubby B _____
35.Open B _____

Water Regime Indicator:
1.Permanently flooded ___
2.Saturated ✓
3.Seasonally flooded _____

Water Depth:
1.0-5 cm _____
2.5-20 cm _____
3.20-50 cm ____ NA
4.50-100 cm ____
5.>100 cm ____

Note: 1. Canadian Wetland Classification System (2nd Edition)

Impounded Wetland Type:
1.Beaver Pond ____
2.Man-made Impoundment ____ NA
3.Ducks Unlimited Impoundment ____
4. None of the above ✓

Percent Vegetation Cover:
1.> 95% ✓
2.76-95% in peripheral band ___
3.76-96% in patches ___
4.26-75% in peripheral band ____
5.26-75% in patches ____
6. 5-25% in peripheral band ____
7. 5-25% in patches ____
8.< 5% ____

Wetland Site:
1.Lacustrine ____
2.Riverine ✓
3.Palustrine ____
4.Isolated ____
5.Deltaic ___

Vegetation Types (%):
1.Deciduous trees 5% Red Maple, Sorbus americana
2.Coniferous trees 90% Black Spruce, Balsam Fir
3.Dead trees RA-2%
4.Tall shrubs 30% Nemopanthus
5.Low shrubs 5% Kalmia angustifolia
6.Dead shrubs 1%
7.Herbs 5% Maianthemum trifolium, Sarracenia purpurea
8.Mosses Sphagnum 100%
9.Narrow-leaved emergents 10% Carex trisperma
10.Broad-leaved emergents
11.Robust emergents —
12.Free-floating plants —
13.Floating plants (rooted) —
14.Submerged plants —
15. Other Cinnamon fern 15%

Interspersion: 1.Minimal ✓ 2.Low ___ 3.Medium ___ 4.High ___

Conductivity: N/A
Alkalinity: N/A
pH: N/A

Hydrological Classification:
1.Surface water depression ____
2.Ground water depression ____
3.Surface water slope ✓
4.Ground water slope ____

Inlets/Outlets/water bodies:
Inflow out-flow

Wildlife: (Observation/Signs/Reports)
None ; deertracks on ATV trail which cross the WC
Deer tracks

Adjacent Wildlife habitat (%):

1.Salt marsh ____
2.Forest 100%
3.Dykelands ____
4.Mudflats ____
5.Beach ____
6.River ____
7. Other ____

Description: ~~mixed~~ woods coniferous woods (to mixed woods in patches)

Surrounding Land Use %:

1 Agriculture ____
2.Forestry possible, but not harvested
3 Recreation abandoned ATV trail
4.Industrial ____
5.Urban development ____
6.Transportation ____
7.Residential ____
8.Waste Disposal ____
9.Scientific Research ____
10.Trapping ____
11.Education ____
12.Seasonal resident ____

Description:

Disturbance: 1.Low ✓ 2.Moderate ____ 3.High ____

Description:

Roads and/or tracks:

1.Private road adjacent ____
2.DOT road adjacent ____
3.Private road within ____
4.DOT road within ____
5.Vehicle tracks ____
6.Other abandoned ATV trail; crosses wetland

Description:

Existing Uses of Wetlands:

1.Economic use (e.g. farming) ____
2.Recreational activities ____
3.Aesthetics ____
4.Education & public awareness ____
5. None evident ✓

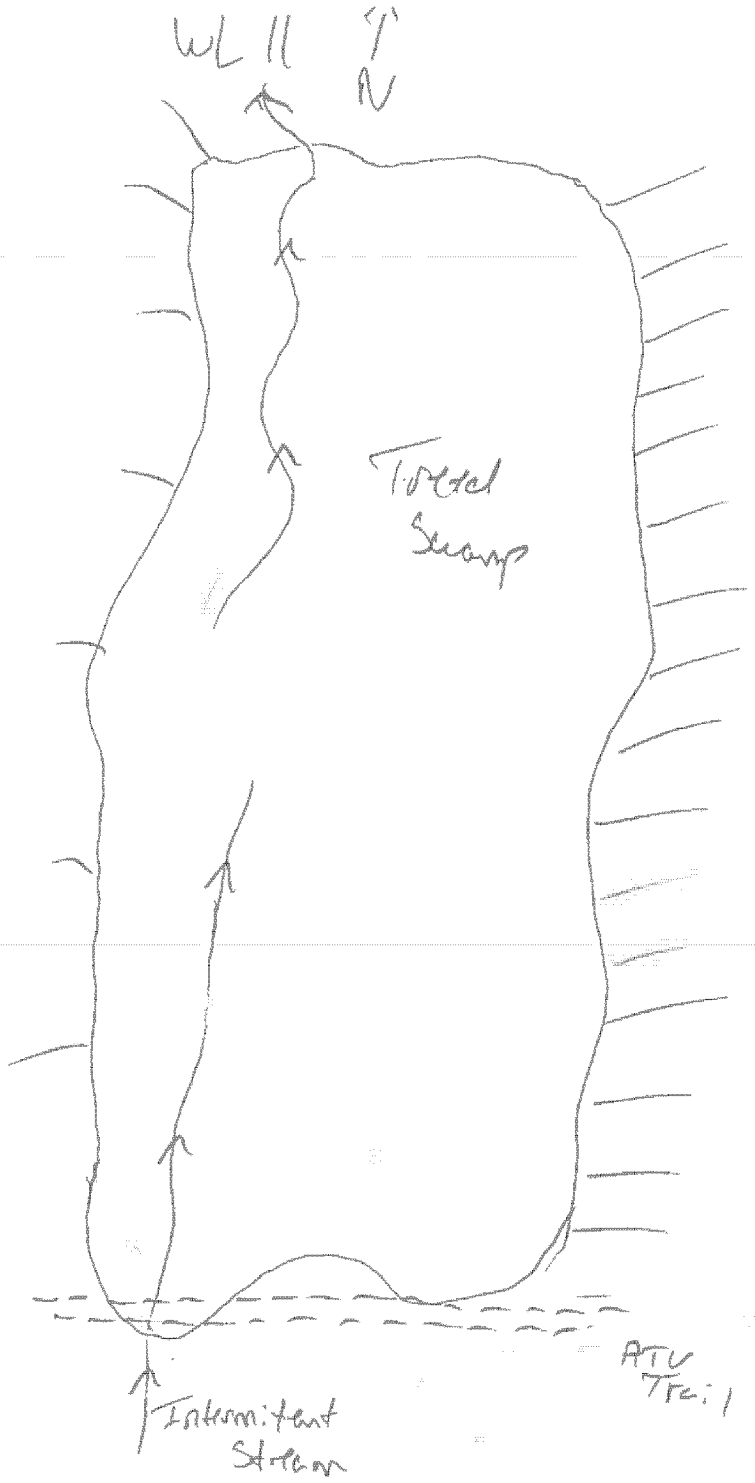
Potential Threats: development

Special Features:

1.Rare wetland type ____
2.Rare animal or plant species ____
3.Habitat of rare species ____
4.Nesting site for colonial water birds ____
5.Migration stop-over site ____
6. None evident ✓

Description:

Notes:


WL II
N
Forested
Swamp
ATU
Trail
Intermittent
Stream

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Rule Point Municipality/County: Guysborough Sampling Date: Aug 22/14

Applicant/Owner: Irving Sampling Point: WL11-UP1

Investigator(s): S. Rickey Affiliation: AMEC

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Hummocky

Slope (%): 40 Lat: 6413860 Long: 5013676 Datum: NAD 83

Soil Map Unit Name/Type: Redmond Wetland Type: Upland - Forest

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Abies balsamea	30	✓	FAC
2. Picea mariana	10	✓	FACW
3.			
4.			
5.			
	40	= Total Cover	

Sapling/Shrub Stratum (Plot size: 5m)			
1. Abies balsamea	5	✓	FAC
2. Sorbus ~~decora~~ americana	5	✓	FAC
3.			
4.			
5.			
	10	= Total Cover	

Herb Stratum (Plot size: 1m)			
1. Aralia nudicaulis	10	✓	FAC
2. Trientalis borealis	5	✓	FAC
3. Maianthemum canadense	2		FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	17	= Total Cover	

Woody Vine Stratum (Plot size: ____)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 6 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species	x 1 =	
FACW species 10	x 2 =	20
FAC species 57	x 3 =	171
FACU species	x 4 =	
UPL species	x 5 =	
Column Totals: 67 (A)		191 (B)

Prevalence Index = B/A = 2.9

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ✓ Dominance Test is >50%
- ✓ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

SOIL

Sampling Point: WL-UP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-10							organic	Duff

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Bedrock

Depth (inches): 10cm

Hydric Soil Present? Yes _____ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Black Point Municipality/County: Guysborough Co. Sampling Date: Aug. 12/14

Applicant/Owner: Vulcan Sampling Point: Wetl-WP1

Investigator(s): S. Rudy Affiliation: AMEC

Landform (hillslope, terrace, etc.): Slope Local relief (concave, convex, none): Hummocky

Slope (%): 2 Lat: 643861 Long: 5023677 Datum: NAD83

Soil Map Unit Name/Type: Rockland Wetland Type: Treed Swamp

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	If yes, optional Wetland Site ID: WL11
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Abies balsamea	25	✓	FAC
2. Picea rubens	5		FACW
3.			
4.			
5.			
	30	= Total Cover	

Sapling/Shrub Stratum (Plot size: 5m)			
1. Betula papyrifera	5		FACW
2. Abies balsamea	15	✓	FAC
3. Cinnamon fern	5		FAC
4. Acer spicatum	2		FAC
5.			
	27	= Total Cover	

Herb Stratum (Plot size: 1m)			
1. Carex trisperma	20	✓	OBL
2. Maianthemum trifolia	2		OBL
3. Cornus canadensis	2		FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	24	= Total Cover	

Woody Vine Stratum (Plot size: ____)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species 22	x 1 =	22
FACW species 5	x 2 =	10
FAC species 46	x 3 =	147
FACU species 5	x 4 =	20
UPL species ____	x 5 =	____
Column Totals: 81 (A)		199 (B)

Prevalence Index = B/A = 2.4

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ✓ Dominance Test is >50%
- ✓ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

C 1340-1438

SOIL

Sampling Point: Well-AP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3+							Organic	Peat

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ✓ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ✓ No ___ Depth (inches): 5cm

Water Table Present? Yes ___ No ✓ Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (inches): 5cm

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

Freshwater Wetland Data Sheet WL 12

Date: Sept 2/10
Investigator(s): S. Burley
Weather: Sunny
Topographic Sheet: ______
Aerial Photo Number: ______

Wetland Atlas Number : ______
GIS Map / Stand No. : C453561129/C4530611 1c
Wetland Form[1]:: open bog (Dome)
Wetland size: ______ ha
Associated Watercourse: ______

Wetland Type:

1.Aquatic bed/unconsolidated bottom (AB) ____
2.Bog(BO) _X_
3.Fen (FE) ____
4.Emergent wetland (EW) ____
5.Shrub wetland (SB) ____
6.Forested wetland (FW) ____

Wetland Class:

1.Open water __
2.Deep marsh ____
3.Shallow marsh _____
4.Seasonally flooded flats ____
5.Meadow ____
6.Shrub swamp _____
7.Wooded swamp ____
8.Bog _X_

Wetland Subclass:

1.Vegetated open water ___
2.Non-vegetated OW __
3.Floating leaved OW ___
4.Rooted floating leaved OW ___
5.Dead woody OW ____
6.Vegetated deep marsh ____
7.Non-vegetated DM ____
8.Dead woody DM ____
9.Sub-shrub DM ____
10.Floating leaved DM ____
11.Rooted floating leaved DM ____
12.Robust DM ____
13.Narrow-leaved DM ____
14.Broad-leaved DM ____
15.Dead woody shallow marsh ____
16.Robust SM _____
17.Narrow leaved SM _____
18.Broad leaved SM ____
19.Floating leaved SM ____
20.Rooted floating leaved SM ____
21.Non-vegetated SM ____
22.Emergent seasonally flooded flats ____
23.Shrubby SFF ____
24.Grazed meadow ____
25.Ungrazed M ____
26.Sedge M ____
27.Sapling shrub swamp ____
28.Bushy SS ____
29.Compact SS _____
30.Low sparse SS ____
31.Deciduous wooded swamp ____
32.Evergreen WS ____
33.Wooded bog ____
34.Shrubby B _____
35.Open B _X_

Water Regime Indicator:

1.Permanently flooded __
2.Saturated _X_
3.Seasonally flooded _____

Water Depth:

1.0-5 cm _X_
2.5-20 cm ______
3.20-50 cm ____
4.50-100 cm ____
5.>100 cm ____

Note: 1. Canadian Wetland Classification System (2nd Edition)

Impounded Wetland Type:
1.Beaver Pond _____
2.Man-made Impoundment ____
3.Ducks Unlimited Impoundment ____
4. None of the above X

Percent Vegetation Cover:
1.> 95% 100
2.76-95% in peripheral band ___
3.76-96% in patches ___
4.26-75% in peripheral band ____
5.26-75% in patches ____
6. 5-25% in peripheral band ____
7. 5-25% in patches ____
8.< 5% ____

Wetland Site:
1.Lacustrine ____
2.Riverine _____
3.Palustrine X
4.Isolated _____
5.Deltaic ___

Vegetation Types (%):
1.Deciduous trees –
2.Coniferous trees - 5% Picea mariana
3.Dead trees 2%
4.Tall shrubs 5% - Viburnum nudum, Nemo
5.Low shrubs 50% - Gaylussacia, Bog Rosemary, Juniper
6.Dead shrubs –
7.Herbs - 65% - Scirpus cespitosis.
8.Mosses 95% - Sphagnum
9.Narrow-leaved emergents –
10.Broad-leaved emergents –
11.Robust emergents –
12.Free-floating plants –
13.Floating plants (rooted) –
14.Submerged plants –
15. Other –

Interspersion: 1.Minimal X 2.Low _____ 3.Medium ___ 4.High ____

Conductivity: N/A
Alkalinity: N/A
pH: N/A

Hydrological Classification:
1.Surface water depression _____
2.Ground water depression _____
3.Surface water slope X
4.Ground water slope ____
5. Dennal Bay

Inlets/Outlets/water bodies:
~~Outflow stream to North~~

Wildlife: (Observation/Signs/Reports)
Deer tracks

Adjacent Wildlife habitat (%):

1.Salt marsh ____
2.Forest 90%
3.Dykelands ____
4.Mudflats ____
5.Beach ____
6.River ____
7. Other 10% Lake

Description: ~~mixed woods~~ Conifers

Surrounding Land Use %:

1 Agriculture ____
2.Forestry _____
3 Recreation ____
4.Industrial _____
5.Urban development ___
6.Transportation ____
7.Residential ____
8.Waste Disposal ____
9.Scientific Research ____
10.Trapping ____
11.Education ____
12.Seasonal resident ____

Description: None

Disturbance: 1.Low X 2.Moderate ____ 3.High ____

Description:

Roads and/or tracks:

1.Private road adjacent ____
2.DOT road adjacent ____
3.Private road within ____
4.DOT road within ____
5.Vehicle tracks ____
6.Other ____

Description: None

Existing Uses of Wetlands:

1.Economic use (e.g. farming) ___
2.Recreational activities ___
3.Aesthetics ____
4.Education & public awareness ____
5. None evident X

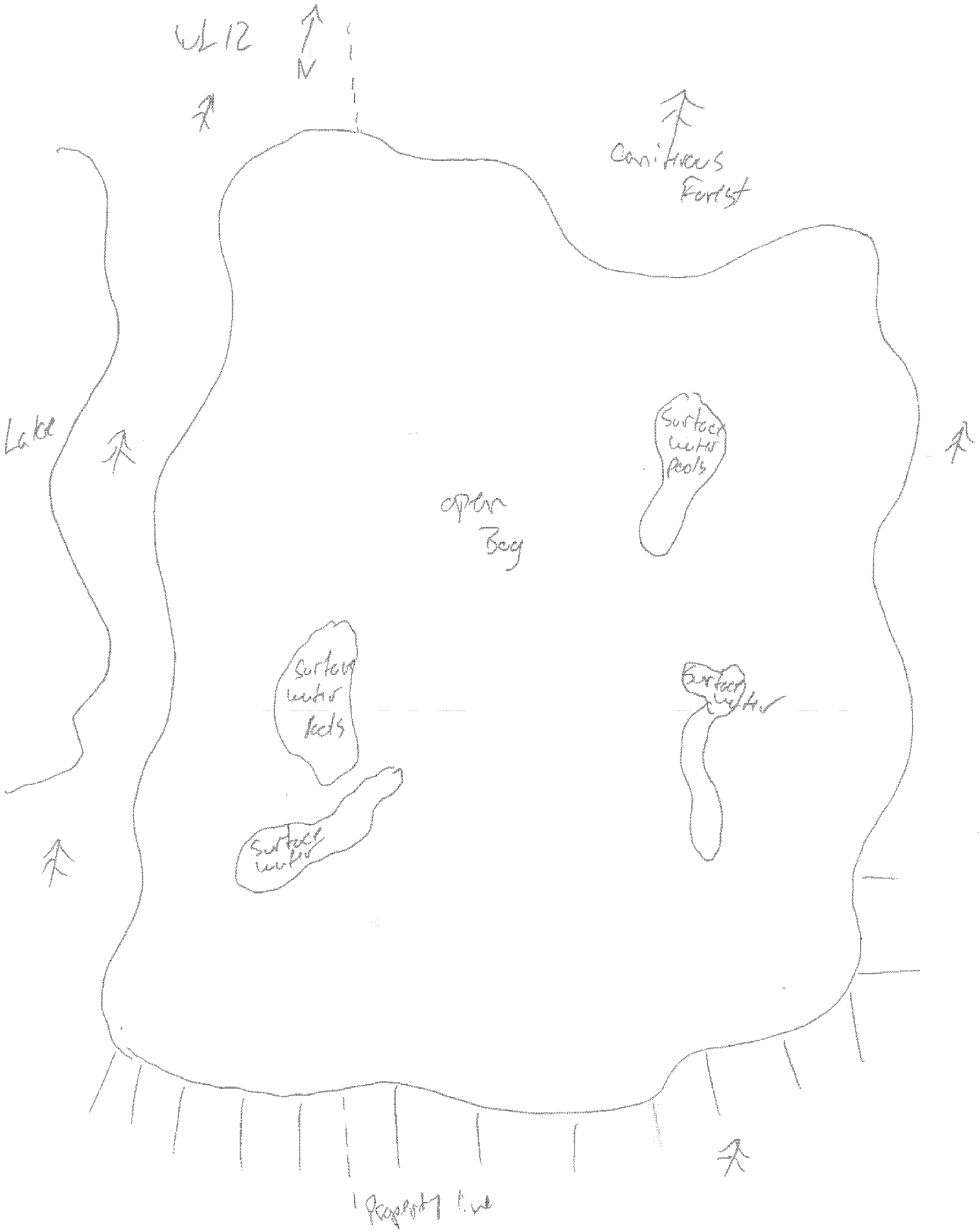
Potential Threats:

Special Features:

1.Rare wetland type ___
2.Rare animal or plant species ____
3.Habitat of rare species X
4.Nesting site for colonial water birds ____
5.Migration stop-over site ____
6. None evident _____

Description: Potential

Notes:


WL 12
N
Coniferous Forest
Lake
Surface water pools
open Bog
Surface water pools
Surface water
Surface water
Property line

C 1340-1443

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Black Point Municipality/County: Guysborough Sampling Date: Aug 21/14

Applicant/Owner: Vulcan Sampling Point: WL12-WP1

Investigator(s): S. Bishop Affiliation: AMEC

Landform (hillslope, terrace, etc.): Drained bog Local relief (concave, convex, none): Convex

Slope (%): 1 Lat: 64454 Long: 5023349 Datum: NAD83

Soil Map Unit Name/Type: Recklund Wetland Type: BOG

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No _____	**Is the Sampled Area within a Wetland?** Yes ✓ No _____
Hydric Soil Present?	Yes ✓	No _____	If yes, optional Wetland Site ID: WL12
Wetland Hydrology Present?	Yes ✓	No _____	

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Picea rubens	15	✓	FAC
2. Picea mariana	2		FACW
3. Acer rubrum	2		FAC
4.			
5.			
	19	= Total Cover	

Sapling/Shrub Stratum (Plot size: 5m)			
1. Rhodora	10	✓	FAC
2. Osmunda cinnamomea	5		FAC
3. Nemopanthus mucronata	20	✓	FAC
4. Ilex mucronata	5		FAC
5. Myrica gale	10	✓	FAC
	50	= Total Cover	

Herb Stratum (Plot size: 1m)			
1. Ledum groenlandicum	5	✓	FACW
2. Sarracenia purpurea	5	✓	OBL
3. Carex trisperma	2		OBL
4. Maianthemum trifolia	5	✓	OBL
5.			
6.			
7.			
8.			
9.			
10.			
	17	= Total Cover	

Woody Vine Stratum (Plot size: _____)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 7 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	12	x 1 =	12
FACW species	7	x 2 =	14
FAC species	67	x 3 =	201
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	86 (A)		227 (B)

Prevalence Index = B/A = 2.6

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ✓ Dominance Test is >50%
- ✓ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No _____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

SOIL

Sampling Point: WL1-UP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4cm							Organic	Peat

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ✓ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): _____

Water Table Present? Yes ✓ No ___ Depth (inches): 34cm

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (inches): 5cm

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Black Point Municipality/County: Guysborough Sampling Date: Aug. 21/14

Applicant/Owner: Vulcan Sampling Point: WL12-UP1

Investigator(s): S. Burley Affiliation: AMEC

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Hummocky

Slope (%): 10-20 Lat: 44 57 12 Long: 52 33 36 Datum: NAD 83

Soil Map Unit Name/Type: Rocklund Wetland Type: upland - Barren

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Larix laricina	5	✓	FAC
2. Acer rubrum	5	✓	FAC
3. Picea mariana	5	✓	FACW
4.			
5.			
	15	= Total Cover	

Sapling/Shrub Stratum (Plot size: 5m)			
1. Viburnum nudum	5		FAC
2. Acer rubrum	5		FAC
3. Gaylussacia baccata	70	✓	FAC
4. Alnus sp.	5		FAC
5. Kalmia angustifolia	15		FAC
	100	= Total Cover	

Herb Stratum (Plot size: 1m)			
1. Carex canescens	25	✓	FAC
2. Kalmia angustifolia	10		FAC
3. Eriophorum vaginatum	30	✓	FAC
4. Vaccinium angustifolium	10		FAC
5. Trientalis borealis	5		FAC
6. Maianthemum canadense	5		FAC
7. Gaylussacia brachycera	2		FAC
8. Ledum groenlandicum	5		FACW
9.			
10.			
	92	= Total Cover	

Woody Vine Stratum (Plot size: ____)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 6 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species ____	x 1 =	____
FACW species 10	x 2 =	20
FAC species 164	x 3 =	594
FACU species ____	x 4 =	____
UPL species ____	x 5 =	____
Column Totals: 208 (A)		614 (B)

Prevalence Index = B/A = 3.0

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ✓ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

C 1340-1446

SOIL

Sampling Point: WDS2-UPL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0	10YR						Organic	Duff

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Bedrock

Depth (inches): 11 cm

Hydric Soil Present? Yes _____ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

WL #13

Freshwater Wetland Data Sheet

WL-13

Date: Sept 3/13
Investigator(s): S. Bulkley
Weather: Sunny
Topographic Sheet: _____
Aerial Photo Number: _____

Wetland Atlas Number : _____
GIS Map / Stand No. : _____
Wetland Form[1]:: Bog / Swamp
Wetland size: _____ ha
Associated Watercourse: _____

Wetland Type:
1.Aquatic bed/unconsolidated bottom (AB) ____
2.Bog(BO) X
3.Fen (FE) ____
4.Emergent wetland (EW) ____
5.Shrub wetland (SB) X
6.Forested wetland (FW) ____

Wetland Class:
1.Open water ___
2.Deep marsh ____
3.Shallow marsh _____
4.Seasonally flooded flats ____
5.Meadow ____
6.Shrub swamp _____
7.Wooded swamp ____
8.Bog X

Wetland Subclass:
1.Vegetated open water ___
2.Non-vegetated OW ___
3.Floating leaved OW ___
4.Rooted floating leaved OW ___
5.Dead woody OW ____
6.Vegetated deep marsh ____
7.Non-vegetated DM ____
8.Dead woody DM ____
9.Sub-shrub DM ____
10.Floating leaved DM ____
11.Rooted floating leaved DM ____
12.Robust DM ____
13.Narrow-leaved DM ____
14.Broad-leaved DM ____
15.Dead woody shallow marsh ____
16.Robust SM _____
17.Narrow leaved SM _____
18.Broad leaved SM ____
19.Floating leaved SM ____
20.Rooted floating leaved SM ____
21.Non-vegetated SM ____
22.Emergent seasonally flooded flats ____
23.Shrubby SFF ____
24.Grazed meadow ____
25.Ungrazed M ____
26.Sedge M ____
27.Sapling shrub swamp ____
28.Bushy SS X
29.Compact SS _____
30.Low sparse SS ____
31.Deciduous wooded swamp ____
32.Evergreen WS ____
33.Wooded bog ____
34.Shrubby B X
35.Open B X

Water Regime Indicator:
1.Permanently flooded ___
2.Saturated 1
3.Seasonally flooded _____

Water Depth:
1.0-5 cm 12
2.5-20 cm _____
3.20-50 cm ____
4.50-100 cm ____
5.>100 cm ____

Note: 1. Canadian Wetland Classification System (2nd Edition)

Impounded Wetland Type:
1.Beaver Pond _____
2.Man-made Impoundment ____
3.Ducks Unlimited Impoundment ____
4. None of the above X

Percent Vegetation Cover:
1.> 95% X
2.76-95% in peripheral band ___
3.76-96% in patches ___
4.26-75% in peripheral band ____
5.26-75% in patches ____
6. 5-25% in peripheral band ____
7. 5-25% in patches ____
8.< 5% ____

Wetland Site:
1.Lacustrine ____
2.Riverine _____
3.Palustrine X
4.Isolated _____
5.Deltaic ___

Vegetation Types (%):
1.Deciduous trees 2%
2.Coniferous trees 10% - Black Spruce, fir
3.Dead trees 2%
4.Tall shrubs - 80%
5.Low shrubs - 3%
6.Dead shrubs -
7.Herbs - 3% - Cinnamon fern
8.Mosses - 100%
9.Narrow-leaved emergents -
10.Broad-leaved emergents -
11.Robust emergents -
12.Free-floating plants -
13.Floating plants (rooted) -
14.Submerged plants -
15. Other

Interspersion: 1.Minimal ___ 2.Low X 3.Medium ___ 4.High ____

Conductivity: N/A
Alkalinity: N/A
pH: N/A

Hydrological Classification:
1.Surface water depression _____
2.Ground water depression _____
3.Surface water slope X
4.Ground water slope ____

Inlets/Outlets/water bodies:
Stream cutted to inlet (possible)

Wildlife: (Observation/Signs/Reports)
Pig droppings

Adjacent Wildlife habitat (%):

1.Salt marsh ____
2.Forest 100
3.Dykelands ____
4.Mudflats ____
5.Beach ____
6.River ____
7. Other Sea Bivers

Description: mixed woods

Surrounding Land Use %:

1 Agriculture ____
2.Forestry ____
3 Recreation ____
4.Industrial ____
5.Urban development ____
6.Transportation ____
7.Residential ____
8.Waste Disposal ____
9.Scientific Research ____
10.Trapping ____
11.Education ____
12.Seasonal resident ____

Description: none

Disturbance: 1.Low X 2.Moderate ____ 3.High ____

Description: none

Roads and/or tracks:

1.Private road adjacent ____
2.DOT road adjacent ____
3.Private road within ____
4.DOT road within ____
5.Vehicle tracks ____
6.Other X

Description: ~~none~~ Property entrance

Existing Uses of Wetlands:

1.Economic use (e.g. farming) ____
2.Recreational activities ____
3.Aesthetics ____
4.Education & public awareness ____
5. None evident X

Potential Threats:

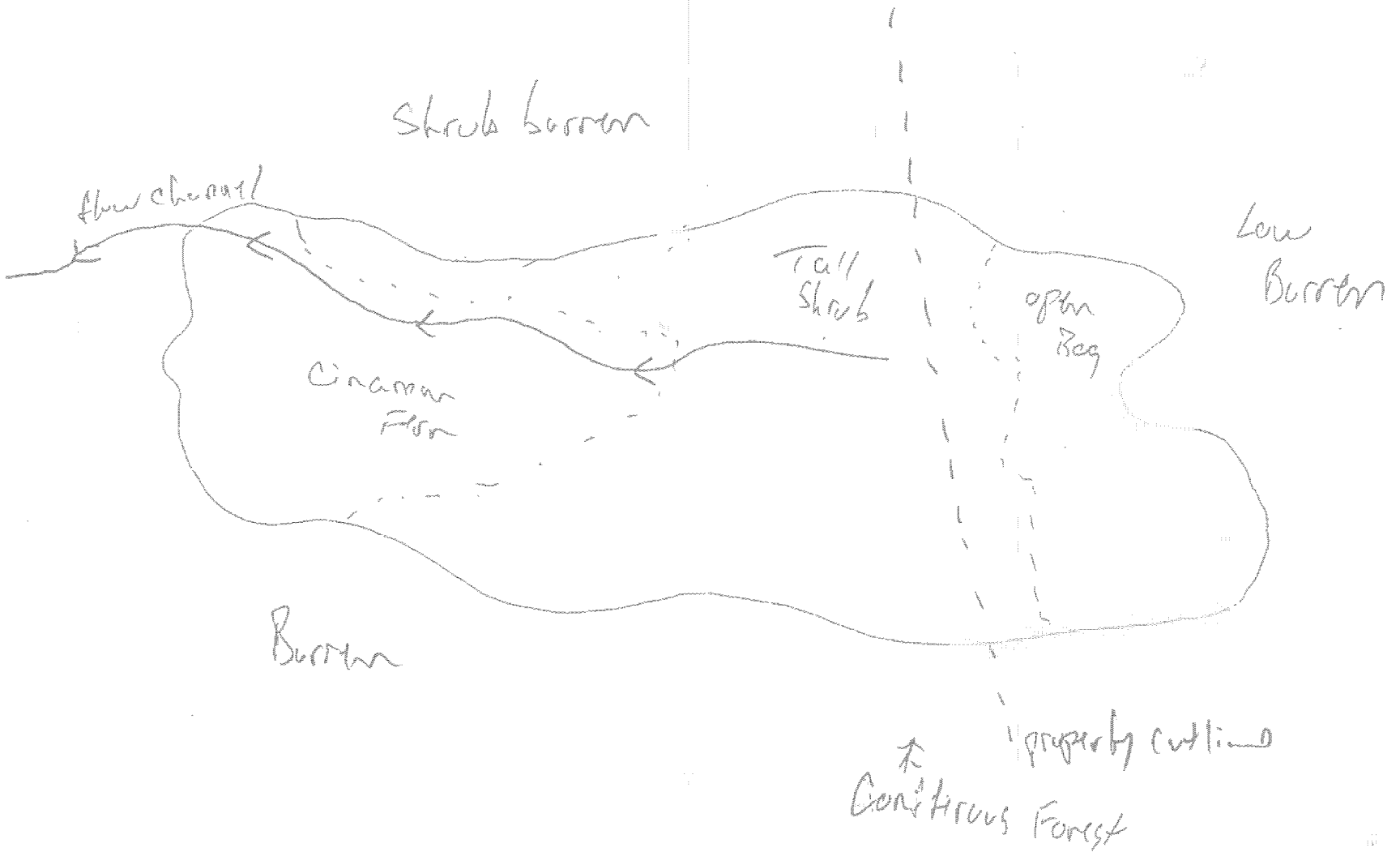
Special Features:

1.Rare wetland type ____
2.Rare animal or plant species ____
3.Habitat of rare species X
4.Nesting site for colonial water birds ____
5.Migration stop-over site ____
6. None evident ____

Description: Potential

Notes:

WLB 2



C 1340-1451

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Bleuet Point Municipality/County: Guysborough Sampling Date: Aug. 21/14

Applicant/Owner: Vulcan Sampling Point: WL3 WP1

Investigator(s): S Buckley Affiliation: AMEC

Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): Hummocky

Slope (%): 1 Lat: 6414690 Long: 5023576 Datum: NAD 83

Soil Map Unit Name/Type: Pockwock Wetland Type: Fen

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	If yes, optional Wetland Site ID: WL13
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Picea mariana	2	✓	FACW
2.			
3.			
4.			
5.			
	2 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. Myrica gale	15		FAC
2. Acer rubrum var. glaucescens	5		FACW
3. Gaylussacia baccata	15		FAC
4. Cinnamon fern	40	✓	FAC
5. Rhodora canadensis	5		FAC
	60 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. Eriophorum virginicum	2		OBL
2. Aster nemoralis	2		OBL
3. Carex trisperma	5	✓	OBL
4. Maianthemum trifolium	2		OBL
5.			
6.			
7.			
8.			
9.			
10.			
	11 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	11	x 1 =	11
FACW species	7	x 2 =	14
FAC species	85	x 3 =	255
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	103 (A)		280 (B)

Prevalence Index = B/A = 2.7

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ✓ Dominance Test is >50%
- ✓ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

SOIL

Sampling Point: WL13-wp1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-35							Organic Peat	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ✓ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Rock

Depth (inches): 57cm

Hydric Soil Present? Yes ✓ No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ✓ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): ___

Water Table Present? Yes ✓ No ___ Depth (inches): 9cm

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (inches): Ocm

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Rock Point Municipality/County: Guysborough Sampling Date: Aug 21/14

Applicant/Owner: Vidler Sampling Point: WL3-UPL

Investigator(s): S. Buckley Affiliation: AMEC

Landform (hillslope, terrace, etc.): Flat Local relief (concave, convex, none): Hummocky

Slope (%): 5% Lat: 44 Long: 52 Datum: NAD 83

Soil Map Unit Name/Type: Rockland Wetland Type: Upland - Barren

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Picea mariana	2	____	FACW
2.			
3.			
4.			
5.			
	2 = Total Cover		

Sapling/Shrub Stratum (Plot size: 5m)			
1. Abies balsamea	5	____	FAC
2. Picea mariana	5	____	FACW
3. Gaylussacia baccata	40	✓	FAC
4. Rhododendron canadense	5	____	FAC
5. Chamaedaphne calyculata	5	____	OBL
	60 = Total Cover		

Herb Stratum (Plot size: 1m)			
1. Maianthemum canadense	2	✓	FAC
2. Aronia prunifolia	2	✓	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	4 = Total Cover		

Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species 5	x 1 =	5
FACW species 9	x 2 =	18
FAC species 57	x 3 =	171
FACU species ____	x 4 =	____
UPL species ____	x 5 =	____
Column Totals: 71 (A)		194 (B)

Prevalence Index = B/A = 2.7

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Marsh Hawk noted Circling WL

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

C 1340-1454

SOIL

Sampling Point: WL13-4P1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-5cm							organic	duff

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Rock

Depth (inches): 5cm

Hydric Soil Present? Yes _____ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

Freshwater Wetland Data Sheet WL 14

Date: Sept 3 2010
Investigator(s): M. Studen
Weather: sunny, hot
Topographic Sheet: _____
Aerial Photo Number: _____

Wetland Atlas Number : NA / unmapped
GIS Map / Stand No. : _____
Wetland Form[1]:: Swamp
Wetland size: _____ ha
Associated Watercourse: —

Wetland Type:
1.Aquatic bed/unconsolidated bottom (AB) ____
2.Bog(BO) ____
3.Fen (FE) ____
4.Emergent wetland (EW) ____
5.Shrub wetland (SB) ____
6.Forested wetland (FW) ✓

Wetland Class:
1.Open water ___
2.Deep marsh ____
3.Shallow marsh _____
4.Seasonally flooded flats ____
5.Meadow ____
6.Shrub swamp (✓)
7.Wooded swamp ✓
8.Bog ____

Wetland Subclass:
1.Vegetated open water ___
2.Non-vegetated OW ___
3.Floating leaved OW ___
4.Rooted floating leaved OW ___
5.Dead woody OW ____
6.Vegetated deep marsh ____
7.Non-vegetated DM ____
8.Dead woody DM ____
9.Sub-shrub DM ____
10.Floating leaved DM ____
11.Rooted floating leaved DM ____
12.Robust DM ____
13.Narrow-leaved DM ____
14.Broad-leaved DM ____
15.Dead woody shallow marsh ____
16.Robust SM _____
17.Narrow leaved SM _____
18.Broad leaved SM ____
19.Floating leaved SM ____
20.Rooted floating leaved SM ____
21.Non-vegetated SM ____
22.Emergent seasonally flooded flats ____
23.Shrubby SFF ____
24.Grazed meadow ____
25.Ungrazed M ____
26.Sedge M ____
27.Sapling shrub swamp ____
28.Bushy SS (✓)
29.Compact SS ____
30.Low sparse SS ____
31.Deciduous wooded swamp ✓ mixed WS
32.Evergreen WS ____
33.Wooded bog ____
34.Shrubby B _____
35.Open B _____

Water Regime Indicator:
1.Permanently flooded ___
2.Saturated ✓
3.Seasonally flooded _____

Water Depth:
1.0-5 cm ✓
2.5-20 cm _____
3.20-50 cm ____
4.50-100 cm ____
5.>100 cm ____

Note: 1. Canadian Wetland Classification System (2nd Edition)

Impounded Wetland Type:
1.Beaver Pond ____
2.Man-made Impoundment ____
3.Ducks Unlimited Impoundment ____
4. None of the above ✓

Percent Vegetation Cover:
1.> 95% ✓
2.76-95% in peripheral band ____
3.76-96% in patches ____
4.26-75% in peripheral band ____
5.26-75% in patches ____
6. 5-25% in peripheral band ____
7. 5-25% in patches ____
8.< 5% ____

Wetland Site:
1.Lacustrine ____
2.Riverine ____
3.Palustrine ____
4.Isolated ✓
5.Deltaic ____

Vegetation Types (%):
1.Deciduous trees 30% ; Red Maple, Bet. cordifolia
2.Coniferous trees 30-40% Black Spruce,
3.Dead trees <5%
4.Tall shrubs 30% Rhododendron, myrsinites, Viburnum Nudum
5.Low shrubs 20% Kalmia angustifolia,
6.Dead shrubs <10%
7.Herbs Cinna (5%) 20%
8.Mosses 100% Sphagnum sp.
9.Narrow-leaved emergents
10.Broad-leaved emergents 5% Carex trisperma
11.Robust emergents —
12.Free-floating plants —
13.Floating plants (rooted) —
14.Submerged plants —
15. Other

Interspersion: 1.Minimal ____ 2.Low ✓ 3.Medium ____ 4.High ____

Conductivity: N/A
Alkalinity: N/A
pH: N/A

Hydrological Classification:
1.Surface water depression ✓
2.Ground water depression ____
3.Surface water slope ____
4.Ground water slope ____

Inlets/Outlets/water bodies:
NA

Wildlife: (Observation/Signs/Reports)
birds

Adjacent Wildlife habitat (%):

1.Salt marsh ____
2.Forest ✓ 10-20 %
3.Dykelands ____
4.Mudflats ____
5.Beach ____
6.River ____
7. Other Shrub barren 80% - 90%

Description: mixed woods or coniferous

Surrounding Land Use %:

1 Agriculture ____
2.Forestry ~~possible~~, but not done
3 Recreation ____
4.Industrial ____
5.Urban development ____
6.Transportation ____
7.Residential ____
8.Waste Disposal ____
9.Scientific Research ____
10.Trapping ____
11.Education ____
12.Seasonal resident ____

Description:

Disturbance: 1.Low ✓ 2.Moderate ____ 3.High ____

Description:

Roads and/or tracks:

1.Private road adjacent ____
2.DOT road adjacent ____
3.Private road within ____
4.DOT road within ____
5.Vehicle tracks ____
6.Other ____

Description: Property line, cut, ca 100m

Existing Uses of Wetlands:

1.Economic use (e.g. farming) ____
2.Recreational activities ____
3.Aesthetics ____
4.Education & public awareness ____
5. None evident ✓

Potential Threats: development

Special Features:

1.Rare wetland type ____
2.Rare animal or plant species ____
3.Habitat of rare species ____
4.Nesting site for colonial water birds ____
5.Migration stop-over site ____
6. None evident ✓

Description:

Notes:

C 1340-1459

WETLAND DETERMINATION DATA FORM – NOVA SCOTIA

Project/Site: GRQ Municipality/County: Guysborough Sampling Date: Sept 3/16

Applicant/Owner: Ecodyne Sampling Point: WL14-WP1

Investigator(s): S. Burley Section, Township, Range: Blacks Point

Landform (hillslope, terrace, etc.): depression Local relief (concave, convex, none): Hummocky

Slope (%): 2% E Lat: 6449869 N Long: 502334 8 Datum: NAD 83 UTM

Soil Map Unit Name: Rockland Wetland Type: Treed Swamp

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ✓ No ____

Hydric Soil Present? Yes ✓ No ____

Wetland Hydrology Present? Yes ✓ No ____

Is the Sampled Area within a Wetland? Yes ✓ No ____

If yes, optional Wetland Site ID: WL 14

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer rubrum	15%	✓	FAC
2. Picea mariana	15%	✓	FACW
3. Abies balsamea	5%		FAC
4.			
5.			
	35	= Total Cover	

Sapling/Shrub Stratum (Plot size: 5m)			
1. Rhododendron maximum	10%	✓	OBL
2. Viburnum nudum	5%	✓	FACW
3. Osmunda cinnamomea	10%	✓	FACW
4.			
5.			
	25	= Total Cover	

Herb Stratum (Plot size: 1m)			
1. Carex disperma	50%	✓	OBL
2. Maianthemum canadense	20%	✓	FAC
3. Picea mariana	5%		FACW
4. Viburnum nudum	10%		FAC
5.			
6.			
7.			
8.			
9.			
10.			
	65	= Total Cover	

Woody Vine Stratum (Plot size: ____)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 7 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	60	x 1 =	60
FACW species	35	x 2 =	70
FAC species	50	x 3 =	150
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	145 (A)		280 (B)

Prevalence Index = B/A = 1.9

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

✓ Dominance Test is >50%

✓ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2009)

C 1340-1460

Sampling Point: 1a2/14-WP1

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
O 20-0							Organic	Peat
A 0-20	5YR2.5/1						G.L	Hist, organic enrich

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ✓ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ✓ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Depleted Dark Surface (F7)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Redox Depressions (F8)
- ___ Red Parent Material (TF2)

Indicators for Problematic Hydric Soils[3]:

- ___ Sandy Gleyed Matrix (S4)
- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (cm): _____

Hydric Soil Present? Yes ✓ No _____

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ✓ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No ✓ Depth (cm): _____

Water Table Present? Yes _____ No ✓ Depth (cm): _____

Saturation Present? (Includes capillary fringe) Yes ✓ No _____ Depth (cm): 0 cm

Wetland Hydrology Present? Yes ✓ No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2009)

C 1340-1461

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Black Point Municipality/County: Guysborough Sampling Date: Aug 21/14

Applicant/Owner: Vulcan Sampling Point: WL14-up1

Investigator(s): S. Burley Affiliation: AMEC

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Hummocky

Slope (%): 1 Lat: 644 854 Long: 5023322 Datum: NAD 83

Soil Map Unit Name/Type: Pictou Wetland Type: upland - Barren

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ✓ No ____

Hydric Soil Present? Yes ____ No ✓

Wetland Hydrology Present? Yes ____ No ✓

Is the Sampled Area within a Wetland? Yes ____ No ✓

If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

Wetland is a Depression

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Picea mariana	30%	✓	FACW
2.			
3.			
4.			
5.			
	30 = Total Cover		

Sapling/Shrub Stratum (Plot size: 5m)			
1. Picea mariana	10	✓	FACW
2. Alnus crispa	10	✓	FACW
3. Gaylussacia baccata	20	✓	FAC
4. Rhododendron maximum	10	✓	FAC
5. Kalmia angustifolia	20	✓	FAC
	70 = Total Cover		

Herb Stratum (Plot size: 1m)			
1. Cornus canadensis	30	✓	FAC
2. Empetrum nigra	50	✓	FAC
3. Kalmia angustifolia	5		FAC
4. Vaccinium angustifolium	10		FAC
5.			
6.			
7.			
8.			
9.			
10.			
	95 = Total Cover		

Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 7 (A)

Total Number of Dominant Species Across All Strata: 8 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 88 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	—	x 1 =	
FACW species	40	x 2 =	80
FAC species	145	x 3 =	435
FACU species	10	x 4 =	40
UPL species		x 5 =	
Column Totals:	195 (A)		555 (B)

Prevalence Index = B/A = 2.8

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ✓ Dominance Test is >50%
- ✓ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

C 1340-1462

SOIL

Sampling Point: WLH-UP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-5							Organic	Duff

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Bedrock

Depth (inches): 5 cm

Hydric Soil Present? Yes _____ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

Freshwater Wetland Data Sheet WL 15

Date: Sept 3/10
Investigator(s): S. Burley
Weather: Sunny
Topographic Sheet: _____
Aerial Photo Number: _____

Wetland Atlas Number : _____
GIS Map / Stand No. : C45306/1 126
Wetland Form[1]:: Treed Bog / Treed Swamp / Fen
Wetland size: _____ ha
Associated Watercourse: _____

Wetland Type:
1.Aquatic bed/unconsolidated bottom (AB) ____
2.Bog(BO) X
3.Fen (FE) X
4.Emergent wetland (EW) ____
5.Shrub wetland (SB) ____
6.Forested wetland (FW) X

Wetland Class:
1.Open water ___
2.Deep marsh ____
3.Shallow marsh _____
4.Seasonally flooded flats ____
5.Meadow ____
6.Shrub swamp _____
7.Wooded swamp X
8.Bog X

Wetland Subclass:
1.Vegetated open water ___
2.Non-vegetated OW ___
3.Floating leaved OW ___
4.Rooted floating leaved OW ___
5.Dead woody OW ____
6.Vegetated deep marsh ____
7.Non-vegetated DM ____
8.Dead woody DM ____
9.Sub-shrub DM ____
10.Floating leaved DM ____
11.Rooted floating leaved DM ____
12.Robust DM ____
13.Narrow-leaved DM ____
14.Broad-leaved DM ____
15.Dead woody shallow marsh ____
16.Robust SM _____
17.Narrow leaved SM _____
18.Broad leaved SM ____
19.Floating leaved SM ____
20.Rooted floating leaved SM ____
21.Non-vegetated SM ____
22.Emergent seasonally flooded flats ____
23.Shrubby SFF ____
24.Grazed meadow ____
25.Ungrazed M ____
26.Sedge M ____
27.Sapling shrub swamp ____
28.Bushy SS ____
29.Compact SS _____
30.Low sparse SS ____
31.Deciduous wooded swamp ____
32.Evergreen WS X
33.Wooded bog X
34.Shrubby B X
35.Open B X
Uplm Fld X

Water Regime Indicator:
1.Permanently flooded ___
2.Saturated X
3.Seasonally flooded _____

Water Depth:
1.0-5 cm X
2.5-20 cm _____
3.20-50 cm ____
4.50-100 cm ____
5.>100 cm ____

Note: 1. Canadian Wetland Classification System (2nd Edition)

Impounded Wetland Type:
1.Beaver Pond ____
2.Man-made Impoundment ____
3.Ducks Unlimited Impoundment ____
4. None of the above X

Percent Vegetation Cover:
1.> 95% X
2.76-95% in peripheral band ___
3.76-96% in patches ___
4.26-75% in peripheral band ____
5.26-75% in patches ____
6. 5-25% in peripheral band ____
7. 5-25% in patches ____
8.< 5% ____

Wetland Site:
1.Lacustrine ____
2.Riverine X
3.Palustrine ____
4.Isolated ____
5.Deltaic ___

Vegetation Types (%):
1.Deciduous trees 20% Acer Rubrum
2.Coniferous trees 40% & Spruce
3.Dead trees 5%
4.Tall shrubs 40% - Huckleberry, Nemopanthus, wild raisin, Alder, Bayberry
5.Low shrubs 30% - Leatherleaf, Kalmia Angustifolia, Ledum
6.Dead shrubs -
7.Herbs 30% - Carex, Trisetum
8.Mosses 100% - Sphagnum
9.Narrow-leaved emergents -
10.Broad-leaved emergents -
11.Robust emergents -
12.Free-floating plants -
13.Floating plants (rooted) -
14.Submerged plants -
15. Other -

Interspersion: 1.Minimal ___ 2.Low ____ 3.Medium X 4.High ____

Conductivity: N/A
Alkalinity: N/A
pH: N/A

Hydrological Classification:
1.Surface water depression ____
2.Ground water depression ____
3.Surface water slope X
4.Ground water slope ___

Inlets/Outlets/water bodies:
Stream inlet through swamp @ west side and outlets through culvert @ SE

Wildlife: (Observation/Signs/Reports)
Passerines
Common yellow throat.

Adjacent Wildlife habitat (%):

1.Salt marsh ____
2.Forest 50%
3.Dykelands ____
4.Mudflats ____
5.Beach ____
6.River ____
7. Other 50% Berries

Description: ~~mixed woods~~

Surrounding Land Use %:

1 Agriculture ____
2.Forestry ____
3 Recreation ____
4.Industrial ____
5.Urban development ____
6.Transportation ____
7.Residential ____
8.Waste Disposal ____
9.Scientific Research ____
10.Trapping ____
11.Education ____
12.Seasonal resident ____

Description: None

Disturbance: 1.Low X 2.Moderate ____ 3.High ____

Description: none

Roads and/or tracks:

1.Private road adjacent ____
2.DOT road adjacent ____
3.Private road within ____
4.DOT road within ____
5.Vehicle tracks ____
6.Other X

Description: Property cut line

Existing Uses of Wetlands:

1.Economic use (e.g. farming) ____
2.Recreational activities ____
3.Aesthetics ____
4.Education & public awareness ____
5. None evident X

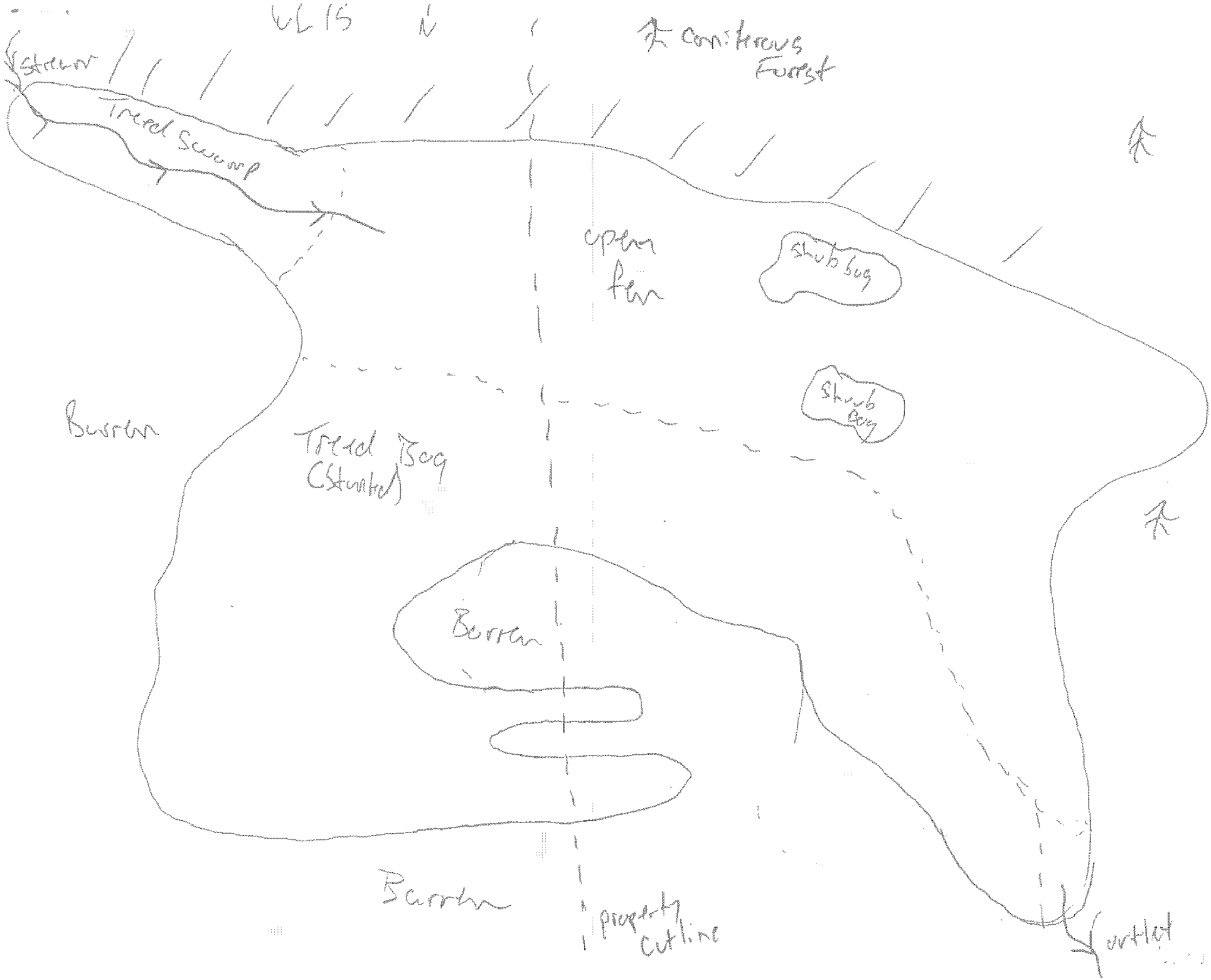
Potential Threats:

Special Features:

1.Rare wetland type ____
2.Rare animal or plant species ____
3.Habitat of rare species X
4.Nesting site for colonial water birds ____
5.Migration stop-over site ____
6. None evident ____

Description: Potentially

Notes:


UL 15
N
coniferous Forest
stream
treed swamp
open fen
shrub bog
Barren
Treed Bog (stunted)
shrub bog
Barren
Barren
property cutline
outlet

C 1340-1467

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Black Point Municipality/County: Guysborough Sampling Date: Aug 19/14

Applicant/Owner: Victura Sampling Point: WL15-UPL

Investigator(s): S. Burley Affiliation: AMEC

Landform (hillslope, terrace, etc.): slope Local relief (concave, convex, none): Hummocky

Slope (%): 3 Lat: 6045'496 Long: 5023'00 Datum: NAD 83

Soil Map Unit Name/Type: Rockland Wetland Type: Wetland Bog

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓ No ____	**Is the Sampled Area within a Wetland?**	Yes ✓ No ____
Hydric Soil Present?	Yes ✓ No ____	If yes, optional Wetland Site ID:	WL15
Wetland Hydrology Present?	Yes ✓ No ____		

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Picea mariana	5	✓	FACW
2. Abies balsamea	10	✓	FAC
3.			
4.			
5.			
	15	= Total Cover	

Sapling/Shrub Stratum (Plot size: 5m)			
1. Myrica gale	25	✓	FAC
2. Gaylussacia baccata	30	✓	FAC
3. Picea mariana	5		FACW
4. Maianthemum canadense	5		FAC
5. Viburnum nudum	2		FAC
	67	= Total Cover	

Herb Stratum (Plot size: 1m)			
1. Osmunda cinnamomea	2		FAC
2. Maianthemum trifolium	10	✓	OBL
3. Eriophorum (Tawny multi)	5		ORL
4. Ledum groenlandicum	5		FACW
5. Carex trisperma	5		ORL
6.			
7.			
8.			
9.			
10.			
	27	= Total Cover	

Woody Vine Stratum (Plot size: ____)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	15	x 1 =	15
FACW species	15	x 2 =	30
FAC species	74	x 3 =	222
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	104 (A)		267 (B)

Prevalence Index = B/A = 2.6

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ✓ Dominance Test is >50%
- ✓ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Eriophorum, Heather Hut, Black Spruce dominate WL overall

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

SOIL

Sampling Point: WL15-WP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches) cm	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-39							Organic	Peat

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ✓ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ✓ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Bedrock

Depth (inches): 39 cm

Hydric Soil Present? Yes ✓ No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ✓ No ___ Depth (inches): 0 cm

Water Table Present? Yes ✓ No ___ Depth (inches): 5 cm

Saturation Present? (includes capillary fringe) Yes ___ No ___ Depth (inches): 0 cm

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Rock Point Municipality/County: Guysborough Sampling Date: Aug 19/14

Applicant/Owner: Various Sampling Point: WL15-UP1

Investigator(s): S Burley Affiliation: AMEC

Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): Hummocky

Slope (%): 30% Lat: 645490 Long: 5023193 Datum: NAD83

Soil Map Unit Name/Type: Rock Barrens Wetland Type: Upland

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Picea mariana	5	✓	FACW
2. Abies balsamea	2		FAC
3.			
4.			
5.			
	7 = Total Cover		

Sapling/Shrub Stratum (Plot size: 5m)			
1. Picea mariana	15	✓	FACW
2. V. bitrenum dentum	5		FAC
3. Eulonia conjugatifolia	30	✓	FAC
4. Gaylussacia baccata	30	✓	FAC
5. Aronia prunifolia	10		FAC
	90 = Total Cover		

Herb Stratum (Plot size: 1m.)			
1. Cornus canadensis	2		FAC
2. Empetrum nigrum	10	✓	FAC
3. Eulonia conjugatifolia	20	✓	FAC
4. Gaultheria procumbens	2		FAC
5. Trientalis borealis	2		FAC
6. Vaccinium angustifolium	2		FAC
7. Aronia prunifolia	2		FAC
8.			
9.			
10.			
	40 = Total Cover		

Woody Vine Stratum (Plot size: ~)			
1.			
2.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 6 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species	x 1 =	
FACW species 20	x 2 =	40
FAC species 102	x 3 =	306
FACU species	x 4 =	
UPL species	x 5 =	
Column Totals: 122 (A)		346 (B)

Prevalence Index = B/A = 2.8

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ✓ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

C 1340-1470

SOIL

Sampling Point: WL15-UPl

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-8cm							organic	Duff

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Bedrock

Depth (inches): 8cm

Hydric Soil Present? Yes _____ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

Freshwater Wetland Data Sheet WL 16

Date: Sept. 8/10
Investigator(s): S. Beatty
Weather: Cloudy
Topographic Sheet: _____
Aerial Photo Number: _____

Wetland Atlas Number : _____
GIS Map / Stand No. : _____
Wetland Form[1]:: Fen
Wetland size: _____ ha
Associated Watercourse: _____

Wetland Type:
1.Aquatic bed/unconsolidated bottom (AB) ____
2.Bog(BO) ____
3.Fen (FE) X
4.Emergent wetland (EW) ____
5.Shrub wetland (SB) ____
6.Forested wetland (FW) ____

Wetland Class:
1.Open water ___
2.Deep marsh ____
3.Shallow marsh _____
4.Seasonally flooded flats ____
5.Meadow ____
6.Shrub swamp _____
7.Wooded swamp ____
8.Bog ____

Wetland Subclass:
1.Vegetated open water ___
2.Non-vegetated OW ___
3.Floating leaved OW ___
4.Rooted floating leaved OW ___
5.Dead woody OW ____
6.Vegetated deep marsh ____
7.Non-vegetated DM ____
8.Dead woody DM ____
9.Sub-shrub DM ____
10.Floating leaved DM ____
11.Rooted floating leaved DM ____
12.Robust DM ____
13.Narrow-leaved DM ____
14.Broad-leaved DM ____
15.Dead woody shallow marsh ____
16.Robust SM ____
17.Narrow leaved SM _____
18.Broad leaved SM ____
19.Floating leaved SM ____
20.Rooted floating leaved SM ____
21.Non-vegetated SM ____
22.Emergent seasonally flooded flats ____
23.Shrubby SFF ____
24.Grazed meadow ____
25.Ungrazed M ____
26.Sedge M ____
27.Sapling shrub swamp ____
28.Bushy SS ____
29.Compact SS _____
30.Low sparse SS ____
31.Deciduous wooded swamp ____
32.Evergreen WS ____
33.Wooded bog ____
34.Shrubby B _____
35.Open B _____

Water Regime Indicator:
1.Permanently flooded ___
2.Saturated X
3.Seasonally flooded X

Water Depth:
1.0-5 cm X
2.5-20 cm X → channels
3.20-50 cm ____
4.50-100 cm ____
5.>100 cm ____

Note: 1. Canadian Wetland Classification System (2nd Edition)

Impounded Wetland Type:
1.Beaver Pond _____
2.Man-made Impoundment ____
3.Ducks Unlimited Impoundment ____
4. None of the above X

Percent Vegetation Cover:
1.> 95% X
2.76-95% in peripheral band ___
3.76-96% in patches ___
4.26-75% in peripheral band ____
5.26-75% in patches ____
6. 5-25% in peripheral band ____
7. 5-25% in patches ____
8.< 5% ____

Wetland Site:
1.Lacustrine ____
2.Riverine X
3.Palustrine ____
4.Isolated _____
5.Deltaic ___

Vegetation Types (%):
1.Deciduous trees –
2.Coniferous trees 10% - B. Spruce, B. Fir
3.Dead trees 5%
4.Tall shrubs 35% - Rosa, wild Raisin,
5.Low shrubs 15% - Myrica gale, Labrea
6.Dead shrubs –
7.Herbs 40% - cinnamon fern, lady fr.
8.Mosses 100% - sphagnum
9.Narrow-leaved emergents –
10.Broad-leaved emergents –
11.Robust emergents –
12.Free-floating plants –
13.Floating plants (rooted) –
14.Submerged plants –
15. Other –

Interspersion: 1.Minimal ____ 2.Low X 3.Medium ___ 4.High ____

Conductivity: N/A
Alkalinity: N/A
pH: N/A

Hydrological Classification:
1.Surface water depression X
2.Ground water depression ____
3.Surface water slope ____
4.Ground water slope ____

Inlets/Outlets/water bodies:
Stream Through Pkw

Wildlife: (Observation/Signs/Reports)
Chickadee
Yellow throat

Adjacent Wildlife habitat (%):

1.Salt marsh ____
2.Forest 100%
3.Dykelands ____
4.Mudflats ____
5.Beach ____
6.River ____
7. Other ____

Description: mixed woods

Surrounding Land Use %:

1 Agriculture ____
2.Forestry ____
3 Recreation ____
4.Industrial ____
5.Urban development ____
6.Transportation ____
7.Residential ____
8.Waste Disposal ____
9.Scientific Research ____
10.Trapping ____
11.Education ____
12.Seasonal resident ____

Description: None

Disturbance: 1.Low ____ 2.Moderate X 3.High ____

Description: Drill Rig through wetland.

Roads and/or tracks:

1.Private road adjacent ____
2.DOT road adjacent ____
3.Private road within ____
4.DOT road within ____
5.Vehicle tracks ____
6.Other X

Description: Drill Rig track

Existing Uses of Wetlands:

1.Economic use (e.g. farming) ____
2.Recreational activities ____
3.Aesthetics ____
4.Education & public awareness ____
5. None evident X

Potential Threats:

Special Features:

1.Rare wetland type ____
2.Rare animal or plant species ____
3.Habitat of rare species X
4.Nesting site for colonial water birds ____
5.Migration stop-over site ____
6. None evident ____

Description: Potential

Notes:

Tall Shrubs
Low Elev
Drill Rig Truck
Standing water

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Black Point Municipality/County: Guysborough Sampling Date: Aug. 21/14

Applicant/Owner: Lafarge Sampling Point: WL16 - WP1

Investigator(s): S. Beckett Affiliation: AMEC

Landform (hillslope, terrace, etc.): depression Local relief (concave, convex, none): Concave

Slope (%): 1 Lat: 645473 Long: 5023573 Datum: NAD 83

Soil Map Unit Name/Type: Parkelmont Wetland Type: Fen

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	
Wetland Hydrology Present?	Yes ✓	No ____	If yes, optional Wetland Site ID: WL16

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Picea mariana	10	✓	FACW
2. Abies balsamea	5		FAC
3.			
4.			
5.			
	15	= Total Cover	

Sapling/Shrub Stratum (Plot size: 5m)			
1. Myrica gale	20	✓	FACW
2. Gaultheria hispidula	5		FACW
3. Nemopanthus mucronata	5		FAC
4. Kalmia angustifolia	5		FAC
5.			
	35	= Total Cover	

Herb Stratum (Plot size: 1m)			
1. Carex trisperma	5	✓	OBL
2. Carex canescens	2		FACW
3. Kalmia angustifolia	2		FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	9	= Total Cover	

Woody Vine Stratum (Plot size:)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	5	x 1 =	5
FACW species	60	x 2 =	120
FAC species	44	x 3 =	132
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	59 (A)		157 (B)

Prevalence Index = B/A = 2.7

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

✓ Dominance Test is >50%

✓ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

* Dominants in WL

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

SOIL

Sampling Point: WL16 - wp1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-40+							Organic	Peat

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ✓ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ✓ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ✓ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): _____

Water Table Present? Yes ✓ No ___ Depth (inches): 10cm

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (inches): 0cm

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Black Point Municipality/County: Queensborough Sampling Date: Aug. 21/14

Applicant/Owner: Unknown Sampling Point: WL1-UP1

Investigator(s): S. Buckley Affiliation: AMEC

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Convex

Slope (%): 30 Lat: 6455273 Long: 5021350 Datum: NAD 83

Soil Map Unit Name/Type: Rockland Wetland Type: Upland - Barren

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Abies balsamea	15%	✓	FAC
2. Picea mariana	5%	✓	FACW
3.			
4.			
5.			
	20	= Total Cover	

Sapling/Shrub Stratum (Plot size: 5m)			
1. Amelanchier bartramiana	10	✓	FACW
2. Kalmia angustifolia	30	✓	FAC
3. Betula spp.	10	✓	FACW
4. Nemopanthus mucronata	5		FAC
5. Rhodora canadensis	10	✓	FAC
	65	= Total Cover	

Herb Stratum (Plot size: 1m)			
1. Trientalis borealis	20	✓	FAC
2. Cornus canadensis	20	✓	FAC
3. Rubus chamaemorus	10	✓	FACW
4. Vaccinium angustifolium	5		FACW
5.			
6.			
7.			
8.			
9.			
10.			
	55	= Total Cover	

Woody Vine Stratum (Plot size: ____)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 83 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	–	x 1 =	
FACW species	20	x 2 =	40
FAC species	100	x 3 =	300
FACU species	20	x 4 =	80
UPL species		x 5 =	
Column Totals:	140 (A)		420 (B)

Prevalence Index = B/A = 3.0

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

✓ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

SOIL

Sampling Point: Wetland-up1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-10							Organic	Duff

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Bedrock

Depth (inches): 10cm

Hydric Soil Present? Yes _____ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

Freshwater Wetland Data Sheet WL19

Date: Sept. 8/10
Investigator(s): S Burke,
Weather: cloudy
Topographic Sheet: _____
Aerial Photo Number: _____

Wetland Atlas Number : _____
GIS Map / Stand No. : _____
Wetland Form[1]:: Bog
Wetland size: _____ ha
Associated Watercourse: _____

Wetland Type:
1.Aquatic bed/unconsolidated bottom (AB) ____
2.Bog(BO) X
3.Fen (FE) ____
4.Emergent wetland (EW) ____
5.Shrub wetland (SB) ____
6.Forested wetland (FW) X

Wetland Class:
1.Open water ___
2.Deep marsh ____
3.Shallow marsh _____
4.Seasonally flooded flats ____
5.Meadow ____
6.Shrub swamp _____
7.Wooded swamp ____
8.Bog X

Wetland Subclass:
1.Vegetated open water ___
2.Non-vegetated OW __
3.Floating leaved OW ___
4.Rooted floating leaved OW ___
5.Dead woody OW ____
6.Vegetated deep marsh ____
7.Non-vegetated DM ____
8.Dead woody DM ____
9.Sub-shrub DM ____
10.Floating leaved DM ____
11.Rooted floating leaved DM ____
12.Robust DM ____
13.Narrow-leaved DM ____
14.Broad-leaved DM ____
15.Dead woody shallow marsh ____
16.Robust SM _____
17.Narrow leaved SM _____
18.Broad leaved SM ____
19.Floating leaved SM ____
20.Rooted floating leaved SM ____
21.Non-vegetated SM ____
22.Emergent seasonally flooded flats ____
23.Shrubby SFF ____
24.Grazed meadow ____
25.Ungrazed M ____
26.Sedge M ____
27.Sapling shrub swamp ____
28.Bushy SS ____
29.Compact SS _____
30.Low sparse SS ____
31.Deciduous wooded swamp ____
32.Evergreen WS ____
33.Wooded bog X
34.Shrubby B ____
35.Open B X

Water Regime Indicator:
1.Permanently flooded ___
2.Saturated X
3.Seasonally flooded X

Water Depth:
1.0-5 cm X
2.5-20 cm _____
3.20-50 cm ____
4.50-100 cm ____
5.>100 cm ____

Note: 1. Canadian Wetland Classification System (2nd Edition)

Impounded Wetland Type:
1.Beaver Pond ____
2.Man-made Impoundment ____
3.Ducks Unlimited Impoundment ____
4. None of the above X

Percent Vegetation Cover:
1.> 95% X
2.76-95% in peripheral band ____
3.76-96% in patches ____
4.26-75% in peripheral band ____
5.26-75% in patches ____
6. 5-25% in peripheral band ____
7. 5-25% in patches ____
8.< 5% ____

Wetland Site:
1.Lacustrine ____
2.Riverine ____
3.Palustrine ____
4.Isolated X
5.Deltaic ____

Vegetation Types (%):
1.Deciduous trees –
2.Coniferous trees 25% - B. Spruce, Larch
3.Dead trees 5%
4.Tall shrubs 15% - Alnus, vibirnum
5.Low shrubs 40% - Labrador tea, blueberry, Ledum
6.Dead shrubs –
7.Herbs 25% - Carex sp., Rhy coperia alba
8.Mosses
9.Narrow-leaved emergents
10.Broad-leaved emergents
11.Robust emergents
12.Free-floating plants
13.Floating plants (rooted)
14.Submerged plants
15. Other

Interspersion: 1.Minimal X 2.Low ____ 3.Medium ____ 4.High ____

Conductivity: N/A
Alkalinity: N/A
pH: N/A

Hydrological Classification:
1.Surface water depression X
2.Ground water depression ____
3.Surface water slope ____
4.Ground water slope ____

Inlets/Outlets/water bodies:
None observed

Wildlife: (Observation/Signs/Reports)
Dragon flies

Adjacent Wildlife habitat (%):

1.Salt marsh ____
2.Forest 90%
3.Dykelands ____
4.Mudflats ____
5.Beach ____
6.River ____
7. Other 10% - Bog @ East Side

Description: mixed woods

Surrounding Land Use %:

1 Agriculture ____
2.Forestry ____
3 Recreation ____
4.Industrial ____
5.Urban development ____
6.Transportation ____
7.Residential ____
8.Waste Disposal ____
9.Scientific Research ____
10.Trapping ____
11.Education ____
12.Seasonal resident ____

Description: None

Disturbance: 1.Low X 2.Moderate ____ 3.High ____

Description:

Roads and/or tracks:

1.Private road adjacent ____
2.DOT road adjacent ____
3.Private road within ____
4.DOT road within ____
5.Vehicle tracks ____
6.Other X

Description: Property Cut line

Existing Uses of Wetlands:

1.Economic use (e.g. farming) ____
2.Recreational activities ____
3.Aesthetics ____
4.Education & public awareness ____
5. None evident X

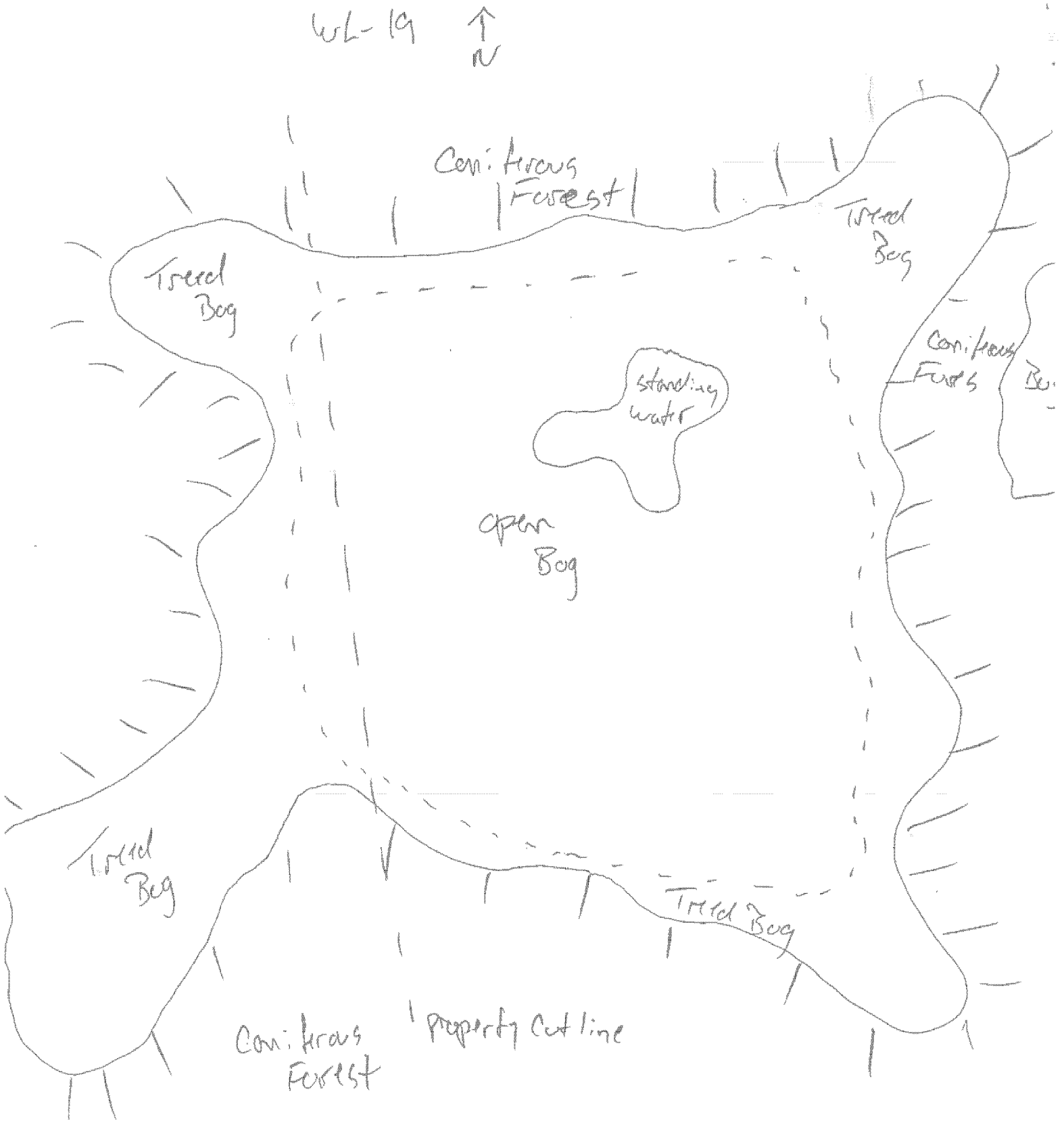
Potential Threats:

Special Features:

1.Rare wetland type ____
2.Rare animal or plant species ____
3.Habitat of rare species ✓
4.Nesting site for colonial water birds ____
5.Migration stop-over site ____
6. None evident ____

Description: Potential

Notes:


WL-19
N
Coniferous Forest
Treed Bog
Treed Bog
Coniferous Fores
standing water
open Bog
Treed Bog
Treed Bog
Coniferous Forest
Property Cut line

C 1340-1483

Freshwater Wetland Data Sheet WL-20

Date: Sept. 8/10
Investigator(s): S Zurbuch
Weather: Cloudy
Topographic Sheet: _____
Aerial Photo Number: _____

Wetland Atlas Number : _____
GIS Map / Stand No. : _____
Wetland Form[1]:: Treed Bog
Wetland size: _____ ha
Associated Watercourse: _____

Wetland Type:
1.Aquatic bed/unconsolidated bottom (AB) ____
2.Bog(BO) ____
3.Fen (FE) ____
4.Emergent wetland (EW) ____
5.Shrub wetland (SB) ____
6.Forested wetland (FW) X

Wetland Class:
1.Open water ___
2.Deep marsh ____
3.Shallow marsh _____
4.Seasonally flooded flats ____
5.Meadow ____
6.Shrub swamp _____
7.Wooded swamp X
8.Bog ____

Wetland Subclass:
1.Vegetated open water ___
2.Non-vegetated OW __
3.Floating leaved OW __
4.Rooted floating leaved OW __
5.Dead woody OW ____
6.Vegetated deep marsh ____
7.Non-vegetated DM ____
8.Dead woody DM ____
9.Sub-shrub DM ____
10.Floating leaved DM ____
11.Rooted floating leaved DM ____
12.Robust DM ____
13.Narrow-leaved DM ____
14.Broad-leaved DM ____
15.Dead woody shallow marsh ____
16.Robust SM _____
17.Narrow leaved SM _____
18.Broad leaved SM ____
19.Floating leaved SM ____
20.Rooted floating leaved SM ____
21.Non-vegetated SM ____
22.Emergent seasonally flooded flats ____
23.Shrubby SFF ____
24.Grazed meadow ____
25.Ungrazed M ____
26.Sedge M ____
27.Sapling shrub swamp ____
28.Bushy SS ____
29.Compact SS _____
30.Low sparse SS ____
31.Deciduous wooded swamp ____
32.Evergreen WS X
33.Wooded bog ____
34.Shrubby B _____
35.Open B _____

Water Regime Indicator:
1.Permanently flooded ___
2.Saturated X
3.Seasonally flooded _____

Water Depth:
1.0-5 cm X
2.5-20 cm _____
3.20-50 cm ____
4.50-100 cm ____
5.>100 cm ____

Note: 1. Canadian Wetland Classification System (2nd Edition)

Impounded Wetland Type:
1.Beaver Pond _____
2.Man-made Impoundment ____
3.Ducks Unlimited Impoundment ____
4. None of the above X

Percent Vegetation Cover:
1.> 95% X
2.76-95% in peripheral band ___
3.76-96% in patches ___
4.26-75% in peripheral band ____
5.26-75% in patches ____
6. 5-25% in peripheral band ____
7. 5-25% in patches ____
8.< 5% ____

Wetland Site:
1.Lacustrine ____
2.Riverine _____
3.Palustrine ____
4.Isolated X
5.Deltaic ___

Vegetation Types (%):
1.Deciduous trees - 2%
2.Coniferous trees - 60% - Fir, B. Spruce
3.Dead trees 2%
4.Tall shrubs 15 - Acer - Viburnum
5.Low shrubs 10 - Salix
6.Dead shrubs -
7.Herbs 25% - Cornus trispermia
8.Mosses 100% -
9.Narrow-leaved emergents -
10.Broad-leaved emergents -
11.Robust emergents -
12.Free-floating plants -
13.Floating plants (rooted) -
14.Submerged plants -
15. Other -

Interspersion: 1.Minimal X 2.Low _____ 3.Medium ___ 4.High ____

Conductivity: N/A
Alkalinity: N/A
pH: N/A

Hydrological Classification:
1.Surface water depression X
2.Ground water depression _____
3.Surface water slope _____
4.Ground water slope ____

Inlets/Outlets/water bodies:
None

Wildlife: (Observation/Signs/Reports)

Adjacent Wildlife habitat (%):

1.Salt marsh ____
2.Forest 100%
3.Dykelands ____
4.Mudflats ____
5.Beach ____
6.River ____
7. Other ____

Description: mixed woods

Surrounding Land Use %:

1 Agriculture ____
2.Forestry ____
3 Recreation ____
4.Industrial 5%
5.Urban development ____
6.Transportation ____
7.Residential ____
8.Waste Disposal ____
9.Scientific Research ____
10.Trapping ____
11.Education ____
12.Seasonal resident ____

Description: Powerline

Disturbance: 1.Low X 2.Moderate ____ 3.High ____

Description:

Roads and/or tracks:

1.Private road adjacent ____
2.DOT road adjacent ____
3.Private road within ____
4.DOT road within ____
5.Vehicle tracks ____
6.Other X

Description: Property line

Existing Uses of Wetlands:

1.Economic use (e.g. farming) ____
2.Recreational activities ____
3.Aesthetics ____
4.Education & public awareness ____
5. None evident X

Potential Threats:

Special Features:

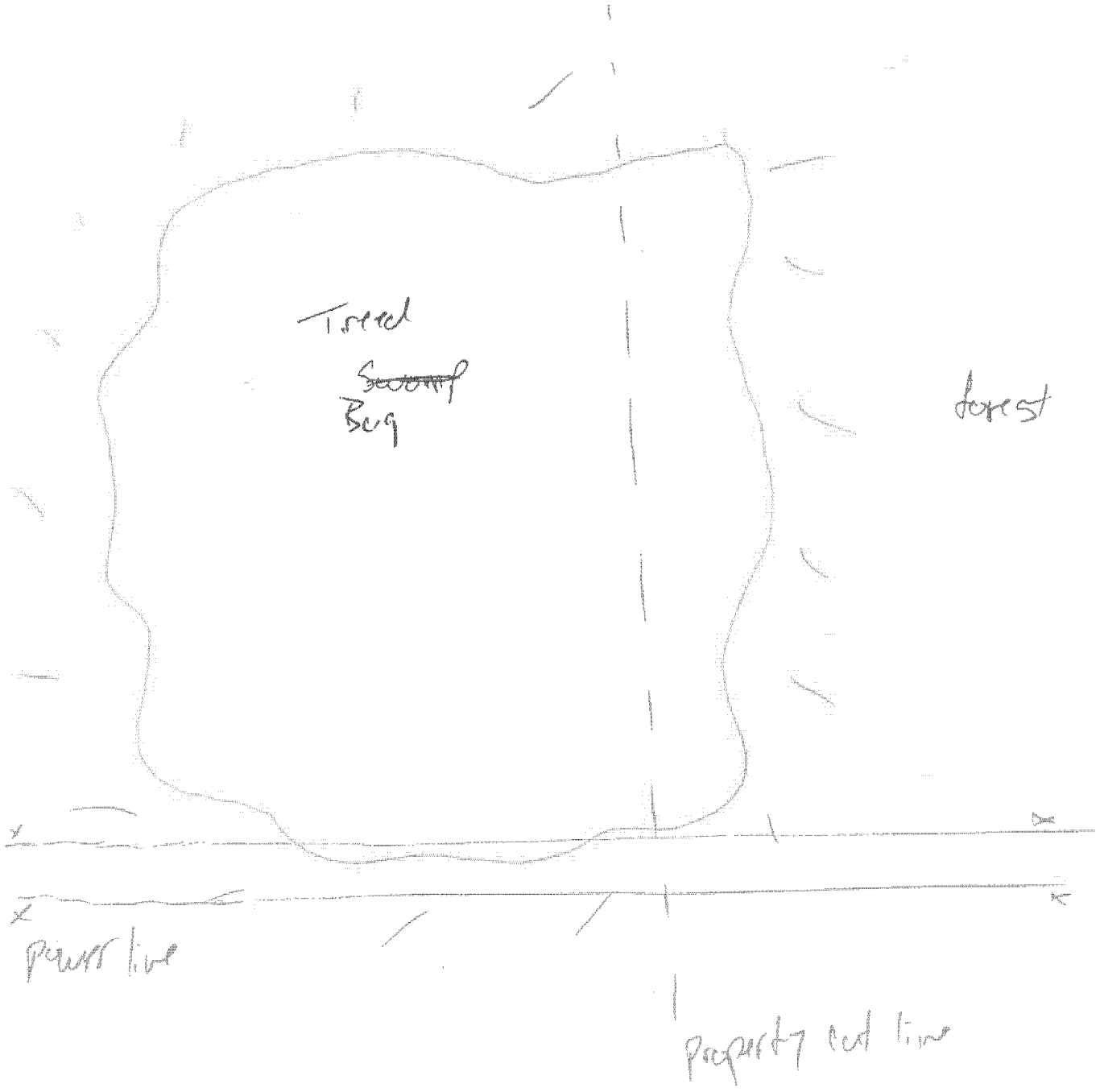
1.Rare wetland type ____
2.Rare animal or plant species ____
3.Habitat of rare species X
4.Nesting site for colonial water birds ____
5.Migration stop-over site ____
6. None evident ____

Description: Potential

Notes:

WL-20

N



C 1340-1487

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Black Point Municipality/County: Guysborough Sampling Date: Aug 19/14

Applicant/Owner: Vulcan Sampling Point: WL19 - WP1

Investigator(s): S. Burley Affiliation: AMEC

Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): Hummocky

Slope (%): 1 Lat: 6045938 Long: 5012562 Datum: NAD 83

Soil Map Unit Name/Type: Peatland Wetland Type: Bog

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	If yes, optional Wetland Site ID: WL19
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Larix laricina	20	✓	FAC
2. Picea mariana	10	✓	FACW
3. Abies balsamea	2		FAC
4.			
5.			
	32	= Total Cover	

Sapling/Shrub Stratum (Plot size: 5m)			
1. Abies balsamea	20	✓	FAC
2. Kalmia angustifolia	30	✓	FAC
3. Rhododendron canadense	10		FAC
4. Rhodora canadensis	5		FAC
5. Picea mariana	2		FACW
	67	= Total Cover	

Herb Stratum (Plot size: 1m)			
1. Rhizomnium andrewsianum	15	✓	UPL
2. Carex trisperma	5	✓	OBL
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	20	= Total Cover	

Woody Vine Stratum (Plot size: ____)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 6 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	20	x 1 =	20
FACW species	12	x 2 =	24
FAC species	87	x 3 =	261
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	119 (A)		305 (B)

Prevalence Index = B/A = 2.6

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ✓ Dominance Test is >50%
- ✓ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

SOIL

Sampling Point: WL19-WP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 0-40+							organic	Root

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ✓ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ✓ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ✓ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): _____

Water Table Present? Yes ✓ No ___ Depth (inches): 25cm

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (inches): 5cm

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Black Point Municipality/County: Guysborough Sampling Date: Aug. 19/14

Applicant/Owner: Vulcan Sampling Point: WL9-UP1

Investigator(s): S. Burley Affiliation: AMEC

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): _____

Slope (%): 25% Lat: 6459441 Long: 5022560 Datum: NAD 83

Soil Map Unit Name/Type: _____ Wetland Type: Upland

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No _____	**Is the Sampled Area within a Wetland?** Yes _____ No ✓
Hydric Soil Present?	Yes _____	No ✓	
Wetland Hydrology Present?	Yes _____	No ✓	If yes, optional Wetland Site ID: _____

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Abies balsamea	15	✓	FAC
2. Acer rubrum	5	✓	FAC
3. Picea rubens	5		FACU
4.			
5.			
	20	= Total Cover	

Sapling/Shrub Stratum (Plot size: 5m)			
1. Abies balsamea	20	✓	FAC
2. Kalmia angustifolia	5		FAC
3. Acer rubrum	2		FAC
4. Sorbus decora	2		FAC
5.			
	29	= Total Cover	

Herb Stratum (Plot size: 1m)			
1. Maianthemum canadense	5	✓	FAC
2. Trientalis borealis	2		FAC
3. Dendrolycopodium obscurum	2		FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	9	= Total Cover	

Woody Vine Stratum (Plot size: ~)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species	x 1 =	
FACW species 5	x 2 =	10
FAC species 53	x 3 =	159
FACU species	x 4 =	
UPL species	x 5 =	
Column Totals: 58 (A)		169 (B)

Prevalence Index = B/A = 2.9

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ✓ Dominance Test is >50%
- ✓ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No _____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

C 1340-1490

SOIL

Sampling Point: WL-19-UPL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm) (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
O 0-16							Organic Duff	
Ae 16-19	10YR 5/2						Sand	(Weathered bedrock)

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Bedrock

Depth (inches): 19cm

Hydric Soil Present? Yes ____ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No ____ Depth (inches): ____

Water Table Present? Yes ____ No ____ Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ____ No ____ Depth (inches): ____

Wetland Hydrology Present? Yes ____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

open Con. forest.

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

Freshwater Wetland Data Sheet: WL21

Date: Aug. 18/14
Investigator(s): Scott Burley
Weather: Sun/Cloud/Showers
Topographic Sheet: _____
Aerial Photo Number: _____

Wetland Atlas Number : _____
GIS Map / Stand No. : _____
Wetland Form[1]:: _____
Wetland size: _____ ha
Associated Watercourse: _____

Wetland Type:
1.Aquatic bed/unconsolidated bottom (AB) ____
2.Bog(BO) X
3.Fen (FE) ____
4.Emergent wetland (EW) ____
5.Shrub wetland (SB) ____
6.Forested wetland (FW) X

Wetland Class:
1.Open water ___
2.Deep marsh ____
3.Shallow marsh ____
4.Seasonally flooded flats ____
5.Meadow ____
6.Shrub swamp ____
7.Wooded swamp X
8.Bog X

Wetland Subclass:
1.Vegetated open water ___
2.Non-vegetated OW ___
3.Floating leaved OW ___
4.Rooted floating leaved OW ___
5.Dead woody OW ____
6.Vegetated deep marsh ____
7.Non-vegetated DM ____
8.Dead woody DM ____
9.Sub-shrub DM ____
10.Floating leaved DM ____
11.Rooted floating leaved DM ____
12.Robust DM ____
13.Narrow-leaved DM ____
14.Broad-leaved DM ____
15.Dead woody shallow marsh ____
16.Robust SM ____
17.Narrow leaved SM ____
18.Broad leaved SM ____
19.Floating leaved SM ____
20.Rooted floating leaved SM ____
21.Non-vegetated SM ____
22.Emergent seasonally flooded flats ____
23.Shrubby SFF ____
24.Grazed meadow ____
25.Ungrazed M ____
26.Sedge M X
27.Sapling shrub swamp ____
28.Bushy SS ____
29.Compact SS ____
30.Low sparse SS ____
31.Deciduous wooded swamp ____
32.Evergreen WS X
33.Wooded bog X
34.Shrubby B X
35.Open B X

Water Regime Indicator:
1.Permanently flooded ___
2.Saturated X
3.Seasonally flooded ____

Water Depth:
1.0-5 cm X
2.5-20 cm ____
3.20-50 cm ____
4.50-100 cm ____
5.>100 cm ____

Note: 1. Canadian Wetland Classification System (2nd Edition)

WL Depth: >40cm organic

Impounded Wetland Type:
1.Beaver Pond ____
2.Man-made Impoundment ____
3.Ducks Unlimited Impoundment ____
4. None of the above X

Percent Vegetation Cover:
1.> 95% X
2.76-95% in peripheral band ____
3.76-96% in patches ____
4.26-75% in peripheral band ____
5.26-75% in patches ____
6. 5-25% in peripheral band ____
7. 5-25% in patches ____
8.< 5% ____

Wetland Site:
1.Lacustrine ____
2.Riverine ____
3.Palustrine X
4.Isolated ____
5.Deltaic ____

Vegetation Types (%):
1.Deciduous trees 5% Red maple
2.Coniferous trees Black spruce*, Larch (5%) Balsam Fir
3.Dead trees 1%
4.Tall shrubs 5% Amelanchier, Ilex verticillata, Viburnum nudum
5.Low shrubs 5% Leatherleaf, Labrador tea
6.Dead shrubs
7.Herbs 30% Sensitive fern, Osmunda cinnamomea, Maianthemum trifolium*, Dulichium arundinaceum
8.Mosses 100% Sphagnum
9.Narrow-leaved emergents 60% Carex spp.*, Eriophorum, Calamagrostis canadensis
10.Broad-leaved emergents —
11.Robust emergents —
12.Free-floating plants —
13.Floating plants (rooted) —
14.Submerged plants —
15. Other —

Interspersion: 1.Minimal X 2.Low ____ 3.Medium ___ 4.High ____

Conductivity: N/A
Alkalinity: N/A
pH: N/A

Hydrological Classification:
1.Surface water depression X
2.Ground water depression ____
3.Surface water slope ____
4.Ground water slope ____

Inlets/Outlets/water bodies:
2 main outlet channels @ west end

Wildlife: (Observation/Signs/Reports)
Coyote Scat
Rabbit droppings
Leopard Frog

Adjacent Wildlife habitat (%):

1.Salt marsh ____
2.Forest 60%
3.Dykelands ____
4.Mudflats ____
5.Beach ____
6.River ____
7. Other ____

Description:

Surrounding Land Use %:

1 Agriculture ____
2.Forestry ____
3 Recreation ____
4.Industrial ____
5.Urban development ____
6.Transportation ____
7.Residential ____
8.Waste Disposal ____
9.Scientific Research ____
10.Trapping ____
11.Education ____
12.Seasonal resident ____

Description:

Disturbance: 1.Low X 2.Moderate ____ 3.High ____

Description:

Roads and/or tracks:

1.Private road adjacent ____
2.DOT road adjacent ____
3.Private road within ____
4.DOT road within ____
5.Vehicle tracks ____
6.Other X

Description: Survey cut line & East end. Highway 16 ~150m to South.

Existing Uses of Wetlands:

1.Economic use (e.g. farming) ____
2.Recreational activities ____
3.Aesthetics ____
4.Education & public awareness ____
5. None evident X

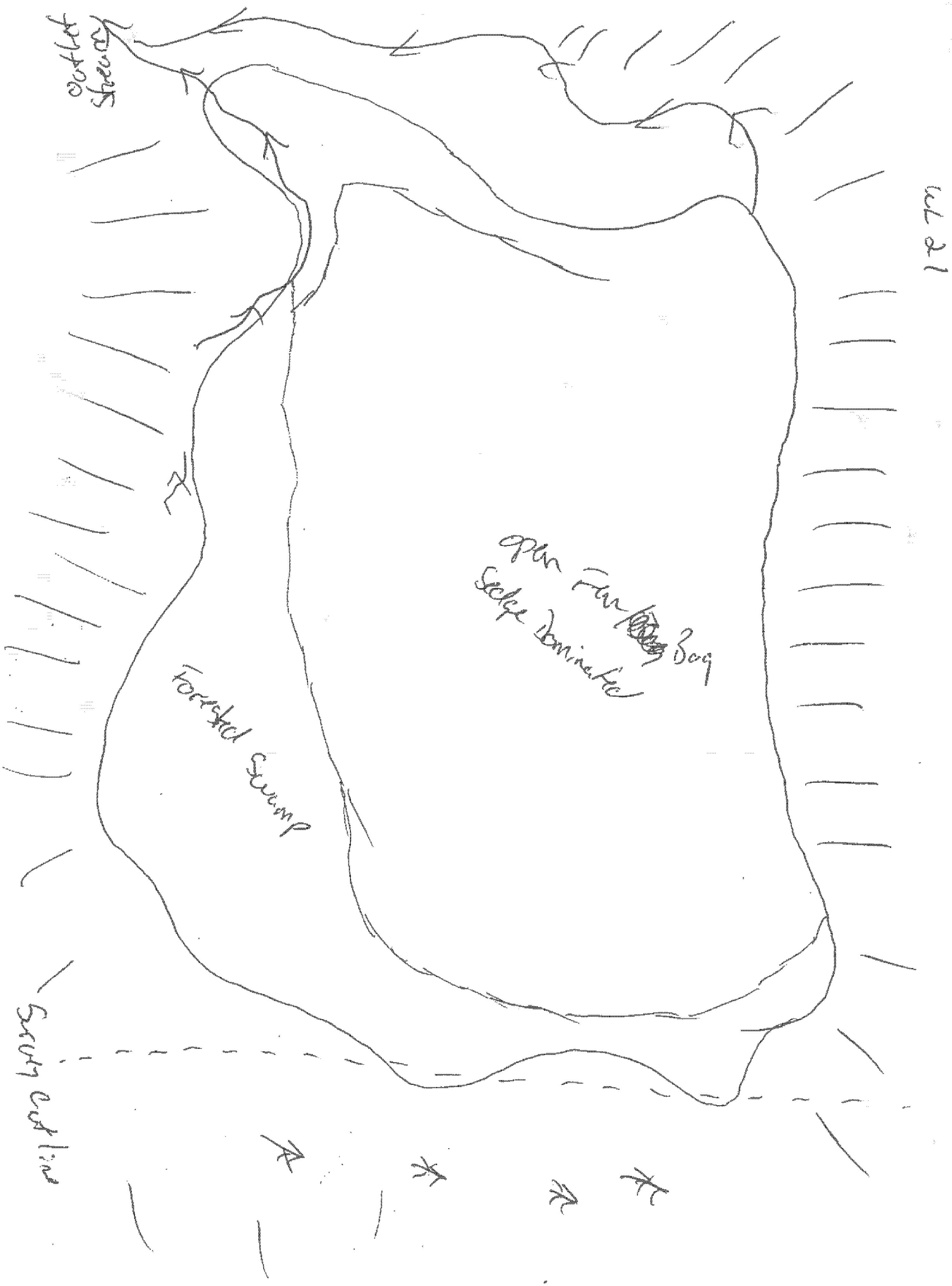
Potential Threats:

Special Features:

1.Rare wetland type ____
2.Rare animal or plant species ____
3.Habitat of rare species ____
4.Nesting site for colonial water birds ____
5.Migration stop-over site ____
6. None evident X

Description:

Notes:


wl 21
Outlet Stream
Open Fen Bog
Sedge Dominated
Forested Swamp
Survey Cut line

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Black Point Municipality/County: Guysborough Sampling Date: July 2011

Applicant/Owner: Uniacke Sampling Point: WL-WP1

Investigator(s): [redacted] Tara Pepper Affiliation: AMEC

Landform (hillslope, terrace, etc.): Basin Local relief (concave, convex, none): Hummocky

Slope (%): 2 Lat: 6444735 Long: 5021602 Datum: NAD 83

Soil Map Unit Name/Type: Rockland Wetland Type:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	If yes, optional Wetland Site ID: ____
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10)	Absolute % Cover	Dominant Species?	Indicator Status
1. Picea mariana	15	✓	FACW
2.			
3.			
4.			
5.			
	= Total Cover		

Sapling/Shrub Stratum (Plot size: 5)			
1. Chamaedaphne calyculata	20	✓	OBL
2. Kalmia polifolia	5		OBL
3. Rhododendron canadense	10	✓	FACW
4. Alnus incana	10	✓	FAC
5. Picea mariana	10	✓	FACW
	= Total Cover		

Herb Stratum (Plot size: 1)			
1. Rhynchospora alba	15	✓	OBL
2. Sarracenia purpurea	5		OBL
3. Andromeda polifolia	5		OBL
4. Drosera rotundifolia	5		OBL
5. Maianthemum trifolium	10	✓	OBL
6. Carex exilis	5		OBL
7.			
8.			
9.			
10.			
	45 = Total Cover		

Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 7 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	50	x 1 =	50
FACW species	35	x 2 =	70
FAC species	10	x 3 =	30
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	95 (A)		150 (B)

Prevalence Index = B/A = 1.6

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

C 1340-1496

SOIL

Sampling Point: GL21-UP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-40+							OrgMix	Root

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- X Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): _____

Water Table Present? Yes ✓ No ___ Depth (inches): 10

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (inches): 0

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Black Point Municipality/County: Guysborough Sampling Date: Aug 18/14
Applicant/Owner: Vulcan Sampling Point: WL-21-UP1
Investigator(s): S Burley Affiliation: AMEC
Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Hummock
Slope (%): 5% Lat: 6448'42 Long: 502'792 Datum: NAD 83
Soil Map Unit Name/Type: Restigouche Wetland Type: Upland
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10)	Absolute % Cover	Dominant Species?	Indicator Status
1. Picea Mariana	15	✓	FACW
2. Abies balsamea	20	✓	FAC
3.			
4.			
5.			
	35	= Total Cover	

Sapling/Shrub Stratum (Plot size: 5)			
1. Picea Mariana	5	✓	FACW
2. Abies balsamea	5	✓	FAC
3.			
4.			
5.			
	10	= Total Cover	

Herb Stratum (Plot size: 1)			
1. Kalmia angustifolia	5	✓	FAC
2. Acer rubrum	#1		FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	6	= Total Cover	

Woody Vine Stratum (Plot size: —)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)
Total Number of Dominant Species Across All Strata: 5 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	—	x 1 =	
FACW species	20	x 2 =	40
FAC species	31	x 3 =	93
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	51 (A)		133 (B)

Prevalence Index = B/A = 2.60

Hydrophytic Vegetation Indicators:
___ Rapid Test for Hydrophytic Vegetation
✓ Dominance Test is >50%
✓ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

C 1340-1498

SOIL

Sampling Point: LK-21-UP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm) (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
O 0-10	—						organic	Duff
Ae 10-16	10YR 6/2	100					Silt Loam	
B 16-21	7.5YR 5/4	100					clay Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Bedrock

Depth (inches): 21 cm

Hydric Soil Present? Yes _____ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

Freshwater Wetland Data Sheet: WL 22

Date: Aug. 16/14
Investigator(s): Scott Burley
Weather: Sun/Cloud/Showers
Topographic Sheet: _____
Aerial Photo Number: _____

Wetland Atlas Number : _____
GIS Map / Stand No. : _____
Wetland Form[1]:: _____
Wetland size: _____ ha
Associated Watercourse: _____

Wetland Type:
1.Aquatic bed/unconsolidated bottom (AB) ____
2.Bog(BO) ____
3.Fen (FE) ____
4.Emergent wetland (EW) ____
5.Shrub wetland (SB) ____
6.Forested wetland (FW) X

Wetland Class:
1.Open water ___
2.Deep marsh ____
3.Shallow marsh ____
4.Seasonally flooded flats ____
5.Meadow ____
6.Shrub swamp ____
7.Wooded swamp X
8.Bog ____

Wetland Subclass:
1.Vegetated open water ___
2.Non-vegetated OW ___
3.Floating leaved OW ___
4.Rooted floating leaved OW ___
5.Dead woody OW ____
6.Vegetated deep marsh ____
7.Non-vegetated DM ____
8.Dead woody DM ____
9.Sub-shrub DM ____
10.Floating leaved DM ____
11.Rooted floating leaved DM ____
12.Robust DM ____
13.Narrow-leaved DM ____
14.Broad-leaved DM ____
15.Dead woody shallow marsh ____
16.Robust SM ____
17.Narrow leaved SM ____
18.Broad leaved SM ____
19.Floating leaved SM ____
20.Rooted floating leaved SM ____
21.Non-vegetated SM ____
22.Emergent seasonally flooded flats ____
23.Shrubby SFF ____
24.Grazed meadow ____
25.Ungrazed M ____
26.Sedge M ____
27.Sapling shrub swamp ____
28.Bushy SS ____
29.Compact SS ____
30.Low sparse SS ____
31.Deciduous wooded swamp ____
32.Evergreen WS X
33.Wooded bog ____
34.Shrubby B ____
35.Open B ____

Water Regime Indicator:
1.Permanently flooded ___
2.Saturated X
3.Seasonally flooded ____

Water Depth:
1.0-5 cm X
2.5-20 cm ____
3.20-50 cm ____
4.50-100 cm ____
5.>100 cm ____

Note: 1. Canadian Wetland Classification System (2nd Edition)

WL Soil - 15cm peat
15 cm Black muck = A3
10YR 2/1
Bedrock @ 30cm

C 1340-1500

Impounded Wetland Type:
1.Beaver Pond ____
2.Man-made Impoundment ____
3.Ducks Unlimited Impoundment ____
4. None of the above X

Percent Vegetation Cover:
1.> 95% X
2.76-95% in peripheral band ____
3.76-96% in patches ____
4.26-75% in peripheral band ____
5.26-75% in patches ____
6. 5-25% in peripheral band ____
7. 5-25% in patches ____
8.< 5% ____

Wetland Site:
1.Lacustrine ____
2.Riverine ____
3.Palustrine ____
4.Isolated X
5.Deltaic ____

Vegetation Types (%):
1.Deciduous trees 20% Red maple
2.Coniferous trees 30% Picea mariana*, Larch, Fir
3.Dead trees (0%)
4.Tall shrubs (5% Rhamnus frangula*, Kalmia, Wild Rosin, Sweet Gale, Meadowsweet*
5.Low shrubs 20% Vaccinium corymbosum, Cranberry
6.Dead shrubs -
7.Herbs - 15% Cinnamon Fern, Pitcher Plant, Bake Apple
8.Mosses - 10% Sphagnum
9.Narrow-leaved emergents - Scirpus cespitosus
10.Broad-leaved emergents
11.Robust emergents
12.Free-floating plants
13.Floating plants (rooted)
14.Submerged plants
15. Other

Interspersion: 1.Minimal X 2.Low ____ 3.Medium ____ 4.High ____

Conductivity: N/A
Alkalinity: N/A
pH: N/A

Hydrological Classification:
1.Surface water depression X
2.Ground water depression ____
3.Surface water slope ____
4.Ground water slope ____

Inlets/Outlets/water bodies:

None

Wildlife: (Observation/Signs/Reports)

Adjacent Wildlife habitat (%):

1.Salt marsh ____
2.Forest ____
3.Dykelands ____
4.Mudflats ____
5.Beach ____
6.River ____
7. Other ____

Description: 25% Forest; 20% Bog; 55% Shrub Barren

Surrounding Land Use %:

1 Agriculture ____
2.Forestry 55%
3 Recreation ____
4.Industrial ____
5.Urban development ____
6.Transportation ____
7.Residential ____
8.Waste Disposal ____
9.Scientific Research ____
10.Trapping ____
11.Education ____
12.Seasonal resident ____

Description: Small

Disturbance: 1.Low ____ 2.Moderate ____ 3.High ____

Description:

Roads and/or tracks:

1.Private road adjacent ____
2.DOT road adjacent ____
3.Private road within ____
4.DOT road within ____
5.Vehicle tracks ____
6.Other X

Description: Survey Cut line & Wet land

Existing Uses of Wetlands:

1.Economic use (e.g. farming) ____
2.Recreational activities ____
3.Aesthetics ____
4.Education & public awareness ____
5. None evident X

Potential Threats:

Special Features:

1.Rare wetland type ____
2.Rare animal or plant species X
3.Habitat of rare species X
4.Nesting site for colonial water birds ____
5.Migration stop-over site ____
6. None evident ____

Description: Graminoid Fen present in Bog

Notes:

C 1340-1503

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Black Point Municipality/County: Guysborough Sampling Date: July 2011

Applicant/Owner: Crown Sampling Point: WL1-WP1

Investigator(s): ~~S Buckley~~ Theo Pepona Affiliation: AMEC

Landform (hillslope, terrace, etc.): Basin Local relief (concave, convex, none): Hummocky

Slope (%): 1 Lat: 644 365 Long: 5021032 Datum: NAD 83

Soil Map Unit Name/Type: Rockland Wetland Type: Bog

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	If yes, optional Wetland Site ID: ____
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10)	Absolute % Cover	Dominant Species?	Indicator Status
1. Picea mariana	25	✓	FACW
2.			
3.			
4.			
5.			
	25 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5)			
1. Picea mariana	20	✓	FACW
2.			
3.			
4.			
5.			
	20 = Total Cover		
Herb Stratum (Plot size: 1)			
1. Nemopanthus mucronatus	10	✓	FAC
2. Cornus canadensis	10	✓	FAC
3. Carex trisperma	10	✓	OBL
4. Osmunda cinnamomea	15	✓	FAC
5.			
6.			
7.			
8.			
9.			
10.			
	45 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 6 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	10	x 1 =	10
FACW species	45	x 2 =	90
FAC species	35	x 3 =	105
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	90 (A)		205 (B)

Prevalence Index = B/A = 2.3

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

✓ Dominance Test is >50%

✓ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

SOIL

Sampling Point: WL-1d-UP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-40+							organic	Root

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ✓ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ✓ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): ___

Water Table Present? Yes ✓ No ___ Depth (inches): 40

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (inches): 0

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Black Point Municipality/County: Guysborough Sampling Date: Aug. 16/17

Applicant/Owner: Various Sampling Point: WP-22-upl

Investigator(s): S. Beatty Affiliation: AMEC

Landform (hillslope, terrace, etc.): Terrace / Flat Local relief (concave, convex, none): Hummocky

Slope (%): 1% Lat: 64430 Long: 50 20 Datum: NAD 83

Soil Map Unit Name/Type: Pockwock Wetland Type: upland

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Picea mariana	10	✓	FACW
2. Abies balsamea	5		FAC
3. Larix laricina	5		FAC
4. Acer rubrum	1		FAC
5.			
	21	= Total Cover	

Sapling/Shrub Stratum (Plot size: 5m)			
1. Aronia melanocarpa	2		FAC
2. Kalmia angustifolia	20	✓	FAC
3. Gaylussacia baccata	15	✓	FAC
4. Viburnum nudum	2		FAC
5. Ledum groenlandicum	1		FACW
	40	= Total Cover	

Herb Stratum (Plot size: 1m)			
1. Cornus canadensis	25	✓	FAC
2. Trientalis borealis	10		FAC
3. Clintonia borealis	10		FAC
4. Maianthemum canadense	5		FAC
5. Vaccinium angustifolium	2		FAC
6.			
7.			
8.			
9.			
10.			
	52	= Total Cover	

Woody Vine Stratum (Plot size: ✓)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	~	x 1 =	
FACW species	11	x 2 =	22
FAC species	102	x 3 =	306
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	113 (A)		328 (B)

Prevalence Index = B/A = 2.9

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

✓ Dominance Test is >50%

✓ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

SOIL

Sampling Point: WL22-sp1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
O 0-10								organic duff
Ae 10-15	10YR 5/2	100					silt loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Bedrock

Depth (inches): 15 cm

Hydric Soil Present? Yes _____ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

Freshwater Wetland Data Sheet: WL 23

Date: Aug. 18/14
Investigator(s): Scott Burley
Weather: Sun/Cloud/Showers
Topographic Sheet: _____
Aerial Photo Number: _____
Rain previous Day

Wetland Atlas Number : _____
GIS Map / Stand No. : _____
Wetland Form[1]:: _____
Wetland size: _____ ha
Associated Watercourse: _____

Wetland Type:
1.Aquatic bed/unconsolidated bottom (AB) ____
2.Bog(BO) X
3.Fen (FE) ____
4.Emergent wetland (EW) ____
5.Shrub wetland (SB) ____
6.Forested wetland (FW) ____

Wetland Class:
1.Open water ___
2.Deep marsh ____
3.Shallow marsh _____
4.Seasonally flooded flats ____
5.Meadow ____
6.Shrub swamp _____
7.Wooded swamp ____
8.Bog X

Wetland Subclass:
1.Vegetated open water ___
2.Non-vegetated OW ___
3.Floating leaved OW ___
4.Rooted floating leaved OW ___
5.Dead woody OW ____
6.Vegetated deep marsh ____
7.Non-vegetated DM ____
8.Dead woody DM ____
9.Sub-shrub DM ____
10.Floating leaved DM ____
11.Rooted floating leaved DM ____
12.Robust DM ____
13.Narrow-leaved DM ____
14.Broad-leaved DM ____
15.Dead woody shallow marsh ____
16.Robust SM _____
17.Narrow leaved SM _____
18.Broad leaved SM ____
19.Floating leaved SM ____
20.Rooted floating leaved SM ____
21.Non-vegetated SM ____
22.Emergent seasonally flooded flats ____
23.Shrubby SFF ____
24.Grazed meadow ____
25.Ungrazed M ____
26.Sedge M ____
27.Sapling shrub swamp ____
28.Bushy SS ____
29.Compact SS _____
30.Low sparse SS ____
31.Deciduous wooded swamp ____
32.Evergreen WS ____
33.Wooded bog _____
34.Shrubby B X
35.Open B X

Water Regime Indicator:
1.Permanently flooded ___
2.Saturated X
3.Seasonally flooded _____

Water Depth:
1.0-5 cm X
2.5-20 cm _____
3.20-50 cm ____
4.50-100 cm ____
5.>100 cm ____

Note: 1. Canadian Wetland Classification System (2nd Edition)

WL Soil Hot Pit A1

Impounded Wetland Type:
1.Beaver Pond ____
2.Man-made Impoundment ____
3.Ducks Unlimited Impoundment ____
4. None of the above X

Percent Vegetation Cover:
1.> 95% X
2.76-95% in peripheral band ____
3.76-96% in patches ____
4.26-75% in peripheral band ____
5.26-75% in patches ____
6. 5-25% in peripheral band ____
7. 5-25% in patches ____
8.< 5% ____

Wetland Site:
1.Lacustrine ____
2.Riverine ____
3.Palustrine ____
4.Isolated X
5.Deltaic ____

Vegetation Types (%):
1.Deciduous trees 1% - Red Maple
2.Coniferous trees 5% - B. Spruce, Fir, Tamarack
3.Dead trees 1%
4.Tall shrubs 30% - Alnus, Huckleberry, Alder, Viburnum edulum, Sweet Gale
5.Low shrubs 3% - Cranberry, Creeping Juniper
6.Dead shrubs ~
7.Herbs 5% Pitcher Plant
8.Mosses
9.Narrow-leaved emergents - Rynchospora, Beergrass, Eriophorum tenuy
10.Broad-leaved emergents
11.Robust emergents
12.Free-floating plants
13.Floating plants (rooted)
14.Submerged plants
15. Other

Interspersion: 1.Minimal X 2.Low ____ 3.Medium ____ 4.High ____

Conductivity: N/A
Alkalinity: N/A
pH: N/A

Hydrological Classification:
1.Surface water depression X
2.Ground water depression ____
3.Surface water slope ____
4.Ground water slope ____

Inlets/Outlets/water bodies:
None

Wildlife: (Observation/Signs/Reports)
Rabbit droppings.

C 1340-1509

Adjacent Wildlife habitat (%):

1.Salt marsh ____
2.Forest ____
3.Dykelands ____
4.Mudflats ____
5.Beach ____
6.River ____
7. Other ____

Description: 30% wetland (Reg 4/E 30m); 20% Forest; 50% shrub Barren

Surrounding Land Use %:

1 Agriculture ____
2.Forestry ____
3 Recreation ____
4.Industrial ____
5.Urban development ____
6.Transportation ____
7.Residential ____
8.Waste Disposal ____
9.Scientific Research ____
10.Trapping ____
11.Education ____
12.Seasonal resident ____

Description: Scouty

Disturbance: 1.Low X 2.Moderate ____ 3.High ____

Description: Gravel cut line

Roads and/or tracks:

1.Private road adjacent ____
2.DOT road adjacent ____
3.Private road within ____
4.DOT road within ____
5.Vehicle tracks ____
6.Other ____

Description: —

Existing Uses of Wetlands:

1.Economic use (e.g. farming) ____
2.Recreational activities ____
3.Aesthetics ____
4.Education & public awareness ____
5. None evident X

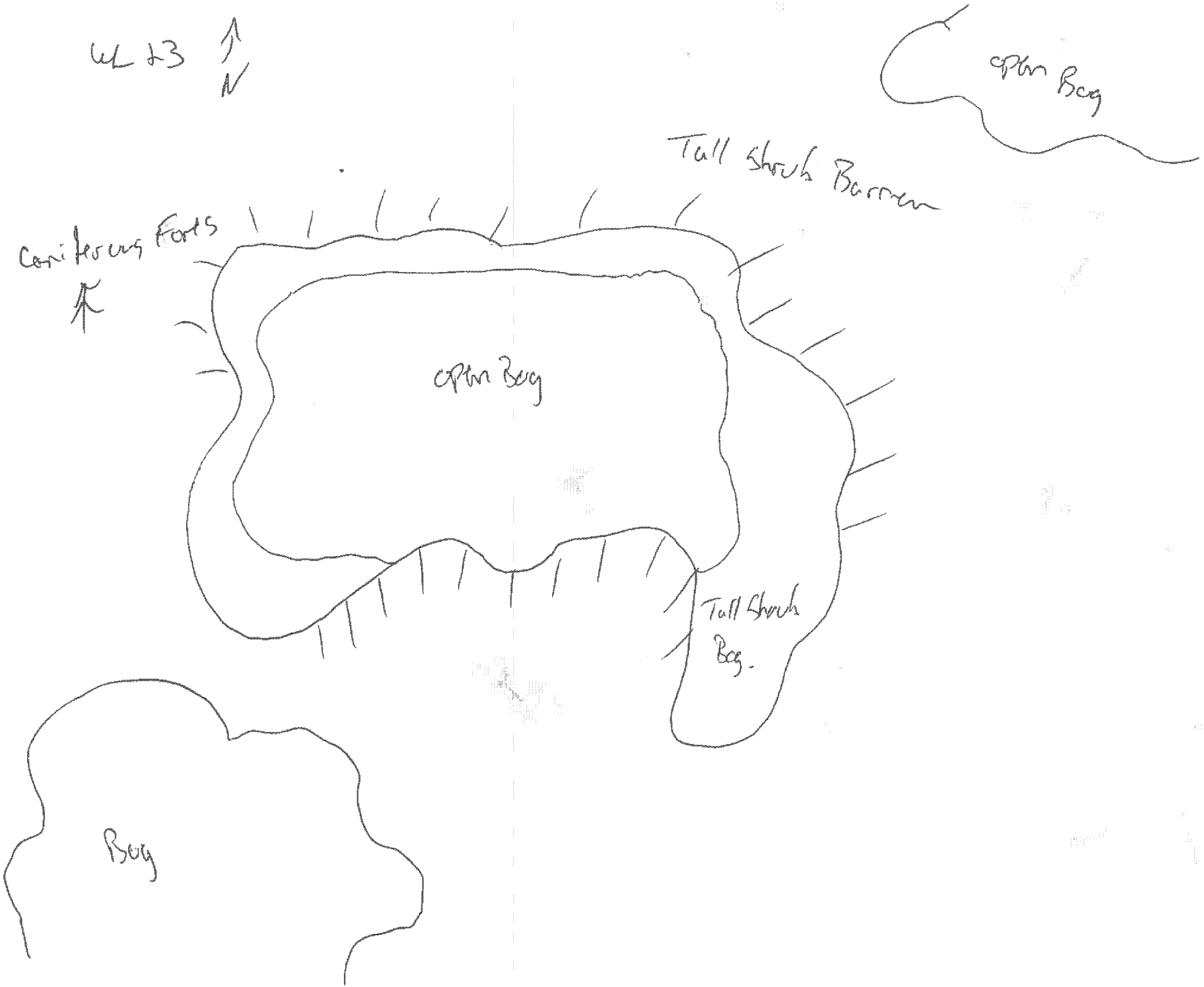
Potential Threats:

Special Features:

1.Rare wetland type ____
2.Rare animal or plant species X
3.Habitat of rare species X
4.Nesting site for colonial water birds ____
5.Migration stop-over site ____
6. None evident ____

Description: Cladonia stygia present

Notes:


WL 23
N
open Bog
Tall Shrub Barren
Coniferous Forest
open Bog
Tall Shrub Bog.
Bog

C 1340-1511

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Black Point Municipality/County: Guysborough Sampling Date: July 2011

Applicant/Owner: Various Sampling Point: WL23-UP1

Investigator(s): ~~Sidney~~ Theo Pepman Affiliation: AMEC

Landform (hillslope, terrace, etc.): Basin Local relief (concave, convex, none): Hummocky

Slope (%): 1 Lat: 644447 Long: 622143 Datum: NAD 83

Soil Map Unit Name/Type: Rockland Wetland Type: Bog

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	If yes, optional Wetland Site ID: ____
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10)	Absolute % Cover	Dominant Species?	Indicator Status
1. Larix laricina	5	✓	FAC
2.			
3.			
4.			
5.			
	5 = Total Cover		

Sapling/Shrub Stratum (Plot size: 5)			
1. Rhododendron canadense	5		FACW
2. Gaylussacia baccata	15	✓	FAC
3. Ilex mucronata	10	✓	FACW
4. Nemopanthus mucronatus	10	✓	FAC
5. Viburnum nudum	5		FAC
	45 = Total Cover		

Herb Stratum (Plot size: 1)			
1. Scirpus cespitosus	10	✓	OBL
2. Rhynchospora alba	10	✓	OBL
3. Sarracenia purpurea	10	✓	OBL
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	30 = Total Cover		

Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 7 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	30	x 1 =	30
FACW species	15	x 2 =	30
FAC species	35	x 3 =	105
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	80 (A)		165 (B)

Prevalence Index = B/A = 1.3

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ✓ Dominance Test is >50%
- ✓ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

SOIL

Sampling Point: WL 23-UP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0	0-40						OSpodic	Peat

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ✓ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ✓ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): _____

Water Table Present? Yes ✓ No ___ Depth (inches): 10

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (inches): 0

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Beek Point Municipality/County: Guysborough Sampling Date: Aug. 18/14

Applicant/Owner: Unknown Sampling Point: 423-up1

Investigator(s): S. Bartley Affiliation: AMEC

Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): Hummocky

Slope (%): 1 Lat: 644453 Long: 5072142 Datum: NAD 83

Soil Map Unit Name/Type: Peckford Wetland Type: Upland

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Picea mariana	2	____	FACW
2. Larix laricina	2	____	FAC
3.			
4.			
5.			
	4	= Total Cover	

Sapling/Shrub Stratum (Plot size: 5m)			
1. Gaylussacia baccata	25	✓	FAC
2. Kalmia angustifolia	5	____	FAC
3. Alnus crispa	2	____	FACW
4. Viburnum nudum	2	____	FAC
5. Aronia prunifolia Maximowicz	5	____	FAC
	44	= Total Cover	

Herb Stratum (Plot size: 1m)			
1. Kalmia angustifolia	55%	____	FAC
2. Anaphalis margaritacea	2%	____	FAC
3. Trientalis borealis	2%	____	FAC
4. Gaultheria procumbens	2%	____	FAC
5. Eriophorum sp.	50%	✓	FAC
6.			
7.			
8.			
9.			
10.			
	61	= Total Cover	

Woody Vine Stratum (Plot size: —)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species —	x 1 =	
FACW species 2	x 2 =	4
FAC species 105	x 3 =	315
FACU species 2	x 4 =	8
UPL species —	x 5 =	
Column Totals: 109 (A)		327 (B)

Prevalence Index = B/A = 3.0

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

✓ Dominance Test is >50%

✓ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

SOIL

Sampling Point: WL23-UP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-5							Organic	Duff

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Bedrock

Depth (inches): 5 cm

Hydric Soil Present? Yes _____ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

Freshwater Wetland Data Sheet: WL 24

Date: Aug. 18/14
Investigator(s): Scott Burley/
Weather: Sun/Cloud/Showers

Wetland Form[1]::
Wetland size: _____ ha
Associated Watercourse: _____

Wetland Type:
1.Aquatic bed/unconsolidated bottom (AB) ____
2.Bog(BO) X
3.Fen (FE) ____
4.Emergent wetland (EW) ____
5.Shrub wetland (SB) ____
6.Forested wetland (FW) ____

Wetland Class:
1.Open water ___
2.Deep marsh ____
3.Shallow marsh _____
4.Seasonally flooded flats ____
5.Meadow ____
6.Shrub swamp _____
7.Wooded swamp ____
8.Bog X

Wetland Subclass:
1.Vegetated open water ___
2.Non-vegetated OW __
3.Floating leaved OW __
4.Rooted floating leaved OW __
5.Dead woody OW ____
6.Vegetated deep marsh ____
7.Non-vegetated DM ____
8.Dead woody DM ____
9.Sub-shrub DM ____
10.Floating leaved DM ____
11.Rooted floating leaved DM ____
12.Robust DM ____
13.Narrow-leaved DM ____
14.Broad-leaved DM ____
15.Dead woody shallow marsh ____
16.Robust SM _____
17.Narrow leaved SM _____
18.Broad leaved SM ____
19.Floating leaved SM ____
20.Rooted floating leaved SM ____
21.Non-vegetated SM ____
22.Emergent seasonally flooded flats ____
23.Shrubby SFF ____
24.Grazed meadow ____
25.Ungrazed M ____
26.Sedge M ____
27.Sapling shrub swamp ____
28.Bushy SS ____
29.Compact SS _____
30.Low sparse SS ____
31.Deciduous wooded swamp ____
32.Evergreen WS ____
33.Wooded bog X
34.Shrubby B X
35.Open B X

Water Regime Indicator:
1.Permanently flooded __
2.Saturated X
3.Seasonally flooded _____

Water Depth:
1.0-5 cm X
2.5-20 cm _____
3.20-50 cm ____
4.50-100 cm ____
5.>100 cm ____

Note: 1. Canadian Wetland Classification System (2nd Edition)

Impounded Wetland Type:
1.Beaver Pond ____
2.Man-made Impoundment ____
3.Ducks Unlimited Impoundment ____
4. None of the above X

Percent Vegetation Cover:
1.> 95% X
2.76-95% in peripheral band ___
3.76-96% in patches ___
4.26-75% in peripheral band ____
5.26-75% in patches ____
6. 5-25% in peripheral band ____
7. 5-25% in patches ____
8.< 5% ____

Wetland Site:
1.Lacustrine ____
2.Riverine ____
3.Palustrine ____
4.Isolated X
5.Deltaic ___

Vegetation Types (%):
1.Deciduous trees – 2% Red Maple
2.Coniferous trees – 30% Larch, S. Spruce*, Fir
3.Dead trees - 1%
4.Tall shrubs - 25% - Alder*, Bush Honeysuckle*, Alnus, wild Raisin, Kalmia
5.Low shrubs - Juniper, Labrador Tea, Blueberry, Vaccinium microcarpum
6.Dead shrubs - –
7.Herbs – 15% - Pitcher plant, Bunch berry, Bunchberry
8.Mosses –
9.Narrow-leaved emergents - 30% - Deer Grass*, Eriophorum, Carex exilis
10.Broad-leaved emergents - –
11.Robust emergents - –
12.Free-floating plants - –
13.Floating plants (rooted) - –
14.Submerged plants - –
15. Other - –

Interspersion: 1.Minimal X 2.Low ____ 3.Medium ___ 4.High __

Conductivity: N/A
Alkalinity: N/A
pH: N/A

Hydrological Classification:
1.Surface water depression X
2.Ground water depression ___
3.Surface water slope ____
4.Ground water slope ____

Inlets/Outlets/water bodies:

None

Wildlife: (Observation/Signs/Reports)

Passerines
Rabbit Droppings

Adjacent Wildlife habitat (%):

1.Salt marsh ____
2.Forest ____
3.Dykelands ____
4.Mudflats ____
5.Beach ____
6.River ____
7. Other ____

Description: 60% Forest; 30% Shrub Barren; 10% wetland.

Surrounding Land Use %:

1 Agriculture ____
2.Forestry ____
3 Recreation ____
4.Industrial ____
5.Urban development ____
6.Transportation ____
7.Residential ____
8.Waste Disposal ____
9.Scientific Research ____
10.Trapping ____
11.Education ____
12.Seasonal resident ____

Description:

Disturbance: 1.Low X 2.Moderate ____ 3.High ____

Description:

Roads and/or tracks:

1.Private road adjacent ____
2.DOT road adjacent ____
3.Private road within ____
4.DOT road within ____
5.Vehicle tracks ____
6.Other X

Description: Survey cut line through wetland

Existing Uses of Wetlands:

1.Economic use (e.g. farming) ____
2.Recreational activities ____
3.Aesthetics ____
4.Education & public awareness ____
5. None evident X

Potential Threats:

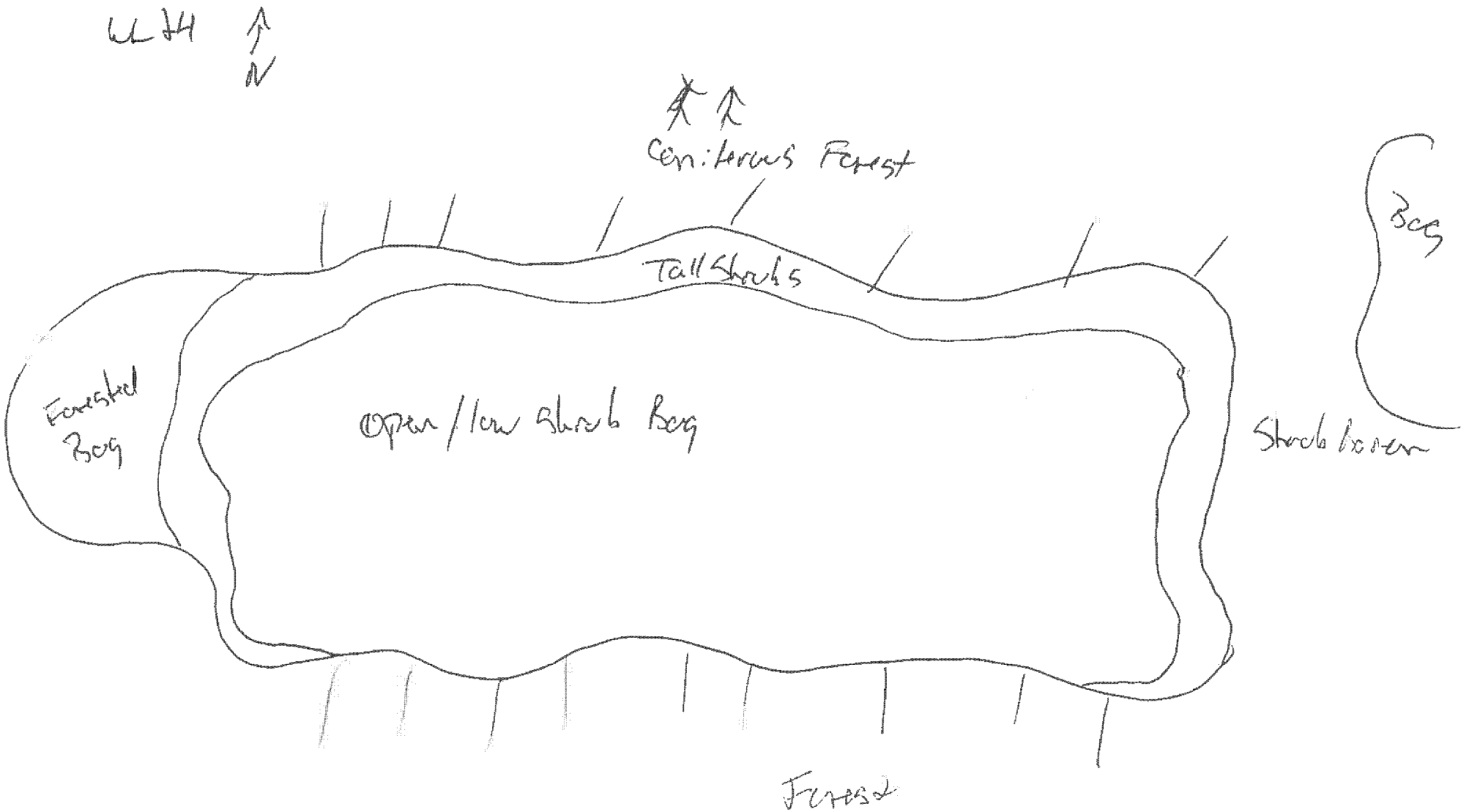
Special Features:

1.Rare wetland type ____
2.Rare animal or plant species X
3.Habitat of rare species X
4.Nesting site for colonial water birds ____
5.Migration stop-over site ____
6. None evident ____

Description: Cladonia Stygia

Notes:

C 1340-1521


WH
N
Coniferous Forest
Tall Shrubs
Bog
Forested Bog
Open / low shrub Bog
Shrub bog
Forest

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Aug. 18/14

Project/Site: Black Point Municipality/County: Guysborough Sampling Date: ~~Aug. 18/14~~ Aug. 19/14

Applicant/Owner: Vulcan Sampling Point: WP24-WP1

Investigator(s): S. Barker Affiliation: AMEC

Landform (hillslope, terrace, etc.): depression Local relief (concave, convex, none): Hummocky

Slope (%): 1% Lat: 644456 Long: 5021260 Datum: NAD 83

Soil Map Unit Name/Type: Rockland Wetland Type: BOG

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	If yes, optional Wetland Site ID: ____
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Larix laricina	5	✓	FAC
2. Picea mariana	2		FACW
3.			
4.			
5.			
	7 = Total Cover		

Sapling/Shrub Stratum (Plot size: 5m)			
1. Kalmia angustifolia	5	✓	FAC
2. Rhododendron canadense	15	✓	FAC
3. Vaccinium corymbosum	15	✓	FAC
4. Myrica gale	5	✓	FAC
5. Picea mariana	2		FACW
	42 = Total Cover		

Herb Stratum (Plot size: 1m)			
1. Scirpus cyperinus	30	✓	OBL
2. Eriophorum spissum	15	✓	OBL
3. Aster nemoralis	2		OBL
4. Lilium canadense	2		FACW
5. Eriophorum (Calamagrostis) virginicum			OBL
6. Carex trisperma	2		FAC
7.			
8.			
9.			
10.			
	53 = Total Cover		

Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 7 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	49	x 1 =	49
FACW species	6	x 2 =	12
FAC species	47	x 3 =	141
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	102 (A)		202 (B)

Prevalence Index = B/A = 2.0

Hydrophytic Vegetation Indicators:

__ Rapid Test for Hydrophytic Vegetation

✓ Dominance Test is >50%

__ Prevalence Index is ≤3.0[1]

__ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

SOIL

Sampling Point: 22-24-WP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
O 0-20							Organic Peat	
A 20-30	10YR/5/2	100					Loamy Sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ✓ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): _____

Water Table Present? Yes ___ No ✓ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (inches): Soil Surface

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Black Point Municipality/County: Guysborough Sampling Date: Aug 16/14

Applicant/Owner: Unknown Sampling Point: WL24-UP1

Investigator(s): S Burley Affiliation: AMEC

Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): Hummocky

Slope (%): 5 Lat: 44454 Long: 5214213 Datum: NAD 83

Soil Map Unit Name/Type: Rockland Wetland Type: upland

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ____	
Wetland Hydrology Present?	Yes ____	No ____	If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10)	Absolute % Cover	Dominant Species?	Indicator Status
1. Picea mariana	10	✓	FAC
2. Picea marina	5	✓	FACW
3. Betula papyrifera	2		FACU
4.			
5.			
	17	= Total Cover	

Sapling/Shrub Stratum (Plot size: 5)			
1. Viburnum nudum	5	✓	FAC
2. Alnus incana	2		FAC
3. Cornus sericea subsp. stolonifera	30	✓	FAC
4. Rhododendron canadense	5		FACW
5. Rhododendron canadense	30	✓	FAC
Nemopanthus mucronatus	10		FAC
	79	= Total Cover	

Herb Stratum (Plot size: ____)			
1. Carex canescens	5		FAC
2. Kalmia angustifolia	15	✓	FAC
3. Vaccinium angustifolium	5		FAC
4. Coptis trifolia	2		FAC
5.			
6.			
7.			
8.			
9.			
10.			
	22	= Total Cover	

Woody Vine Stratum (Plot size: —)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 6 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	—	x 1 =	
FACW species	7	x 2 =	14
FAC species	166	x 3 =	333
FACU species	2	x 4 =	8
UPL species		x 5 =	
Column Totals:	175 (A)		355 (B)

Prevalence Index = B/A = 3.0

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

✓ Dominance Test is >50%

✓ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

SOIL

Sampling Point: WL 24-P1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-10							Organic	Duff

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Bedrock

Depth (inches): 10cm

Hydric Soil Present? Yes _____ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

Freshwater Wetland Data Sheet: WL25

Date: Aug. 20/14
Investigator(s): Scott Burley/__
Weather: Sun

Wetland Form[1]::
Wetland size: _____ha
Associated Watercourse: _____

Wetland Type:
1.Aquatic bed/unconsolidated bottom (AB) ____
2.Bog(BO) ____
3.Fen (FE) X
4.Emergent wetland (EW) ____
5.Shrub wetland (SB) ____
6.Forested wetland (FW) ____

Wetland Class:
1.Open water ___
2.Deep marsh ____
3.Shallow marsh _____
4.Seasonally flooded flats ____
5.Meadow ____
6.Shrub swamp _____
7.Wooded swamp ____
8.Bog ____ Fen X

Wetland Subclass:
1.Vegetated open water ___
2.Non-vegetated OW ___
3.Floating leaved OW ___
4.Rooted floating leaved OW ___
5.Dead woody OW ____
6.Vegetated deep marsh ____
7.Non-vegetated DM ____
8.Dead woody DM ____
9.Sub-shrub DM ____
10.Floating leaved DM ____
11.Rooted floating leaved DM ____
12.Robust DM ____
13.Narrow-leaved DM ____
14.Broad-leaved DM ____
15.Dead woody shallow marsh ____
16.Robust SM _____
17.Narrow leaved SM _____
18.Broad leaved SM ____
19.Floating leaved SM ____
20.Rooted floating leaved SM ____
21.Non-vegetated SM ____
22.Emergent seasonally flooded flats ____
23.Shrubby SFF X
24.Grazed meadow ____
25.Ungrazed M ____
26.Sedge M X
27.Sapling shrub swamp ____
28.Bushy SS ____
29.Compact SS _____
30.Low sparse SS ____
31.Deciduous wooded swamp ____
32.Evergreen WS ____
33.Wooded bog ____
34.Shrubby B _____
35.Open B _____

Water Regime Indicator:
1.Permanently flooded ___
2.Saturated X
3.Seasonally flooded _____

Water Depth:
1.0-5 cm X
2.5-20 cm _____
3.20-50 cm ____
4.50-100 cm ____
5.>100 cm ____

Note: 1. Canadian Wetland Classification System (2nd Edition)

Impounded Wetland Type:
1.Beaver Pond ____
2.Man-made Impoundment ____
3.Ducks Unlimited Impoundment ____
4. None of the above ✓

Percent Vegetation Cover:
1.> 95% X
2.76-95% in peripheral band ____
3.76-96% in patches ____
4.26-75% in peripheral band ____
5.26-75% in patches ____
6. 5-25% in peripheral band ____
7. 5-25% in patches ____
8.< 5% ____

Wetland Site:
1.Lacustrine ____
2.Riverine ____
3.Palustrine ✓
4.Isolated ____
5.Deltaic ____

Vegetation Types (%):
1.Deciduous trees – 1% - Red maple
2.Coniferous trees – 10% · Picea glauca, Abies
3.Dead trees - –
4.Tall shrubs - 20% – Alder, Aronia
5.Low shrubs - 3%
6.Dead shrubs - –
7.Herbs – 30% · Aster acuminatus, St. John's wort, Cinnamon fern
8.Mosses – 100% sphagnum
9.Narrow-leaved emergents - Carex - Eriophorum*, Calamagrostis*, ~~Scirpus~~ Juncus*, Scirpus
10.Broad-leaved emergents - 15% Iris
11.Robust emergents - –
12.Free-floating plants - –
13.Floating plants (rooted) - –
14.Submerged plants - –
15. Other - –

Interspersion: 1.Minimal ✓ 2.Low ____ 3.Medium ____ 4.High ____

Conductivity: N/A
Alkalinity: N/A
pH: N/A

Hydrological Classification:
1.Surface water depression X
2.Ground water depression ____
3.Surface water slope ____
4.Ground water slope ____

Inlets/Outlets/water bodies:

One seasonal inlet @ South west side.

Wildlife: (Observation/Signs/Reports)

Deer tracks / Scat
Passerines

Adjacent Wildlife habitat (%):

1.Salt marsh ____
2.Forest ____
3.Dykelands ____
4.Mudflats ____
5.Beach ____
6.River ____
7. Other ____

Description: 50% Forest / 50% Beach

Surrounding Land Use %:

1 Agriculture ____
2.Forestry ____
3 Recreation 50%
4.Industrial ____
5.Urban development ____
6.Transportation ____
7.Residential ____
8.Waste Disposal ____
9.Scientific Research ____
10.Trapping ____
11.Education ____
12.Seasonal resident ____

Description: cottages

Disturbance: 1.Low X 2.Moderate ____ 3.High ____

Description: ATV tracks crossed / through wetland

Roads and/or tracks:

1.Private road adjacent ____
2.DOT road adjacent ____
3.Private road within ____
4.DOT road within ____
5.Vehicle tracks ____
6.Other ____

Description:

Existing Uses of Wetlands:

1.Economic use (e.g. farming) ____
2.Recreational activities ____
3.Aesthetics ____
4.Education & public awareness ____
5. None evident X

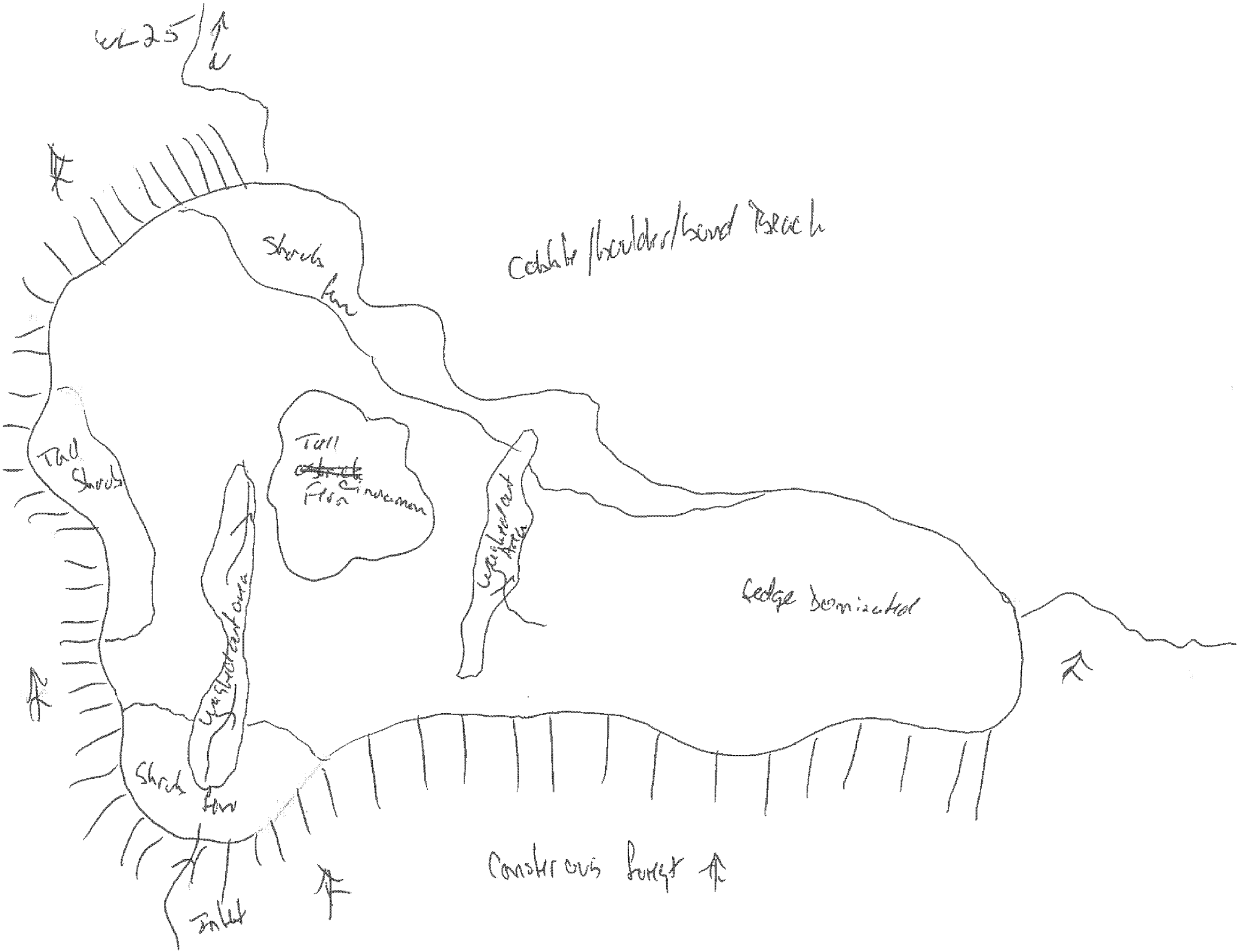
Potential Threats:

Special Features:

1.Rare wetland type ____
2.Rare animal or plant species ____
3.Habitat of rare species X
4.Nesting site for colonial water birds ____
5.Migration stop-over site ____
6. None evident ____

Description:

Notes:


WL25
Shrub
Cobble/boulder/gravel Beach
Tall Shrub
Tall
Cinnamon
Fern
Sedge dominated
Shrub
Inlet
Conspicuous burger

C 1340-1531

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Black Point Municipality/County: Guysborough Sampling Date: Aug. 2014
Applicant/Owner: Various Sampling Point: WL25-WP1
Investigator(s): S Burbey Affiliation: AMEC
Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Hummocky
Slope (%): 3 Lat: 645 864 Long: 5022 3655 Datum: NAD 83
Soil Map Unit Name/Type: Rockland Wetland Type: Fen
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	If yes, optional Wetland Site ID: WL25
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Abies balsamea	5	✓	FAC
2. Picea glauca	10	✓	FAC
3. Acer rubrum	5	✓	FAC
4.			
5.			
	20	= Total Cover	

Sapling/Shrub Stratum (Plot size: 5m)			
1. Alnus incana ssp. rugosa	5		FACW
2. Kalmia angustifolia	20	✓	FAC
3. Viburnum nudum	5		FAC
4. Aronia prunifolia x melanocarpa	10	✓	FACW
5.			
	40	= Total Cover	

Herb Stratum (Plot size: 1m)			
1. Cornus canadensis	10	✓	FAC
2. Eriophorum [illegible]	5	✓	OBL
3. Rhodora canadensis	2		OBL
4. Aster almoenus	5	✓	OBL
5. Vaccinium myrtilloides	5	✓	FACU
6. Vaccinium oxycoccos			OBL
7. Trientalis borealis	5	✓	FACU
8.			
9.			
10.			
	34	= Total Cover	

Woody Vine Stratum (Plot size: ____)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 10 (A)
Total Number of Dominant Species Across All Strata: 10 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	14	x 1 =	14
FACW species	20	x 2 =	40
FAC species	55	x 3 =	165
FACU species	5	x 4 =	20
UPL species		x 5 =	
Column Totals:	94 (A)		239 (B)

Prevalence Index = B/A = 2.5

Hydrophytic Vegetation Indicators:
___ Rapid Test for Hydrophytic Vegetation
✓ Dominance Test is >50%
✓ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

SOIL

Sampling Point: WL25-WP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-30							organic	dead

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ✓ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Bedrock

Depth (inches): 30cm

Hydric Soil Present? Yes ✓ No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): ___

Water Table Present? Yes ___ No ✓ Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (inches): 5cm

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Black Point Municipality/County: Guysborough Sampling Date: Aug 20/14

Applicant/Owner: Vulcan Sampling Point: WL-25-UP1

Investigator(s): S. Burley Affiliation: AMEC

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Hummocky

Slope (%): 45 Lat: 6045 955 Long: 5023636 Datum: NAD 83

Soil Map Unit Name/Type: Peckwood Wetland Type: upland

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No ✓	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	If yes, optional Wetland Site ID: ____
Wetland Hydrology Present?	Yes ____	No ✓	

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10 m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Picea glauca	15	✓	FAC
2. Abies balsamea	10		FAC
3. Picea mariana	2		FACW
4.			
5.			
	27	= Total Cover	

Sapling/Shrub Stratum (Plot size: 5 m)			
1. Abies balsamea	15	✓	FAC
2. Gaultheria hispidula	5	✓	FAC
3. Alnus incana crispa	5	✓	FACW
4. Betula papyrifera	5	✓	FACW
5.			
	25	= Total Cover	

Herb Stratum (Plot size: 1 m)			
1. Cornus canadensis	10	✓	FAC
2. Dryopteris cumpletoptera	5	✓	FAC
3. Rubus allegheniensis	5	✓	FACW
4. Vaccinium vitis-idaea	10	✓	FAC
5. Coptis trifolia	2		FAC
6. Carex trisperma	2		OBL
7. Maianthemum canadense	2		FAC
8.			
9.			
10.			
	36	= Total Cover	

Woody Vine Stratum (Plot size: ____)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ~~6~~ 7 (A)

Total Number of Dominant Species Across All Strata: 10 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 70 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	2	x 1 =	2
FACW species	2	x 2 =	4
FAC species	74	x 3 =	222
FACU species	15	x 4 =	60
UPL species		x 5 =	
Column Totals:	93 (A)		288 (B)

Prevalence Index = B/A = 3.1

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

✓ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No ✓

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

SOIL

Sampling Point: WL25-UP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm) (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-10							Organic Duff	
10-30	10YR3/6	100					Sandy loam	(Possible plowlayer)

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Rock

Depth (inches): 30+

Hydric Soil Present? Yes _____ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

Freshwater Wetland Data Sheet: WL26

Date: Aug. 20/14
Investigator(s): Scott Burley/__
Weather: Sun/Cloud

Wetland Form[1]::
Wetland size: _____ ha
Associated Watercourse: unnamed stream

Wetland Type:
1.Aquatic bed/unconsolidated bottom (AB) ____
2.Bog(BO) ____
3.Fen (FE) X
4.Emergent wetland (EW) ____
5.Shrub wetland (SB) ____
6.Forested wetland (FW) ____

Wetland Class:
1.Open water ___
2.Deep marsh ____
3.Shallow marsh _____
4.Seasonally flooded flats ____
5.Meadow ____
6.Shrub swamp _____
7.Wooded swamp ____
8.Bog ____ Fen X

Wetland Subclass:
1.Vegetated open water ___
2.Non-vegetated OW ___
3.Floating leaved OW ___
4.Rooted floating leaved OW ___
5.Dead woody OW ____
6.Vegetated deep marsh ____
7.Non-vegetated DM ____
8.Dead woody DM ____
9.Sub-shrub DM ____
10.Floating leaved DM ____
11.Rooted floating leaved DM ____
12.Robust DM ____
13.Narrow-leaved DM ____
14.Broad-leaved DM ____
15.Dead woody shallow marsh ____
16.Robust SM _____
17.Narrow leaved SM _____
18.Broad leaved SM ____
19.Floating leaved SM ____
20.Rooted floating leaved SM ____
21.Non-vegetated SM ____
22.Emergent seasonally flooded flats ____
23.Shrubby SFF X
24.Grazed meadow ____
25.Ungrazed M ____
26.Sedge M X
27.Sapling shrub swamp X
28.Bushy SS X
29.Compact SS _____
30.Low sparse SS ____
31.Deciduous wooded swamp ____
32.Evergreen WS ____
33.Wooded bog ____
34.Shrubby B _____
35.Open B _____

Water Regime Indicator:
1.Permanently flooded ___
2.Saturated X
3.Seasonally flooded _____

Water Depth:
1.0-5 cm X
2.5-20 cm X-> in pools
3.20-50 cm ____
4.50-100 cm ____
5.>100 cm ____

Note: 1. Canadian Wetland Classification System (2nd Edition)

Impounded Wetland Type:
1.Beaver Pond ____
2.Man-made Impoundment ____
3.Ducks Unlimited Impoundment ____
4. None of the above X

Percent Vegetation Cover:
1.> 95% X
2.76-95% in peripheral band ___
3.76-96% in patches ___
4.26-75% in peripheral band ____
5.26-75% in patches ____
6. 5-25% in peripheral band ____
7. 5-25% in patches ____
8.< 5% ____

Wetland Site:
1.Lacustrine ____
2.Riverine X
3.Palustrine ____
4.Isolated ____
5.Deltaic ___

Vegetation Types (%):
1.Deciduous trees – 15% Red maple birch
2.Coniferous trees – 10% white spruce
3.Dead trees - ~
4.~~Tall~~ shrubs - 20% - Cultivar, Kalmia, Meadowsweet
5.~~Low~~ shrubs - 20% - Viburnum, Alder,
6.Dead shrubs -
7.Herbs – 40% - Bog Aster*, Cinnamon Fern*
8.Mosses – 100% Sphagnum
9.Narrow-leaved emergents - 10% - Calamagrostis*, Carex
10.Broad-leaved emergents - ~
11.Robust emergents - ~~10%~~ Iris, Typha
12.Free-floating plants -
13.Floating plants (rooted) -
14.Submerged plants -
15. Other -

Interspersion: 1.Minimal X 2.Low ____ 3.Medium ___ 4.High __

Conductivity: N/A
Alkalinity: N/A
pH: N/A

Hydrological Classification:
1.Surface water depression ___
2.Ground water depression ___
3.Surface water slope X
4.Ground water slope ____

Inlets/Outlets/water bodies:
Stream flowing through W west to east.

Wildlife: (Observation/Signs/Reports)
Deer tracks
Rabbit scat
Leopard frog

Adjacent Wildlife habitat (%):

1.Salt marsh ____
2.Forest 90%
3.Dykelands ____
4.Mudflats ____
5.Beach 10%
6.River ____
7. Other ____

Description:

Surrounding Land Use %:

1 Agriculture ____
2.Forestry ____
3 Recreation ~
4.Industrial ____
5.Urban development ____
6.Transportation ____
7.Residential ____
8.Waste Disposal ____
9.Scientific Research ____
10.Trapping ____
11.Education ____
12.Seasonal resident ____

Description: ATV use in area

Disturbance: 1.Low K 2.Moderate ____ 3.High ____

Description:

Roads and/or tracks:

1.Private road adjacent ____
2.DOT road adjacent ____
3.Private road within ____
4.DOT road within ____
5.Vehicle tracks ____
6.Other ____

Description:

Existing Uses of Wetlands:

1.Economic use (e.g. farming) ____
2.Recreational activities ____
3.Aesthetics ____
4.Education & public awareness ____
5. None evident K

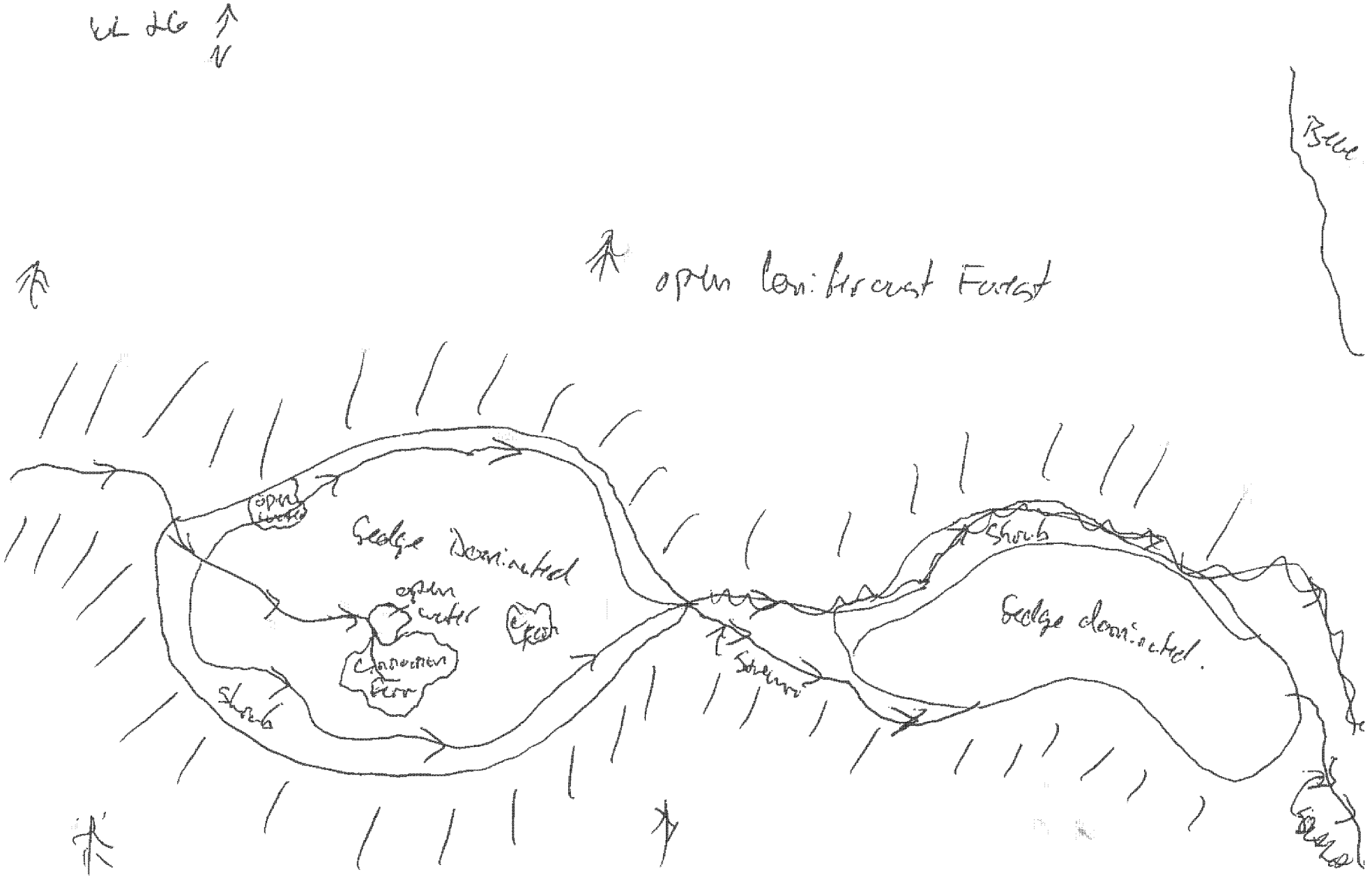
Potential Threats:

Special Features:

1.Rare wetland type ____
2.Rare animal or plant species ____
3.Habitat of rare species K
4.Nesting site for colonial water birds ____
5.Migration stop-over site ____
6. None evident ____

Description:

Notes:


open boreal Forest
open water
Sedge Dominated
Shrub
Sedge dominated.

C 1340-1541

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Black Point Municipality/County: Guysborough Sampling Date: Aug 20/14

Applicant/Owner: Various Sampling Point: WL26-UP1

Investigator(s): S. Bulley Affiliation: AMEC

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): _____

Slope (%): 2 Lat: 645703 Long: 5013752 Datum: NAD 83

Soil Map Unit Name/Type: _____ Wetland Type: Riparian Fen

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓ No _____	**Is the Sampled Area within a Wetland?** Yes ✓ No _____
Hydric Soil Present?	Yes ✓ No _____	If yes, optional Wetland Site ID: WL26
Wetland Hydrology Present?	Yes ✓ No _____	

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10 m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Picea glauca	20	✓	FAC
2. Abies balsamea	10	✓	FAC
3. Betula cordifolia	5		FACW
4.			
5.			
	35	= Total Cover	

Sapling/Shrub Stratum (Plot size: 5 m)			
1. Alnus crispa	5	✓	FACW
2. Chamaedaphne calyculata	5	✓	OBL
3. Rubus sp.	10	✓	FACW
4.			
5.			
	20	= Total Cover	

Herb Stratum (Plot size: 1 m)			
1. Calamagrostis canadensis	20	✓	FACW
2. Aster nemoralis	10	✓	OBL
3. Eriophorum tenellum	20	✓	FACW
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	50	= Total Cover	

Woody Vine Stratum (Plot size: _____)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 7 (A)

Total Number of Dominant Species Across All Strata: 8 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 88 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	15	x 1 =	15
FACW species	50	x 2 =	100
FAC species	30	x 3 =	90
FACU species	10	x 4 =	40
UPL species		x 5 =	
Column Totals:	105 (A)		145 (B)

Prevalence Index = B/A = 1.4

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

✓ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No _____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

SOIL

Sampling Point: WL26-wp1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0	O-Hor						organic	Peat

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ✓ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ✓ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ✓ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): _____

Water Table Present? Yes ✓ No ___ Depth (inches): 33cm

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (inches): 3cm

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Black Point Municipality/County: Guysborough Sampling Date: Aug 20/14
Applicant/Owner: Vulcan Sampling Point: WL26-UP1
Investigator(s): S. Burley Affiliation: AMEC
Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Hummocky
Slope (%): 3-5% Lat: 6445765 Long: 5023741 Datum: NAD83
Soil Map Unit Name/Type: Rockland Wetland Type: upland - open Forest
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ____ No ✓
Hydric Soil Present? Yes ____ No ✓
Wetland Hydrology Present? Yes ____ No ✓

Is the Sampled Area within a Wetland? Yes ____ No ✓
If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Picea glauca	20	✓	FAC
2. Abies balsamea	5		FAC
3.			
4.			
5.			
	25	= Total Cover	

Sapling/Shrub Stratum (Plot size: 5m)			
1. Betula papyrifera	10	✓	FACU
2. Abies balsamea	10	✓	FAC
3. Sorbus decora americana	30	✓	FAC
4.			
5.			
	50	= Total Cover	

Herb Stratum (Plot size: 1m)			
1. Dryopteris campyloptera	20	✓	FAC
2. Aralia nudicaulis	5		FAC
3. Cornus canadensis	10	✓	FAC
4. Carex bigelowii	2		FAC
5. Maianthemum canadense	2		FAC
6.			
7.			
8.			
9.			
10.			
	39	= Total Cover	

Woody Vine Stratum (Plot size: ____)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)
Total Number of Dominant Species Across All Strata: 6 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 83 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species —	x 1 = —
FACW species —	x 2 = —
FAC species 101	x 3 = 303
FACU species 10	x 4 = 40
UPL species ____	x 5 = ____
Column Totals: 111 (A)	352 (B)

Prevalence Index = B/A = 3.1

Hydrophytic Vegetation Indicators:
___ Rapid Test for Hydrophytic Vegetation
✓ Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No ✓

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

C 1340-1544

SOIL

Sampling Point: WL26-UP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-15							Organic	duff
15-25	7.5YR3/3	100					Silt loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

APPENDIX F 2
AMEC 2010 and 2014 Wetland Baseline Survey Report

Attachment B - Wetlands Delineation Test Pit Locations (GPS Coordinates)

Attachment C – Wetland Photographs

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

APPENDIX B
Wetland Delineation GPS Waypoints

WL Test Pit ID	Easting	Northing
WL2-WP1	645378	5024218
WL2-UP1	645373	5024214
WL3-WP1	645147	5024038
WL3-UP1	645147	5024038
WL4-WP1	645104	5024219
WL4-UP1	645041	5024173
WL5-WP1	644453	5024118
WL5-UP1	644453	5024120
WL6-WP1	644700	5024111
WL6-UP1	644676	5024122
WL7-WP1	644869	5024338
WL7-UP1	644874	5024335
WL8-WP1	643967	5022590
WL8-UP1	643961	5022587
WL10-WP1	643751	5023307
WL10-UP1	643757	5023280
WL11-WP1	643860	5023677
WL11-UP1	643862	5023677
WL12-WP1	644542	5023349
WL12-UP1	644541	5023337
WL13-WP1	644890	5023576
WL13-UP1	644892	5023573
WL14-WP1	644869	5023348
WL14-UP1	644894	5023322
WL15-WP1	645496	5023200
WL15-UP1	645490	5023193
WL16-WP1	645274	5023524
WL16-UP1	645274	5023521
WL17-WP1	645309	5022432
WL17-UP1	645303	5022398
WL19-WP1	645938	5022562
WL19-UP1	645944	5022580
WL21-WP1	644235	5021802
WL21-UP1	644242	5021792
WL22-WP1	644365	5022022
WL22-UP1	644362	5022022
WL23-WP1	644447	5022145
WL23-UP1	644453	5022142
WL24-WP1	644456	5022220
WL24-UP1	644454	5022213
WL25-WP1	645864	5023655
WL25-UP1	645855	5023636
WL26-WP1	645703	5023752
WL26-UP1	645705	5023741

APPENDIX C
Wetland Photographs

Appendix C – Wetland Photographs

Photograph 1: Wetland 1 (WL1) - Wetland Habitat

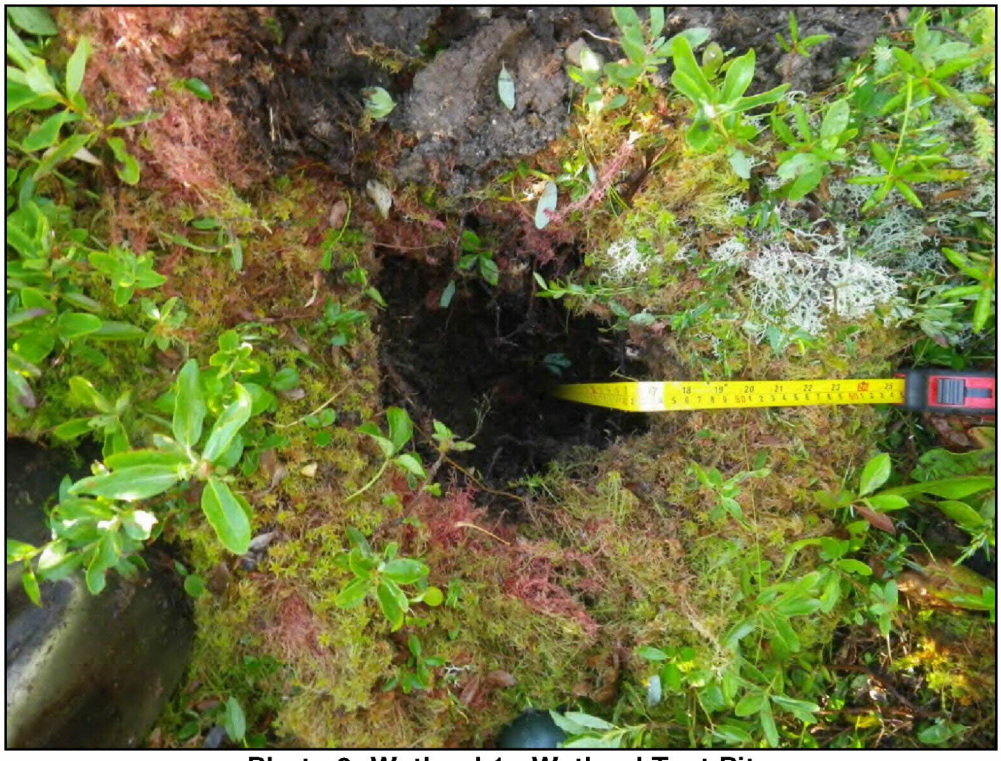


Photo 2: Wetland 1 - Wetland Test Pit

Photograph 3: Wetland 1 (WL1) – Upland Habitat

Photograph 4: Wetland 1 (WL1) – Upland Test Pit

Photograph 5: Wetland 2 (WL2) – Wetland Habitat

Photograph 6: Wetland 2 (WL2) – Wetland Test Pit

Photograph 7: Wetland 2 (WL2) – Upland Habitat

Photograph 8: Wetland 2 (WL2) – Upland Test Pit

Photograph 9: Wetland 3 (WL3) – Wetland Habitat

Photograph 10: Wetland 3 (WL3) – Wetland Test Pit

Photograph 11: Wetland 3 (WL3) – Upland Habitat

Photograph 12: Wetland 3 (WL3) – Upland Test Pit

Photograph 13: Wetland 4 (WL4) – Wetland Habitat

Photograph 14: Wetland 4 (WL4) – Wetland Test Pit

Photograph 15: Wetland 4 (WL4) – Upland Habitat

Photograph 16: Wetland 4 (WL4) – Upland Test Pit

Photograph 17: Wetland 5 (WL5) – Wetland Habitat

Photograph 18: Wetland 5 (WL5) – Wetland Test Pit

Photograph 19: Wetland 5 (WL5) – Upland Habitat

Photograph 20: Wetland 5 (WL5) – Upland Test Pit

Photograph 21: Wetland 6 (WL6) – Wetland Habitat

Photograph 22: Wetland 6 (WL6) – Wetland Test Pit

Photograph 23: Wetland 6 (WL6) – Upland Habitat

Photograph 24: Wetland 6 (WL6) – Upland Test Pit

Photograph 25: Wetland 7 (WL7) – Wetland Habitat

Photograph 26: Wetland 7 (WL7) – Wetland Test Pit

Photograph 27: Wetland 7 (WL7) – Upland Habitat

Photograph 28: Wetland 7 (WL7) – Upland Test Pit

Photograph 29: Wetland 8 (WL8) – Wetland Habitat

Photograph 30: Wetland 8 (WL8) – Wetland Test Pit

Photograph 31: Wetland 8 (WL8) – Upland Habitat

Photograph 32: Wetland 8 (WL8) – Upland Test Pit

Photograph 33: Wetland 9 (WL9) – Wetland Habitat

Photograph 34: Wetland 9 (WL9) – Wetland Test Pit

Photograph 35: Wetland 9 (WL9) – Upland Habitat

Photograph 36: Wetland 9 (WL9) – Upland Test Pit

Photograph 37: Wetland 10 (WL10) – Wetland Habitat

Photograph 38: Wetland 10 (WL10) – Wetland Test Pit

Photograph 39: Wetland 10 (WL10) – Upland Habitat

Photograph 40: Wetland 10 (WL10) – Upland Test Pit

Photograph 41: Wetland 11 (WL11) – Wetland Habitat

Photograph 42: Wetland 11 (WL11) – Wetland Test Pit

Photograph 44: Wetland 11 (WL11) – Upland Habitat

Photograph 45: Wetland 11 (WL11) – Upland Test Pit

Photograph 46: Wetland 12 (WL12) – Wetland Habitat

Photograph 47: Wetland 12 (WL12) – Wetland Test Pit

Photograph 48: Wetland 12 (WL12) – Upland Habitat

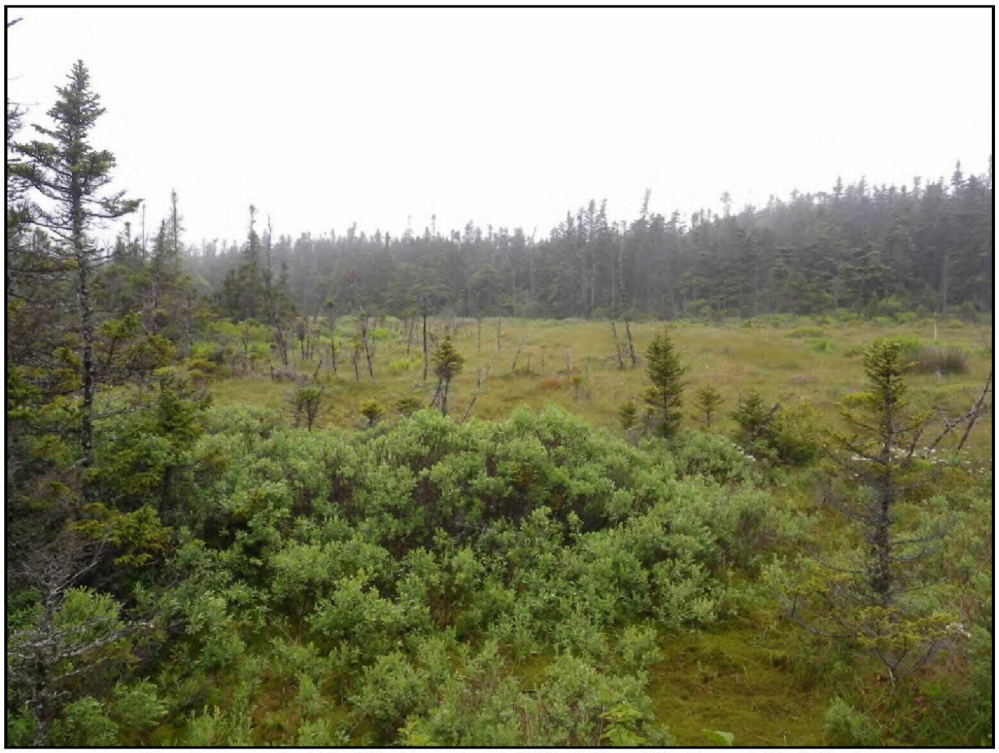
Photograph 49: Wetland 12 (WL12) – Upland Test Pit

Photograph 50: Wetland 13 (WL13) – Wetland Habitat

Photograph 51: Wetland 13 (WL13) – Wetland Test Pit

Photograph 52: Wetland 13 (WL13) – Upland Habitat

Photograph 53: Wetland 13 (WL13) – Upland Test Pit



Photograph 54: Wetland 14 (WL14) – Wetland Habitat

Photograph 55: Wetland 14 (WL14) – Wetland Test Pit

Photograph 56: Wetland 14 (WL14) – Upland Habitat

Photograph 57: Wetland 14 (WL14) – Upland Test Pit

Photograph 58: Wetland 15 (WL15) – Wetland Habitat

Photograph 59: Wetland 15 (WL15) – Wetland Test Pit

Photograph 60: Wetland 15 (WL15) – Upland Habitat

Photograph 61: Wetland 15 (WL15) – Upland Test Pit

Photograph 62: Wetland 16 (WL16) – Wetland Habitat

Photograph 63: Wetland 16 (WL16) – Wetland Test Pit

Photograph 64: Wetland 16 (WL16) – Upland Habitat

Photograph 65: Wetland 16 (WL16) – Upland Test Pit

Photograph 66: Wetland 17 (WL17) – Wetland Habitat

Photograph 67: Wetland 17 (WL17) – Wetland Test Pit

Photograph 68: Wetland 17 (WL17) – Upland Habitat

Photograph 69: Wetland 17 (WL17) – Upland Test Pit

Photograph 70: Wetland 18 (WL18) – Wetland Habitat

Photograph 71: Wetland 18 (WL18) – Wetland Test Pit

Photograph 72: Wetland 18 (WL18) – Upland Habitat

Photograph 73: Wetland 18 (WL18) – Upland Test Pit

Photograph 74: Wetland 19 (WL19) – Wetland Habitat

Photograph 75: Wetland 19 (WL19) – Wetland Test Pit

Photograph 76: Wetland 19 (WL19) – Upland Habitat

Photograph 77: Wetland 19 (WL19) – Upland Test Pit

Photograph 78: Wetland 20 (WL20) – Wetland Habitat

Photograph 79: Wetland 20 (WL20) – Wetland Test Pit

Photograph 80: Wetland 20 (WL20) – Upland Habitat

Photograph 81: Wetland 20 (WL20) – Upland Test Pit

Photograph 82: Wetland 21 (WL21) – Wetland Habitat

Photograph 83: Wetland 21 (WL21) – Wetland Test Pit

Photograph 84: Wetland 21 (WL21) – Upland Habitat

Photograph 85: Wetland 21 (WL21) – Upland Test Pit

Photograph 86: Wetland 22 (WL22) – Wetland Habitat

Photograph 87: Wetland 22 (WL22) – Wetland Test Pit

Photograph 88: Wetland 22 (WL22) – Upland Habitat

Photograph 89: Wetland 22 (WL22) – Upland Test Pit

APPENDIX F3
AMEC 2010 and 2014 Wetland Baseline Survey Report

Attachment D – Wetland Functional Assessment Forms

Attachment E – Additional Wetland Delineation Data Sheets

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

APPENDIX D
Wetland Functional Assessment Forms

APPENDIX D: WL1	**Nova Scotia Wetland Evaluation Technique Field Data Sheet**									
Project Name: Black Point Quarry		Evaluator: Scott Burley			GPS Coordinates: 645437 E x 5022529 N					
PID:35212497, 35212505, 35212521, 35212513, 35044056, 35214014, 35214022, 35214022 and 35213990			Site Address: Black Point, Guysborough County, NS							
Sources and Dates of Mapping/Images: NS Wetlands Inventory (2012); NS Forest Inventory (Current Forest Data - 2004); Google Earth (2003)										
Evaluation Date: 04-Sep-14		Site Visit Date: 19-Aug-14								
Weather Conditions (past 48 hours): Periods of rain with clouds										
Seasonal Weather Conditions: Typical										
SECTION ONE: WATERSHED CHARACTERISTICS										
1	Watershed Name (tertiary): 1EQ-SD	Size: 518 km^2								
2	% Watershed Land Cover	For: 43	Nat: 36	Past/Hay: <1	Crop: <1	Urb/Com: 2	Road: <1	Other Dev: <1 (Gravel Pit, Landfill, Industrial		
3	% Watershed WL Cover and by Class	Total: 10%	SM: <1	BO: 6	FE: 1	FM: 2	FS: 1	SS: 1	CP: <1	VP: Present
SF1	***Watershed condition***	***H***	***M***	***L***						
SF2	***Proportion of WL area in watershed & opportunity for floodwater detention***	***H***	***M***	***L***						
SECTION TWO: WETLAND CHARACTERISTICS										
Wetland Type: Bog/Swamp		WL size: 15 hectares			Landform: Basin			Landscape Position: Lotic-Stream Confined		
Water flow path: Throughflow		Wetland Origin: Natural								
1	Water Regime	PF	SF	TF	SS	PS	RfT	IfT	AF	
2	# WL's within 30m project area	Total# 0	SM:	BO:	FE:	FM:	FS:	SS:	CP:	VP:
3	Is WL part of complex	Yes	No							
4	% each wetland type in complex	SM:	BO: 43	FE:	FM:	FS: 32	SS: 25	CP:	VP:	
5	Is WL bordering or associated with a lake or pond?	bordering		within 100m		N/A		specify		
6	Standing water?	Yes	Avg Dep: 5-20		% Inundated: 10%		No			
7	Inlet or Outlet (circle all that apply)?	Inlet	Outlet							
8	Adjacent Upland Land Use within 100m (%)	For: 90	Nat:	PasHay:	Crop:	UrbCm:	Road:	Other Dev: 10 Powerline corridor		
9	Are there stressors in WL or WL buffer area? Circle primary stressor(s).	DD__, CW__, WcS__, O/C__,EB__,DP__,F__,M__, ES__,NE__,DwP__,								
		M__,GC__,ATV_x_,OG__,EA__, R__,Rr__,U/CD__,F__,FA__, other (specify): Powerline corridor along south end								
10	Hydrology Altered (circle all that apply)?	Ditching	Dams	Tiles	Culvert	Well	Diversion	Other Specify:		
SF3	***Rate the general wetland condition/integrity***	**H**	**M**	**L**						
SECTION THREE: ADJACENT LAND CONDITION AND INTEGRITY										
1	Average width of adjacent naturalized buffer	>1000__m								
2	Widths for water quality	H >15	M 8-15	L <8	Powerline located along one side of wetland					
3	Widths for wildlife habitat	H >100	M 15-100	L <15	Powerline located along one side of wetland					
4	Adjacent area vegetation condition (list % in each category)	H 90%	M	L 10%						
5	Adjacent area diversity and structure (list % in each category)	H 90%	M	L 10%						
6	Adjacent Upland Slope (list % in each category)	Steep 5%	Mod 20%	Gentle 75%						
7	Adjacent land supports water quality	*Yes*	*No*	Specify:						
8	Adjacent land supports wildlife habitat	*Yes*	*No*	Specify:						
SF4	***Rate the overall condition and integrity land adjacent to wetland***	***H***	***M***	***L***	**is buffer required to maintain red flag functions of wetland? If yes if no**					
SECTION FOUR: DOCUMENTED IMPORTANT FEATURES										
SF5	***Is the WL a WSS?***	***Yes***	***No***							

SF6	***Does the WL support commercial/recreational fish/shellfish?***	***Yes***	***No***						
SF7	***Species of concern (Fed/Prov)? Specify. Cladonia stygia***	***End***	***Thr***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF8	***Wetland has conservation/compensation agreements/activity?***	***Yes***	***No***	specify:						
SF9	***Wetland is calcerous fen, black ash or cedar swamp?***	***Yes***	***No***							
SF10	***Within Drinking Water Protected Area (designated watershed/wellfield)***	***Yes***	***No***	specify:						
SF11	***WL within a floodplain and upstream of or within of a populated area?***	***Yes***	***No***							
SF12	***Fed/Prov/Municipal area of interest?***	***Yes***	***No***	specify:						
SECTION FIVE: HYDROLOGIC CONDITION AND INTEGRITY										
1	Is WL source of stream or headwater(wc order 1 or 2)	***Yes***	No	Specify: Located along a first order stream						
2	Is WL geographically isolated?	Yes	No	Specify:						
3	WL ability to maintain characteristic hydrologic regime	High		Med		Low				
4	Water Storage Depth (list % in each class)	>30cm	15-30cm 10%	up to 15cm 10%		No ponding				
5	Signs of surface water retention observed?	SW_30_cm, WSL__, WCD__, WM__cm, SM__cm, SD__, AD__, ID__, PMT_x_, AI__, BT__, AR__, Other:								
6	Describe observable/historical anthropogenic sediment delivery	Low		Med		High				
7	Disturbance of WL soils	Low		Med		High				
8	Predominant soils adjacent to WL	Sand		Silt/loam		Clay/bedrock				
9	Capacity of WL to alter/retard flows	High		Med		Low				
10	Roughness coefficient for surface water flow path	High		Med		Low				
11	Strormwater/Wastewater/Agricultural runoff detention	High		Med		Low				
12	Water Source	Natural		Mostly natural		Partly altered		Controlled		
13	Hydrology of tidal wetlands	Unrestricted		Reduced		Restricted		N/A		
14	Coastal storm surge	***Yes***	No							
SF13	***WL hydrologic condition***	***Natural***	***Modified***		***Significantly Modified***					
SF14	***WL important for maintaining stream flow?***	***Yes***	***No***							
SF15	***WL ability to detain surface water***	***High***	***Med***	***Low***						
SECTION SIX: WATER QUALITY										
1	Strormwater/Wastewater/Agricultural runoff as water source?	High		Med		Low				
2	Nutrients/sediments from surrounding land	High		Med		Low				
3	Significant flood/stormwater attenuation	***Yes***	***No***							
4	Vegetation capacity to settle suspended sediments	High		Med		Low				
5	WL type /landscape position holds/filters runoff?	***Yes***	***No***							
SF16	***Wetland improves water quality?***	***Yes***	***No***							
SF17	***Evidence of excess nutrient loading/contamination?***	***Low***	***Med***	***High***						
SF18	***WL contributes to water quality in downstream resources***	***High***	***Med***	***Low***						
SECTION SEVEN: GROUNDWATER INTERACTIONS										
1	Describe soils in wetland	Recharge		Discharge						
2	Land use / run off in subwatershed upstream	Recharge		Discharge						
3	Conditions of upland soils within 200m of wetland	Recharge		Discharge						
4	Hydroperiod of wetland	Recharge		Discharge						
5	Describe inlet/outlet configuration	Recharge		Discharge						
6	Characterize topographic relief surrounding wetland	Recharge		Discharge						

SF19	***WL serves as a recharge site***	***Yes***	***No***								
SF20	***WL serves as a discharge site***	***Yes***	***No***								
SECTION EIGHT: SHORELINE STABILIZATION AND INTEGRITY											
1	Wetland fringing ocean/estuary/lake/pond/river/stream?	***Yes***	No	streamwidth >4m	streamwidth<4m	WB Exposed	WB Sheltered				
2	% cover of rooted vegetation in shallow water zone	H >50%	M 10-50	L <10%							
3	Avg veg WL width b/w shoreline/streambank & 2 m depth contour	H >10m	M 3-10	L <3m							
4	Prevalence of strong-stemmed emerg. veg (shoreline marshes and fens only)	High	Med	Low							
5	Describe shoreline erosion potential	High	Med	Low							
6	Shoreline/streambank veg condition upslope of water level	Low	Med	High	Artificial						
SF21	***WL ability to stabilize shoreline***	***H***	***M***	***L***	N/A						
SECTION NINE: PLANT COMMUNITY											
1	Vegetation diversity	High	Med	Low							
1b	Dominant plant species and % cover in the WL	list: *Picea mariana* (30%)/*Chamaedaphne calyculata* (20%)/ *Nemopanthes mucronata* (15%)									
3	Dominant Non-native or Invasive species and % cover	Yes	No	specify: %							
4	Vegetation Disturbance	H	M	L	specify type(s) below						
5	Disturbance Types	H___,ATV___,G___,,M___,In__, D/D___, Im___, OAH___, Ii___, Sd___,E___,,other___,									
7	Vegetative Integrity of plant community	E	H	M	L						
SF22	***Is the plant community unique or rare regionally or provincially?***	***Yes***	***no***	***specify:***							
SF23	***Does the WL contain a diversity of plant communities***	***H***	***M***	***L***							
SF24	***Rate the overall integrity/quality of plant community?***	***H***	***M***	***L***							
SF25	***Are there any observed rare or endangered plant species? Specify.***	***End***	***Thr***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***	***C. stygia***
SECTION TEN: FISH AND WILDLIFE HABITAT AND INTEGRITY											
1	Interspersion of open water and vegetation (open water types only)	H	M	L							
1b	% cover in vegetation verus open water	__90___%									
2	Interspersion that best fits entire wetland	H	M	L	N/A						
3	Wetland condition related to detritus	H	M	L	N/A						
4	Interspersion of other wetlands in vicinity	H	M	L							
6	Barriers/restriction between wetland and other habitat	L	M	H							
7	Noteworthy wildlife or evidence (birds, mammals, amphibians,etc)	Yes	No	list: Dragon flies, Passerines, Beaver, Moose Tracks							
8	Connected to permanent water (accessible to fish)?	Exceptional	High	Med	Low	N/A					
9	Fish species observed or evidence seen (list)	Yes	No	list:							
10	Wetland part of contiguous upland or wetland:	>50ha	25-50ha	10-25ha	<10ha						
11	WL provides habitat for:	Amphibians	Reptiles	Waterfowl	Waterbirds	Mammals	Fish	R/E species			
SF26	***Does wetland support fish/fish habitat?***	***Yes***	***No***	***specify:***							
SF27	***Rare or endangered fish/wildlife species found in the wetland?***	***End***	***Thr***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***	
SF28	***Overall fish and wildlife habitat quality***	***H***	***M***	L							
SECTION ELEVEN: COMMUNITY USE/VALUE											
1	Describe community use	VV__,CP__,CO__,PO__,PA__,AV_x_,GB__,E__,HI__, WV__, BO__,HU__, PG_x_, BP_x_,F__, E__, R__, Other:									
SF29	***Rate the wetland's community use/value***	***H***	***M***	L							

SF ratings highlighted in red indicate critical wetland functions or watershed conditions that are highly degraded. Whenever a wetland is found to have red-highlighted **SFs** the proponent

APPENDIX D: WL2	Nova Scotia Wetland Evaluation Technique Field Data Sheet									
Project Name: Black Point Quarry	Evaluator: Scott Burley			GPS Coordinates: 645430 E x 5024058 N						
PID:35212497, 35212505, 35212521, 35212513, 35044056, 35214014, 35214022, 35214022 and 35213990	Site Address: Black Point, Guysborough County, NS									
Sources and Dates of Mapping/Images: NS Wetlands Inventory (2012); NS Forest Inventory (Current Forest Data - 2004); Google Earth (2003)										
Evaluation Date: 04-Sep-14	Site Visit Date: 20-Aug-14									
Weather Conditions (past 48 hours): Periods of rain with clouds; sun and cloud										
Seasonal Weather Conditions: Typical										
SECTION ONE: WATERSHED CHARACTERISTICS										
1	Watershed Name (tertiary): 1EQ-SD	Size: 518 km^2								
2	% Watershed Land Cover	For: 43	Nat: 36	Past/Hay: <1	Crop: <1	Urb/Com: 2	Road: <1	Other Dev: <1 (Gravel Pit, Landfill, Industrial		
3	% Watershed WL Cover and by Class	Total: 10%	SM: <1	BO: 6	FE: 1	FM: 2	FS: 1	SS: 1	CP: <1	VP: Present
SF1	***Watershed condition***	***H***	***M***	***L***						
SF2	***Proportion of WL area in watershed & opportunity for floodwater detention***	***H***	***M***	***L***						
SECTION TWO: WETLAND CHARACTERISTICS										
Wetland Type: Fen/Swamp/Marsh		WL size: 6 hectares			Landform: Basin			Landscape Position: Lotic Pond		
Water flow path: Inflow		Wetland Origin: Natural								
1	Water Regime	PF	SF	TF	SS	PS	RfT	IfT	AF	
2	# WL's within 30m project area	Total# 0	SM:	BO:	FE:	FM:	FS:	SS:	CP:	VP:
3	Is WL part of complex	Yes	No							
4	% each wetland type in complex	SM:	BO:	FE: 23	FM: 45	FS: 32	SS:	CP:	VP:	
5	Is WL bordering or associated with a lake or pond?	bordering		within 100m		N/A		specify: small pond at northern end of wetland		
6	Standing water?	Yes	Avg Dep: 5-20		% Inundated: 15%		No			
7	Inlet or Outlet (circle all that apply)?	Inlet	Outlet							
8	Adjacent Upland Land Use within 100m (%)	For: 90	Nat:	PasHay:	Crop:	UrbCm:	Road:	Other Dev: 10 gravel cobble beach		
9	Are there stressors in WL or WL buffer area? Circle primary stressor(s).	DD__, CW__, WcS__, O/C__,EB__,DP__,F__,M__, ES__,NE__,DwP__,								
		M__,GC__,ATV__,DG_x_,EA__, R__,Rr__,U/CD__,F_x_,FA__, other (specify): Coastal garbage								
10	Hydrology Altered (circle all that apply)?	Ditching	Dams	Tiles	Culvert	Well	Diversion	Other Specify:		
SF3	***Rate the general wetland condition/integrity***	**H**	**M**	**L**						
SECTION THREE: ADJACENT LAND CONDITION AND INTEGRITY										
1	Average width of adjacent naturalized buffer	>1000__m								
2	Widths for water quality	H >15	M 8-15	L <8	gravel/cobble/boulder Beach along northern end of wetland					
3	Widths for wildlife habitat	H >100	M 15-100	L <15						
4	Adjacent area vegetation condition (list % in each category)	H 90%	M	L 10%						
5	Adjacent area diversity and structure (list % in each category)	H 90%	M	L 10%						
6	Adjacent Upland Slope (list % in each category)	Steep 5%	Mod 20%	Gentle 75%						
7	Adjacent land supports water quality	*Yes*	*No*	Specify:						
8	Adjacent land supports wildlife habitat	*Yes*	*No*	Specify:						
SF4	***Rate the overall condition and integrity land adjacent to wetland***	***H***	***M***	***L***	**is buffer required to maintain red flag functions of wetland? If yes if no**					
SECTION FOUR: DOCUMENTED IMPORTANT FEATURES										
SF5	***Is the WL a WSS?***	***Yes***	***No***							

SF6	***Does the WL support commercial/recreational fish/shellfish?***	***Yes***	***No***							
SF7	***Species of concern (Fed/Prov)? Specify.***	***End***	***Thr***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF8	***Wetland has conservation/compensation agreements/activity?***	***Yes***	***No***	specify:						
SF9	***Wetland is calcerous fen, black ash or cedar swamp?***	***Yes***	***No***							
SF10	***Within Drinking Water Protected Area (designated watershed/wellfield)***	***Yes***	***No***	specify:						
SF11	***WL within a floodplain and upstream of or within of a populated area?***	***Yes***	***No***							
SF12	***Fed/Prov/Municipal area of interest?***	***Yes***	***No***	specify:						
SECTION FIVE: HYDROLOGIC CONDITION AND INTEGRITY										
1	Is WL source of stream or headwater(wc order 1 or 2)	***Yes***	No	Specify:						
2	Is WL geographically isolated?	Yes	No	Specify:						
3	WL ability to maintain characteristic hydrologic regime	High		Med		Low				
4	Water Storage Depth (list % in each class)	>30cm	15-30cm 10%	up to 15cm 5%		No ponding				
5	Signs of surface water retention observed?	SW_30_cm, WSL_x_, WCD_x_, WM__cm, SM__cm, SD__, AD_x_, ID__, PMT_x_, AI__, BT__, AR__, Other:								
6	Describe observable/historical anthropogenic sediment delivery	Low		Med		High				
7	Disturbance of WL soils	Low		Med		High				
8	Predominant soils adjacent to WL	Sand		Silt/loam		Clay/bedrock				
9	Capacity of WL to alter/retard flows	High		Med		Low				
10	Roughness coefficient for surface water flow path	High		Med		Low				
11	Strormwater/Wastewater/Agricultural runoff detention	High		Med		Low				
12	Water Source	Natural		Mostly natural		Partly altered		Controlled		
13	Hydrology of tidal wetlands	Unrestricted		Reduced		Restricted		N/A		
14	Coastal storm surge	***Yes***	No							
SF13	***WL hydrologic condition***	***Natural***	***Modified***		**Significantly Modified**					
SF14	***WL important for maintaining stream flow?***	***Yes***	***No***							
SF15	***WL ability to detain surface water***	***High***	***Med***	**Low**						
SECTION SIX: WATER QUALITY										
1	Strormwater/Wastewater/Agricultural runoff as water source?	High		Med		Low				
2	Nutrients/sediments from surrounding land	High		Med		Low				
3	Significant flood/stormwater attenuation	***Yes***	***No***							
4	Vegetation capacity to settle suspended sediments	High		Med		Low				
5	WL type /landscape position holds/filters runoff?	***Yes***	***No***							
SF16	***Wetland improves water quality?***	***Yes***	***No***							
SF17	***Evidence of excess nutrient loading/contamination?***	***Low***	***Med***	***High***						
SF18	***WL contributes to water quality in downstream resources***	***High***	***Med***	***Low***						
SECTION SEVEN: GROUNDWATER INTERACTIONS										
1	Describe soils in wetland	Recharge		Discharge						
2	Land use / run off in subwatershed upstream	Recharge		Discharge						
3	Conditions of upland soils within 200m of wetland	Recharge		Discharge						
4	Hydroperiod of wetland	Recharge		Discharge						
5	Describe inlet/outlet configuration	Recharge		Discharge						
6	Characterize topographic relief surrounding wetland	Recharge		Discharge						

SF19	***WL serves as a recharge site***	***Yes***	***No***							
SF20	***WL serves as a discharge site***	***Yes***	***No***							
SECTION EIGHT: SHORELINE STABILIZATION AND INTEGRITY										
1	Wetland fringing ocean/estuary/lake/pond/river/stream? Small pond	***Yes***	No	streamwidth >4m	streamwidth<4m	WB Exposed	WB Sheltered			
2	% cover of rooted vegetation in shallow water zone	H >50%	M 10-50	L <10%						
3	Avg veg WL width b/w shoreline/streambank & 2 m depth contour	H >10m	M 3-10	L <3m						
4	Prevalence of strong-stemmed emerg. veg (shoreline marshes and fens only)	High	Med	Low						
5	Describe shoreline erosion potential	High	Med	Low						
6	Shoreline/streambank veg condition upslope of water level	Low	Med	High	Artificial					
SF21	***WL ability to stabilize shoreline***	***H***	***M***	***L***	N/A					
SECTION NINE: PLANT COMMUNITY										
1	Vegetation diversity	High	Med	Low						
1b	Dominant plant species and % cover in the WL	list: *Typha latifolia* (30%)/*Chamaedaphne calyculata* (10%)/ *Scirpus* (15%)								
3	Dominant Non-native or Invasive species and % cover	Yes	No	specify: %						
4	Vegetation Disturbance	H	M	L	Specify type(s) below: regenerating vegetation in south end					
5	Disturbance Types	H___,ATV___,G___,,M___,In__, D/D___, Im___, OAH___, Ii___, Sd___,E___,,other___,								
7	Vegetative Integrity of plant community	E	H	M	L					
SF22	***Is the plant community unique or rare regionally or provincially?***	***Yes***	***no***	***specify:***						
SF23	***Does the WL contain a diversity of plant communities***	***H***	***M***	***L***						
SF24	***Rate the overall integrity/quality of plant community?***	***H***	***M***	***L***						
SF25	***Are there any observed rare or endangered plant species? Specify.***	***End***	***Thr***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SECTION TEN: FISH AND WILDLIFE HABITAT AND INTEGRITY										
1	Interspersion of open water and vegetation (open water types only)	H	M	L						
1b	% cover in vegetation verus open water	__85___%								
2	Interspersion that best fits entire wetland	H	M	L	N/A					
3	Wetland condition related to detritus	H	M	L	N/A					
4	Interspersion of other wetlands in vicinity	H	M	L						
6	Barriers/restriction between wetland and other habitat	L	M	H						
7	Noteworthy wildlife or evidence (birds, mammals, amphibians,etc)	Yes	No	list: Dragon flies, Passerines, Newts						
8	Connected to permanent water (accessible to fish)?	Exceptional	High	Med	Low	N/A				
9	Fish species observed or evidence seen (list)	Yes	No	list:						
10	Wetland part of contiguous upland or wetland:	>50ha	25-50ha	10-25ha	<10ha					
11	WL provides habitat for:	Amphibians	Reptiles	Waterfowl	Waterbirds	Mammals	Fish	R/E species		
SF26	***Does wetland support fish/fish habitat?***	***Yes***	***No***	***specify:***						
SF27	***Rare or endangered fish/wildlife species found in the wetland?***	***End***	***Thr***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF28	***Overall fish and wildlife habitat quality***	***H***	***M***	L						
SECTION ELEVEN: COMMUNITY USE/VALUE										
1	Describe community use	VV__,CP__,CO__,PO__,PA__,AV_x_,GB__,E__,HI__, WV__, BO__,HU__, PG__, BP__,F__, E__, R__, Other:								
SF29	***Rate the wetland's community use/value***	***H***	***M***	L						

SF ratings highlighted in red indicate critical wetland functions or watershed conditions that are highly degraded. Whenever a wetland is found to have red-highlighted **SFs** the proponent

APPENDIX D: WL3	Nova Scotia Wetland Evaluation Technique Field Data Sheet									
Project Name: Black Point Quarry	Evaluator: Scott Burley			GPS Coordinates: 645076 E x 5024059 N						
PID:35212497, 35212505, 35212521, 35212513, 35044056, 35214014, 35214022, 35214022 and 35213990	Site Address: Black Point, Guysborough County, NS									
Sources and Dates of Mapping/Images: NS Wetlands Inventory (2012); NS Forest Inventory (Current Forest Data - 2004); Google Earth (2003)										
Evaluation Date: 04-Sep-14	Site Visit Date: 20-Aug-14									
Weather Conditions (past 48 hours): Sun and Clouds										
Seasonal Weather Conditions: Typical										
SECTION ONE: WATERSHED CHARACTERISTICS										
1	Watershed Name (tertiary): 1EQ-SD	Size: 518 km^2								
2	% Watershed Land Cover	For: 43	Nat: 36	Past/Hay: <1	Crop: <1	Urb/Com: 2	Road: <1	Other Dev: <1 (Gravel Pit, Landfill, Industrial		
3	% Watershed WL Cover and by Class	Total: 10%	SM: <1	BO: 6	FE: 1	FM: 2	FS: 1	SS: 1	CP: <1	VP: Present
SF1	***Watershed condition***	***H***	***M***	***L***						
SF2	***Proportion of WL area in watershed & opportunity for floodwater detention***	***H***	***M***	***L***						
SECTION TWO: WETLAND CHARACTERISTICS										
Wetland Type: Fen		WL size: 0.5 hectares			Landform: Slope			Landscape Position: Lotic-Stream Confined		
Water flow path: Throughflow		Wetland Origin: Natural								
1	Water Regime	PF	SF	TF	SS	PS	RfT	IfT	AF	
2	# WL's within 30m project area	Total# 0	SM:	BO:	FE:	FM:	FS:	SS:	CP:	VP:
3	Is WL part of complex	Yes	No							
4	% each wetland type in complex	SM:	BO:	FE: 100	FM:	FS:	SS:	CP:	VP:	
5	Is WL bordering or associated with a lake or pond?	bordering		within 100m		N/A		specify		
6	Standing water?	Yes	Avg Dep: 5-10		% Inundated: 5%		No			
7	Inlet or Outlet (circle all that apply)?	Inlet	Outlet							
8	Adjacent Upland Land Use within 100m (%)	For: 100	Nat:	PasHay:	Crop:	UrbCm:	Road:	Other Dev:		
9	Are there stressors in WL or WL buffer area? Circle primary stressor(s).	DD__, CW__, WcS__, O/C__,EB__,DP__,F__,M__, ES__,NE__,DwP__,								
		M__,GC__,ATV__,DG__,EA__, R__,Rr__,U/CD__,F__,FA__, other (specify):								
10	Hydrology Altered (circle all that apply)?	Ditching	Dams	Tiles	Culvert	Well	Diversion	Other Specify:		
SF3	***Rate the general wetland condition/integrity***	**H**	**M**	**L**						
SECTION THREE: ADJACENT LAND CONDITION AND INTEGRITY										
1	Average width of adjacent naturalized buffer	>1000__m								
2	Widths for water quality	H >15	M 8-15	L <8						
3	Widths for wildlife habitat	H >100	M 15-100	L <15						
4	Adjacent area vegetation condition (list % in each category)	H 100%	M	L						
5	Adjacent area diversity and structure (list % in each category)	H 100%	M	L						
6	Adjacent Upland Slope (list % in each category)	Steep 80%	Mod 15%	Gentle 5%						
7	Adjacent land supports water quality	*Yes*	*No*	Specify:						
8	Adjacent land supports wildlife habitat	*Yes*	*No*	Specify:						
SF4	***Rate the overall condition and integrity land adjacent to wetland***	***H***	***M***	***L***	**is buffer required to maintain red flag functions of wetland? If yes if no**					
SECTION FOUR: DOCUMENTED IMPORTANT FEATURES										
SF5	***Is the WL a WSS?***	***Yes***	***No***							

SF6	***Does the WL support commercial/recreational fish/shellfish?***	***Yes***	***No***						
SF7	***Species of concern (Fed/Prov)? Specify.***	***End***	***Thr - SARA***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF8	***Wetland has conservation/compensation agreements/activity?***	***Yes***	***No***	specify:					
SF9	***Wetland is calcerous fen, black ash or cedar swamp?***	***Yes***	***No***						
SF10	***Within Drinking Water Protected Area (designated watershed/wellfield)***	***Yes***	***No***	specify:					
SF11	***WL within a floodplain and upstream of or within of a populated area?***	***Yes***	***No***						
SF12	***Fed/Prov/Municipal area of interest?***	***Yes***	***No***	specify:					
SECTION FIVE: HYDROLOGIC CONDITION AND INTEGRITY									
1	Is WL source of stream or headwater(wc order 1 or 2)	Yes	No	Specify: small first order stream flows through wetland					
2	Is WL geographically isolated?	Yes	No	Specify:					
3	WL ability to maintain characteristic hydrologic regime	High		Med		Low			
4	Water Storage Depth (list % in each class)	>30cm	15-30cm	up to 15cm 5%		No ponding			
5	Signs of surface water retention observed?	SW_10_cm, WSL__, WCD__, WM__cm, SM__cm, SD__, AD__, ID__, PMT__, AI__, BT__, AR__, Other:							
6	Describe observable/historical anthropogenic sediment delivery	Low		Med		High			
7	Disturbance of WL soils	Low		Med		High			
8	Predominant soils adjacent to WL	Sand		Silt/loam		Clay/bedrock			
9	Capacity of WL to alter/retard flows	High		Med		Low			
10	Roughness coefficient for surface water flow path	High		Med		Low			
11	Strormwater/Wastewater/Agricultural runoff detention	High		Med		Low			
12	Water Source	Natural		Mostly natural		Partly altered		Controlled	
13	Hydrology of tidal wetlands	Unrestricted		Reduced		Restricted		N/A	
14	Coastal storm surge	Yes	No						
SF13	***WL hydrologic condition***	***Natural***	***Modified***		***Significantly Modified***				
SF14	***WL important for maintaining stream flow?***	***Yes***	***No***						
SF15	***WL ability to detain surface water***	***High***	***Med***	**Low**					
SECTION SIX: WATER QUALITY									
1	Strormwater/Wastewater/Agricultural runoff as water source?	High		Med		Low			
2	Nutrients/sediments from surrounding land	High		Med		Low			
3	Significant flood/stormwater attenuation	***Yes***	***No***						
4	Vegetation capacity to settle suspended sediments	High		Med		Low			
5	WL type /landscape position holds/filters runoff?	***Yes***	***No***						
SF16	***Wetland improves water quality?***	***Yes***	***No***						
SF17	***Evidence of excess nutrient loading/contamination?***	***Low***	***Med***	***High***					
SF18	***WL contributes to water quality in downstream resources***	***High***	***Med***	***Low***					
SECTION SEVEN: GROUNDWATER INTERACTIONS									
1	Describe soils in wetland	Recharge		Discharge					
2	Land use / run off in subwatershed upstream	Recharge		Discharge					
3	Conditions of upland soils within 200m of wetland	Recharge		Discharge					
4	Hydroperiod of wetland	Recharge		Discharge					
5	Describe inlet/outlet configuration	Recharge		Discharge					
6	Characterize topographic relief surrounding wetland	Recharge		Discharge					

SF19	***WL serves as a recharge site***	***Yes***	***No***							
SF20	***WL serves as a discharge site***	***Yes***	***No***							
SECTION EIGHT: SHORELINE STABILIZATION AND INTEGRITY										
1	Wetland fringing ocean/estuary/lake/pond/river/stream?	***Yes***	No	streamwidth >4m	streamwidth<4m	WB Exposed	WB Sheltered			
2	% cover of rooted vegetation in shallow water zone	H >50%	M 10-50	L <10%						
3	Avg veg WL width b/w shoreline/streambank & 2 m depth contour	H >10m	M 3-10	L <3m						
4	Prevalence of strong-stemmed emerg. veg (shoreline marshes and fens only)	High	Med	Low						
5	Describe shoreline erosion potential	High	Med	Low						
6	Shoreline/streambank veg condition upslope of water level	Low	Med	High	Artificial					
SF21	***WL ability to stabilize shoreline***	***H***	***M***	***L***	N/A					
SECTION NINE: PLANT COMMUNITY										
1	Vegetation diversity	High	Med	Low						
1b	Dominant plant species and % cover in the WL	list: *Osmunda cinnamomea* (20%)/*Rhynchospora alba* (20%)/ *Mainanthemum trifolium* (15%)								
3	Dominant Non-native or Invasive species and % cover	Yes	No	specify: %						
4	Vegetation Disturbance	H	M	L	specify type(s) below					
5	Disturbance Types	H___,ATV___,G___,,M___,In__, D/D___, Im___, OAH___, Ii___, Sd___,E___,,other___,								
7	Vegetative Integrity of plant community	E	H	M	L					
SF22	***Is the plant community unique or rare regionally or provincially?***	***Yes***	***no***	***specify:***						
SF23	***Does the WL contain a diversity of plant communities***	***H***	***M***	***L***						
SF24	***Rate the overall integrity/quality of plant community?***	***H***	***M***	***L***						
SF25	***Are there any observed rare or endangered plant species? Specify.***	***End***	***Thr***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SECTION TEN: FISH AND WILDLIFE HABITAT AND INTEGRITY										
1	Interspersion of open water and vegetation (open water types only)	H	M	L						
1b	% cover in vegetation verus open water	__95___%								
2	Interspersion that best fits entire wetland	H	M	L	N/A					
3	Wetland condition related to detritus	H	M	L	N/A					
4	Interspersion of other wetlands in vicinity	H	M	L						
6	Barriers/restriction between wetland and other habitat	L	M	H						
7	Noteworthy wildlife or evidence (birds, mammals, amphibians,etc)	Yes	No	list: Dragon flies, Passerines, Bull Frog						
8	Connected to permanent water (accessible to fish)?	Exceptional	High	Med	Low	N/A				
9	Fish species observed or evidence seen (list)	Yes	No	list:						
10	Wetland part of contiguous upland or wetland:	>50ha	25-50ha	10-25ha	<10ha					
11	WL provides habitat for:	Amphibians	Reptiles	Waterfowl	Waterbirds	Mammals	Fish	R/E species		
SF26	***Does wetland support fish/fish habitat?***	***Yes***	***No***	***specify:***						
SF27	***Rare or endangered fish/wildlife species found in the wetland?***	***End***	***Thr-SARA***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF28	***Overall fish and wildlife habitat quality***	***H***	***M***	L						
SECTION ELEVEN: COMMUNITY USE/VALUE										
1	Describe community use	VV__,CP__,CO__,PO__,PA__,,AV_x_,GB__,E__,HI__, WV__, BO__,HU__, PG__, BP__,F__, E__, R__, Other:								
SF29	***Rate the wetland's community use/value***	***H***	***M***	L						

SF ratings highlighted in red indicate critical wetland functions or watershed conditions that are highly degraded. Whenever a wetland is found to have red-highlighted **SFs** the proponent

APPENDIX D: WL4	Nova Scotia Wetland Evaluation Technique Field Data Sheet									
Project Name: Black Point Quarry	Evaluator: Scott Burley			GPS Coordinates: 645076 E x 5024059 N						
PID:35212497, 35212505, 35212521, 35212513, 35044056, 35214014, 35214022, 35214022 and 35213990	Site Address: Black Point, Guysborough County, NS									
Sources and Dates of Mapping/Images: NS Wetlands Inventory (2012); NS Forest Inventory (Current Forest Data - 2004); Google Earth (2003)										
Evaluation Date: 04-Sep-14	Site Visit Date: 20-Aug-14									
Weather Conditions (past 48 hours): Sun and Clouds										
Seasonal Weather Conditions: Typical										
SECTION ONE: WATERSHED CHARACTERISTICS										
1	Watershed Name (tertiary): 1EQ-SD	Size: 518 km^2								
2	% Watershed Land Cover	For: 43	Nat: 36	Past/Hay: <1	Crop: <1	Urb/Com: 2	Road: <1	Other Dev: <1 (Gravel Pit, Landfill, Industrial		
3	% Watershed WL Cover and by Class	Total: 10%	SM: <1	BO: 6	FE: 1	FM: 2	FS: 1	SS: 1	CP: <1	VP: Present
SF1	***Watershed condition***	***H***	***M***	***L***						
SF2	***Proportion of WL area in watershed & opportunity for floodwater detention***	***H***	***M***	***L***						
SECTION TWO: WETLAND CHARACTERISTICS										
Wetland Type: Bog		WL size: 0.2 hectares			Landform: Basin			Landscape Position: Terrene		
Water flow path: Isolated		Wetland Origin: Natural								
1	Water Regime	PF	SF	TF	SS	PS	RfT	IfT	AF	
2	# WL's within 30m project area	Total# 0	SM:	BO:	FE:	FM:	FS:	SS:	CP:	VP:
3	Is WL part of complex	Yes	No							
4	% each wetland type in complex	SM:	BO: 100	FE:	FM:	FS:	SS:	CP:	VP:	
5	Is WL bordering or associated with a lake or pond?	bordering		within 100m		N/A		specify		
6	Standing water?	Yes	Avg Dep: 5-10		% Inundated:		No			
7	Inlet or Outlet (circle all that apply)?	Inlet	Outlet							
8	Adjacent Upland Land Use within 100m (%)	For: 100	Nat:	PasHay:	Crop:	UrbCm:	Road:	Other Dev:		
9	Are there stressors in WL or WL buffer area? Circle primary stressor(s).	DD__, CW__, WcS__, O/C__,EB__,DP__,F__,M__, ES__,NE__,DwP__,								
		M__,GC__,ATV__,DG__,EA__, R__,Rr__,U/CD__,F__,FA__, other (specify):								
10	Hydrology Altered (circle all that apply)?	Ditching	Dams	Tiles	Culvert	Well	Diversion	Other Specify:		
SF3	***Rate the general wetland condition/integrity***	**H**	**M**	**L**						
SECTION THREE: ADJACENT LAND CONDITION AND INTEGRITY										
1	Average width of adjacent naturalized buffer	>1000__m								
2	Widths for water quality	H >15	M 8-15	L <8						
3	Widths for wildlife habitat	H >100	M 15-100	L <15						
4	Adjacent area vegetation condition (list % in each category)	H 100%	M	L						
5	Adjacent area diversity and structure (list % in each category)	H 100%	M	L						
6	Adjacent Upland Slope (list % in each category)	Steep 40%	Mod 40%	Gentle 20%						
7	Adjacent land supports water quality	*Yes*	*No*	Specify:						
8	Adjacent land supports wildlife habitat	*Yes*	*No*	Specify:						
SF4	***Rate the overall condition and integrity land adjacent to wetland***	***H***	***M***	***L***	**is buffer required to maintain red flag functions of wetland? If yes if no**					
SECTION FOUR: DOCUMENTED IMPORTANT FEATURES										
SF5	***Is the WL a WSS?***	***Yes***	***No***							

SF6	***Does the WL support commercial/recreational fish/shellfish?***	***Yes***	***No***							
SF7	***Species of concern (Fed/Prov)? Specify.***	***End***	***Thr - SARA***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF8	***Wetland has conservation/compensation agreements/activity?***	***Yes***	***No***	specify:						
SF9	***Wetland is calcerous fen, black ash or cedar swamp?***	***Yes***	***No***							
SF10	***Within Drinking Water Protected Area (designated watershed/wellfield)***	***Yes***	***No***	specify:						
SF11	***WL within a floodplain and upstream of or within of a populated area?***	***Yes***	***No***							
SF12	***Fed/Prov/Municipal area of interest?***	***Yes***	***No***	specify:						
SECTION FIVE: HYDROLOGIC CONDITION AND INTEGRITY										
1	Is WL source of stream or headwater(wc order 1 or 2)	***Yes***	No	Specify:						
2	Is WL geographically isolated?	Yes	No	Specify:						
3	WL ability to maintain characteristic hydrologic regime	High		Med		Low				
4	Water Storage Depth (list % in each class)	>30cm	15-30cm	up to 15cm		No ponding				
5	Signs of surface water retention observed?	SW__cm, WSL__, WCD__, WM__cm, SM__cm, SD__, AD__, ID__, PMT__, AI__, BT__, AR__, Other:								
6	Describe observable/historical anthropogenic sediment delivery	Low		Med		High				
7	Disturbance of WL soils	Low		Med		High				
8	Predominant soils adjacent to WL	Sand		Silt/loam		Clay/bedrock				
9	Capacity of WL to alter/retard flows	High		Med		Low				
10	Roughness coefficient for surface water flow path	High		Med		Low				
11	Strormwater/Wastewater/Agricultural runoff detention	High		Med		Low				
12	Water Source	Natural		Mostly natural		Partly altered		Controlled		
13	Hydrology of tidal wetlands	Unrestricted		Reduced		Restricted		N/A		
14	Coastal storm surge	***Yes***	No							
SF13	***WL hydrologic condition***	***Natural***	***Modified***		***Significantly Modified***					
SF14	***WL important for maintaining stream flow?***	***Yes***	***No***							
SF15	***WL ability to detain surface water***	***High***	***Med***	**Low**						
SECTION SIX: WATER QUALITY										
1	Strormwater/Wastewater/Agricultural runoff as water source?	High		Med		Low				
2	Nutrients/sediments from surrounding land	High		Med		Low				
3	Significant flood/stormwater attenuation	***Yes***	***No***							
4	Vegetation capacity to settle suspended sediments	High		Med		Low				
5	WL type /landscape position holds/filters runoff?	***Yes***	***No***							
SF16	***Wetland improves water quality?***	***Yes***	***No***							
SF17	***Evidence of excess nutrient loading/contamination?***	***Low***	***Med***	***High***						
SF18	***WL contributes to water quality in downstream resources***	***High***	***Med***	***Low***						
SECTION SEVEN: GROUNDWATER INTERACTIONS										
1	Describe soils in wetland	Recharge		Discharge						
2	Land use / run off in subwatershed upstream	Recharge		Discharge						
3	Conditions of upland soils within 200m of wetland	Recharge		Discharge						
4	Hydroperiod of wetland	Recharge		Discharge						
5	Describe inlet/outlet configuration	Recharge		Discharge						
6	Characterize topographic relief surrounding wetland	Recharge		Discharge						

SF19	***WL serves as a recharge site***	***Yes***	***No***							
SF20	***WL serves as a discharge site***	***Yes***	***No***							
SECTION EIGHT: SHORELINE STABILIZATION AND INTEGRITY										
1	Wetland fringing ocean/estuary/lake/pond/river/stream?	***Yes***	No	streamwidth >4m	streamwidth<4m	WB Exposed	WB Sheltered			
2	% cover of rooted vegetation in shallow water zone	H >50%	M 10-50	L <10%						
3	Avg veg WL width b/w shoreline/streambank & 2 m depth contour	H >10m	M 3-10	L <3m						
4	Prevalence of strong-stemmed emerg. veg (shoreline marshes and fens only)	High	Med	Low						
5	Describe shoreline erosion potential	High	Med	Low						
6	Shoreline/streambank veg condition upslope of water level	Low	Med	High	Artificial					
SF21	***WL ability to stabilize shoreline***	***H***	***M***	***L***	N/A					
SECTION NINE: PLANT COMMUNITY										
1	Vegetation diversity	High	Med	Low						
1b	Dominant plant species and % cover in the WL	list: *Picea mariana* (70%)/*Carex trisperma* (40%)/ *Mainanthemum trifolium* (25%)								
3	Dominant Non-native or Invasive species and % cover	Yes	No	specify: %						
4	Vegetation Disturbance	H	M	L	specify type(s) below					
5	Disturbance Types	H___,ATV___,G___,,M___,In__, D/D___, Im___, OAH___, Ii___, Sd___,E___,,other___,								
7	Vegetative Integrity of plant community	E	H	M	L					
SF22	***Is the plant community unique or rare regionally or provincially?***	***Yes***	***no***	***specify:***						
SF23	***Does the WL contain a diversity of plant communities***	***H***	***M***	***L***						
SF24	***Rate the overall integrity/quality of plant community?***	***H***	***M***	***L***						
SF25	***Are there any observed rare or endangered plant species? Specify.***	***End***	***Thr***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SECTION TEN: FISH AND WILDLIFE HABITAT AND INTEGRITY										
1	Interspersion of open water and vegetation (open water types only)	H	M	L						
1b	% cover in vegetation verus open water	__100___%								
2	Interspersion that best fits entire wetland	H	M	L	N/A					
3	Wetland condition related to detritus	H	M	L	N/A					
4	Interspersion of other wetlands in vicinity	H	M	L						
6	Barriers/restriction between wetland and other habitat	L	M	H						
7	Noteworthy wildlife or evidence (birds, mammals, amphibians,etc)	Yes	No	list:						
8	Connected to permanent water (accessible to fish)?	Exceptional	High	Med	Low	N/A				
9	Fish species observed or evidence seen (list)	Yes	No	list:						
10	Wetland part of contiguous upland or wetland:	>50ha	25-50ha	10-25ha	<10ha					
11	WL provides habitat for:	Amphibians	Reptiles	Waterfowl	Waterbirds	Mammals	Fish	R/E species		
SF26	***Does wetland support fish/fish habitat?***	***Yes***	***No***	***specify:***						
SF27	***Rare or endangered fish/wildlife species found in the wetland?***	***End***	***Thr-SARA***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF28	***Overall fish and wildlife habitat quality***	***H***	***M***	L						
SECTION ELEVEN: COMMUNITY USE/VALUE										
1	Describe community use	VV__,CP__,CO__,PO__,PA__,,AV__,GB__,E__,HI__, WV__, BO__,HU__, PG__, BP__,F__, E__, R__, Other:								
SF29	***Rate the wetland's community use/value***	***H***	***M***	L						

SF ratings highlighted in red indicate critical wetland functions or watershed conditions that are highly degraded. Whenever a wetland is found to have red-highlighted **SFs** the proponent

APPENDIX D: WL5	Nova Scotia Wetland Evaluation Technique Field Data Sheet									
Project Name: Black Point Quarry		Evaluator: Scott Burley			GPS Coordinates: 644431 E x 5024129 N					
PID:35212497, 35212505, 35212521, 35212513, 35044056, 35214014, 35214022, 35214022 and 35213990		Site Address: Black Point, Guysborough County, NS								
Sources and Dates of Mapping/Images: NS Wetlands Inventory (2012); NS Forest Inventory (Current Forest Data - 2004); Google Earth (2003)										
Evaluation Date: 04-Sep-14		Site Visit Date: 20-Aug-14								
Weather Conditions (past 48 hours): Sun and Clouds										
Seasonal Weather Conditions: Typical										
SECTION ONE: WATERSHED CHARACTERISTICS										
1	Watershed Name (tertiary): 1EQ-SD	Size: 518 km^2								
2	% Watershed Land Cover	For: 43	Nat: 36	Past/Hay: <1	Crop: <1	Urb/Com: 2	Road: <1	Other Dev: <1 (Gravel Pit, Landfill, Industrial		
3	% Watershed WL Cover and by Class	Total: 10%	SM: <1	BO: 6	FE: 1	FM: 2	FS: 1	SS: 1	CP: <1	VP: Present
SF1	***Watershed condition***	***H***	***M***	***L***						
SF2	***Proportion of WL area in watershed & opportunity for floodwater detention***	***H***	***M***	***L***						
SECTION TWO: WETLAND CHARACTERISTICS										
Wetland Type: Fen		WL size: 0.5 hectares			Landform: Slope			Landscape Position: Lotic Stream-Confined		
Water flow path: Throughflow		Wetland Origin: Natural								
1	Water Regime	PF	SF	TF	SS	PS	RfT	IfT	AF	
2	# WL's within 30m project area	Total# 0	SM:	BO:	FE:	FM:	FS:	SS:	CP:	VP:
3	Is WL part of complex	Yes	No							
4	% each wetland type in complex	SM:	BO:	FE: 100	FM:	FS:	SS:	CP:	VP:	
5	Is WL bordering or associated with a lake or pond?	bordering		within 100m		N/A		specify		
6	Standing water?	Yes	Avg Dep: 5-10		% Inundated:		No			
7	Inlet or Outlet (circle all that apply)?	Inlet	Outlet							
8	Adjacent Upland Land Use within 100m (%)	For: 90	Nat: 10	PasHay:	Crop:	UrbCm:	Road:	Other Dev:		
9	Are there stressors in WL or WL buffer area? Circle primary stressor(s).	DD__, CW__, WcS__, O/C__,EB__,DP__,F__,M__, ES__,NE__,DwP__,								
		M__,GC__,ATV__,DG__,EA__, R__,Rr__,U/CD__,F__,FA__, other (specify):								
10	Hydrology Altered (circle all that apply)?	Ditching	Dams	Tiles	Culvert	Well	Diversion	Other Specify:		
SF3	***Rate the general wetland condition/integrity***	**H**	**M**	**L**						
SECTION THREE: ADJACENT LAND CONDITION AND INTEGRITY										
1	Average width of adjacent naturalized buffer	>1000__m								
2	Widths for water quality	H >15	M 8-15	L <8						
3	Widths for wildlife habitat	H >100	M 15-100	L <15						
4	Adjacent area vegetation condition (list % in each category)	H 100%	M	L						
5	Adjacent area diversity and structure (list % in each category)	H 100%	M	L						
6	Adjacent Upland Slope (list % in each category)	Steep 70%	Mod 25%	Gentle 5%						
7	Adjacent land supports water quality	*Yes*	*No*	Specify:						
8	Adjacent land supports wildlife habitat	*Yes*	*No*	Specify:						
SF4	***Rate the overall condition and integrity land adjacent to wetland***	***H***	***M***	***L***	**is buffer required to maintain red flag functions of wetland? If yes if no**					
SECTION FOUR: DOCUMENTED IMPORTANT FEATURES										
SF5	***Is the WL a WSS?***	***Yes***	***No***							

SF6	***Does the WL support commercial/recreational fish/shellfish?***	***Yes***	***No***							
SF7	***Species of concern (Fed/Prov)? Specify.***	***End***	***Thr - SARA***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF8	***Wetland has conservation/compensation agreements/activity?***	***Yes***	***No***	specify:						
SF9	***Wetland is calcerous fen, black ash or cedar swamp?***	***Yes***	***No***							
SF10	***Within Drinking Water Protected Area (designated watershed/wellfield)***	***Yes***	***No***	specify:						
SF11	***WL within a floodplain and upstream of or within of a populated area?***	***Yes***	***No***							
SF12	***Fed/Prov/Municipal area of interest?***	***Yes***	***No***	specify:						
SECTION FIVE: HYDROLOGIC CONDITION AND INTEGRITY										
1	Is WL source of stream or headwater(wc order 1 or 2)	***Yes***	No	Specify:						
2	Is WL geographically isolated?	Yes	No	Specify:						
3	WL ability to maintain characteristic hydrologic regime	High		Med		Low				
4	Water Storage Depth (list % in each class)	>30cm	15-30cm	up to 15cm		No ponding				
5	Signs of surface water retention observed?	SW__cm, WSL__, WCD__, WM__cm, SM__cm, SD__, AD__, ID__, PMT__, AI__, BT__, AR__, Other:								
6	Describe observable/historical anthropogenic sediment delivery	Low		Med		High				
7	Disturbance of WL soils	Low		Med		High				
8	Predominant soils adjacent to WL	Sand		Silt/loam		Clay/bedrock				
9	Capacity of WL to alter/retard flows	High		Med		Low				
10	Roughness coefficient for surface water flow path	High		Med		Low				
11	Strormwater/Wastewater/Agricultural runoff detention	High		Med		Low				
12	Water Source	Natural		Mostly natural		Partly altered		Controlled		
13	Hydrology of tidal wetlands	Unrestricted		Reduced		Restricted		N/A		
14	Coastal storm surge	***Yes***	No							
SF13	***WL hydrologic condition***	***Natural***	***Modified***			**Significantly Modified**				
SF14	***WL important for maintaining stream flow?***	***Yes***	***No***							
SF15	***WL ability to detain surface water***	***High***	***Med***	**Low**						
SECTION SIX: WATER QUALITY										
1	Strormwater/Wastewater/Agricultural runoff as water source?	High		Med		Low				
2	Nutrients/sediments from surrounding land	High		Med		Low				
3	Significant flood/stormwater attenuation	***Yes***	***No***							
4	Vegetation capacity to settle suspended sediments	High		Med		Low				
5	WL type /landscape position holds/filters runoff?	***Yes***	***No***							
SF16	***Wetland improves water quality?***	***Yes***	***No***							
SF17	***Evidence of excess nutrient loading/contamination?***	***Low***	***Med***	***High***						
SF18	***WL contributes to water quality in downstream resources***	***High***	***Med***	***Low***						
SECTION SEVEN: GROUNDWATER INTERACTIONS										
1	Describe soils in wetland	Recharge		Discharge						
2	Land use / run off in subwatershed upstream	Recharge		Discharge						
3	Conditions of upland soils within 200m of wetland	Recharge		Discharge						
4	Hydroperiod of wetland	Recharge		Discharge						
5	Describe inlet/outlet configuration	Recharge		Discharge						
6	Characterize topographic relief surrounding wetland	Recharge		Discharge						

SF19	***WL serves as a recharge site***	***Yes***	***No***							
SF20	***WL serves as a discharge site***	***Yes***	***No***							
SECTION EIGHT: SHORELINE STABILIZATION AND INTEGRITY										
1	Wetland fringing ocean/estuary/lake/pond/river/stream?	***Yes***	No	streamwidth >4m	streamwidth<4m	WB Exposed	WB Sheltered			
2	% cover of rooted vegetation in shallow water zone	H >50%	M 10-50	L <10%						
3	Avg veg WL width b/w shoreline/streambank & 2 m depth contour	H >10m	M 3-10	L <3m						
4	Prevalence of strong-stemmed emerg. veg (shoreline marshes and fens only)	High	Med	Low						
5	Describe shoreline erosion potential	High	Med	Low						
6	Shoreline/streambank veg condition upslope of water level	Low	Med	High	Artificial					
SF21	***WL ability to stabilize shoreline***	***H***	***M***	***L***	N/A					
SECTION NINE: PLANT COMMUNITY										
1	Vegetation diversity	High	Med	Low						
1b	Dominant plant species and % cover in the WL	list: *Illex glabra* (20%)/*Osmunda cinnamomea* (20%)/ *Picea mariana* (10%)								
3	Dominant Non-native or Invasive species and % cover	Yes	No	specify: %						
4	Vegetation Disturbance	H	M	L	specify type(s) below					
5	Disturbance Types	H___,ATV___,G___,,M___,In__, D/D___, Im___, OAH___, Ii___, Sd___,E___,,other___,								
7	Vegetative Integrity of plant community	E	H	M	L					
SF22	***Is the plant community unique or rare regionally or provincially?***	***Yes***	***no***	***specify:***						
SF23	***Does the WL contain a diversity of plant communities***	***H***	***M***	***L***						
SF24	***Rate the overall integrity/quality of plant community?***	***H***	***M***	***L***						
SF25	***Are there any observed rare or endangered plant species? Specify.***	***End***	***Thr***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SECTION TEN: FISH AND WILDLIFE HABITAT AND INTEGRITY										
1	Interspersion of open water and vegetation (open water types only)	H	M	L						
1b	% cover in vegetation verus open water	__100___%								
2	Interspersion that best fits entire wetland	H	M	L	N/A					
3	Wetland condition related to detritus	H	M	L	N/A					
4	Interspersion of other wetlands in vicinity	H	M	L						
6	Barriers/restriction between wetland and other habitat	L	M	H						
7	Noteworthy wildlife or evidence (birds, mammals, amphibians,etc)	Yes	No	list: Passerines, Wood frog, Brown Snake						
8	Connected to permanent water (accessible to fish)?	Exceptional	High	Med	Low	N/A				
9	Fish species observed or evidence seen (list)	Yes	No	list:						
10	Wetland part of contiguous upland or wetland:	>50ha	25-50ha	10-25ha	<10ha					
11	WL provides habitat for:	Amphibians	Reptiles	Waterfowl	Waterbirds	Mammals	Fish	R/E species		
SF26	***Does wetland support fish/fish habitat?***	***Yes***	***No***	***specify:***						
SF27	***Rare or endangered fish/wildlife species found in the wetland?***	***End***	***Thr-SARA***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF28	***Overall fish and wildlife habitat quality***	***H***	***M***	***L***						
SECTION ELEVEN: COMMUNITY USE/VALUE										
1	Describe community use	VV__,CP__,CO__,PO__,PA__,,AV_x_,GB__,E__,HI__, WV__, BO__,HU__, PG__, BP__,F__, E__, R__, Other:								
SF29	***Rate the wetland's community use/value***	***H***	***M***	***L***						

SF ratings highlighted in red indicate critical wetland functions or watershed conditions that are highly degraded. Whenever a wetland is found to have red-highlighted **SFs** the proponent

APPENDIX D: WL6	Nova Scotia Wetland Evaluation Technique Field Data Sheet									
Project Name: Black Point Quarry		Evaluator: Scott Burley			GPS Coordinates: 644737 E x 5024077 N					
PID:35212497, 35212505, 35212521, 35212513, 35044056, 35214014, 35214022, 35214022 and 35213990		Site Address: Black Point, Guysborough County, NS								
Sources and Dates of Mapping/Images: NS Wetlands Inventory (2012); NS Forest Inventory (Current Forest Data - 2004); Google Earth (2003)										
Evaluation Date: 04-Sep-14		Site Visit Date: 20-Aug-14								
Weather Conditions (past 48 hours): Sun and Clouds										
Seasonal Weather Conditions: Typical										
SECTION ONE: WATERSHED CHARACTERISTICS										
1	Watershed Name (tertiary): 1EQ-SD	Size: 518 km^2								
2	% Watershed Land Cover	For: 43	Nat: 36	Past/Hay: <1	Crop: <1	Urb/Com: 2	Road: <1	Other Dev: <1 (Gravel Pit, Landfill, Industrial		
3	% Watershed WL Cover and by Class	Total: 10%	SM: <1	BO: 6	FE: 1	FM: 2	FS: 1	SS: 1	CP: <1	VP: Present
SF1	***Watershed condition***	***H***	***M***	***L***						
SF2	***Proportion of WL area in watershed & opportunity for floodwater detention***	***H***	***M***	***L***						
SECTION TWO: WETLAND CHARACTERISTICS										
Wetland Type: Bog		WL size: 0.3 hectares			Landform: Basin			Landscape Position: Terrene outflow		
Water flow path: Outflow		Wetland Origin: Natural								
1	Water Regime	PF	SF	TF	SS	PS	RfT	IfT	AF	
2	# WL's within 30m project area	Total# 0	SM:	BO:	FE:	FM:	FS:	SS:	CP:	VP:
3	Is WL part of complex	Yes	No							
4	% each wetland type in complex	SM:	BO: 100	FE:	FM:	FS:	SS:	CP:	VP:	
5	Is WL bordering or associated with a lake or pond?	bordering		within 100m		N/A		specify		
6	Standing water?	Yes	Avg Dep: 5-10		% Inundated:		No			
7	Inlet or Outlet (circle all that apply)?	Inlet	Outlet							
8	Adjacent Upland Land Use within 100m (%)	For: 90	Nat: 10	PasHay:	Crop:	UrbCm:	Road:	Other Dev:		
9	Are there stressors in WL or WL buffer area? Circle primary stressor(s).	DD__, CW__, WcS__, O/C__,EB__,DP__,F__,M__, ES__,NE__,DwP__,								
		M__,GC__,ATV__,DG__,EA__, R__,Rr__,U/CD__,F__,FA__, other (specify):								
10	Hydrology Altered (circle all that apply)?	Ditching	Dams	Tiles	Culvert	Well	Diversion	Other Specify:		
SF3	***Rate the general wetland condition/integrity***	**H**	**M**	**L**						
SECTION THREE: ADJACENT LAND CONDITION AND INTEGRITY										
1	Average width of adjacent naturalized buffer	>1000__m								
2	Widths for water quality	H >15	M 8-15	L <8						
3	Widths for wildlife habitat	H >100	M 15-100	L <15						
4	Adjacent area vegetation condition (list % in each category)	H 100%	M	L						
5	Adjacent area diversity and structure (list % in each category)	H 100%	M	L						
6	Adjacent Upland Slope (list % in each category)	Steep 70%	Mod 25%	Gentle 5%						
7	Adjacent land supports water quality	*Yes*	*No*	Specify:						
8	Adjacent land supports wildlife habitat	*Yes*	*No*	Specify:						
SF4	***Rate the overall condition and integrity land adjacent to wetland***	***H***	***M***	***L***	**is buffer required to maintain red flag functions of wetland? If yes if no**					
SECTION FOUR: DOCUMENTED IMPORTANT FEATURES										
SF5	***Is the WL a WSS?***	***Yes***	***No***							

SF6	***Does the WL support commercial/recreational fish/shellfish?***	***Yes***	***No***						
SF7	***Species of concern (Fed/Prov)? Specify.***	***End***	***Thr - SARA***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF8	***Wetland has conservation/compensation agreements/activity?***	***Yes***	***No***	specify:					
SF9	***Wetland is calcerous fen, black ash or cedar swamp?***	***Yes***	***No***						
SF10	***Within Drinking Water Protected Area (designated watershed/wellfield)***	***Yes***	***No***	specify:					
SF11	***WL within a floodplain and upstream of or within of a populated area?***	***Yes***	***No***						
SF12	***Fed/Prov/Municipal area of interest?***	***Yes***	***No***	specify:					
SECTION FIVE: HYDROLOGIC CONDITION AND INTEGRITY									
1	Is WL source of stream or headwater(wc order 1 or 2)	Yes	No	Specify: Small outlet stream at east and west end of wetlands					
2	Is WL geographically isolated?	Yes	No	Specify:					
3	WL ability to maintain characteristic hydrologic regime	High		Med		Low			
4	Water Storage Depth (list % in each class)	>30cm	15-30cm	up to 15cm		No ponding			
5	Signs of surface water retention observed?	SW__cm, WSL__, WCD__, WM__cm, SM__cm, SD__, AD__, ID__, PMT__, AI__, BT__, AR__, Other:							
6	Describe observable/historical anthropogenic sediment delivery	Low		Med		High			
7	Disturbance of WL soils	Low		Med		High			
8	Predominant soils adjacent to WL	Sand		Silt/loam		Clay/bedrock			
9	Capacity of WL to alter/retard flows	High		Med		Low			
10	Roughness coefficient for surface water flow path	High		Med		Low			
11	Strormwater/Wastewater/Agricultural runoff detention	High		Med		Low			
12	Water Source	Natural		Mostly natural		Partly altered		Controlled	
13	Hydrology of tidal wetlands	Unrestricted		Reduced		Restricted		N/A	
14	Coastal storm surge	Yes	No						
SF13	***WL hydrologic condition***	***Natural***	***Modified***		***Significantly Modified***				
SF14	***WL important for maintaining stream flow?***	***Yes***	***No***						
SF15	***WL ability to detain surface water***	***High***	***Med***	***Low***					
SECTION SIX: WATER QUALITY									
1	Strormwater/Wastewater/Agricultural runoff as water source?	High		Med		Low			
2	Nutrients/sediments from surrounding land	High		Med		Low			
3	Significant flood/stormwater attenuation	Yes	No						
4	Vegetation capacity to settle suspended sediments	High		Med		Low			
5	WL type /landscape position holds/filters runoff?	Yes	No						
SF16	***Wetland improves water quality?***	***Yes***	***No***						
SF17	***Evidence of excess nutrient loading/contamination?***	***Low***	***Med***	***High***					
SF18	***WL contributes to water quality in downstream resources***	***High***	***Med***	***Low***					
SECTION SEVEN: GROUNDWATER INTERACTIONS									
1	Describe soils in wetland	Recharge		Discharge					
2	Land use / run off in subwatershed upstream	Recharge		Discharge					
3	Conditions of upland soils within 200m of wetland	Recharge		Discharge					
4	Hydroperiod of wetland	Recharge		Discharge					
5	Describe inlet/outlet configuration	Recharge		Discharge					
6	Characterize topographic relief surrounding wetland	Recharge		Discharge					

SF19	***WL serves as a recharge site***	***Yes***	***No***								
SF20	***WL serves as a discharge site***	***Yes***	***No***								
SECTION EIGHT: SHORELINE STABILIZATION AND INTEGRITY											
1	Wetland fringing ocean/estuary/lake/pond/river/stream?	***Yes***	No	streamwidth >4m		streamwidth<4m		WB Exposed		WB Sheltered	
2	% cover of rooted vegetation in shallow water zone	H >50%	M 10-50	L <10%							
3	Avg veg WL width b/w shoreline/streambank & 2 m depth contour	H >10m	M 3-10	L <3m							
4	Prevalence of strong-stemmed emerg. veg (shoreline marshes and fens only)	High	Med	Low							
5	Describe shoreline erosion potential	High	Med	Low							
6	Shoreline/streambank veg condition upslope of water level	Low	Med	High	Artificial						
SF21	***WL ability to stabilize shoreline***	***H***	***M***	***L***	N/A						
SECTION NINE: PLANT COMMUNITY											
1	Vegetation diversity	High	Med	Low							
1b	Dominant plant species and % cover in the WL	list: *Mainanthemum trifolium* (20%)/*Gaylussacia baccata* (10%)/ *Eriophorum virginicum* (10%)									
3	Dominant Non-native or Invasive species and % cover	Yes	No	specify: %							
4	Vegetation Disturbance	H	M	L	specify type(s) below						
5	Disturbance Types	H___,ATV___,G___,,M___,In__, D/D___, Im___, OAH___, Ii___, Sd___,E___,,other___,									
7	Vegetative Integrity of plant community	E	H	M	L						
SF22	***Is the plant community unique or rare regionally or provincially?***	***Yes***	***no***	***specify:***							
SF23	***Does the WL contain a diversity of plant communities***	***H***	***M***	***L***							
SF24	***Rate the overall integrity/quality of plant community?***	***H***	***M***	***L***							
SF25	***Are there any observed rare or endangered plant species? Specify.***	***End***	***Thr***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***	
SECTION TEN: FISH AND WILDLIFE HABITAT AND INTEGRITY											
1	Interspersion of open water and vegetation (open water types only)	H	M	L							
1b	% cover in vegetation verus open water	__100___%									
2	Interspersion that best fits entire wetland	H	M	L	N/A						
3	Wetland condition related to detritus	H	M	L	N/A						
4	Interspersion of other wetlands in vicinity	H	M	L							
6	Barriers/restriction between wetland and other habitat	L	M	H							
7	Noteworthy wildlife or evidence (birds, mammals, amphibians,etc)	Yes	No	list: Passerines, Wood frog, Passerines							
8	Connected to permanent water (accessible to fish)?	Exceptional	High	Med	Low	N/A					
9	Fish species observed or evidence seen (list)	Yes	No	list:							
10	Wetland part of contiguous upland or wetland:	>50ha	25-50ha	10-25ha	<10ha						
11	WL provides habitat for:	Amphibians	Reptiles	Waterfowl	Waterbirds	Mammals	Fish	R/E species			
SF26	***Does wetland support fish/fish habitat?***	***Yes***	***No***	***specify:***							
SF27	***Rare or endangered fish/wildlife species found in the wetland?***	***End***	***Thr-SARA***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***	
SF28	***Overall fish and wildlife habitat quality***	***H***	***M***	L							
SECTION ELEVEN: COMMUNITY USE/VALUE											
1	Describe community use	VV__,CP__,CO__,PO__,PA__,,AV__,GB__,E__,HI__, WV__, BO__,HU__, PG__, BP__,F__, E__, R__, Other:									
SF29	***Rate the wetland's community use/value***	***H***	***M***	L							

SF ratings highlighted in red indicate critical wetland functions or watershed conditions that are highly degraded. Whenever a wetland is found to have red-highlighted **SFs** the proponent

APPENDIX D: WL7	Nova Scotia Wetland Evaluation Technique Field Data Sheet									
Project Name: Black Point Quarry		Evaluator: Scott Burley			GPS Coordinates: 644845 E x 5024349 N					
PID:35212497, 35212505, 35212521, 35212513, 35044056, 35214014, 35214022, 35214022 and 35213990		Site Address: Black Point, Guysborough County, NS								
Sources and Dates of Mapping/Images: NS Wetlands Inventory (2012); NS Forest Inventory (Current Forest Data - 2004); Google Earth (2003)										
Evaluation Date: 04-Sep-14		Site Visit Date: 20-Aug-14								
Weather Conditions (past 48 hours): Sun and Clouds										
Seasonal Weather Conditions: Typical										
SECTION ONE: WATERSHED CHARACTERISTICS										
1	Watershed Name (tertiary): 1EQ-SD	Size: 518 km^2								
2	% Watershed Land Cover	For: 43	Nat: 36	Past/Hay: <1	Crop: <1	Urb/Com: 2	Road: <1	Other Dev: <1 (Gravel Pit, Landfill, Industrial		
3	% Watershed WL Cover and by Class	Total: 10%	SM: <1	BO: 6	FE: 1	FM: 2	FS: 1	SS: 1	CP: <1	VP: Present
SF1	***Watershed condition***	***H***	***M***	***L***						
SF2	***Proportion of WL area in watershed & opportunity for floodwater detention***	***H***	***M***	***L***						
SECTION TWO: WETLAND CHARACTERISTICS										
Wetland Type: Treed Swamp		WL size: 0.5 hectares			Landform: Slope			Landscape Position: Lotic Stream-Confined		
Water flow path: Throughflow		Wetland Origin: Natural								
1	Water Regime	PF	SF	TF	SS	PS	RfT	IfT	AF	
2	# WL's within 30m project area	Total# 0	SM:	BO:	FE:	FM:	FS:	SS:	CP:	VP:
3	Is WL part of complex	Yes	No							
4	% each wetland type in complex	SM:	BO:	FE:	FM:	FS: 100	SS:	CP:	VP:	
5	Is WL bordering or associated with a lake or pond?	bordering		within 100m		N/A		specify		
6	Standing water?	Yes	Avg Dep: 5-10		% Inundated:		No			
7	Inlet or Outlet (circle all that apply)?	Inlet	Outlet							
8	Adjacent Upland Land Use within 100m (%)	For: 70	Nat: 20	PasHay:	Crop:	UrbCm:	Road:	Other Dev:	10 Rock cliff	
9	Are there stressors in WL or WL buffer area? Circle primary stressor(s).	DD__, CW__, WcS__, O/C__,EB__,DP__,F__,M__, ES__,NE__,DwP__,								
		M__,GC__,ATV__,DG__,EA__, R__,Rr__,U/CD__,F__,FA__, other (specify):								
10	Hydrology Altered (circle all that apply)?	Ditching	Dams	Tiles	Culvert	Well	Diversion	Other Specify:		
SF3	***Rate the general wetland condition/integrity***	**H**	**M**	**L**						
SECTION THREE: ADJACENT LAND CONDITION AND INTEGRITY										
1	Average width of adjacent naturalized buffer	>1000__m								
2	Widths for water quality	H >15	M 8-15	L <8						
3	Widths for wildlife habitat	H >100	M 15-100	L <15						
4	Adjacent area vegetation condition (list % in each category)	H 100%	M	L						
5	Adjacent area diversity and structure (list % in each category)	H 100%	M	L						
6	Adjacent Upland Slope (list % in each category)	Steep 30%	Mod 60%	Gentle 10%						
7	Adjacent land supports water quality	*Yes*	*No*	Specify:						
8	Adjacent land supports wildlife habitat	*Yes*	*No*	Specify:						
SF4	***Rate the overall condition and integrity land adjacent to wetland***	***H***	***M***	***L***	**is buffer required to maintain red flag functions of wetland? If yes if no**					
SECTION FOUR: DOCUMENTED IMPORTANT FEATURES										
SF5	***Is the WL a WSS?***	***Yes***	***No***							

SF6	***Does the WL support commercial/recreational fish/shellfish?***	***Yes***	***No***							
SF7	***Species of concern (Fed/Prov)? Specify.***	***End***	***Thr - SARA***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF8	***Wetland has conservation/compensation agreements/activity?***	***Yes***	***No***	specify:						
SF9	***Wetland is calcerous fen, black ash or cedar swamp?***	***Yes***	***No***							
SF10	***Within Drinking Water Protected Area (designated watershed/wellfield)***	***Yes***	***No***	specify:						
SF11	***WL within a floodplain and upstream of or within of a populated area?***	***Yes***	***No***							
SF12	***Fed/Prov/Municipal area of interest?***	***Yes***	***No***	specify:						
SECTION FIVE: HYDROLOGIC CONDITION AND INTEGRITY										
1	Is WL source of stream or headwater(wc order 1 or 2)	***Yes***	No	Specify:						
2	Is WL geographically isolated?	Yes	No	Specify:						
3	WL ability to maintain characteristic hydrologic regime	High		Med		Low				
4	Water Storage Depth (list % in each class)	>30cm	15-30cm	up to 15cm		No ponding				
5	Signs of surface water retention observed?	SW__cm, WSL__, WCD__, WM__cm, SM__cm, SD__, AD__, ID__, PMT_x_, AI__, BT__, AR__, Other:								
6	Describe observable/historical anthropogenic sediment delivery	Low		Med		High				
7	Disturbance of WL soils	Low		Med		High				
8	Predominant soils adjacent to WL	Sand		Silt/loam		Clay/bedrock				
9	Capacity of WL to alter/retard flows	High		Med		Low				
10	Roughness coefficient for surface water flow path	High		Med		Low				
11	Strormwater/Wastewater/Agricultural runoff detention	High		Med		Low				
12	Water Source	Natural		Mostly natural		Partly altered		Controlled		
13	Hydrology of tidal wetlands	Unrestricted		Reduced		Restricted		N/A		
14	Coastal storm surge	***Yes***	No							
SF13	***WL hydrologic condition***	***Natural***	***Modified***		***Significantly Modified***					
SF14	***WL important for maintaining stream flow?***	***Yes***	***No***							
SF15	***WL ability to detain surface water***	***High***	***Med***	***Low***						
SECTION SIX: WATER QUALITY										
1	Strormwater/Wastewater/Agricultural runoff as water source?	High		Med		Low				
2	Nutrients/sediments from surrounding land	High		Med		Low				
3	Significant flood/stormwater attenuation	***Yes***	***No***							
4	Vegetation capacity to settle suspended sediments	High		Med		Low				
5	WL type /landscape position holds/filters runoff?	***Yes***	***No***							
SF16	***Wetland improves water quality?***	***Yes***	***No***							
SF17	***Evidence of excess nutrient loading/contamination?***	***Low***	***Med***	***High***						
SF18	***WL contributes to water quality in downstream resources***	***High***	***Med***	***Low***						
SECTION SEVEN: GROUNDWATER INTERACTIONS										
1	Describe soils in wetland	Recharge		Discharge						
2	Land use / run off in subwatershed upstream	Recharge		Discharge						
3	Conditions of upland soils within 200m of wetland	Recharge		Discharge						
4	Hydroperiod of wetland	Recharge		Discharge						
5	Describe inlet/outlet configuration	Recharge		Discharge						
6	Characterize topographic relief surrounding wetland	Recharge		Discharge						

SF19	***WL serves as a recharge site***	***Yes***	***No***							
SF20	***WL serves as a discharge site***	***Yes***	***No***							
SECTION EIGHT: SHORELINE STABILIZATION AND INTEGRITY										
1	Wetland fringing ocean/estuary/lake/pond/river/stream?	***Yes***	No	streamwidth >4m	streamwidth<4m	WB Exposed	WB Sheltered			
2	% cover of rooted vegetation in shallow water zone	H >50%	M 10-50	L <10%						
3	Avg veg WL width b/w shoreline/streambank & 2 m depth contour	H >10m	M 3-10	L <3m						
4	Prevalence of strong-stemmed emerg. veg (shoreline marshes and fens only)	High	Med	Low						
5	Describe shoreline erosion potential	High	Med	Low						
6	Shoreline/streambank veg condition upslope of water level	Low	Med	High	Artificial					
SF21	***WL ability to stabilize shoreline***	***H***	***M***	***L***	N/A					
SECTION NINE: PLANT COMMUNITY										
1	Vegetation diversity	High	Med	Low						
1b	Dominant plant species and % cover in the WL	list: *Picea mariana* (60%)/*Osmunda cinnamomea* (20%)								
3	Dominant Non-native or Invasive species and % cover	Yes	No	specify: %						
4	Vegetation Disturbance	H	M	L	specify type(s) below					
5	Disturbance Types	H___,ATV___,G___,,M___,In__, D/D___, Im___, OAH___, Ii___, Sd___,E___,,other___,								
7	Vegetative Integrity of plant community	E	H	M	L					
SF22	***Is the plant community unique or rare regionally or provincially?***	***Yes***	***no***	***specify:***						
SF23	***Does the WL contain a diversity of plant communities***	***H***	***M***	***L***						
SF24	***Rate the overall integrity/quality of plant community?***	***H***	***M***	***L***						
SF25	***Are there any observed rare or endangered plant species? Specify.***	***End***	***Thr***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SECTION TEN: FISH AND WILDLIFE HABITAT AND INTEGRITY										
1	Interspersion of open water and vegetation (open water types only)	H	M	L						
1b	% cover in vegetation verus open water	__100___%								
2	Interspersion that best fits entire wetland	H	M	L	N/A					
3	Wetland condition related to detritus	H	M	L	N/A					
4	Interspersion of other wetlands in vicinity	H	M	L						
6	Barriers/restriction between wetland and other habitat	L	M	H						
7	Noteworthy wildlife or evidence (birds, mammals, amphibians,etc)	Yes	No	list: Passerines, Wood frog						
8	Connected to permanent water (accessible to fish)?	Exceptional	High	Med	Low	N/A				
9	Fish species observed or evidence seen (list)	Yes	No	list:						
10	Wetland part of contiguous upland or wetland:	>50ha	25-50ha	10-25ha	<10ha					
11	WL provides habitat for:	Amphibians	Reptiles	Waterfowl	Waterbirds	Mammals	Fish	R/E species		
SF26	***Does wetland support fish/fish habitat?***	***Yes***	***No***	***specify:***						
SF27	***Rare or endangered fish/wildlife species found in the wetland?***	***End***	***Thr-SARA***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF28	***Overall fish and wildlife habitat quality***	***H***	***M***	L						
SECTION ELEVEN: COMMUNITY USE/VALUE										
1	Describe community use	VV__,CP__,CO__,PO__,PA__,,AV__,GB__,E__,HI__, WV__, BO__,HU__, PG__, BP__,F__, E__, R__, Other:								
SF29	***Rate the wetland's community use/value***	***H***	***M***	L						

SF ratings highlighted in red indicate critical wetland functions or watershed conditions that are highly degraded. Whenever a wetland is found to have red-highlighted **SFs** the proponent

APPENDIX D: WL8	Nova Scotia Wetland Evaluation Technique Field Data Sheet									
Project Name: Black Point Quarry		Evaluator: Scott Burley			GPS Coordinates: 644009 E x 5023134 N					
PID:35212497, 35212505, 35212521, 35212513, 35044056, 35214014, 35214022, 35214022 and 35213990			Site Address: Black Point, Guysborough County, NS							
Sources and Dates of Mapping/Images: NS Wetlands Inventory (2012); NS Forest Inventory (Current Forest Data - 2004); Google Earth (2003)										
Evaluation Date: 04-Sep-14		Site Visit Date: 22-Aug-14								
Weather Conditions (past 48 hours): Sun and Clouds										
Seasonal Weather Conditions: Typical										
SECTION ONE: WATERSHED CHARACTERISTICS										
1	Watershed Name (tertiary): 1EQ-SD	Size: 518 km^2								
2	% Watershed Land Cover	For: 43	Nat: 36	Past/Hay: <1	Crop: <1	Urb/Com: 2	Road: <1	Other Dev: <1 (Gravel Pit, Landfill, Industrial		
3	% Watershed WL Cover and by Class	Total: 10%	SM: <1	BO: 6	FE: 1	FM: 2	FS: 1	SS: 1	CP: <1	VP: Present
SF1	***Watershed condition***	***H***	***M***	***L***						
SF2	***Proportion of WL area in watershed & opportunity for floodwater detention***	***H***	***M***	***L***						
SECTION TWO: WETLAND CHARACTERISTICS										
Wetland Type: Swamp/Bog/Fen		WL size: 10.3 hectares			Landform: Flat			Landscape Position: Lotic Stream-Confined		
Water flow path: Throughflow		Wetland Origin: Natural								
1	Water Regime	PF	SF	TF	SS	PS	RfT	IfT	AF	
2	# WL's within 30m project area	Total# 0	SM:	BO:	FE:	FM:	FS:	SS:	CP:	VP:
3	Is WL part of complex	Yes	No							
4	% each wetland type in complex	SM:	BO: 26	FE: 24	FM:	FS: 50	SS:	CP:	VP:	
5	Is WL bordering or associated with a lake or pond?	bordering		within 100m		N/A		specify Portion of wetland borers Fogherty Lak		
6	Standing water?	Yes	Avg Dep: 0-5		% Inundated: 2%		No			
7	Inlet or Outlet (circle all that apply)?	Inlet	Outlet							
8	Adjacent Upland Land Use within 100m (%)	For: 40	Nat: 50	PasHay:	Crop:	UrbCm:	Road:	Other Dev: 10 lake		
9	Are there stressors in WL or WL buffer area? Circle primary stressor(s).	DD__, CW__, WcS__, O/C__,EB__,DP__,F__,M__, ES__,NE__,DwP__,								
		M__,GC__,ATV__,DG__,EA__, R__,Rr__,U/CD__,F__,FA__, other (specify):								
10	Hydrology Altered (circle all that apply)?	Ditching	Dams	Tiles	Culvert	Well	Diversion	Other Specify:		
SF3	***Rate the general wetland condition/integrity***	**H**	**M**	**L**						
SECTION THREE: ADJACENT LAND CONDITION AND INTEGRITY										
1	Average width of adjacent naturalized buffer	>1000__m								
2	Widths for water quality	H >15	M 8-15	L <8						
3	Widths for wildlife habitat	H >100	M 15-100	L <15						
4	Adjacent area vegetation condition (list % in each category)	H 100%	M	L						
5	Adjacent area diversity and structure (list % in each category)	H 100%	M	L						
6	Adjacent Upland Slope (list % in each category)	Steep 10%	Mod 60%	Gentle 30%						
7	Adjacent land supports water quality	*Yes*	*No*	Specify:						
8	Adjacent land supports wildlife habitat	*Yes*	*No*	Specify:						
SF4	***Rate the overall condition and integrity land adjacent to wetland***	***H***	***M***	***L***	**is buffer required to maintain red flag functions of wetland? If yes if no**					
SECTION FOUR: DOCUMENTED IMPORTANT FEATURES										
SF5	***Is the WL a WSS?***	***Yes***	***No***							

SF6	***Does the WL support commercial/recreational fish/shellfish?***	***Yes***	***No***						
SF7	***Species of concern (Fed/Prov)? Specify. Usnea flammea; Cladonia stygia***	***End***	***Thr - SARA***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF8	***Wetland has conservation/compensation agreements/activity?***	***Yes***	***No***	specify:						
SF9	***Wetland is calcerous fen, black ash or cedar swamp?***	***Yes***	***No***							
SF10	***Within Drinking Water Protected Area (designated watershed/wellfield)***	***Yes***	***No***	specify:						
SF11	***WL within a floodplain and upstream of or within of a populated area?***	***Yes***	***No***							
SF12	***Fed/Prov/Municipal area of interest?***	***Yes***	***No***	specify:						
SECTION FIVE: HYDROLOGIC CONDITION AND INTEGRITY										
1	Is WL source of stream or headwater(wc order 1 or 2)	Yes	No	Specify: Small watercourse flows through wetland from north to south						
2	Is WL geographically isolated?	Yes	No	Specify:						
3	WL ability to maintain characteristic hydrologic regime	High		Med		Low				
4	Water Storage Depth (list % in each class)	>30cm	15-30cm	up to 15cm		No ponding				
5	Signs of surface water retention observed?	SW_5_cm, WSL__, WCD__, WM__cm, SM__cm, SD__, AD__, ID__, PMT_x_, AI__, BT__, AR__, Other:								
6	Describe observable/historical anthropogenic sediment delivery	Low		Med		High				
7	Disturbance of WL soils	Low		Med		High				
8	Predominant soils adjacent to WL	Sand		Silt/loam		Clay/bedrock				
9	Capacity of WL to alter/retard flows	High		Med		Low				
10	Roughness coefficient for surface water flow path	High		Med		Low				
11	Strormwater/Wastewater/Agricultural runoff detention	High		Med		Low				
12	Water Source	Natural		Mostly natural		Partly altered		Controlled		
13	Hydrology of tidal wetlands	Unrestricted		Reduced		Restricted		N/A		
14	Coastal storm surge	Yes	No							
SF13	***WL hydrologic condition***	***Natural***	***Modified***	**Significantly Modified**						
SF14	***WL important for maintaining stream flow?***	***Yes***	***No***							
SF15	***WL ability to detain surface water***	***High***	***Med***	**Low**						
SECTION SIX: WATER QUALITY										
1	Strormwater/Wastewater/Agricultural runoff as water source?	High		Med		Low				
2	Nutrients/sediments from surrounding land	High		Med		Low				
3	Significant flood/stormwater attenuation	***Yes***	***No***							
4	Vegetation capacity to settle suspended sediments	High		Med		Low				
5	WL type /landscape position holds/filters runoff?	***Yes***	***No***							
SF16	***Wetland improves water quality?***	***Yes***	***No***							
SF17	***Evidence of excess nutrient loading/contamination?***	***Low***	***Med***	***High***						
SF18	***WL contributes to water quality in downstream resources***	***High***	***Med***	***Low***						
SECTION SEVEN: GROUNDWATER INTERACTIONS										
1	Describe soils in wetland	Recharge		Discharge						
2	Land use / run off in subwatershed upstream	Recharge		Discharge						
3	Conditions of upland soils within 200m of wetland	Recharge		Discharge						
4	Hydroperiod of wetland	Recharge		Discharge						
5	Describe inlet/outlet configuration	Recharge		Discharge						
6	Characterize topographic relief surrounding wetland	Recharge		Discharge						

SF19	***WL serves as a recharge site***	***Yes***	***No***							
SF20	***WL serves as a discharge site***	***Yes***	***No***							
SECTION EIGHT: SHORELINE STABILIZATION AND INTEGRITY										
1	Wetland fringing ocean/estuary/lake/pond/river/stream?	***Yes***	No	streamwidth >4m	streamwidth<4m	WB Exposed	WB Sheltered			
2	% cover of rooted vegetation in shallow water zone	H >50%	M 10-50	L <10%						
3	Avg veg WL width b/w shoreline/streambank & 2 m depth contour	H >10m	M 3-10	L <3m						
4	Prevalence of strong-stemmed emerg. veg (shoreline marshes and fens only)	High	Med	Low						
5	Describe shoreline erosion potential	High	Med	Low						
6	Shoreline/streambank veg condition upslope of water level	Low	Med	High	Artificial					
SF21	***WL ability to stabilize shoreline***	***H***	***M***	***L***	N/A					
SECTION NINE: PLANT COMMUNITY										
1	Vegetation diversity	High	Med	Low						
1b	Dominant plant species and % cover in the WL	list: *Picea mariana* (60%)/*Osmunda cinnamomea* (20%)/*Carex trisperma* (40%)								
3	Dominant Non-native or Invasive species and % cover	Yes	No	specify: %						
4	Vegetation Disturbance	H	M	L	specify type(s) below					
5	Disturbance Types	H___,ATV___,G___,,M___,In__, D/D___, Im___, OAH___, Ii___, Sd___,E___,,other___,								
7	Vegetative Integrity of plant community	E	H	M	L					
SF22	***Is the plant community unique or rare regionally or provincially?***	***Yes***	***no***	***specify:***						
SF23	***Does the WL contain a diversity of plant communities***	***H***	***M***	***L***						
SF24	***Rate the overall integrity/quality of plant community?***	***H***	***M***	***L***						
SF25	***Are there any observed rare or endangered plant species? Specify.***	***End***	***Thr***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SECTION TEN: FISH AND WILDLIFE HABITAT AND INTEGRITY										
1	Interspersion of open water and vegetation (open water types only)	H	M	L						
1b	% cover in vegetation verus open water	__100___%								
2	Interspersion that best fits entire wetland	H	M	L	N/A					
3	Wetland condition related to detritus	H	M	L	N/A					
4	Interspersion of other wetlands in vicinity	H	M	L						
6	Barriers/restriction between wetland and other habitat	L	M	H						
7	Noteworthy wildlife or evidence (birds, mammals, amphibians,etc)	Yes	No	list: Passerines, Wood frog, Deer						
8	Connected to permanent water (accessible to fish)?	Exceptional	High	Med	Low	N/A				
9	Fish species observed or evidence seen (list)	Yes	No	list:						
10	Wetland part of contiguous upland or wetland:	>50ha	25-50ha	10-25ha	<10ha					
11	WL provides habitat for:	Amphibians	Reptiles	Waterfowl	Waterbirds	Mammals	Fish	R/E species		
SF26	***Does wetland support fish/fish habitat?***	***Yes***	***No***	***specify:***						
SF27	***Rare or endangered fish/wildlife species found in the wetland?***	***End***	***Thr-SARA***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF28	***Overall fish and wildlife habitat quality***	***H***	***M***	L						
SECTION ELEVEN: COMMUNITY USE/VALUE										
1	Describe community use	VV__,CP__,CO__,PO__,PA__,,AV_x_,GB__,E__,HI__, WV__, BO__,HU__, PG_x_, BP_x_,F__, E__, R__, Other:								
SF29	***Rate the wetland's community use/value***	***H***	***M***	L						

SF ratings highlighted in red indicate critical wetland functions or watershed conditions that are highly degraded. Whenever a wetland is found to have red-highlighted **SFs** the proponent

APPENDIX D: WL9	Nova Scotia Wetland Evaluation Technique Field Data Sheet									
Project Name: Black Point Quarry		Evaluator: Scott Burley			GPS Coordinates: 643617 E x 5023397 N					
PID:35212497, 35212505, 35212521, 35212513, 35044056, 35214014, 35214022, 35214022 and 35213990		Site Address: Black Point, Guysborough County, NS								
Sources and Dates of Mapping/Images: NS Wetlands Inventory (2012); NS Forest Inventory (Current Forest Data - 2004); Google Earth (2003)										
Evaluation Date: 05-Sep-14		Site Visit Date: 22-Aug-14								
Weather Conditions (past 48 hours): Sun and Clouds										
Seasonal Weather Conditions: Typical										
SECTION ONE: WATERSHED CHARACTERISTICS										
1	Watershed Name (tertiary): 1EQ-SD	Size: 518 km^2								
2	% Watershed Land Cover	For: 43	Nat: 36	Past/Hay: <1	Crop: <1	Urb/Com: 2	Road: <1	Other Dev: <1 (Gravel Pit, Landfill, Industrial		
3	% Watershed WL Cover and by Class	Total: 10%	SM: <1	BO: 6	FE: 1	FM: 2	FS: 1	SS: 1	CP: <1	VP: Present
SF1	***Watershed condition***	***H***	***M***	***L***						
SF2	***Proportion of WL area in watershed & opportunity for floodwater detention***	***H***	***M***	***L***						
SECTION TWO: WETLAND CHARACTERISTICS										
Wetland Type: Bog		WL size: 4.6 hectares			Landform: Flat			Landscape Position: Terrene		
Water flow path: Isolated		Wetland Origin: Natural								
1	Water Regime	PF	SF	TF	SS	PS	RfT	IfT	AF	
2	# WL's within 30m project area	Total# 0	SM:	BO:	FE:	FM:	FS:	SS:	CP:	VP:
3	Is WL part of complex	Yes	No							
4	% each wetland type in complex	SM:	BO: 100	FE:	FM:	FS:	SS:	CP:	VP:	
5	Is WL bordering or associated with a lake or pond?	bordering		within 100m		N/A		specify		
6	Standing water?	Yes	Avg Dep: 0-10 cm		% Inundated: 5%		No			
7	Inlet or Outlet (circle all that apply)?	Inlet	Outlet							
8	Adjacent Upland Land Use within 100m (%)	For: 60	Nat: 40	PasHay:	Crop:	UrbCm:	Road:	Other Dev:		
9	Are there stressors in WL or WL buffer area? Circle primary stressor(s).	DD__, CW__, WcS__, O/C__,EB__,DP__,F__,M__, ES__,NE__,DwP__,								
		M__,GC__,ATV__,DG__,EA__, R__,Rr__,U/CD__,F__,FA__, other (specify):								
10	Hydrology Altered (circle all that apply)?	Ditching	Dams	Tiles	Culvert	Well	Diversion	Other Specify:		
SF3	***Rate the general wetland condition/integrity***	**H**	**M**	**L**						
SECTION THREE: ADJACENT LAND CONDITION AND INTEGRITY										
1	Average width of adjacent naturalized buffer	>1000__m								
2	Widths for water quality	H >1	M 8-15	L <8						
3	Widths for wildlife habitat	H >100	M 15-100	L <15						
4	Adjacent area vegetation condition (list % in each category)	H 100%	M	L						
5	Adjacent area diversity and structure (list % in each category)	H 100%	M	L						
6	Adjacent Upland Slope (list % in each category)	Steep 10%	Mod 30%	Gentle 60%						
7	Adjacent land supports water quality	*Yes*	*No*	Specify:						
8	Adjacent land supports wildlife habitat	*Yes*	*No*	Specify:						
SF4	***Rate the overall condition and integrity land adjacent to wetland***	***H***	***M***	***L***	**is buffer required to maintain red flag functions of wetland? If yes if no**					
SECTION FOUR: DOCUMENTED IMPORTANT FEATURES										
SF5	***Is the WL a WSS?***	***Yes***	***No***							

SF6	***Does the WL support commercial/recreational fish/shellfish?***	***Yes***	***No***						
SF7	***Species of concern (Fed/Prov)? Specify.***	***End***	***Thr - SARA***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF8	***Wetland has conservation/compensation agreements/activity?***	***Yes***	***No***	specify:					
SF9	***Wetland is calcerous fen, black ash or cedar swamp?***	***Yes***	***No***						
SF10	***Within Drinking Water Protected Area (designated watershed/wellfield)***	***Yes***	***No***	specify:					
SF11	***WL within a floodplain and upstream of or within of a populated area?***	***Yes***	***No***						
SF12	***Fed/Prov/Municipal area of interest?***	***Yes***	***No***	specify:					
SECTION FIVE: HYDROLOGIC CONDITION AND INTEGRITY									
1	Is WL source of stream or headwater(wc order 1 or 2)	***Yes***	No	Specify:					
2	Is WL geographically isolated?	Yes	No	Specify:					
3	WL ability to maintain characteristic hydrologic regime	High		Med		Low			
4	Water Storage Depth (list % in each class)	>30cm	15-30cm	up to 15cm		No ponding			
5	Signs of surface water retention observed?	SW_5_cm, WSL_x_, WCD__, WM__cm, SM__cm, SD__, AD__, ID__, PMT_x_, AI__, BT__, AR__, Other:							
6	Describe observable/historical anthropogenic sediment delivery	Low		Med		High			
7	Disturbance of WL soils	Low		Med		High			
8	Predominant soils adjacent to WL	Sand		Silt/loam		Clay/bedrock			
9	Capacity of WL to alter/retard flows	High		Med		Low			
10	Roughness coefficient for surface water flow path	High		Med		Low			
11	Strormwater/Wastewater/Agricultural runoff detention	High		Med		Low			
12	Water Source	Natural		Mostly natural		Partly altered		Controlled	
13	Hydrology of tidal wetlands	Unrestricted		Reduced		Restricted		N/A	
14	Coastal storm surge	***Yes***	No						
SF13	***WL hydrologic condition***	***Natural***	***Modified***			***Significantly Modified***			
SF14	***WL important for maintaining stream flow?***	***Yes***	***No***						
SF15	***WL ability to detain surface water***	***High***	***Med***	***Low***					
SECTION SIX: WATER QUALITY									
1	Strormwater/Wastewater/Agricultural runoff as water source?	High		Med		Low			
2	Nutrients/sediments from surrounding land	High		Med		Low			
3	Significant flood/stormwater attenuation	***Yes***	***No***						
4	Vegetation capacity to settle suspended sediments	High		Med		Low			
5	WL type /landscape position holds/filters runoff?	***Yes***	***No***						
SF16	***Wetland improves water quality?***	***Yes***	***No***						
SF17	***Evidence of excess nutrient loading/contamination?***	***Low***	***Med***	***High***					
SF18	***WL contributes to water quality in downstream resources***	***High***	***Med***	***Low***					
SECTION SEVEN: GROUNDWATER INTERACTIONS									
1	Describe soils in wetland	Recharge		Discharge					
2	Land use / run off in subwatershed upstream	Recharge		Discharge					
3	Conditions of upland soils within 200m of wetland	Recharge		Discharge					
4	Hydroperiod of wetland	Recharge		Discharge					
5	Describe inlet/outlet configuration	Recharge		Discharge					
6	Characterize topographic relief surrounding wetland	Recharge		Discharge					

SF19	***WL serves as a recharge site***	***Yes***	***No***	Possible recharge wetland						
SF20	***WL serves as a discharge site***	***Yes***	***No***							
SECTION EIGHT: SHORELINE STABILIZATION AND INTEGRITY										
1	Wetland fringing ocean/estuary/lake/pond/river/stream?	***Yes***	No	streamwidth >4m	streamwidth<4m	WB Exposed	WB Sheltered			
2	% cover of rooted vegetation in shallow water zone	H >50%	M 10-50	L <10%						
3	Avg veg WL width b/w shoreline/streambank & 2 m depth contour	H >10m	M 3-10	L <3m						
4	Prevalence of strong-stemmed emerg. veg (shoreline marshes and fens only)	High	Med	Low						
5	Describe shoreline erosion potential	High	Med	Low						
6	Shoreline/streambank veg condition upslope of water level	Low	Med	High	Artificial					
SF21	***WL ability to stabilize shoreline***	***H***	***M***	***L***	N/A					
SECTION NINE: PLANT COMMUNITY										
1	Vegetation diversity	High	Med	Low						
1b	Dominant plant species and % cover in the WL	list: *Gaylussacia baccata* (60%)/*Trichophorum caesptiosus* (20%)								
3	Dominant Non-native or Invasive species and % cover	Yes	No	specify: %						
4	Vegetation Disturbance	H	M	L	specify type(s) below					
5	Disturbance Types	H___,ATV___,G___,,M___,In__, D/D___, Im___, OAH___, Ii___, Sd___,E___,,other___,								
7	Vegetative Integrity of plant community	E	H	M	L					
SF22	***Is the plant community unique or rare regionally or provincially?***	***Yes***	***no***	***specify:***						
SF23	***Does the WL contain a diversity of plant communities***	***H***	***M***	***L***						
SF24	***Rate the overall integrity/quality of plant community?***	***H***	***M***	***L***						
SF25	***Are there any observed rare or endangered plant species? Specify.***	***End***	***Thr***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SECTION TEN: FISH AND WILDLIFE HABITAT AND INTEGRITY										
1	Interspersion of open water and vegetation (open water types only)	H	M	L						
1b	% cover in vegetation verus open water	__95__%								
2	Interspersion that best fits entire wetland	H	M	L	N/A					
3	Wetland condition related to detritus	H	M	L	N/A					
4	Interspersion of other wetlands in vicinity	H	M	L						
6	Barriers/restriction between wetland and other habitat	L	M	H						
7	Noteworthy wildlife or evidence (birds, mammals, amphibians,etc)	Yes	No	list: Passerines, Deer						
8	Connected to permanent water (accessible to fish)?	Exceptional	High	Med	Low	N/A				
9	Fish species observed or evidence seen (list)	Yes	No	list:						
10	Wetland part of contiguous upland or wetland:	>50ha	25-50ha	10-25ha	<10ha					
11	WL provides habitat for:	Amphibians	Reptiles	Waterfowl	Waterbirds	Mammals	Fish	R/E species		
SF26	***Does wetland support fish/fish habitat?***	***Yes***	***No***	***specify:***						
SF27	***Rare or endangered fish/wildlife species found in the wetland?***	***End***	***Thr-SARA***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF28	***Overall fish and wildlife habitat quality***	***H***	***M***	L						
SECTION ELEVEN: COMMUNITY USE/VALUE										
1	Describe community use	VV__,CP__,CO__,PO__,PA__,,AV_x_,GB__,E__,HI__, WV__, BO__,HU__, PG__, BP__,F__, E__, R__, Other:								
SF29	***Rate the wetland's community use/value***	***H***	***M***	L						

SF ratings highlighted in red indicate critical wetland functions or watershed conditions that are highly degraded. Whenever a wetland is found to have red-highlighted **SFs** the proponent

APPENDIX D: WL10	Nova Scotia Wetland Evaluation Technique Field Data Sheet								
Project Name: Black Point Quarry	Evaluator: Scott Burley			GPS Coordinates: 643857 E x 5023694 N					
PID:35212497, 35212505, 35212521, 35212513, 35044056, 35214014, 35214022, 35214022 and 35213990	Site Address: Black Point, Guysborough County, NS								
Sources and Dates of Mapping/Images: NS Wetlands Inventory (2012); NS Forest Inventory (Current Forest Data - 2004); Google Earth (2003)									
Evaluation Date: 04-Sep-14	Site Visit Date: 22-Aug-14								
Weather Conditions (past 48 hours): Sun and Clouds									
Seasonal Weather Conditions: Typical									
SECTION ONE: WATERSHED CHARACTERISTICS									
1 Watershed Name (tertiary): 1EQ-SD	Size: 518 km^2								
2 % Watershed Land Cover	For: 43	Nat: 36	Past/Hay: <1	Crop: <1	Urb/Com: 2	Road: <1	Other Dev: <1 (Gravel Pit, Landfill, Industrial		
3 % Watershed WL Cover and by Class	Total: 10%	SM: <1	BO: 6	FE: 1	FM: 2	FS: 1	SS: 1	CP: <1	VP: Present
SF1 ***Watershed condition***	***H***	***M***	***L***						
SF2 ***Proportion of WL area in watershed & opportunity for floodwater detention***	***H***	***M***	***L***						
SECTION TWO: WETLAND CHARACTERISTICS									
Wetland Type: Treed Swamp	WL size: 0.1 hectares			Landform: Slope			Landscape Position: Lotic Stream-Confined		
Water flow path: Throughflow	Wetland Origin: Natural								
1 Water Regime	PF	SF	TF	SS	PS	RfT	IfT	AF	
2 # WL's within 30m project area	Total# 0	SM:	BO:	FE:	FM:	FS:	SS:	CP:	VP:
3 Is WL part of complex	Yes	No							
4 % each wetland type in complex	SM:	BO:	FE:	FM:	FS: 100	SS:	CP:	VP:	
5 Is WL bordering or associated with a lake or pond?	bordering		within 100m		N/A		specify		
6 Standing water?	Yes	Avg Dep: 5-10		% Inundated: 2%		No			
7 Inlet or Outlet (circle all that apply)?	Inlet	Outlet							
8 Adjacent Upland Land Use within 100m (%)	For: 100	Nat:	PasHay:	Crop:	UrbCm:	Road:	Other Dev:		
9 Are there stressors in WL or WL buffer area? Circle primary stressor(s).	DD__, CW__, WcS__, O/C__,EB__,DP__,F__,M__, ES__,NE__,DwP__,								
	M__,GC__,ATV x,DG__,EA__, R__,Rr__,U/CD__,F__,FA__, other (specify):								
10 Hydrology Altered (circle all that apply)?	Ditching	Dams	Tiles	Culvert	Well	Diversion	Other Specify:		
SF3 ***Rate the general wetland condition/integrity***	**H**	**M**	**L**						
SECTION THREE: ADJACENT LAND CONDITION AND INTEGRITY									
1 Average width of adjacent naturalized buffer	>1000__m								
2 Widths for water quality	H >15	M 8-15	L <8						
3 Widths for wildlife habitat	H >100	M 15-100	L <15						
4 Adjacent area vegetation condition (list % in each category)	H 100%	M	L						
5 Adjacent area diversity and structure (list % in each category)	H 100%	M	L						
6 Adjacent Upland Slope (list % in each category)	Steep 30%	Mod 40%	Gentle 20%						
7 Adjacent land supports water quality	*Yes*	*No*	Specify:						
8 Adjacent land supports wildlife habitat	*Yes*	*No*	Specify:						
SF4 ***Rate the overall condition and integrity land adjacent to wetland***	***H***	***M***	***L***	**is buffer required to maintain red flag functions of wetland? If yes if no**					
SECTION FOUR: DOCUMENTED IMPORTANT FEATURES									
SF5 ***Is the WL a WSS?***	***Yes***	***No***							

SF6	***Does the WL support commercial/recreational fish/shellfish?***	***Yes***	***No***						
SF7	***Species of concern (Fed/Prov)? Specify. Nephroma bellum***	***End***	***Thr - SARA***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF8	***Wetland has conservation/compensation agreements/activity?***	***Yes***	***No***	specify:						
SF9	***Wetland is calcerous fen, black ash or cedar swamp?***	***Yes***	***No***							
SF10	***Within Drinking Water Protected Area (designated watershed/wellfield)***	***Yes***	***No***	specify:						
SF11	***WL within a floodplain and upstream of or within of a populated area?***	***Yes***	***No***							
SF12	***Fed/Prov/Municipal area of interest?***	***Yes***	***No***	specify:						
SECTION FIVE: HYDROLOGIC CONDITION AND INTEGRITY										
1	Is WL source of stream or headwater(wc order 1 or 2)	***Yes***	No	Specify:						
2	Is WL geographically isolated?	Yes	No	Specify:						
3	WL ability to maintain characteristic hydrologic regime	High		Med		Low				
4	Water Storage Depth (list % in each class)	>30cm	15-30cm	up to 15cm		No ponding				
5	Signs of surface water retention observed?	SW_5_cm, WSL__, WCD__, WM__cm, SM__cm, SD__, AD__, ID__, PMT_x_, AI__, BT__, AR__, Other:								
6	Describe observable/historical anthropogenic sediment delivery	Low		Med		High				
7	Disturbance of WL soils	Low		Med		High				
8	Predominant soils adjacent to WL	Sand		Silt/loam		Clay/bedrock				
9	Capacity of WL to alter/retard flows	High		Med		Low				
10	Roughness coefficient for surface water flow path	High		Med		Low				
11	Strormwater/Wastewater/Agricultural runoff detention	High		Med		Low				
12	Water Source	Natural		Mostly natural		Partly altered		Controlled		
13	Hydrology of tidal wetlands	Unrestricted		Reduced		Restricted		N/A		
14	Coastal storm surge	***Yes***	No							
SF13	***WL hydrologic condition***	***Natural***	***Modified***			**Significantly Modified**				
SF14	***WL important for maintaining stream flow?***	***Yes***	***No***							
SF15	***WL ability to detain surface water***	***High***	***Med***	**Low**						
SECTION SIX: WATER QUALITY										
1	Strormwater/Wastewater/Agricultural runoff as water source?	High		Med		Low				
2	Nutrients/sediments from surrounding land	High		Med		Low				
3	Significant flood/stormwater attenuation	***Yes***	***No***							
4	Vegetation capacity to settle suspended sediments	High		Med		Low				
5	WL type /landscape position holds/filters runoff?	***Yes***	***No***							
SF16	***Wetland improves water quality?***	***Yes***	***No***							
SF17	***Evidence of excess nutrient loading/contamination?***	***Low***	***Med***	***High***						
SF18	***WL contributes to water quality in downstream resources***	***High***	***Med***	***Low***						
SECTION SEVEN: GROUNDWATER INTERACTIONS										
1	Describe soils in wetland	Recharge		Discharge						
2	Land use / run off in subwatershed upstream	Recharge		Discharge						
3	Conditions of upland soils within 200m of wetland	Recharge		Discharge						
4	Hydroperiod of wetland	Recharge		Discharge						
5	Describe inlet/outlet configuration	Recharge		Discharge						
6	Characterize topographic relief surrounding wetland	Recharge		Discharge						

SF19	***WL serves as a recharge site***	***Yes***	***No***							
SF20	***WL serves as a discharge site***	***Yes***	***No***							
SECTION EIGHT: SHORELINE STABILIZATION AND INTEGRITY										
1	Wetland fringing ocean/estuary/lake/pond/river/stream?	***Yes***	No	streamwidth >4m	streamwidth<4m	WB Exposed	WB Sheltered			
2	% cover of rooted vegetation in shallow water zone	H >50%	M 10-50	L <10%						
3	Avg veg WL width b/w shoreline/streambank & 2 m depth contour	H >10m	M 3-10	L <3m						
4	Prevalence of strong-stemmed emerg. veg (shoreline marshes and fens only)	High	Med	Low						
5	Describe shoreline erosion potential	High	Med	Low						
6	Shoreline/streambank veg condition upslope of water level	Low	Med	High	Artificial					
SF21	***WL ability to stabilize shoreline***	***H***	***M***	***L***	N/A					
SECTION NINE: PLANT COMMUNITY										
1	Vegetation diversity	High	Med	Low						
1b	Dominant plant species and % cover in the WL	list: *Abies balsamea* (40%)/*Osmunda cinnamomea* (10%)/*Carex trisperma* (20%)								
3	Dominant Non-native or Invasive species and % cover	Yes	No	specify: %						
4	Vegetation Disturbance	H	M	L	specify type(s) below					
5	Disturbance Types	H___,ATV_x__,G___,,M___,In__, D/D___, Im___, OAH___, Ii___, Sd___,E___,other___,								
7	Vegetative Integrity of plant community	E	H	M	L					
SF22	***Is the plant community unique or rare regionally or provincially?***	***Yes***	***no***	***specify:***						
SF23	***Does the WL contain a diversity of plant communities***	***H***	***M***	***L***						
SF24	***Rate the overall integrity/quality of plant community?***	***H***	***M***	***L***						
SF25	***Are there any observed rare or endangered plant species? Specify.N. bellum***	***End***	***Thr***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SECTION TEN: FISH AND WILDLIFE HABITAT AND INTEGRITY										
1	Interspersion of open water and vegetation (open water types only)	H	M	L						
1b	% cover in vegetation verus open water	__100___%								
2	Interspersion that best fits entire wetland	H	M	L	N/A					
3	Wetland condition related to detritus	H	M	L	N/A					
4	Interspersion of other wetlands in vicinity	H	M	L						
6	Barriers/restriction between wetland and other habitat	L	M	H						
7	Noteworthy wildlife or evidence (birds, mammals, amphibians,etc)	Yes	No	list: Passerines, Deer						
8	Connected to permanent water (accessible to fish)?	Exceptional	High	Med	Low	N/A				
9	Fish species observed or evidence seen (list)	Yes	No	list:						
10	Wetland part of contiguous upland or wetland:	>50ha	25-50ha	10-25ha	<10ha					
11	WL provides habitat for:	Amphibians	Reptiles	Waterfowl	Waterbirds	Mammals	Fish	R/E species		
SF26	***Does wetland support fish/fish habitat?***	***Yes***	***No***	***specify:***						
SF27	***Rare or endangered fish/wildlife species found in the wetland?***	***End***	***Thr-SARA***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF28	***Overall fish and wildlife habitat quality***	***H***	***M***	L						
SECTION ELEVEN: COMMUNITY USE/VALUE										
1	Describe community use	VV__,CP__,CO__,PO__,PA__,,AV__,GB__,E__,HI__, WV__, BO__,HU__, PG__, BP__,F__, E__, R__, Other:								
SF29	***Rate the wetland's community use/value***	***H***	***M***	L						

SF ratings highlighted in red indicate critical wetland functions or watershed conditions that are highly degraded. Whenever a wetland is found to have red-highlighted **SFs** the proponent

APPENDIX D: WL11	Nova Scotia Wetland Evaluation Technique Field Data Sheet								
Project Name: Black Point Quarry	Evaluator: Scott Burley			GPS Coordinates: 644458 E x 5023456 N					
PID:35212497, 35212505, 35212521, 35212513, 35044056, 35214014, 35214022, 35214022 and 35213990	Site Address: Black Point, Guysborough County, NS								
Sources and Dates of Mapping/Images: NS Wetlands Inventory (2012); NS Forest Inventory (Current Forest Data - 2004); Google Earth (2003)									
Evaluation Date: 05-Sep-14	Site Visit Date: 21-Aug-14								
Weather Conditions (past 48 hours): Sun and Clouds									
Seasonal Weather Conditions: Typical									
SECTION ONE: WATERSHED CHARACTERISTICS									
1 Watershed Name (tertiary): 1EQ-SD	Size: 518 km^2								
2 % Watershed Land Cover	For: 43	Nat: 36	Past/Hay: <1	Crop: <1	Urb/Com: 2	Road: <1	Other Dev: <1 (Gravel Pit, Landfill, Industrial		
3 % Watershed WL Cover and by Class	Total: 10%	SM: <1	BO: 6	FE: 1	FM: 2	FS: 1	SS: 1	CP: <1	VP: Present
SF1 ***Watershed condition***	***H***	***M***	***L***						
SF2 ***Proportion of WL area in watershed & opportunity for floodwater detention***	***H***	***M***	***L***						
SECTION TWO: WETLAND CHARACTERISTICS									
Wetland Type: Bog	WL size: 9.0 hectares			Landform: Flat			Landscape Position: Terrene		
Water flow path: Isolated	Wetland Origin: Natural								
1 Water Regime	PF	SF	TF	SS	PS	RfT	IfT	AF	
2 # WL's within 30m project area	Total# 0	SM:	BO:	FE:	FM:	FS:	SS:	CP:	VP:
3 Is WL part of complex	Yes	No							
4 % each wetland type in complex	SM:	BO: 100	FE:	FM:	FS:	SS:	CP:	VP:	
5 Is WL bordering or associated with a lake or pond?	bordering		within 100m		N/A		specify		
6 Standing water?	Yes	Avg Dep: 0-10 cm		% Inundated: 5%		No			
7 Inlet or Outlet (circle all that apply)?	Inlet	Outlet							
8 Adjacent Upland Land Use within 100m (%)	For: 40	Nat: 60	PasHay:	Crop:	UrbCm:	Road:	Other Dev:		
9 Are there stressors in WL or WL buffer area? Circle primary stressor(s).	DD__, CW__, WcS__, O/C__,EB__,DP__,F__,M__, ES__,NE__,DwP__,								
	M__,GC__,ATV__,DG__,EA__, R__,Rr__,U/CD__,F__,FA__, other (specify):								
10 Hydrology Altered (circle all that apply)?	Ditching	Dams	Tiles	Culvert	Well	Diversion	Other Specify:		
SF3 ***Rate the general wetland condition/integrity***	**H**	**M**	**L**						
SECTION THREE: ADJACENT LAND CONDITION AND INTEGRITY									
1 Average width of adjacent naturalized buffer	>1000__m								
2 Widths for water quality	H >1	M 8-15	L <8						
3 Widths for wildlife habitat	H >100	M 15-100	L <15						
4 Adjacent area vegetation condition (list % in each category)	H 100%	M	L						
5 Adjacent area diversity and structure (list % in each category)	H 100%	M	L						
6 Adjacent Upland Slope (list % in each category)	Steep 10%	Mod 30%	Gentle 60%						
7 Adjacent land supports water quality	*Yes*	*No*	Specify:						
8 Adjacent land supports wildlife habitat	*Yes*	*No*	Specify:						
SF4 ***Rate the overall condition and integrity land adjacent to wetland***	***H***	***M***	***L***	**is buffer required to maintain red flag functions of wetland? If yes if no**					
SECTION FOUR: DOCUMENTED IMPORTANT FEATURES									
SF5 ***Is the WL a WSS?***	***Yes***	***No***							

SF6	***Does the WL support commercial/recreational fish/shellfish?***	***Yes***	***No***						
SF7	***Species of concern (Fed/Prov)? Specify. Cladonia stygia***	***End***	***Thr - SARA***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF8	***Wetland has conservation/compensation agreements/activity?***	***Yes***	***No***	specify:						
SF9	***Wetland is calcerous fen, black ash or cedar swamp?***	***Yes***	***No***							
SF10	***Within Drinking Water Protected Area (designated watershed/wellfield)***	***Yes***	***No***	specify:						
SF11	***WL within a floodplain and upstream of or within of a populated area?***	***Yes***	***No***							
SF12	***Fed/Prov/Municipal area of interest?***	***Yes***	***No***	specify:						
SECTION FIVE: HYDROLOGIC CONDITION AND INTEGRITY										
1	Is WL source of stream or headwater(wc order 1 or 2)	***Yes***	No	Specify:						
2	Is WL geographically isolated?	Yes	No	Specify:						
3	WL ability to maintain characteristic hydrologic regime	High		Med		Low				
4	Water Storage Depth (list % in each class)	>30cm	15-30cm	up to 15cm		No ponding				
5	Signs of surface water retention observed?	SW_5_cm, WSL_x_, WCD__, WM__cm, SM__cm, SD__, AD__, ID__, PMT_x_, AI__, BT__, AR__, Other:								
6	Describe observable/historical anthropogenic sediment delivery	Low		Med		High				
7	Disturbance of WL soils	Low		Med		High				
8	Predominant soils adjacent to WL	Sand		Silt/loam		Clay/bedrock				
9	Capacity of WL to alter/retard flows	High		Med		Low				
10	Roughness coefficient for surface water flow path	High		Med		Low				
11	Strormwater/Wastewater/Agricultural runoff detention	High		Med		Low				
12	Water Source	Natural		Mostly natural		Partly altered		Controlled		
13	Hydrology of tidal wetlands	Unrestricted		Reduced		Restricted		N/A		
14	Coastal storm surge	***Yes***	No							
SF13	***WL hydrologic condition***	***Natural***	***Modified***			**Significantly Modified**				
SF14	***WL important for maintaining stream flow?***	***Yes***	***No***							
SF15	***WL ability to detain surface water***	***High***	***Med***	**Low**						
SECTION SIX: WATER QUALITY										
1	Strormwater/Wastewater/Agricultural runoff as water source?	High		Med		Low				
2	Nutrients/sediments from surrounding land	High		Med		Low				
3	Significant flood/stormwater attenuation	***Yes***	***No***							
4	Vegetation capacity to settle suspended sediments	High		Med		Low				
5	WL type /landscape position holds/filters runoff?	***Yes***	***No***							
SF16	***Wetland improves water quality?***	***Yes***	***No***							
SF17	***Evidence of excess nutrient loading/contamination?***	***Low***	***Med***	***High***						
SF18	***WL contributes to water quality in downstream resources***	***High***	***Med***	***Low***						
SECTION SEVEN: GROUNDWATER INTERACTIONS										
1	Describe soils in wetland	Recharge		Discharge						
2	Land use / run off in subwatershed upstream	Recharge		Discharge						
3	Conditions of upland soils within 200m of wetland	Recharge		Discharge						
4	Hydroperiod of wetland	Recharge		Discharge						
5	Describe inlet/outlet configuration	Recharge		Discharge						
6	Characterize topographic relief surrounding wetland	Recharge		Discharge						

SF19	***WL serves as a recharge site***	***Yes***	***No***	Possible recharge wetland						
SF20	***WL serves as a discharge site***	***Yes***	***No***							
SECTION EIGHT: SHORELINE STABILIZATION AND INTEGRITY										
1	Wetland fringing ocean/estuary/lake/pond/river/stream?	***Yes***	No	streamwidth >4m	streamwidth<4m	WB Exposed	WB Sheltered			
2	% cover of rooted vegetation in shallow water zone	H >50%	M 10-50	L <10%						
3	Avg veg WL width b/w shoreline/streambank & 2 m depth contour	H >10m	M 3-10	L <3m						
4	Prevalence of strong-stemmed emerg. veg (shoreline marshes and fens only)	High	Med	Low						
5	Describe shoreline erosion potential	High	Med	Low						
6	Shoreline/streambank veg condition upslope of water level	Low	Med	High	Artificial					
SF21	***WL ability to stabilize shoreline***	***H***	***M***	***L***	N/A					
SECTION NINE: PLANT COMMUNITY										
1	Vegetation diversity	High	Med	Low						
1b	Dominant plant species and % cover in the WL	list: *Gaylussacia baccata* (60%)/*Trichophorum caesptiosus* (20%)								
3	Dominant Non-native or Invasive species and % cover	Yes	No	specify: %						
4	Vegetation Disturbance	H	M	L	specify type(s) below					
5	Disturbance Types	H___,ATV___,G___,,M___,In__, D/D___, Im___, OAH___, Ii___, Sd___,E___,,other___,								
7	Vegetative Integrity of plant community	E	H	M	L					
SF22	***Is the plant community unique or rare regionally or provincially?***	***Yes***	***no***	***specify:***						
SF23	***Does the WL contain a diversity of plant communities***	***H***	***M***	***L***						
SF24	***Rate the overall integrity/quality of plant community?***	***H***	***M***	***L***						
SF25	***Are there any observed rare or endangered plant species? Specify. C.stygia***	***End***	***Thr***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SECTION TEN: FISH AND WILDLIFE HABITAT AND INTEGRITY										
1	Interspersion of open water and vegetation (open water types only)	H	M	L						
1b	% cover in vegetation verus open water	__95__%								
2	Interspersion that best fits entire wetland	H	M	L	N/A					
3	Wetland condition related to detritus	H	M	L	N/A					
4	Interspersion of other wetlands in vicinity	H	M	L						
6	Barriers/restriction between wetland and other habitat	L	M	H						
7	Noteworthy wildlife or evidence (birds, mammals, amphibians,etc)	Yes	No	list: Passerines, Deer						
8	Connected to permanent water (accessible to fish)?	Exceptional	High	Med	Low	N/A				
9	Fish species observed or evidence seen (list)	Yes	No	list:						
10	Wetland part of contiguous upland or wetland:	>50ha	25-50ha	10-25ha	<10ha					
11	WL provides habitat for:	Amphibians	Reptiles	Waterfowl	Waterbirds	Mammals	Fish	R/E species		
SF26	***Does wetland support fish/fish habitat?***	***Yes***	***No***	***specify:***						
SF27	***Rare or endangered fish/wildlife species found in the wetland?***	***End***	***Thr-SARA***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF28	***Overall fish and wildlife habitat quality***	***H***	***M***	L						
SECTION ELEVEN: COMMUNITY USE/VALUE										
1	Describe community use	VV__,CP__,CO__,PO__,PA__,,AV_x_,GB__,E__,HI__, WV__, BO__,HU__, PG_x_, BP_x_,F__, E__, R__, Other:								
SF29	***Rate the wetland's community use/value***	***H***	***M***	L						

SF ratings highlighted in red indicate critical wetland functions or watershed conditions that are highly degraded. Whenever a wetland is found to have red-highlighted **SFs** the proponent

APPENDIX D: WL12	Nova Scotia Wetland Evaluation Technique Field Data Sheet									
Project Name: Black Point Quarry		Evaluator: Scott Burley			GPS Coordinates: 644737 E x 5024077 N					
PID:35212497, 35212505, 35212521, 35212513, 35044056, 35214014, 35214022, 35214022 and 35213990		Site Address: Black Point, Guysborough County, NS								
Sources and Dates of Mapping/Images: NS Wetlands Inventory (2012); NS Forest Inventory (Current Forest Data - 2004); Google Earth (2003)										
Evaluation Date: 04-Sep-14		Site Visit Date: 21-Aug-14								
Weather Conditions (past 48 hours): Sun and Clouds										
Seasonal Weather Conditions: Typical										
SECTION ONE: WATERSHED CHARACTERISTICS										
1	Watershed Name (tertiary): 1EQ-SD	Size: 518 km^2								
2	% Watershed Land Cover	For: 43	Nat: 36	Past/Hay: <1	Crop: <1	Urb/Com: 2	Road: <1	Other Dev: <1 (Gravel Pit, Landfill, Industrial		
3	% Watershed WL Cover and by Class	Total: 10%	SM: <1	BO: 6	FE: 1	FM: 2	FS: 1	SS: 1	CP: <1	VP: Present
SF1	***Watershed condition***	***H***	***M***	***L***						
SF2	***Proportion of WL area in watershed & opportunity for floodwater detention***	***H***	***M***	***L***						
SECTION TWO: WETLAND CHARACTERISTICS										
Wetland Type: Bog/fen		WL size: 0.3 hectares			Landform: Basin			Landscape Position: Terrene outflow		
Water flow path: Outflow		Wetland Origin: Natural								
1	Water Regime	PF	SF	TF	SS	PS	RfT	IfT	AF	
2	# WL's within 30m project area	Total# 0	SM:	BO:	FE:	FM:	FS:	SS:	CP:	VP:
3	Is WL part of complex	Yes	No							
4	% each wetland type in complex	SM:	BO: 20	FE: 80	FM:	FS:	SS:	CP:	VP:	
5	Is WL bordering or associated with a lake or pond?	bordering		within 100m		N/A		specify		
6	Standing water?	Yes	Avg Dep:		% Inundated:		No			
7	Inlet or Outlet (circle all that apply)?	Inlet	Outlet							
8	Adjacent Upland Land Use within 100m (%)	For: 40	Nat: 60	PasHay:	Crop:	UrbCm:	Road:	Other Dev:		
9	Are there stressors in WL or WL buffer area? Circle primary stressor(s).	DD__, CW__, WcS__, O/C__,EB__,DP__,F__,M__, ES__,NE__,DwP__,								
		M__,GC__,ATV__,DG__,EA__, R__,Rr__,U/CD__,F__,FA__, other (specify): Skidder trail through wetland								
10	Hydrology Altered (circle all that apply)?	Ditching	Dams	Tiles	Culvert	Well	Diversion	Other Specify:		
SF3	***Rate the general wetland condition/integrity***	**H**	**M**	**L**						
SECTION THREE: ADJACENT LAND CONDITION AND INTEGRITY										
1	Average width of adjacent naturalized buffer	>1000__m								
2	Widths for water quality	H >15	M 8-15	L <8						
3	Widths for wildlife habitat	H >100	M 15-100	L <15						
4	Adjacent area vegetation condition (list % in each category)	H 100%	M	L						
5	Adjacent area diversity and structure (list % in each category)	H 100%	M	L						
6	Adjacent Upland Slope (list % in each category)	Steep 70%	Mod 25%	Gentle 5%						
7	Adjacent land supports water quality	*Yes*	*No*	Specify:						
8	Adjacent land supports wildlife habitat	*Yes*	*No*	Specify:						
SF4	***Rate the overall condition and integrity land adjacent to wetland***	***H***	***M***	***L***	**is buffer required to maintain red flag functions of wetland? If yes if no**					
SECTION FOUR: DOCUMENTED IMPORTANT FEATURES										
SF5	***Is the WL a WSS?***	***Yes***	***No***							

SF6	***Does the WL support commercial/recreational fish/shellfish?***	***Yes***	***No***						
SF7	***Species of concern (Fed/Prov)? Specify. Usnea flammea***	***End***	***Thr - SARA***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF8	***Wetland has conservation/compensation agreements/activity?***	***Yes***	***No***	specify:						
SF9	***Wetland is calcerous fen, black ash or cedar swamp?***	***Yes***	***No***							
SF10	***Within Drinking Water Protected Area (designated watershed/wellfield)***	***Yes***	***No***	specify:						
SF11	***WL within a floodplain and upstream of or within of a populated area?***	***Yes***	***No***							
SF12	***Fed/Prov/Municipal area of interest?***	***Yes***	***No***	specify:						
SECTION FIVE: HYDROLOGIC CONDITION AND INTEGRITY										
1	Is WL source of stream or headwater(wc order 1 or 2)	***Yes***	No	Specify:						
2	Is WL geographically isolated?	Yes	No	Specify:						
3	WL ability to maintain characteristic hydrologic regime	High		Med		Low				
4	Water Storage Depth (list % in each class)	>30cm	15-30cm	up to 15cm		No ponding				
5	Signs of surface water retention observed?	SW__cm, WSL__, WCD__, WM__cm, SM__cm, SD__, AD__, ID__, PMT_x_, AI__, BT__, AR__, Other:								
6	Describe observable/historical anthropogenic sediment delivery	Low		Med		High				
7	Disturbance of WL soils	Low		Med		High				
8	Predominant soils adjacent to WL	Sand		Silt/loam		Clay/bedrock				
9	Capacity of WL to alter/retard flows	High		Med		Low				
10	Roughness coefficient for surface water flow path	High		Med		Low				
11	Strormwater/Wastewater/Agricultural runoff detention	High		Med		Low				
12	Water Source	Natural		Mostly natural		Partly altered		Controlled		
13	Hydrology of tidal wetlands	Unrestricted		Reduced		Restricted		N/A		
14	Coastal storm surge	***Yes***	No							
SF13	***WL hydrologic condition***	***Natural***	***Modified***			**Significantly Modified**				
SF14	***WL important for maintaining stream flow?***	***Yes***	***No***							
SF15	***WL ability to detain surface water***	***High***	***Med***	**Low**						
SECTION SIX: WATER QUALITY										
1	Strormwater/Wastewater/Agricultural runoff as water source?	High		Med		Low				
2	Nutrients/sediments from surrounding land	High		Med		Low				
3	Significant flood/stormwater attenuation	***Yes***	***No***							
4	Vegetation capacity to settle suspended sediments	High		Med		Low				
5	WL type /landscape position holds/filters runoff?	***Yes***	***No***							
SF16	***Wetland improves water quality?***	***Yes***	***No***							
SF17	***Evidence of excess nutrient loading/contamination?***	***Low***	***Med***	***High***						
SF18	***WL contributes to water quality in downstream resources***	***High***	***Med***	***Low***						
SECTION SEVEN: GROUNDWATER INTERACTIONS										
1	Describe soils in wetland	Recharge		Discharge						
2	Land use / run off in subwatershed upstream	Recharge		Discharge						
3	Conditions of upland soils within 200m of wetland	Recharge		Discharge						
4	Hydroperiod of wetland	Recharge		Discharge						
5	Describe inlet/outlet configuration	Recharge		Discharge						
6	Characterize topographic relief surrounding wetland	Recharge		Discharge						

SF19	***WL serves as a recharge site***	***Yes***	***No***							
SF20	***WL serves as a discharge site***	***Yes***	***No***							
SECTION EIGHT: SHORELINE STABILIZATION AND INTEGRITY										
1	Wetland fringing ocean/estuary/lake/pond/river/stream?	***Yes***	No	streamwidth >4m		streamwidth<4m		WB Exposed	WB Sheltered	
2	% cover of rooted vegetation in shallow water zone	H >50%	M 10-50	L <10%						
3	Avg veg WL width b/w shoreline/streambank & 2 m depth contour	H >10m	M 3-10	L <3m						
4	Prevalence of strong-stemmed emerg. veg (shoreline marshes and fens only)	High	Med	Low						
5	Describe shoreline erosion potential	High	Med	Low						
6	Shoreline/streambank veg condition upslope of water level	Low	Med	High	Artificial					
SF21	***WL ability to stabilize shoreline***	***H***	***M***	***L***	N/A					
SECTION NINE: PLANT COMMUNITY										
1	Vegetation diversity	High	Med	Low						
1b	Dominant plant species and % cover in the WL	list: *Osmunda cinnamomea* (20%)/*Gaylussacia baccata* (40%)/ *Eriophorum virginicum* (10%)								
3	Dominant Non-native or Invasive species and % cover	Yes	No	specify: %						
4	Vegetation Disturbance	H	M	L	specify type(s) below					
5	Disturbance Types	H___,ATV___,G___,,M___,In__, D/D___, Im___, OAH___, Ii___, Sd___,E___,,other___,								
7	Vegetative Integrity of plant community	E	H	M	L					
SF22	***Is the plant community unique or rare regionally or provincially?***	***Yes***	***no***	***specify:***						
SF23	***Does the WL contain a diversity of plant communities***	***H***	***M***	***L***						
SF24	***Rate the overall integrity/quality of plant community?***	***H***	***M***	***L***						
SF25	***Are there any observed rare or endangered plant species? Specify.U.flammea***	***End***	***Thr***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SECTION TEN: FISH AND WILDLIFE HABITAT AND INTEGRITY										
1	Interspersion of open water and vegetation (open water types only)	H	M	L						
1b	% cover in vegetation verus open water	__100___%								
2	Interspersion that best fits entire wetland	H	M	L	N/A					
3	Wetland condition related to detritus	H	M	L	N/A					
4	Interspersion of other wetlands in vicinity	H	M	L						
6	Barriers/restriction between wetland and other habitat	L	M	H						
7	Noteworthy wildlife or evidence (birds, mammals, amphibians,etc)	Yes	No	list: Passerines,						
8	Connected to permanent water (accessible to fish)?	Exceptional	High	Med	Low	N/A				
9	Fish species observed or evidence seen (list)	Yes	No	list:						
10	Wetland part of contiguous upland or wetland:	>50ha	25-50ha	10-25ha	<10ha					
11	WL provides habitat for:	Amphibians	Reptiles	Waterfowl	Waterbirds	Mammals	Fish	R/E species		
SF26	***Does wetland support fish/fish habitat?***	***Yes***	***No***	***specify:***						
SF27	***Rare or endangered fish/wildlife species found in the wetland?***	***End***	***Thr-SARA***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF28	***Overall fish and wildlife habitat quality***	***H***	***M***	L						
SECTION ELEVEN: COMMUNITY USE/VALUE										
1	Describe community use	VV__,CP__,CO__,PO__,PA__,,AV__,GB__,E__,HI__, WV__, BO__,HU__, PG__, BP__,F__, E__, R__, Other:								
SF29	***Rate the wetland's community use/value***	***H***	***M***	L						

SF ratings highlighted in red indicate critical wetland functions or watershed conditions that are highly degraded. Whenever a wetland is found to have red-highlighted **SFs** the proponent

APPENDIX D: WL13	Nova Scotia Wetland Evaluation Technique Field Data Sheet									
Project Name: Black Point Quarry		Evaluator: Scott Burley			GPS Coordinates: 644860 E x 5023362 N					
PID:35212497, 35212505, 35212521, 35212513, 35044056, 35214014, 35214022, 35214022 and 35213990		Site Address: Black Point, Guysborough County, NS								
Sources and Dates of Mapping/Images: NS Wetlands Inventory (2012); NS Forest Inventory (Current Forest Data - 2004); Google Earth (2003)										
Evaluation Date: 04-Sep-14		Site Visit Date: 21-Aug-14								
Weather Conditions (past 48 hours): Sun and Clouds										
Seasonal Weather Conditions: Typical										
SECTION ONE: WATERSHED CHARACTERISTICS										
1	Watershed Name (tertiary): 1EQ-SD	Size: 518 km^2								
2	% Watershed Land Cover	For: 43	Nat: 36	Past/Hay: <1	Crop: <1	Urb/Com: 2	Road: <1	Other Dev: <1 (Gravel Pit, Landfill, Industrial		
3	% Watershed WL Cover and by Class	Total: 10%	SM: <1	BO: 6	FE: 1	FM: 2	FS: 1	SS: 1	CP: <1	VP: Present
SF1	***Watershed condition***	***H***	***M***	***L***						
SF2	***Proportion of WL area in watershed & opportunity for floodwater detention***	***H***	***M***	***L***						
SECTION TWO: WETLAND CHARACTERISTICS										
Wetland Type: Treed Swamp		WL size: 0.6 hectares			Landform: Slope			Landscape Position: Terrene		
Water flow path: Isolated		Wetland Origin: Natural								
1	Water Regime	PF	SF	TF	SS	PS	RfT	IfT	AF	
2	# WL's within 30m project area	Total# 0	SM:	BO:	FE:	FM:	FS:	SS:	CP:	VP:
3	Is WL part of complex	Yes	No							
4	% each wetland type in complex	SM:	BO:	FE:	FM:	FS: 100	SS:	CP:	VP:	
5	Is WL bordering or associated with a lake or pond?	bordering		within 100m		N/A		specify		
6	Standing water?	Yes	Avg Dep:		% Inundated:		No			
7	Inlet or Outlet (circle all that apply)?	Inlet	Outlet							
8	Adjacent Upland Land Use within 100m (%)	For: 20	Nat: 80	PasHay:	Crop:	UrbCm:	Road:	Other Dev:		
9	Are there stressors in WL or WL buffer area? Circle primary stressor(s).	DD__, CW__, WcS__, O/C__,EB__,DP__,F__,M__, ES__,NE__,DwP__,								
		M__,GC__,ATV__,DG__,EA__, R__,Rr__,U/CD__,F__,FA__, other (specify):								
10	Hydrology Altered (circle all that apply)?	Ditching	Dams	Tiles	Culvert	Well	Diversion	Other Specify:		
SF3	***Rate the general wetland condition/integrity***	**H**	**M**	**L**						
SECTION THREE: ADJACENT LAND CONDITION AND INTEGRITY										
1	Average width of adjacent naturalized buffer	>1000__m								
2	Widths for water quality	H >15	M 8-15	L <8						
3	Widths for wildlife habitat	H >100	M 15-100	L <15						
4	Adjacent area vegetation condition (list % in each category)	H 100%	M	L						
5	Adjacent area diversity and structure (list % in each category)	H 100%	M	L						
6	Adjacent Upland Slope (list % in each category)	Steep 10%	Mod 70%	Gentle 20%						
7	Adjacent land supports water quality	*Yes*	*No*	Specify:						
8	Adjacent land supports wildlife habitat	*Yes*	*No*	Specify:						
SF4	***Rate the overall condition and integrity land adjacent to wetland***	***H***	***M***	***L***	**is buffer required to maintain red flag functions of wetland? If yes if no**					
SECTION FOUR: DOCUMENTED IMPORTANT FEATURES										
SF5	***Is the WL a WSS?***	***Yes***	***No***							

SF6	***Does the WL support commercial/recreational fish/shellfish?***	***Yes***	***No***							
SF7	***Species of concern (Fed/Prov)? Specify.***	***End***	***Thr - SARA***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF8	***Wetland has conservation/compensation agreements/activity?***	***Yes***	***No***	specify:						
SF9	***Wetland is calcerous fen, black ash or cedar swamp?***	***Yes***	***No***							
SF10	***Within Drinking Water Protected Area (designated watershed/wellfield)***	***Yes***	***No***	specify:						
SF11	***WL within a floodplain and upstream of or within of a populated area?***	***Yes***	***No***							
SF12	***Fed/Prov/Municipal area of interest?***	***Yes***	***No***	specify:						
SECTION FIVE: HYDROLOGIC CONDITION AND INTEGRITY										
1	Is WL source of stream or headwater(wc order 1 or 2)	***Yes***	No	Specify:						
2	Is WL geographically isolated?	Yes	No	Specify:						
3	WL ability to maintain characteristic hydrologic regime	High		Med		Low				
4	Water Storage Depth (list % in each class)	>30cm	15-30cm	up to 15cm		No ponding				
5	Signs of surface water retention observed?	SW__cm, WSL__, WCD__, WM__cm, SM__cm, SD__, AD__, ID__, PMT_x_, AI__, BT__, AR__, Other:								
6	Describe observable/historical anthropogenic sediment delivery	Low		Med		High				
7	Disturbance of WL soils	Low		Med		High				
8	Predominant soils adjacent to WL	Sand		Silt/loam		Clay/bedrock				
9	Capacity of WL to alter/retard flows	High		Med		Low				
10	Roughness coefficient for surface water flow path	High		Med		Low				
11	Strormwater/Wastewater/Agricultural runoff detention	High		Med		Low				
12	Water Source	Natural		Mostly natural		Partly altered		Controlled		
13	Hydrology of tidal wetlands	Unrestricted		Reduced		Restricted		N/A		
14	Coastal storm surge	***Yes***	No							
SF13	***WL hydrologic condition***	***Natural***	***Modified***			***Significantly Modified***				
SF14	***WL important for maintaining stream flow?***	***Yes***	***No***							
SF15	***WL ability to detain surface water***	***High***	***Med***	***Low***						
SECTION SIX: WATER QUALITY										
1	Strormwater/Wastewater/Agricultural runoff as water source?	High		Med		Low				
2	Nutrients/sediments from surrounding land	High		Med		Low				
3	Significant flood/stormwater attenuation	***Yes***	***No***							
4	Vegetation capacity to settle suspended sediments	High		Med		Low				
5	WL type /landscape position holds/filters runoff?	***Yes***	***No***							
SF16	***Wetland improves water quality?***	***Yes***	***No***							
SF17	***Evidence of excess nutrient loading/contamination?***	***Low***	***Med***	***High***						
SF18	***WL contributes to water quality in downstream resources***	***High***	***Med***	***Low***						
SECTION SEVEN: GROUNDWATER INTERACTIONS										
1	Describe soils in wetland	Recharge		Discharge						
2	Land use / run off in subwatershed upstream	Recharge		Discharge						
3	Conditions of upland soils within 200m of wetland	Recharge		Discharge						
4	Hydroperiod of wetland	Recharge		Discharge						
5	Describe inlet/outlet configuration	Recharge		Discharge						
6	Characterize topographic relief surrounding wetland	Recharge		Discharge						

SF19	***WL serves as a recharge site***	***Yes***	***No***							
SF20	***WL serves as a discharge site***	***Yes***	***No***							
SECTION EIGHT: SHORELINE STABILIZATION AND INTEGRITY										
1	Wetland fringing ocean/estuary/lake/pond/river/stream?	***Yes***	No	streamwidth >4m	streamwidth<4m	WB Exposed	WB Sheltered			
2	% cover of rooted vegetation in shallow water zone	H >50%	M 10-50	L <10%						
3	Avg veg WL width b/w shoreline/streambank & 2 m depth contour	H >10m	M 3-10	L <3m						
4	Prevalence of strong-stemmed emerg. veg (shoreline marshes and fens only)	High	Med	Low						
5	Describe shoreline erosion potential	High	Med	Low						
6	Shoreline/streambank veg condition upslope of water level	Low	Med	High	Artificial					
SF21	***WL ability to stabilize shoreline***	***H***	***M***	***L***	N/A					
SECTION NINE: PLANT COMMUNITY										
1	Vegetation diversity	High	Med	Low						
1b	Dominant plant species and % cover in the WL	list: *Picea mariana* (60%)/*Acer rubrum* (30%)								
3	Dominant Non-native or Invasive species and % cover	Yes	No	specify: %						
4	Vegetation Disturbance	H	M	L	specify type(s) below					
5	Disturbance Types	H___,ATV___,G___,,M___,In__, D/D___, Im___, OAH___, Ii___, Sd___,E___,,other___,								
7	Vegetative Integrity of plant community	E	H	M	L					
SF22	***Is the plant community unique or rare regionally or provincially?***	***Yes***	***no***	***specify:***						
SF23	***Does the WL contain a diversity of plant communities***	***H***	***M***	***L***						
SF24	***Rate the overall integrity/quality of plant community?***	***H***	***M***	***L***						
SF25	***Are there any observed rare or endangered plant species? Specify.***	***End***	***Thr***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SECTION TEN: FISH AND WILDLIFE HABITAT AND INTEGRITY										
1	Interspersion of open water and vegetation (open water types only)	H	M	L						
1b	% cover in vegetation verus open water	__100___%								
2	Interspersion that best fits entire wetland	H	M	L	N/A					
3	Wetland condition related to detritus	H	M	L	N/A					
4	Interspersion of other wetlands in vicinity	H	M	L						
6	Barriers/restriction between wetland and other habitat	L	M	H						
7	Noteworthy wildlife or evidence (birds, mammals, amphibians,etc)	Yes	No	list: Passerines						
8	Connected to permanent water (accessible to fish)?	Exceptional	High	Med	Low	N/A				
9	Fish species observed or evidence seen (list)	Yes	No	list:						
10	Wetland part of contiguous upland or wetland:	>50ha	25-50ha	10-25ha	<10ha					
11	WL provides habitat for:	Amphibians	Reptiles	Waterfowl	Waterbirds	Mammals	Fish	R/E species		
SF26	***Does wetland support fish/fish habitat?***	***Yes***	***No***	***specify:***						
SF27	***Rare or endangered fish/wildlife species found in the wetland?***	***End***	***Thr-SARA***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF28	***Overall fish and wildlife habitat quality***	***H***	***M***	L						
SECTION ELEVEN: COMMUNITY USE/VALUE										
1	Describe community use	VV__,CP__,CO__,PO__,PA__,,AV__,GB__,E__,HI__, WV__, BO__,HU__, PG__, BP__,F__, E__, R__, Other:								
SF29	***Rate the wetland's community use/value***	***H***	***M***	L						

SF ratings highlighted in red indicate critical wetland functions or watershed conditions that are highly degraded. Whenever a wetland is found to have red-highlighted **SFs** the proponent

APPENDIX D: WL14	Nova Scotia Wetland Evaluation Technique Field Data Sheet									
Project Name: Black Point Quarry		Evaluator: Scott Burley			GPS Coordinates: 645506 E x 5023190 N					
PID:35212497, 35212505, 35212521, 35212513, 35044056, 35214014, 35214022, 35214022 and 35213990		Site Address: Black Point, Guysborough County, NS								
Sources and Dates of Mapping/Images: NS Wetlands Inventory (2012); NS Forest Inventory (Current Forest Data - 2004); Google Earth (2003)										
Evaluation Date: 04-Sep-14		Site Visit Date: 19-Aug-14								
Weather Conditions (past 48 hours): Periods of rain with clouds; sun and cloud										
Seasonal Weather Conditions: Typical										
SECTION ONE: WATERSHED CHARACTERISTICS										
1	Watershed Name (tertiary): 1EQ-SD	Size: 518 km^2								
2	% Watershed Land Cover	For: 43	Nat: 36	Past/Hay: <1	Crop: <1	Urb/Com: 2	Road: <1	Other Dev: <1 (Gravel Pit, Landfill, Industrial		
3	% Watershed WL Cover and by Class	Total: 10%	SM: <1	BO: 6	FE: 1	FM: 2	FS: 1	SS: 1	CP: <1	VP: Present
SF1	***Watershed condition***	***H***	***M***	***L***						
SF2	***Proportion of WL area in watershed & opportunity for floodwater detention***	***H***	***M***	***L***						
SECTION TWO: WETLAND CHARACTERISTICS										
Wetland Type: Fen/Bog		WL size: 6.2 hectares			Landform: Slope			Landscape Position: Lotic Stream-Confined		
Water flow path: Throughflow		Wetland Origin: Natural								
1	Water Regime	PF	SF	TF	SS	PS	RfT	IfT	AF	
2	# WL's within 30m project area	Total# 0	SM:	BO:	FE:	FM:	FS:	SS:	CP:	VP:
3	Is WL part of complex	Yes	No							
4	% each wetland type in complex	SM:	BO: 79	FE: 21	FM:	FS:	SS:	CP:	VP:	
5	Is WL bordering or associated with a lake or pond?	bordering		within 100m		N/A		specify:		
6	Standing water?	Yes	Avg Dep:		% Inundated:		No			
7	Inlet or Outlet (circle all that apply)?	Inlet	Outlet							
8	Adjacent Upland Land Use within 100m (%)	For: 80	Nat: 20	PasHay:	Crop:	UrbCm:	Road:	Other Dev:		
9	Are there stressors in WL or WL buffer area? Circle primary stressor(s).	DD__, CW__, WcS__, O/C__,EB__,DP__,F__,M__, ES__,NE__,DwP__,								
		M__,GC__,ATV__,DG_x_,EA__, R__,Rr__,U/CD__,F_x_,FA__, other (specify):								
10	Hydrology Altered (circle all that apply)?	Ditching	Dams	Tiles	Culvert	Well	Diversion	Other Specify:		
SF3	***Rate the general wetland condition/integrity***	**H**	**M**	**L**						
SECTION THREE: ADJACENT LAND CONDITION AND INTEGRITY										
1	Average width of adjacent naturalized buffer	>1000__m								
2	Widths for water quality	H >15	M 8-15	L <8						
3	Widths for wildlife habitat	H >100	M 15-100	L <15						
4	Adjacent area vegetation condition (list % in each category)	H 100%	M	L						
5	Adjacent area diversity and structure (list % in each category)	H 100%	M	L						
6	Adjacent Upland Slope (list % in each category)	Steep 5%	Mod 45%	Gentle 50%						
7	Adjacent land supports water quality	*Yes*	*No*	Specify:						
8	Adjacent land supports wildlife habitat	*Yes*	*No*	Specify:						
SF4	***Rate the overall condition and integrity land adjacent to wetland***	***H***	***M***	***L***	**is buffer required to maintain red flag functions of wetland? If yes if no**					
SECTION FOUR: DOCUMENTED IMPORTANT FEATURES										
SF5	***Is the WL a WSS?***	***Yes***	***No***							

SF6	***Does the WL support commercial/recreational fish/shellfish?***	***Yes***	***No***						
SF7	***Species of concern (Fed/Prov)? Specify.***	***End***	***Thr***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF8	***Wetland has conservation/compensation agreements/activity?***	***Yes***	***No***	specify:					
SF9	***Wetland is calcerous fen, black ash or cedar swamp?***	***Yes***	***No***						
SF10	***Within Drinking Water Protected Area (designated watershed/wellfield)***	***Yes***	***No***	specify:					
SF11	***WL within a floodplain and upstream of or within of a populated area?***	***Yes***	***No***						
SF12	***Fed/Prov/Municipal area of interest?***	***Yes***	***No***	specify:					
SECTION FIVE: HYDROLOGIC CONDITION AND INTEGRITY									
1	Is WL source of stream or headwater(wc order 1 or 2)	Yes	No	Specify: Unnamed stream flow thorugh wetland to the southeast					
2	Is WL geographically isolated?	Yes	No	Specify:					
3	WL ability to maintain characteristic hydrologic regime	High		Med		Low			
4	Water Storage Depth (list % in each class)	>30cm	15-30cm	up to 15cm		No ponding			
5	Signs of surface water retention observed?	SW__cm, WSL_x_, WCD__, WM__cm, SM__cm, SD__, AD__, ID__, PMT_x_, AI__, BT__, AR__, Other:							
6	Describe observable/historical anthropogenic sediment delivery	Low		Med		High			
7	Disturbance of WL soils	Low		Med		High			
8	Predominant soils adjacent to WL	Sand		Silt/loam		Clay/bedrock			
9	Capacity of WL to alter/retard flows	High		Med		Low			
10	Roughness coefficient for surface water flow path	High		Med		Low			
11	Strormwater/Wastewater/Agricultural runoff detention	High		Med		Low			
12	Water Source	Natural		Mostly natural		Partly altered		Controlled	
13	Hydrology of tidal wetlands	Unrestricted		Reduced		Restricted		N/A	
14	Coastal storm surge	Yes	No						
SF13	***WL hydrologic condition***	***Natural***	***Modified***		***Significantly Modified***				
SF14	***WL important for maintaining stream flow?***	***Yes***	***No***						
SF15	***WL ability to detain surface water***	***High***	***Med***	***Low***					
SECTION SIX: WATER QUALITY									
1	Strormwater/Wastewater/Agricultural runoff as water source?	High		Med		Low			
2	Nutrients/sediments from surrounding land	High		Med		Low			
3	Significant flood/stormwater attenuation	Yes	No						
4	Vegetation capacity to settle suspended sediments	High		Med		Low			
5	WL type /landscape position holds/filters runoff?	Yes	No						
SF16	***Wetland improves water quality?***	***Yes***	***No***						
SF17	***Evidence of excess nutrient loading/contamination?***	***Low***	***Med***	***High***					
SF18	***WL contributes to water quality in downstream resources***	***High***	***Med***	***Low***					
SECTION SEVEN: GROUNDWATER INTERACTIONS									
1	Describe soils in wetland	Recharge		Discharge					
2	Land use / run off in subwatershed upstream	Recharge		Discharge					
3	Conditions of upland soils within 200m of wetland	Recharge		Discharge					
4	Hydroperiod of wetland	Recharge		Discharge					
5	Describe inlet/outlet configuration	Recharge		Discharge					
6	Characterize topographic relief surrounding wetland	Recharge		Discharge					

SF19	***WL serves as a recharge site***	***Yes***	***No***							
SF20	***WL serves as a discharge site***	***Yes***	***No***							
SECTION EIGHT: SHORELINE STABILIZATION AND INTEGRITY										
1	Wetland fringing ocean/estuary/lake/pond/river/stream?	***Yes***	No	streamwidth >4m		streamwidth<4m		WB Exposed	WB Sheltered	
2	% cover of rooted vegetation in shallow water zone	H >50%	M 10-50	L <10%						
3	Avg veg WL width b/w shoreline/streambank & 2 m depth contour	H >10m	M 3-10	L <3m						
4	Prevalence of strong-stemmed emerg. veg (shoreline marshes and fens only)	High	Med	Low						
5	Describe shoreline erosion potential	High	Med	Low						
6	Shoreline/streambank veg condition upslope of water level	Low	Med	High	Artificial					
SF21	***WL ability to stabilize shoreline***	***H***	***M***	***L***	N/A					
SECTION NINE: PLANT COMMUNITY										
1	Vegetation diversity	High	Med	Low						
1b	Dominant plant species and % cover in the WL	list: *Gaylussacia baccata* (30%)/*Morella pensylvanica* (20%)/ *Eriophorum virginicum* (15%)								
3	Dominant Non-native or Invasive species and % cover	Yes	No	specify: %						
4	Vegetation Disturbance	H	M	L	Specify type(s) below:					
5	Disturbance Types	H___,ATV___,G___,,M___,In__, D/D___, Im___, OAH___, Ii___, Sd___,E___,,other___,								
7	Vegetative Integrity of plant community	E	H	M	L					
SF22	***Is the plant community unique or rare regionally or provincially?***	***Yes***	***no***	***specify:***						
SF23	***Does the WL contain a diversity of plant communities***	***H***	***M***	***L***						
SF24	***Rate the overall integrity/quality of plant community?***	***H***	***M***	***L***						
SF25	***Are there any observed rare or endangered plant species? Specify.***	***End***	***Thr***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SECTION TEN: FISH AND WILDLIFE HABITAT AND INTEGRITY										
1	Interspersion of open water and vegetation (open water types only)	H	M	L						
1b	% cover in vegetation verus open water	__85___%								
2	Interspersion that best fits entire wetland	H	M	L	N/A					
3	Wetland condition related to detritus	H	M	L	N/A					
4	Interspersion of other wetlands in vicinity	H	M	L						
6	Barriers/restriction between wetland and other habitat	L	M	H						
7	Noteworthy wildlife or evidence (birds, mammals, amphibians,etc)	Yes	No	list: Dragon flies, Passerines						
8	Connected to permanent water (accessible to fish)?	Exceptional	High	Med	Low	N/A				
9	Fish species observed or evidence seen (list)	Yes	No	list:						
10	Wetland part of contiguous upland or wetland:	>50ha	25-50ha	10-25ha	<10ha					
11	WL provides habitat for:	Amphibians	Reptiles	Waterfowl	Waterbirds	Mammals	Fish	R/E species		
SF26	***Does wetland support fish/fish habitat?***	***Yes***	***No***	***specify:***						
SF27	***Rare or endangered fish/wildlife species found in the wetland?***	***End***	***Thr***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF28	***Overall fish and wildlife habitat quality***	***H***	***M***	L						
SECTION ELEVEN: COMMUNITY USE/VALUE										
1	Describe community use	VV__,CP__,CO__,PO__,PA__,,AV__,GB__,E__,HI__, WV__, BO__,HU__, PG__, BP__,F__, E__, R__, Other:								
SF29	***Rate the wetland's community use/value***	***H***	***M***	L						

SF ratings highlighted in red indicate critical wetland functions or watershed conditions that are highly degraded. Whenever a wetland is found to have red-highlighted **SFs** the proponent

APPENDIX D: WL15	**Nova Scotia Wetland Evaluation Technique Field Data Sheet**									
Project Name: Black Point Quarry		Evaluator: Scott Burley			GPS Coordinates: 645265 E x 5023544 N					
PID:35212497, 35212505, 35212521, 35212513, 35044056, 35214014, 35214022, 35214022 and 35213990			Site Address: Black Point, Guysborough County, NS							
Sources and Dates of Mapping/Images: NS Wetlands Inventory (2012); NS Forest Inventory (Current Forest Data - 2004); Google Earth (2003)										
Evaluation Date: 10-Sep-14		Site Visit Date: 21-Aug-14								
Weather Conditions (past 48 hours): Sun and Clouds										
Seasonal Weather Conditions: Typical										
SECTION ONE: WATERSHED CHARACTERISTICS										
1	Watershed Name (tertiary): 1EQ-SD	Size: 518 km^2								
2	% Watershed Land Cover	For: 43	Nat: 36	Past/Hay: <1	Crop: <1	Urb/Com: 2	Road: <1	Other Dev: <1 (Gravel Pit, Landfill, Industrial		
3	% Watershed WL Cover and by Class	Total: 10%	SM: <1	BO: 6	FE: 1	FM: 2	FS: 1	SS: 1	CP: <1	VP: Present
SF1	***Watershed condition***	***H***	***M***	***L***						
SF2	***Proportion of WL area in watershed & opportunity for floodwater detention***	***H***	***M***	***L***						
SECTION TWO: WETLAND CHARACTERISTICS										
Wetland Type: Fen		WL size: 0.07 hectares			Landform: Slope			Landscape Position: Lotic Stream-Confined		
Water flow path: Throughflow		Wetland Origin: Natural								
1	Water Regime	PF	SF	TF	SS	PS	RfT	IfT	AF	
2	# WL's within 30m project area	Total# 0	SM:	BO:	FE:	FM:	FS:	SS:	CP:	VP:
3	Is WL part of complex	Yes	No							
4	% each wetland type in complex	SM:	BO:	FE: 100	FM:	FS:	SS:	CP:	VP:	
5	Is WL bordering or associated with a lake or pond?	bordering		within 100m		N/A		specify		
6	Standing water?	Yes	Avg Dep: 5-10		% Inundated: <5%		No			
7	Inlet or Outlet (circle all that apply)?	Inlet	Outlet							
8	Adjacent Upland Land Use within 100m (%)	For: 30	Nat: 70	PasHay:	Crop:	UrbCm:	Road:	Other Dev:		
9	Are there stressors in WL or WL buffer area? Circle primary stressor(s).	DD__, CW__, WcS__, O/C__,EB__,DP__,F__,M__, ES__,NE__,DwP__,								
		M__,GC__,ATV__,DG__,EA__, R__,Rr__,U/CD__,F__,FA__, other (specify): Skidder track though south side of wetland								
10	Hydrology Altered (circle all that apply)?	Ditching	Dams	Tiles	Culvert	Well	Diversion	Other Specify:		
SF3	***Rate the general wetland condition/integrity***	**H**	**M**	**L**						
SECTION THREE: ADJACENT LAND CONDITION AND INTEGRITY										
1	Average width of adjacent naturalized buffer	>1000__m								
2	Widths for water quality	H >15	M 8-15	L <8						
3	Widths for wildlife habitat	H >100	M 15-100	L <15						
4	Adjacent area vegetation condition (list % in each category)	H 100%	M	L						
5	Adjacent area diversity and structure (list % in each category)	H 100%	M	L						
6	Adjacent Upland Slope (list % in each category)	Steep 60%	Mod 30%	Gentle 10%						
7	Adjacent land supports water quality	*Yes*	*No*	Specify:						
8	Adjacent land supports wildlife habitat	*Yes*	*No*	Specify:						
SF4	***Rate the overall condition and integrity land adjacent to wetland***	***H***	***M***	***L***	**is buffer required to maintain red flag functions of wetland? If yes if no**					
SECTION FOUR: DOCUMENTED IMPORTANT FEATURES										
SF5	***Is the WL a WSS?***	***Yes***	***No***							

SF6	***Does the WL support commercial/recreational fish/shellfish?***	***Yes***	***No***						
SF7	***Species of concern (Fed/Prov)? Specify.***	***End***	***Thr - SARA***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF8	***Wetland has conservation/compensation agreements/activity?***	***Yes***	***No***	specify:					
SF9	***Wetland is calcerous fen, black ash or cedar swamp?***	***Yes***	***No***						
SF10	***Within Drinking Water Protected Area (designated watershed/wellfield)***	***Yes***	***No***	specify:					
SF11	***WL within a floodplain and upstream of or within of a populated area?***	***Yes***	***No***						
SF12	***Fed/Prov/Municipal area of interest?***	***Yes***	***No***	specify:					
SECTION FIVE: HYDROLOGIC CONDITION AND INTEGRITY									
1	Is WL source of stream or headwater(wc order 1 or 2)	***Yes***	No	Specify:					
2	Is WL geographically isolated?	Yes	No	Specify:					
3	WL ability to maintain characteristic hydrologic regime	High		Med		Low			
4	Water Storage Depth (list % in each class)	>30cm	15-30cm	up to 15cm		No ponding			
5	Signs of surface water retention observed?	SW_5_cm, WSL__, WCD__, WM__cm, SM__cm, SD__, AD__, ID__, PMT_x_, AI__, BT__, AR__, Other:							
6	Describe observable/historical anthropogenic sediment delivery	Low		Med		High			
7	Disturbance of WL soils	Low		Med		High			
8	Predominant soils adjacent to WL	Sand		Silt/loam		Clay/bedrock			
9	Capacity of WL to alter/retard flows	High		Med		Low			
10	Roughness coefficient for surface water flow path	High		Med		Low			
11	Strormwater/Wastewater/Agricultural runoff detention	High		Med		Low			
12	Water Source	Natural		Mostly natural		Partly altered		Controlled	
13	Hydrology of tidal wetlands	Unrestricted		Reduced		Restricted		N/A	
14	Coastal storm surge	***Yes***	No						
SF13	***WL hydrologic condition***	***Natural***	***Modified***			**Significantly Modified**			
SF14	***WL important for maintaining stream flow?***	***Yes***	***No***						
SF15	***WL ability to detain surface water***	***High***	***Med***	**Low**					
SECTION SIX: WATER QUALITY									
1	Strormwater/Wastewater/Agricultural runoff as water source?	High		Med		Low			
2	Nutrients/sediments from surrounding land	High		Med		Low			
3	Significant flood/stormwater attenuation	***Yes***	***No***						
4	Vegetation capacity to settle suspended sediments	High		Med		Low			
5	WL type /landscape position holds/filters runoff?	***Yes***	***No***						
SF16	***Wetland improves water quality?***	***Yes***	***No***						
SF17	***Evidence of excess nutrient loading/contamination?***	***Low***	***Med***	***High***					
SF18	***WL contributes to water quality in downstream resources***	***High***	***Med***	***Low***					
SECTION SEVEN: GROUNDWATER INTERACTIONS									
1	Describe soils in wetland	Recharge		Discharge					
2	Land use / run off in subwatershed upstream	Recharge		Discharge					
3	Conditions of upland soils within 200m of wetland	Recharge		Discharge					
4	Hydroperiod of wetland	Recharge		Discharge					
5	Describe inlet/outlet configuration	Recharge		Discharge					
6	Characterize topographic relief surrounding wetland	Recharge		Discharge					

SF19	***WL serves as a recharge site***	***Yes***	***No***							
SF20	***WL serves as a discharge site***	***Yes***	***No***							
SECTION EIGHT: SHORELINE STABILIZATION AND INTEGRITY										
1	Wetland fringing ocean/estuary/lake/pond/river/stream?	***Yes***	No	streamwidth >4m	streamwidth<4m	WB Exposed	WB Sheltered			
2	% cover of rooted vegetation in shallow water zone	H >50%	M 10-50	L <10%						
3	Avg veg WL width b/w shoreline/streambank & 2 m depth contour	H >10m	M 3-10	L <3m						
4	Prevalence of strong-stemmed emerg. veg (shoreline marshes and fens only)	High	Med	Low						
5	Describe shoreline erosion potential	High	Med	Low						
6	Shoreline/streambank veg condition upslope of water level	Low	Med	High	Artificial					
SF21	***WL ability to stabilize shoreline***	***H***	***M***	***L***	N/A					
SECTION NINE: PLANT COMMUNITY										
1	Vegetation diversity	High	Med	Low						
1b	Dominant plant species and % cover in the WL	list: *Nemopanthes mucronata* (10%)/*Osmunda cinnamomea* (20%)/ *Myrica gale* (20%)								
3	Dominant Non-native or Invasive species and % cover	Yes	No	specify: %						
4	Vegetation Disturbance	H	M	L	specify type(s) below					
5	Disturbance Types	H___,ATV___,G___,,M___,In__, D/D___, Im___, OAH___, Ii___, Sd___,E___,,other_x__, Skidder trail								
7	Vegetative Integrity of plant community	E	H	M	L					
SF22	***Is the plant community unique or rare regionally or provincially?***	***Yes***	***no***	***specify:***						
SF23	***Does the WL contain a diversity of plant communities***	***H***	***M***	***L***						
SF24	***Rate the overall integrity/quality of plant community?***	***H***	***M***	***L***						
SF25	***Are there any observed rare or endangered plant species? Specify.***	***End***	***Thr***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SECTION TEN: FISH AND WILDLIFE HABITAT AND INTEGRITY										
1	Interspersion of open water and vegetation (open water types only)	H	M	L						
1b	% cover in vegetation verus open water	__95__%								
2	Interspersion that best fits entire wetland	H	M	L	N/A					
3	Wetland condition related to detritus	H	M	L	N/A					
4	Interspersion of other wetlands in vicinity	H	M	L						
6	Barriers/restriction between wetland and other habitat	L	M	H						
7	Noteworthy wildlife or evidence (birds, mammals, amphibians,etc)	Yes	No	list: Passerines						
8	Connected to permanent water (accessible to fish)?	Exceptional	High	Med	Low	N/A				
9	Fish species observed or evidence seen (list)	Yes	No	list:						
10	Wetland part of contiguous upland or wetland:	>50ha	25-50ha	10-25ha	<10ha					
11	WL provides habitat for:	Amphibians	Reptiles	Waterfowl	Waterbirds	Mammals	Fish	R/E species		
SF26	***Does wetland support fish/fish habitat?***	***Yes***	***No***	***specify:***						
SF27	***Rare or endangered fish/wildlife species found in the wetland?***	***End***	***Thr-SARA***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF28	***Overall fish and wildlife habitat quality***	***H***	***M***	L						
SECTION ELEVEN: COMMUNITY USE/VALUE										
1	Describe community use	VV__,CP__,CO__,PO__,PA__,,AV__,GB__,E__,HI__, WV__, BO__,HU__, PG__, BP__,F__, E__, R__, Other:								
SF29	***Rate the wetland's community use/value***	***H***	***M***	L						

SF ratings highlighted in red indicate critical wetland functions or watershed conditions that are highly degraded. Whenever a wetland is found to have red-highlighted **SFs** the proponent

APPENDIX D: WL16	**Nova Scotia Wetland Evaluation Technique Field Data Sheet**									
Project Name: Black Point Quarry		Evaluator: Scott Burley			GPS Coordinates: 645920 E x 5022505 N					
PID:35212497, 35212505, 35212521, 35212513, 35044056, 35214014, 35214022, 35214022 and 35213990			Site Address: Black Point, Guysborough County, NS							
Sources and Dates of Mapping/Images: NS Wetlands Inventory (2012); NS Forest Inventory (Current Forest Data - 2004); Google Earth (2003)										
Evaluation Date: 10-Sep-14		Site Visit Date: 19-Aug-14								
Weather Conditions (past 48 hours): Periods of rain; Sun and Clouds										
Seasonal Weather Conditions: Typical										
SECTION ONE: WATERSHED CHARACTERISTICS										
1	Watershed Name (tertiary): 1EQ-SD	Size: 518 km^2								
2	% Watershed Land Cover	For: 43	Nat: 36	Past/Hay: <1	Crop: <1	Urb/Com: 2	Road: <1	Other Dev: <1 (Gravel Pit, Landfill, Industrial		
3	% Watershed WL Cover and by Class	Total: 10%	SM: <1	BO: 6	FE: 1	FM: 2	FS: 1	SS: 1	CP: <1	VP: Present
SF1	***Watershed condition***	***H***	***M***	***L***						
SF2	***Proportion of WL area in watershed & opportunity for floodwater detention***	***H***	***M***	***L***						
SECTION TWO: WETLAND CHARACTERISTICS										
Wetland Type: Bog		WL size: 0.45 hectares			Landform: Basin			Landscape Position: Terrene		
Water flow path: Isolated		Wetland Origin: Natural								
1	Water Regime	PF	SF	TF	SS	PS	RfT	IfT	AF	
2	# WL's within 30m project area	Total# 0	SM:	BO:	FE:	FM:	FS:	SS:	CP:	VP:
3	Is WL part of complex	Yes	No							
4	% each wetland type in complex	SM:	BO: 100	FE:	FM:	FS:	SS:	CP:	VP:	
5	Is WL bordering or associated with a lake or pond?	bordering		within 100m		N/A		specify		
6	Standing water?	Yes	Avg Dep: 0-10 cm		% Inundated: 5%		No			
7	Inlet or Outlet (circle all that apply)?	Inlet	Outlet							
8	Adjacent Upland Land Use within 100m (%)	For: 90	Nat:	PasHay:	Crop:	UrbCm:	Road:	Other Dev: 10% Power line corridor		
9	Are there stressors in WL or WL buffer area? Circle primary stressor(s).	DD__, CW__, WcS__, O/C__,EB__,DP__,F__,M__, ES__,NE__,DwP__,								
		M__,GC__,ATV__,DG__,EA__, R__,Rr__,U/CD__,F__,FA__, other (specify):								
10	Hydrology Altered (circle all that apply)?	Ditching	Dams	Tiles	Culvert	Well	Diversion	Other Specify:		
SF3	***Rate the general wetland condition/integrity***	**H**	**M**	**L**						
SECTION THREE: ADJACENT LAND CONDITION AND INTEGRITY										
1	Average width of adjacent naturalized buffer	>1000__m								
2	Widths for water quality	H >15	M 8-15	L <8						
3	Widths for wildlife habitat	H >100	M 15-100	L <15						
4	Adjacent area vegetation condition (list % in each category)	H 100%	M	L						
5	Adjacent area diversity and structure (list % in each category)	H 100%	M	L						
6	Adjacent Upland Slope (list % in each category)	Steep 70%	Mod 20%	Gentle 10%						
7	Adjacent land supports water quality	*Yes*	*No*	Specify:						
8	Adjacent land supports wildlife habitat	*Yes*	*No*	Specify:						
SF4	***Rate the overall condition and integrity land adjacent to wetland***	***H***	***M***	***L***	**is buffer required to maintain red flag functions of wetland? If yes if no**					
SECTION FOUR: DOCUMENTED IMPORTANT FEATURES										
SF5	***Is the WL a WSS?***	***Yes***	***No***							

SF6	***Does the WL support commercial/recreational fish/shellfish?***	***Yes***	***No***							
SF7	***Species of concern (Fed/Prov)? Specify.***	***End***	***Thr - SARA***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF8	***Wetland has conservation/compensation agreements/activity?***	***Yes***	***No***	specify:						
SF9	***Wetland is calcerous fen, black ash or cedar swamp?***	***Yes***	***No***							
SF10	***Within Drinking Water Protected Area (designated watershed/wellfield)***	***Yes***	***No***	specify:						
SF11	***WL within a floodplain and upstream of or within of a populated area?***	***Yes***	***No***							
SF12	***Fed/Prov/Municipal area of interest?***	***Yes***	***No***	specify:						
SECTION FIVE: HYDROLOGIC CONDITION AND INTEGRITY										
1	Is WL source of stream or headwater(wc order 1 or 2)	***Yes***	No	Specify:						
2	Is WL geographically isolated?	Yes	No	Specify:						
3	WL ability to maintain characteristic hydrologic regime	High		Med		Low				
4	Water Storage Depth (list % in each class)	>30cm	15-30cm	up to 15cm		No ponding				
5	Signs of surface water retention observed?	SW_5_cm, WSL__, WCD__, WM__cm, SM__cm, SD__, AD__, ID__, PMT_x_, AI__, BT__, AR__, Other:								
6	Describe observable/historical anthropogenic sediment delivery	Low		Med		High				
7	Disturbance of WL soils	Low		Med		High				
8	Predominant soils adjacent to WL	Sand		Silt/loam		Clay/bedrock				
9	Capacity of WL to alter/retard flows	High		Med		Low				
10	Roughness coefficient for surface water flow path	High		Med		Low				
11	Strormwater/Wastewater/Agricultural runoff detention	High		Med		Low				
12	Water Source	Natural		Mostly natural		Partly altered		Controlled		
13	Hydrology of tidal wetlands	Unrestricted		Reduced		Restricted		N/A		
14	Coastal storm surge	***Yes***	No							
SF13	***WL hydrologic condition***	***Natural***	***Modified***			**Significantly Modified**				
SF14	***WL important for maintaining stream flow?***	***Yes***	***No***							
SF15	***WL ability to detain surface water***	***High***	***Med***	**Low**						
SECTION SIX: WATER QUALITY										
1	Strormwater/Wastewater/Agricultural runoff as water source?	High		Med		Low				
2	Nutrients/sediments from surrounding land	High		Med		Low				
3	Significant flood/stormwater attenuation	***Yes***	***No***							
4	Vegetation capacity to settle suspended sediments	High		Med		Low				
5	WL type /landscape position holds/filters runoff?	***Yes***	***No***							
SF16	***Wetland improves water quality?***	***Yes***	***No***							
SF17	***Evidence of excess nutrient loading/contamination?***	***Low***	***Med***	***High***						
SF18	***WL contributes to water quality in downstream resources***	***High***	***Med***	***Low***						
SECTION SEVEN: GROUNDWATER INTERACTIONS										
1	Describe soils in wetland	Recharge		Discharge						
2	Land use / run off in subwatershed upstream	Recharge		Discharge						
3	Conditions of upland soils within 200m of wetland	Recharge		Discharge						
4	Hydroperiod of wetland	Recharge		Discharge						
5	Describe inlet/outlet configuration	Recharge		Discharge						
6	Characterize topographic relief surrounding wetland	Recharge		Discharge						

SF19	***WL serves as a recharge site***	***Yes***	***No***	Possible recharge wetland						
SF20	***WL serves as a discharge site***	***Yes***	***No***							
SECTION EIGHT: SHORELINE STABILIZATION AND INTEGRITY										
1	Wetland fringing ocean/estuary/lake/pond/river/stream?	***Yes***	No	streamwidth >4m	streamwidth<4m	WB Exposed	WB Sheltered			
2	% cover of rooted vegetation in shallow water zone	H >50%	M 10-50	L <10%						
3	Avg veg WL width b/w shoreline/streambank & 2 m depth contour	H >10m	M 3-10	L <3m						
4	Prevalence of strong-stemmed emerg. veg (shoreline marshes and fens only)	High	Med	Low						
5	Describe shoreline erosion potential	High	Med	Low						
6	Shoreline/streambank veg condition upslope of water level	Low	Med	High	Artificial					
SF21	***WL ability to stabilize shoreline***	***H***	***M***	***L***	N/A					
SECTION NINE: PLANT COMMUNITY										
1	Vegetation diversity	High	Med	Low						
1b	Dominant plant species and % cover in the WL	list: *Picea mariana* (40%)/*Mainanthemum trifolium* (20%)								
3	Dominant Non-native or Invasive species and % cover	Yes	No	specify: %						
4	Vegetation Disturbance	H	M	L	specify type(s) below					
5	Disturbance Types	H___,ATV___,G___,,M___,In__, D/D___, Im___, OAH___, Ii___, Sd___,E___,,other___,								
7	Vegetative Integrity of plant community	E	H	M	L					
SF22	***Is the plant community unique or rare regionally or provincially?***	***Yes***	***no***	***specify:***						
SF23	***Does the WL contain a diversity of plant communities***	***H***	***M***	***L***						
SF24	***Rate the overall integrity/quality of plant community?***	***H***	***M***	***L***						
SF25	***Are there any observed rare or endangered plant species? Specify.***	***End***	***Thr***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SECTION TEN: FISH AND WILDLIFE HABITAT AND INTEGRITY										
1	Interspersion of open water and vegetation (open water types only)	H	M	L						
1b	% cover in vegetation verus open water	__95__%								
2	Interspersion that best fits entire wetland	H	M	L	N/A					
3	Wetland condition related to detritus	H	M	L	N/A					
4	Interspersion of other wetlands in vicinity	H	M	L						
6	Barriers/restriction between wetland and other habitat	L	M	H						
7	Noteworthy wildlife or evidence (birds, mammals, amphibians,etc)	Yes	No	list: Passerines, Deer, Dragonflies, Moose tracks						
8	Connected to permanent water (accessible to fish)?	Exceptional	High	Med	Low	N/A				
9	Fish species observed or evidence seen (list)	Yes	No	list:						
10	Wetland part of contiguous upland or wetland:	>50ha	25-50ha	10-25ha	<10ha					
11	WL provides habitat for:	Amphibians	Reptiles	Waterfowl	Waterbirds	Mammals	Fish	R/E species		
SF26	***Does wetland support fish/fish habitat?***	***Yes***	***No***	***specify:***						
SF27	***Rare or endangered fish/wildlife species found in the wetland?***	***End***	***Thr-SARA***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF28	***Overall fish and wildlife habitat quality***	***H***	***M***	L						
SECTION ELEVEN: COMMUNITY USE/VALUE										
1	Describe community use	VV__,CP__,CO__,PO__,PA__,,AV__,GB__,E__,HI__, WV__, BO__,HU__, PG__, BP__,F__, E__, R__, Other:								
SF29	***Rate the wetland's community use/value***	***H***	***M***	L						

SF ratings highlighted in red indicate critical wetland functions or watershed conditions that are highly degraded. Whenever a wetland is found to have red-highlighted **SFs** the proponent

APPENDIX D: WL17	Nova Scotia Wetland Evaluation Technique Field Data Sheet									
Project Name: Black Point Quarry		Evaluator: Scott Burley			GPS Coordinates: 644193 E x 5021827 N					
PID:35212497, 35212505, 35212521, 35212513, 35044056, 35214014, 35214022, 35214022 and 35213990		Site Address: Black Point, Guysborough County, NS								
Sources and Dates of Mapping/Images: NS Wetlands Inventory (2012); NS Forest Inventory (Current Forest Data - 2004); Google Earth (2003)										
Evaluation Date: 10-Sep-14		Site Visit Date: 18-Aug-14								
Weather Conditions (past 48 hours): sun and cloud; Periods of rain with clouds										
Seasonal Weather Conditions: Typical										
SECTION ONE: WATERSHED CHARACTERISTICS										
1	Watershed Name (tertiary): 1EQ-SD	Size: 518 km^2								
2	% Watershed Land Cover	For: 43	Nat: 36	Past/Hay: <1	Crop: <1	Urb/Com: 2	Road: <1	Other Dev: <1 (Gravel Pit, Landfill, Industrial		
3	% Watershed WL Cover and by Class	Total: 10%	SM: <1	BO: 6	FE: 1	FM: 2	FS: 1	SS: 1	CP: <1	VP: Present
SF1	***Watershed condition***	***H***	***M***	***L***						
SF2	***Proportion of WL area in watershed & opportunity for floodwater detention***	***H***	***M***	***L***						
SECTION TWO: WETLAND CHARACTERISTICS										
Wetland Type: Bog/Swamp		WL size: 0.74 hectares			Landform: Basin			Landscape Position: Terrene Outflow		
Water flow path: Outflow		Wetland Origin: Natural								
1	Water Regime	PF	SF	TF	SS	PS	RfT	IfT	AF	
2	# WL's within 30m project area	Total# 0	SM:	BO:	FE:	FM:	FS:	SS:	CP:	VP:
3	Is WL part of complex	Yes	No							
4	% each wetland type in complex	SM:	BO: 64	FE:	FM:	FS: 36	SS:	CP:	VP:	
5	Is WL bordering or associated with a lake or pond?	bordering		within 100m		N/A		specify:		
6	Standing water?	Yes	Avg Dep:		% Inundated:		No			
7	Inlet or Outlet (circle all that apply)?	Inlet	Outlet							
8	Adjacent Upland Land Use within 100m (%)	For: 80	Nat: 20	PasHay:	Crop:	UrbCm:	Road:	Other Dev:		
9	Are there stressors in WL or WL buffer area? Circle primary stressor(s).	DD__, CW__, WcS__, O/C__,EB__,DP__,F__,M__, ES__,NE__,DwP__,								
		M__,GC__,ATV__,DG__,EA__, R__,Rr__,U/CD__,F_x_,FA__, other (specify):								
10	Hydrology Altered (circle all that apply)?	Ditching	Dams	Tiles	Culvert	Well	Diversion	Other Specify:		
SF3	***Rate the general wetland condition/integrity***	**H**	**M**	**L**						
SECTION THREE: ADJACENT LAND CONDITION AND INTEGRITY										
1	Average width of adjacent naturalized buffer	>1000__m								
2	Widths for water quality	H >15	M 8-15	L <8						
3	Widths for wildlife habitat	H >100	M 15-100	L <15						
4	Adjacent area vegetation condition (list % in each category)	H 100%	M	L						
5	Adjacent area diversity and structure (list % in each category)	H 100%	M	L						
6	Adjacent Upland Slope (list % in each category)	Steep 60%	Mod 20%	Gentle 20%						
7	Adjacent land supports water quality	*Yes*	*No*	Specify:						
8	Adjacent land supports wildlife habitat	*Yes*	*No*	Specify:						
SF4	***Rate the overall condition and integrity land adjacent to wetland***	***H***	***M***	***L***	**is buffer required to maintain red flag functions of wetland? If yes if no**					
SECTION FOUR: DOCUMENTED IMPORTANT FEATURES										
SF5	***Is the WL a WSS?***	***Yes***	***No***							

SF6	***Does the WL support commercial/recreational fish/shellfish?***	***Yes***	***No***						
SF7	***Species of concern (Fed/Prov)? Specify. Nephroma bellum; Usnea flammea***	***End***	***Thr***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF8	***Wetland has conservation/compensation agreements/activity?***	***Yes***	***No***	specify:						
SF9	***Wetland is calcerous fen, black ash or cedar swamp?***	***Yes***	***No***							
SF10	***Within Drinking Water Protected Area (designated watershed/wellfield)***	***Yes***	***No***	specify:						
SF11	***WL within a floodplain and upstream of or within of a populated area?***	***Yes***	***No***							
SF12	***Fed/Prov/Municipal area of interest?***	***Yes***	***No***	specify:						
SECTION FIVE: HYDROLOGIC CONDITION AND INTEGRITY										
1	Is WL source of stream or headwater(wc order 1 or 2)	Yes	No	Specify:						
2	Is WL geographically isolated?	Yes	No	Specify:						
3	WL ability to maintain characteristic hydrologic regime	High		Med		Low				
4	Water Storage Depth (list % in each class)	>30cm	15-30cm	up to 15cm		No ponding				
5	Signs of surface water retention observed?	SW__cm, WSL_x_, WCD__, WM__cm, SM__cm, SD__, AD__, ID__, PMT__, AI__, BT__, AR__, Other:								
6	Describe observable/historical anthropogenic sediment delivery	Low		Med		High				
7	Disturbance of WL soils	Low		Med		High				
8	Predominant soils adjacent to WL	Sand		Silt/loam		Clay/bedrock				
9	Capacity of WL to alter/retard flows	High		Med		Low				
10	Roughness coefficient for surface water flow path	High		Med		Low				
11	Strormwater/Wastewater/Agricultural runoff detention	High		Med		Low				
12	Water Source	Natural		Mostly natural		Partly altered		Controlled		
13	Hydrology of tidal wetlands	Unrestricted		Reduced		Restricted		N/A		
14	Coastal storm surge	Yes	No							
SF13	***WL hydrologic condition***	***Natural***	***Modified***			**Significantly Modified**				
SF14	***WL important for maintaining stream flow?***	***Yes***	***No***							
SF15	***WL ability to detain surface water***	***High***	***Med***	**Low**						
SECTION SIX: WATER QUALITY										
1	Strormwater/Wastewater/Agricultural runoff as water source?	High		Med		Low				
2	Nutrients/sediments from surrounding land	High		Med		Low				
3	Significant flood/stormwater attenuation	***Yes***	***No***							
4	Vegetation capacity to settle suspended sediments	High		Med		Low				
5	WL type /landscape position holds/filters runoff?	***Yes***	***No***							
SF16	***Wetland improves water quality?***	***Yes***	***No***							
SF17	***Evidence of excess nutrient loading/contamination?***	***Low***	***Med***	***High***						
SF18	***WL contributes to water quality in downstream resources***	***High***	***Med***	***Low***						
SECTION SEVEN: GROUNDWATER INTERACTIONS										
1	Describe soils in wetland	Recharge		Discharge						
2	Land use / run off in subwatershed upstream	Recharge		Discharge						
3	Conditions of upland soils within 200m of wetland	Recharge		Discharge						
4	Hydroperiod of wetland	Recharge		Discharge						
5	Describe inlet/outlet configuration	Recharge		Discharge						
6	Characterize topographic relief surrounding wetland	Recharge		Discharge						

SF19	***WL serves as a recharge site***	***Yes***	***No***							
SF20	***WL serves as a discharge site***	***Yes***	***No***							
SECTION EIGHT: SHORELINE STABILIZATION AND INTEGRITY										
1	Wetland fringing ocean/estuary/lake/pond/river/stream?	***Yes***	No	streamwidth >4m		streamwidth<4m		WB Exposed	WB Sheltered	
2	% cover of rooted vegetation in shallow water zone	H >50%	M 10-50	L <10%						
3	Avg veg WL width b/w shoreline/streambank & 2 m depth contour	H >10m	M 3-10	L <3m						
4	Prevalence of strong-stemmed emerg. veg (shoreline marshes and fens only)	High	Med	Low						
5	Describe shoreline erosion potential	High	Med	Low						
6	Shoreline/streambank veg condition upslope of water level	Low	Med	High	Artificial					
SF21	***WL ability to stabilize shoreline***	***H***	***M***	***L***	N/A					
SECTION NINE: PLANT COMMUNITY										
1	Vegetation diversity	High	Med	Low						
1b	Dominant plant species and % cover in the WL	list: *Mainanthemum trifolium* (30%)/*Picea mariana* (25%)/ *Eriophorum virginicum* (15%)								
3	Dominant Non-native or Invasive species and % cover	Yes	No	specify: %						
4	Vegetation Disturbance	H	M	L	Specify type(s) below:					
5	Disturbance Types	H___,ATV___,G___,,M___,In__, D/D___, Im___, OAH___, Ii___, Sd___,E___,,other___,								
7	Vegetative Integrity of plant community	E	H	M	L					
SF22	***Is the plant community unique or rare regionally or provincially?***	***Yes***	***no***	***specify:***						
SF23	***Does the WL contain a diversity of plant communities***	***H***	***M***	***L***						
SF24	***Rate the overall integrity/quality of plant community?***	***H***	***M***	***L***						
SF25	***Are there any observed rare or endangered plant species? Specify.***	***End***	***Thr***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SECTION TEN: FISH AND WILDLIFE HABITAT AND INTEGRITY										
1	Interspersion of open water and vegetation (open water types only)	H	M	L						
1b	% cover in vegetation verus open water	__85___%								
2	Interspersion that best fits entire wetland	H	M	L	N/A					
3	Wetland condition related to detritus	H	M	L	N/A					
4	Interspersion of other wetlands in vicinity	H	M	L						
6	Barriers/restriction between wetland and other habitat	L	M	H						
7	Noteworthy wildlife or evidence (birds, mammals, amphibians,etc)	Yes	No	list: Coyote scat, Rabbit droppings, Leapard Frog						
8	Connected to permanent water (accessible to fish)?	Exceptional	High	Med	Low	N/A				
9	Fish species observed or evidence seen (list)	Yes	No	list:						
10	Wetland part of contiguous upland or wetland:	>50ha	25-50ha	10-25ha	<10ha					
11	WL provides habitat for:	Amphibians	Reptiles	Waterfowl	Waterbirds	Mammals	Fish	R/E species		
SF26	***Does wetland support fish/fish habitat?***	***Yes***	***No***	***specify:***						
SF27	***Rare or endangered fish/wildlife species found in the wetland?***	***End***	***Thr***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF28	***Overall fish and wildlife habitat quality***	***H***	***M***	L						
SECTION ELEVEN: COMMUNITY USE/VALUE										
1	Describe community use	VV__,CP__,CO__,PO__,PA__,,AV__,GB__,E__,HI__, WV__, BO__,HU__, PG__, BP__,F__, E__, R__, Other:								
SF29	***Rate the wetland's community use/value***	***H***	***M***	L						

SF ratings highlighted in red indicate critical wetland functions or watershed conditions that are highly degraded. Whenever a wetland is found to have red-highlighted **SFs** the proponent

APPENDIX D: WL18	Nova Scotia Wetland Evaluation Technique Field Data Sheet									
Project Name: Black Point Quarry		Evaluator: Scott Burley			GPS Coordinates: 644396 E x 5022050 N					
PID:35212497, 35212505, 35212521, 35212513, 35044056, 35214014, 35214022, 35214022 and 35213990		Site Address: Black Point, Guysborough County, NS								
Sources and Dates of Mapping/Images: NS Wetlands Inventory (2012); NS Forest Inventory (Current Forest Data - 2004); Google Earth (2003)										
Evaluation Date: 10-Sep-14		Site Visit Date: 18-Aug-14								
Weather Conditions (past 48 hours): Sun and Clouds; Periods of rain										
Seasonal Weather Conditions: Typical										
SECTION ONE: WATERSHED CHARACTERISTICS										
1	Watershed Name (tertiary): 1EQ-SD	Size: 518 km^2								
2	% Watershed Land Cover	For: 43	Nat: 36	Past/Hay: <1	Crop: <1	Urb/Com: 2	Road: <1	Other Dev: <1 (Gravel Pit, Landfill, Industrial		
3	% Watershed WL Cover and by Class	Total: 10%	SM: <1	BO: 6	FE: 1	FM: 2	FS: 1	SS: 1	CP: <1	VP: Present
SF1	***Watershed condition***	***H***	***M***	***L***						
SF2	***Proportion of WL area in watershed & opportunity for floodwater detention***	***H***	***M***	***L***						
SECTION TWO: WETLAND CHARACTERISTICS										
Wetland Type: Bog		WL size: 0.07 hectares			Landform: Basin			Landscape Position: Terrene		
Water flow path: Isolated		Wetland Origin: Natural								
1	Water Regime	PF	SF	TF	SS	PS	RfT	IfT	AF	
2	# WL's within 30m project area	Total# 0	SM:	BO:	FE:	FM:	FS:	SS:	CP:	VP:
3	Is WL part of complex	Yes	No							
4	% each wetland type in complex	SM:	BO: 100	FE:	FM:	FS:	SS:	CP:	VP:	
5	Is WL bordering or associated with a lake or pond?	bordering		within 100m		N/A		specify		
6	Standing water?	Yes	Avg Dep:		% Inundated:		No			
7	Inlet or Outlet (circle all that apply)?	Inlet	Outlet							
8	Adjacent Upland Land Use within 100m (%)	For: 80	Nat: 20	PasHay:	Crop:	UrbCm:	Road:	Other Dev:		
9	Are there stressors in WL or WL buffer area? Circle primary stressor(s).	DD__, CW__, WcS__, O/C__,EB__,DP__,F__,M__, ES__,NE__,DwP__,								
		M__,GC__,ATV__,DG__,EA__, R__,Rr__,U/CD__,F__,FA__, other (specify):								
10	Hydrology Altered (circle all that apply)?	Ditching	Dams	Tiles	Culvert	Well	Diversion	Other Specify:		
SF3	***Rate the general wetland condition/integrity***	**H**	**M**	**L**						
SECTION THREE: ADJACENT LAND CONDITION AND INTEGRITY										
1	Average width of adjacent naturalized buffer	>1000__m								
2	Widths for water quality	H >15	M 8-15	L <8						
3	Widths for wildlife habitat	H >100	M 15-100	L <15						
4	Adjacent area vegetation condition (list % in each category)	H 100%	M	L						
5	Adjacent area diversity and structure (list % in each category)	H 100%	M	L						
6	Adjacent Upland Slope (list % in each category)	Steep 10%	Mod 60%	Gentle 20%						
7	Adjacent land supports water quality	*Yes*	*No*	Specify:						
8	Adjacent land supports wildlife habitat	*Yes*	*No*	Specify:						
SF4	***Rate the overall condition and integrity land adjacent to wetland***	***H***	***M***	***L***	**is buffer required to maintain red flag functions of wetland? If yes if no**					
SECTION FOUR: DOCUMENTED IMPORTANT FEATURES										
SF5	***Is the WL a WSS?***	***Yes***	***No***							

SF6	***Does the WL support commercial/recreational fish/shellfish?***	***Yes***	***No***						
SF7	***Species of concern (Fed/Prov)? Specify. Cladonia stygia; Geocaulon lividum***	***End***	***Thr - SARA***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF8	***Wetland has conservation/compensation agreements/activity?***	***Yes***	***No***	specify:						
SF9	***Wetland is calcerous fen, black ash or cedar swamp?***	***Yes***	***No***							
SF10	***Within Drinking Water Protected Area (designated watershed/wellfield)***	***Yes***	***No***	specify:						
SF11	***WL within a floodplain and upstream of or within of a populated area?***	***Yes***	***No***							
SF12	***Fed/Prov/Municipal area of interest?***	***Yes***	***No***	specify:						
SECTION FIVE: HYDROLOGIC CONDITION AND INTEGRITY										
1	Is WL source of stream or headwater(wc order 1 or 2)	***Yes***	No	Specify:						
2	Is WL geographically isolated?	Yes	No	Specify:						
3	WL ability to maintain characteristic hydrologic regime	High		Med		Low				
4	Water Storage Depth (list % in each class)	>30cm	15-30cm	up to 15cm		No ponding				
5	Signs of surface water retention observed?	SW__cm, WSL__, WCD__, WM__cm, SM__cm, SD__, AD__, ID__, PMT_x_, AI__, BT__, AR__, Other:								
6	Describe observable/historical anthropogenic sediment delivery	Low		Med		High				
7	Disturbance of WL soils	Low		Med		High				
8	Predominant soils adjacent to WL	Sand		Silt/loam		Clay/bedrock				
9	Capacity of WL to alter/retard flows	High		Med		Low				
10	Roughness coefficient for surface water flow path	High		Med		Low				
11	Strormwater/Wastewater/Agricultural runoff detention	High		Med		Low				
12	Water Source	Natural		Mostly natural		Partly altered		Controlled		
13	Hydrology of tidal wetlands	Unrestricted		Reduced		Restricted		N/A		
14	Coastal storm surge	***Yes***	No							
SF13	***WL hydrologic condition***	***Natural***	***Modified***			***Significantly Modified***				
SF14	***WL important for maintaining stream flow?***	***Yes***	***No***							
SF15	***WL ability to detain surface water***	***High***	***Med***	***Low***						
SECTION SIX: WATER QUALITY										
1	Strormwater/Wastewater/Agricultural runoff as water source?	High		Med		Low				
2	Nutrients/sediments from surrounding land	High		Med		Low				
3	Significant flood/stormwater attenuation	***Yes***	***No***							
4	Vegetation capacity to settle suspended sediments	High		Med		Low				
5	WL type /landscape position holds/filters runoff?	***Yes***	***No***							
SF16	***Wetland improves water quality?***	***Yes***	***No***							
SF17	***Evidence of excess nutrient loading/contamination?***	***Low***	***Med***	***High***						
SF18	***WL contributes to water quality in downstream resources***	***High***	***Med***	***Low***						
SECTION SEVEN: GROUNDWATER INTERACTIONS										
1	Describe soils in wetland	Recharge		Discharge						
2	Land use / run off in subwatershed upstream	Recharge		Discharge						
3	Conditions of upland soils within 200m of wetland	Recharge		Discharge						
4	Hydroperiod of wetland	Recharge		Discharge						
5	Describe inlet/outlet configuration	Recharge		Discharge						
6	Characterize topographic relief surrounding wetland	Recharge		Discharge						

SF19	***WL serves as a recharge site***	***Yes***	***No***	Possible recharge wetland						
SF20	***WL serves as a discharge site***	***Yes***	***No***							
SECTION EIGHT: SHORELINE STABILIZATION AND INTEGRITY										
1	Wetland fringing ocean/estuary/lake/pond/river/stream?	***Yes***	No	streamwidth >4m	streamwidth<4m	WB Exposed	WB Sheltered			
2	% cover of rooted vegetation in shallow water zone	H >50%	M 10-50	L <10%						
3	Avg veg WL width b/w shoreline/streambank & 2 m depth contour	H >10m	M 3-10	L <3m						
4	Prevalence of strong-stemmed emerg. veg (shoreline marshes and fens only)	High	Med	Low						
5	Describe shoreline erosion potential	High	Med	Low						
6	Shoreline/streambank veg condition upslope of water level	Low	Med	High	Artificial					
SF21	***WL ability to stabilize shoreline***	***H***	***M***	***L***	N/A					
SECTION NINE: PLANT COMMUNITY										
1	Vegetation diversity	High	Med	Low						
1b	Dominant plant species and % cover in the WL	list: *Picea mariana* (30%)/*Kalmia angustifolia* (15%)/ *Nemopantes mucronata* (15%)								
3	Dominant Non-native or Invasive species and % cover	Yes	No	specify: %						
4	Vegetation Disturbance	H	M	L	specify type(s) below					
5	Disturbance Types	H___,ATV___,G___,,M___,In__, D/D___, Im___, OAH___, Ii___, Sd___,E___,,other___,								
7	Vegetative Integrity of plant community	E	H	M	L					
SF22	***Is the plant community unique or rare regionally or provincially?***	***Yes***	***no***	***specify:***						
SF23	***Does the WL contain a diversity of plant communities***	***H***	***M***	***L***						
SF24	***Rate the overall integrity/quality of plant community?***	***H***	***M***	***L***						
SF25	***Are there any observed rare or endangered plant species? Specify.C.stygia***	***End***	***Thr***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SECTION TEN: FISH AND WILDLIFE HABITAT AND INTEGRITY										
1	Interspersion of open water and vegetation (open water types only)	H	M	L						
1b	% cover in vegetation verus open water	__100__%								
2	Interspersion that best fits entire wetland	H	M	L	N/A					
3	Wetland condition related to detritus	H	M	L	N/A					
4	Interspersion of other wetlands in vicinity	H	M	L						
6	Barriers/restriction between wetland and other habitat	L	M	H						
7	Noteworthy wildlife or evidence (birds, mammals, amphibians,etc)	Yes	No	list: Passerines						
8	Connected to permanent water (accessible to fish)?	Exceptional	High	Med	Low	N/A				
9	Fish species observed or evidence seen (list)	Yes	No	list:						
10	Wetland part of contiguous upland or wetland:	>50ha	25-50ha	10-25ha	<10ha					
11	WL provides habitat for:	Amphibians	Reptiles	Waterfowl	Waterbirds	Mammals	Fish	R/E species		
SF26	***Does wetland support fish/fish habitat?***	***Yes***	***No***	***specify:***						
SF27	***Rare or endangered fish/wildlife species found in the wetland?***	***End***	***Thr-SARA***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF28	***Overall fish and wildlife habitat quality***	***H***	***M***	L						
SECTION ELEVEN: COMMUNITY USE/VALUE										
1	Describe community use	VV__,CP__,CO__,PO__,PA__,,AV__,GB__,E__,HI__, WV__, BO__,HU__, PG__, BP__,F__, E__, R__, Other:								
SF29	***Rate the wetland's community use/value***	***H***	***M***	L						

SF ratings highlighted in red indicate critical wetland functions or watershed conditions that are highly degraded. Whenever a wetland is found to have red-highlighted **SFs** the proponent

APPENDIX D: WL19	Nova Scotia Wetland Evaluation Technique Field Data Sheet									
Project Name: Black Point Quarry		Evaluator: Scott Burley			GPS Coordinates: 644440 E x 5022148 N					
PID:35212497, 35212505, 35212521, 35212513, 35044056, 35214014, 35214022, 35214022 and 35213990		Site Address: Black Point, Guysborough County, NS								
Sources and Dates of Mapping/Images: NS Wetlands Inventory (2012); NS Forest Inventory (Current Forest Data - 2004); Google Earth (2003)										
Evaluation Date: 10-Sep-14		Site Visit Date: 18-Aug-14								
Weather Conditions (past 48 hours): Sun and Clouds; Periods of rain										
Seasonal Weather Conditions: Typical										
SECTION ONE: WATERSHED CHARACTERISTICS										
1	Watershed Name (tertiary): 1EQ-SD	Size: 518 km^2								
2	% Watershed Land Cover	For: 43	Nat: 36	Past/Hay: <1	Crop: <1	Urb/Com: 2	Road: <1	Other Dev: <1 (Gravel Pit, Landfill, Industrial		
3	% Watershed WL Cover and by Class	Total: 10%	SM: <1	BO: 6	FE: 1	FM: 2	FS: 1	SS: 1	CP: <1	VP: Present
SF1	***Watershed condition***	***H***	***M***	***L***						
SF2	***Proportion of WL area in watershed & opportunity for floodwater detention***	***H***	***M***	***L***						
SECTION TWO: WETLAND CHARACTERISTICS										
Wetland Type: Bog		WL size: 0.04 hectares			Landform: Basin			Landscape Position: Terrene		
Water flow path: Isolated		Wetland Origin: Natural								
1	Water Regime	PF	SF	TF	SS	PS	RfT	IfT	AF	
2	# WL's within 30m project area	Total# 0	SM:	BO:	FE:	FM:	FS:	SS:	CP:	VP:
3	Is WL part of complex	Yes	No							
4	% each wetland type in complex	SM:	BO: 100	FE:	FM:	FS:	SS:	CP:	VP:	
5	Is WL bordering or associated with a lake or pond?	bordering		within 100m		N/A		specify		
6	Standing water?	Yes	Avg Dep:		% Inundated:		No			
7	Inlet or Outlet (circle all that apply)?	Inlet	Outlet							
8	Adjacent Upland Land Use within 100m (%)	For: 60	Nat: 40	PasHay:	Crop:	UrbCm:	Road:	Other Dev:		
9	Are there stressors in WL or WL buffer area? Circle primary stressor(s).	DD__, CW__, WcS__, O/C__,EB__,DP__,F__,M__, ES__,NE__,DwP__,								
		M__,GC__,ATV__,DG__,EA__, R__,Rr__,U/CD__,F__,FA__, other (specify):								
10	Hydrology Altered (circle all that apply)?	Ditching	Dams	Tiles	Culvert	Well	Diversion	Other Specify:		
SF3	***Rate the general wetland condition/integrity***	**H**	**M**	**L**						
SECTION THREE: ADJACENT LAND CONDITION AND INTEGRITY										
1	Average width of adjacent naturalized buffer	>1000__m								
2	Widths for water quality	H >15	M 8-15	L <8						
3	Widths for wildlife habitat	H >100	M 15-100	L <15						
4	Adjacent area vegetation condition (list % in each category)	H 100%	M	L						
5	Adjacent area diversity and structure (list % in each category)	H 100%	M	L						
6	Adjacent Upland Slope (list % in each category)	Steep 30%	Mod 40%	Gentle 10%						
7	Adjacent land supports water quality	*Yes*	*No*	Specify:						
8	Adjacent land supports wildlife habitat	*Yes*	*No*	Specify:						
SF4	***Rate the overall condition and integrity land adjacent to wetland***	***H***	***M***	***L***	**is buffer required to maintain red flag functions of wetland? If yes if no**					
SECTION FOUR: DOCUMENTED IMPORTANT FEATURES										
SF5	***Is the WL a WSS?***	***Yes***	***No***							

SF6	***Does the WL support commercial/recreational fish/shellfish?***	***Yes***	***No***							
SF7	***Species of concern (Fed/Prov)? Specify. Cladonia stygia***	***End***	***Thr - SARA***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF8	***Wetland has conservation/compensation agreements/activity?***	***Yes***	***No***	specify:						
SF9	***Wetland is calcerous fen, black ash or cedar swamp?***	***Yes***	***No***							
SF10	***Within Drinking Water Protected Area (designated watershed/wellfield)***	***Yes***	***No***	specify:						
SF11	***WL within a floodplain and upstream of or within of a populated area?***	***Yes***	***No***							
SF12	***Fed/Prov/Municipal area of interest?***	***Yes***	***No***	specify:						
SECTION FIVE: HYDROLOGIC CONDITION AND INTEGRITY										
1	Is WL source of stream or headwater(wc order 1 or 2)	***Yes***	No	Specify:						
2	Is WL geographically isolated?	Yes	No	Specify:						
3	WL ability to maintain characteristic hydrologic regime	High		Med		Low				
4	Water Storage Depth (list % in each class)	>30cm	15-30cm	up to 15cm		No ponding				
5	Signs of surface water retention observed?	SW__cm, WSL__, WCD__, WM__cm, SM__cm, SD__, AD__, ID__, PMT_x_, AI__, BT__, AR__, Other:								
6	Describe observable/historical anthropogenic sediment delivery	Low		Med		High				
7	Disturbance of WL soils	Low		Med		High				
8	Predominant soils adjacent to WL	Sand		Silt/loam		Clay/bedrock				
9	Capacity of WL to alter/retard flows	High		Med		Low				
10	Roughness coefficient for surface water flow path	High		Med		Low				
11	Strormwater/Wastewater/Agricultural runoff detention	High		Med		Low				
12	Water Source	Natural		Mostly natural		Partly altered		Controlled		
13	Hydrology of tidal wetlands	Unrestricted		Reduced		Restricted		N/A		
14	Coastal storm surge	***Yes***	No							
SF13	***WL hydrologic condition***	***Natural***	***Modified***			**Significantly Modified**				
SF14	***WL important for maintaining stream flow?***	***Yes***	***No***							
SF15	***WL ability to detain surface water***	***High***	***Med***	**Low**						
SECTION SIX: WATER QUALITY										
1	Strormwater/Wastewater/Agricultural runoff as water source?	High		Med		Low				
2	Nutrients/sediments from surrounding land	High		Med		Low				
3	Significant flood/stormwater attenuation	***Yes***	***No***							
4	Vegetation capacity to settle suspended sediments	High		Med		Low				
5	WL type /landscape position holds/filters runoff?	***Yes***	***No***							
SF16	***Wetland improves water quality?***	***Yes***	***No***							
SF17	***Evidence of excess nutrient loading/contamination?***	***Low***	***Med***	***High***						
SF18	***WL contributes to water quality in downstream resources***	***High***	***Med***	***Low***						
SECTION SEVEN: GROUNDWATER INTERACTIONS										
1	Describe soils in wetland	Recharge		Discharge						
2	Land use / run off in subwatershed upstream	Recharge		Discharge						
3	Conditions of upland soils within 200m of wetland	Recharge		Discharge						
4	Hydroperiod of wetland	Recharge		Discharge						
5	Describe inlet/outlet configuration	Recharge		Discharge						
6	Characterize topographic relief surrounding wetland	Recharge		Discharge						

SF19	***WL serves as a recharge site***	***Yes***	***No***	Possible recharge wetland						
SF20	***WL serves as a discharge site***	***Yes***	***No***							
SECTION EIGHT: SHORELINE STABILIZATION AND INTEGRITY										
1	Wetland fringing ocean/estuary/lake/pond/river/stream?	***Yes***	No	streamwidth >4m	streamwidth<4m	WB Exposed	WB Sheltered			
2	% cover of rooted vegetation in shallow water zone	H >50%	M 10-50	L <10%						
3	Avg veg WL width b/w shoreline/streambank & 2 m depth contour	H >10m	M 3-10	L <3m						
4	Prevalence of strong-stemmed emerg. veg (shoreline marshes and fens only)	High	Med	Low						
5	Describe shoreline erosion potential	High	Med	Low						
6	Shoreline/streambank veg condition upslope of water level	Low	Med	High	Artificial					
SF21	***WL ability to stabilize shoreline***	***H***	***M***	***L***	N/A					
SECTION NINE: PLANT COMMUNITY										
1	Vegetation diversity	High	Med	Low						
1b	Dominant plant species and % cover in the WL	list: *Gaylussacia baccata* (30%)/*Nemopantes mucronata* (15%)								
3	Dominant Non-native or Invasive species and % cover	Yes	No	specify: %						
4	Vegetation Disturbance	H	M	L	specify type(s) below					
5	Disturbance Types	H___,ATV___,G___,,M___,In__, D/D___, Im___, OAH___, Ii___, Sd___,E___,,other___,								
7	Vegetative Integrity of plant community	E	H	M	L					
SF22	***Is the plant community unique or rare regionally or provincially?***	***Yes***	***no***	***specify:***						
SF23	***Does the WL contain a diversity of plant communities***	***H***	***M***	***L***						
SF24	***Rate the overall integrity/quality of plant community?***	***H***	***M***	***L***						
SF25	***Are there any observed rare or endangered plant species? Specify. C.stygia***	***End***	***Thr***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SECTION TEN: FISH AND WILDLIFE HABITAT AND INTEGRITY										
1	Interspersion of open water and vegetation (open water types only)	H	M	L						
1b	% cover in vegetation verus open water	__100__%								
2	Interspersion that best fits entire wetland	H	M	L	N/A					
3	Wetland condition related to detritus	H	M	L	N/A					
4	Interspersion of other wetlands in vicinity	H	M	L						
6	Barriers/restriction between wetland and other habitat	L	M	H						
7	Noteworthy wildlife or evidence (birds, mammals, amphibians,etc)	Yes	No	list: Passerines, Rabbit droppings						
8	Connected to permanent water (accessible to fish)?	Exceptional	High	Med	Low	N/A				
9	Fish species observed or evidence seen (list)	Yes	No	list:						
10	Wetland part of contiguous upland or wetland:	>50ha	25-50ha	10-25ha	<10ha					
11	WL provides habitat for:	Amphibians	Reptiles	Waterfowl	Waterbirds	Mammals	Fish	R/E species		
SF26	***Does wetland support fish/fish habitat?***	***Yes***	***No***	***specify:***						
SF27	***Rare or endangered fish/wildlife species found in the wetland?***	***End***	***Thr-SARA***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF28	***Overall fish and wildlife habitat quality***	***H***	***M***	L						
SECTION ELEVEN: COMMUNITY USE/VALUE										
1	Describe community use	VV__,CP__,CO__,PO__,PA__,,AV__,GB__,E__,HI__, WV__, BO__,HU__, PG__, BP__,F__, E__, R__, Other:								
SF29	***Rate the wetland's community use/value***	***H***	***M***	L						

SF ratings highlighted in red indicate critical wetland functions or watershed conditions that are highly degraded. Whenever a wetland is found to have red-highlighted **SFs** the proponent

APPENDIX D: WL20	Nova Scotia Wetland Evaluation Technique Field Data Sheet									
Project Name: Black Point Quarry		Evaluator: Scott Burley			GPS Coordinates: 644447 E x 5022225 N					
PID:35212497, 35212505, 35212521, 35212513, 35044056, 35214014, 35214022, 35214022 and 35213990		Site Address: Black Point, Guysborough County, NS								
Sources and Dates of Mapping/Images: NS Wetlands Inventory (2012); NS Forest Inventory (Current Forest Data - 2004); Google Earth (2003)										
Evaluation Date: 10-Sep-14		Site Visit Date: 18-Aug-14								
Weather Conditions (past 48 hours): Sun and Clouds; Periods of rain										
Seasonal Weather Conditions: Typical										
SECTION ONE: WATERSHED CHARACTERISTICS										
1	Watershed Name (tertiary): 1EQ-SD	Size: 518 km^2								
2	% Watershed Land Cover	For: 43	Nat: 36	Past/Hay: <1	Crop: <1	Urb/Com: 2	Road: <1	Other Dev: <1 (Gravel Pit, Landfill, Industrial		
3	% Watershed WL Cover and by Class	Total: 10%	SM: <1	BO: 6	FE: 1	FM: 2	FS: 1	SS: 1	CP: <1	VP: Present
SF1	***Watershed condition***	***H***	***M***	***L***						
SF2	***Proportion of WL area in watershed & opportunity for floodwater detention***	***H***	***M***	***L***						
SECTION TWO: WETLAND CHARACTERISTICS										
Wetland Type: Bog		WL size: 0.15 hectares			Landform: Basin			Landscape Position: Terrene		
Water flow path: Isolated		Wetland Origin: Natural								
1	Water Regime	PF	SF	TF	SS	PS	RfT	IfT	AF	
2	# WL's within 30m project area	Total# 0	SM:	BO:	FE:	FM:	FS:	SS:	CP:	VP:
3	Is WL part of complex	Yes	No							
4	% each wetland type in complex	SM:	BO: 100	FE:	FM:	FS:	SS:	CP:	VP:	
5	Is WL bordering or associated with a lake or pond?	bordering		within 100m		N/A		specify		
6	Standing water?	Yes	Avg Dep:		% Inundated:		No			
7	Inlet or Outlet (circle all that apply)?	Inlet	Outlet							
8	Adjacent Upland Land Use within 100m (%)	For: 60	Nat: 40	PasHay:	Crop:	UrbCm:	Road:	Other Dev:		
9	Are there stressors in WL or WL buffer area? Circle primary stressor(s).	DD__, CW__, WcS__, O/C__,EB__,DP__,F__,M__, ES__,NE__,DwP__,								
		M__,GC__,ATV__,DG__,EA__, R__,Rr__,U/CD__,F__,FA__, other (specify):								
10	Hydrology Altered (circle all that apply)?	Ditching	Dams	Tiles	Culvert	Well	Diversion	Other Specify:		
SF3	***Rate the general wetland condition/integrity***	**H**	**M**	**L**						
SECTION THREE: ADJACENT LAND CONDITION AND INTEGRITY										
1	Average width of adjacent naturalized buffer	>1000__m								
2	Widths for water quality	H >15	M 8-15	L <8						
3	Widths for wildlife habitat	H >100	M 15-100	L <15						
4	Adjacent area vegetation condition (list % in each category)	H 100%	M	L						
5	Adjacent area diversity and structure (list % in each category)	H 100%	M	L						
6	Adjacent Upland Slope (list % in each category)	Steep 30%	Mod 40%	Gentle 10%						
7	Adjacent land supports water quality	*Yes*	*No*	Specify:						
8	Adjacent land supports wildlife habitat	*Yes*	*No*	Specify:						
SF4	***Rate the overall condition and integrity land adjacent to wetland***	***H***	***M***	***L***	**is buffer required to maintain red flag functions of wetland? If yes if no**					
SECTION FOUR: DOCUMENTED IMPORTANT FEATURES										
SF5	***Is the WL a WSS?***	***Yes***	***No***							

SF6	***Does the WL support commercial/recreational fish/shellfish?***	***Yes***	***No***							
SF7	***Species of concern (Fed/Prov)? Specify. Cladonia stygia***	***End***	***Thr - SARA***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF8	***Wetland has conservation/compensation agreements/activity?***	***Yes***	***No***	specify:						
SF9	***Wetland is calcerous fen, black ash or cedar swamp?***	***Yes***	***No***							
SF10	***Within Drinking Water Protected Area (designated watershed/wellfield)***	***Yes***	***No***	specify:						
SF11	***WL within a floodplain and upstream of or within of a populated area?***	***Yes***	***No***							
SF12	***Fed/Prov/Municipal area of interest?***	***Yes***	***No***	specify:						
SECTION FIVE: HYDROLOGIC CONDITION AND INTEGRITY										
1	Is WL source of stream or headwater(wc order 1 or 2)	***Yes***	No	Specify:						
2	Is WL geographically isolated?	Yes	No	Specify:						
3	WL ability to maintain characteristic hydrologic regime	High		Med		Low				
4	Water Storage Depth (list % in each class)	>30cm	15-30cm	up to 15cm		No ponding				
5	Signs of surface water retention observed?	SW__cm, WSL__, WCD__, WM__cm, SM__cm, SD__, AD__, ID__, PMT_x_, AI__, BT__, AR__, Other:								
6	Describe observable/historical anthropogenic sediment delivery	Low		Med		High				
7	Disturbance of WL soils	Low		Med		High				
8	Predominant soils adjacent to WL	Sand		Silt/loam		Clay/bedrock				
9	Capacity of WL to alter/retard flows	High		Med		Low				
10	Roughness coefficient for surface water flow path	High		Med		Low				
11	Strormwater/Wastewater/Agricultural runoff detention	High		Med		Low				
12	Water Source	Natural		Mostly natural		Partly altered		Controlled		
13	Hydrology of tidal wetlands	Unrestricted		Reduced		Restricted		N/A		
14	Coastal storm surge	***Yes***	No							
SF13	***WL hydrologic condition***	***Natural***	***Modified***			**Significantly Modified**				
SF14	***WL important for maintaining stream flow?***	***Yes***	***No***							
SF15	***WL ability to detain surface water***	***High***	***Med***	**Low**						
SECTION SIX: WATER QUALITY										
1	Strormwater/Wastewater/Agricultural runoff as water source?	High		Med		Low				
2	Nutrients/sediments from surrounding land	High		Med		Low				
3	Significant flood/stormwater attenuation	***Yes***	***No***							
4	Vegetation capacity to settle suspended sediments	High		Med		Low				
5	WL type /landscape position holds/filters runoff?	***Yes***	***No***							
SF16	***Wetland improves water quality?***	***Yes***	***No***							
SF17	***Evidence of excess nutrient loading/contamination?***	***Low***	***Med***	***High***						
SF18	***WL contributes to water quality in downstream resources***	***High***	***Med***	***Low***						
SECTION SEVEN: GROUNDWATER INTERACTIONS										
1	Describe soils in wetland	Recharge		Discharge						
2	Land use / run off in subwatershed upstream	Recharge		Discharge						
3	Conditions of upland soils within 200m of wetland	Recharge		Discharge						
4	Hydroperiod of wetland	Recharge		Discharge						
5	Describe inlet/outlet configuration	Recharge		Discharge						
6	Characterize topographic relief surrounding wetland	Recharge		Discharge						

SF19	***WL serves as a recharge site***	***Yes***	***No***	Possible recharge wetland						
SF20	***WL serves as a discharge site***	***Yes***	***No***							
SECTION EIGHT: SHORELINE STABILIZATION AND INTEGRITY										
1	Wetland fringing ocean/estuary/lake/pond/river/stream?	***Yes***	No	streamwidth >4m	streamwidth<4m	WB Exposed	WB Sheltered			
2	% cover of rooted vegetation in shallow water zone	H >50%	M 10-50	L <10%						
3	Avg veg WL width b/w shoreline/streambank & 2 m depth contour	H >10m	M 3-10	L <3m						
4	Prevalence of strong-stemmed emerg. veg (shoreline marshes and fens only)	High	Med	Low						
5	Describe shoreline erosion potential	High	Med	Low						
6	Shoreline/streambank veg condition upslope of water level	Low	Med	High	Artificial					
SF21	***WL ability to stabilize shoreline***	***H***	***M***	***L***	N/A					
SECTION NINE: PLANT COMMUNITY										
1	Vegetation diversity	High	Med	Low						
1b	Dominant plant species and % cover in the WL	list: *Gaylussacia baccata* (20%)/*Nemopantes mucronata* (15%)/*Picea mariana* (20%)/ *Trchoforum cespitosum* (30%)								
3	Dominant Non-native or Invasive species and % cover	Yes	No	specify: %						
4	Vegetation Disturbance	H	M	L	specify type(s) below					
5	Disturbance Types	H___,ATV___,G___,,M___,In__, D/D___, Im___, OAH___, Ii___, Sd___,E___,,other___,								
7	Vegetative Integrity of plant community	E	H	M	L					
SF22	***Is the plant community unique or rare regionally or provincially?***	***Yes***	***no***	***specify:***						
SF23	***Does the WL contain a diversity of plant communities***	***H***	***M***	***L***						
SF24	***Rate the overall integrity/quality of plant community?***	***H***	***M***	***L***						
SF25	***Are there any observed rare or endangered plant species? Specify.C.stygia***	***End***	***Thr***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SECTION TEN: FISH AND WILDLIFE HABITAT AND INTEGRITY										
1	Interspersion of open water and vegetation (open water types only)	H	M	L						
1b	% cover in vegetation verus open water	__100__%								
2	Interspersion that best fits entire wetland	H	M	L	N/A					
3	Wetland condition related to detritus	H	M	L	N/A					
4	Interspersion of other wetlands in vicinity	H	M	L						
6	Barriers/restriction between wetland and other habitat	L	M	H						
7	Noteworthy wildlife or evidence (birds, mammals, amphibians,etc)	Yes	No	list: Passerines, Rabbit droppings						
8	Connected to permanent water (accessible to fish)?	Exceptional	High	Med	Low	N/A				
9	Fish species observed or evidence seen (list)	Yes	No	list:						
10	Wetland part of contiguous upland or wetland:	>50ha	25-50ha	10-25ha	<10ha					
11	WL provides habitat for:	Amphibians	Reptiles	Waterfowl	Waterbirds	Mammals	Fish	R/E species		
SF26	***Does wetland support fish/fish habitat?***	***Yes***	***No***	***specify:***						
SF27	***Rare or endangered fish/wildlife species found in the wetland?***	***End***	***Thr-SARA***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF28	***Overall fish and wildlife habitat quality***	***H***	***M***	L						
SECTION ELEVEN: COMMUNITY USE/VALUE										
1	Describe community use	VV__,CP__,CO__,PO__,PA__,,AV__,GB__,E__,HI__, WV__, BO__,HU__, PG__, BP__,F__, E__, R__, Other:								
SF29	***Rate the wetland's community use/value***	***H***	***M***	L						

SF ratings highlighted in red indicate critical wetland functions or watershed conditions that are highly degraded. Whenever a wetland is found to have red-highlighted **SFs** the proponent

APPENDIX D: WL21	Nova Scotia Wetland Evaluation Technique Field Data Sheet								
Project Name: Black Point Quarry	Evaluator: Scott Burley			GPS Coordinates: 645820 E x 5023684 N					
PID:35212497, 35212505, 35212521, 35212513, 35044056, 35214014, 35214022, 35214022 and 35213990	Site Address: Black Point, Guysborough County, NS								
Sources and Dates of Mapping/Images: NS Wetlands Inventory (2012); NS Forest Inventory (Current Forest Data - 2004); Google Earth (2003)									
Evaluation Date: 10-Sep-14	Site Visit Date: 20-Aug-14								
Weather Conditions (past 48 hours): Sun and Clouds									
Seasonal Weather Conditions: Typical									
SECTION ONE: WATERSHED CHARACTERISTICS									
1 Watershed Name (tertiary): 1EQ-SD	Size: 518 km^2								
2 % Watershed Land Cover	For: 43	Nat: 36	Past/Hay: <1	Crop: <1	Urb/Com: 2	Road: <1	Other Dev: <1 (Gravel Pit, Landfill, Industrial		
3 % Watershed WL Cover and by Class	Total: 10%	SM: <1	BO: 6	FE: 1	FM: 2	FS: 1	SS: 1	CP: <1	VP: Present
SF1 ***Watershed condition***	***H***	***M***	***L***						
SF2 ***Proportion of WL area in watershed & opportunity for floodwater detention***	***H***	***M***	***L***						
SECTION TWO: WETLAND CHARACTERISTICS									
Wetland Type: Fen	WL size: 0.19 hectares			Landform: Slope			Landscape Position: Lotic Stream Confined		
Water flow path: Inflow	Wetland Origin: Natural								
1 Water Regime	PF	SF	TF	SS	PS	RfT	IfT	AF	
2 # WL's within 30m project area	Total# 0	SM:	BO:	FE:	FM:	FS:	SS:	CP:	VP:
3 Is WL part of complex	Yes	No							
4 % each wetland type in complex	SM:	BO: 20	FE: 80	FM:	FS:	SS:	CP:	VP:	
5 Is WL bordering or associated with a lake or pond?	bordering		within 100m		N/A		specify		
6 Standing water?	Yes	Avg Dep:		% Inundated:		No			
7 Inlet or Outlet (circle all that apply)?	Inlet	Outlet							
8 Adjacent Upland Land Use within 100m (%)	For: 80	Nat:	PasHay:	Crop:	UrbCm:	Road:	Other Dev: 20 Beach		
9 Are there stressors in WL or WL buffer area? Circle primary stressor(s).	DD__, CW__, WcS__, O/C__,EB__,DP__,F__,M__, ES__,NE__,DwP__,								
	M__,GC__,ATV__,DG__,EA__, R__,Rr__,U/CD__,F__,FA__, other (specify): Skidder trail through wetland								
10 Hydrology Altered (circle all that apply)?	Ditching	Dams	Tiles	Culvert	Well	Diversion	Other Specify:		
SF3 ***Rate the general wetland condition/integrity***	**H**	**M**	**L**						
SECTION THREE: ADJACENT LAND CONDITION AND INTEGRITY									
1 Average width of adjacent naturalized buffer	>1000__m								
2 Widths for water quality	H >15	M 8-15	L <8						
3 Widths for wildlife habitat	H >100	M 15-100	L <15						
4 Adjacent area vegetation condition (list % in each category)	H 100%	M	L						
5 Adjacent area diversity and structure (list % in each category)	H 100%	M	L						
6 Adjacent Upland Slope (list % in each category)	Steep 60%	Mod 25%	Gentle 15%						
7 Adjacent land supports water quality	*Yes*	*No*	Specify:						
8 Adjacent land supports wildlife habitat	*Yes*	*No*	Specify:						
SF4 ***Rate the overall condition and integrity land adjacent to wetland***	***H***	***M***	***L***	**is buffer required to maintain red flag functions of wetland? If yes if no**					
SECTION FOUR: DOCUMENTED IMPORTANT FEATURES									
SF5 ***Is the WL a WSS?***	***Yes***	***No***							

SF6	***Does the WL support commercial/recreational fish/shellfish?***	***Yes***	***No***							
SF7	***Species of concern (Fed/Prov)? Specify.***	***End***	***Thr - SARA***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF8	***Wetland has conservation/compensation agreements/activity?***	***Yes***	***No***	specify:						
SF9	***Wetland is calcerous fen, black ash or cedar swamp?***	***Yes***	***No***							
SF10	***Within Drinking Water Protected Area (designated watershed/wellfield)***	***Yes***	***No***	specify:						
SF11	***WL within a floodplain and upstream of or within of a populated area?***	***Yes***	***No***							
SF12	***Fed/Prov/Municipal area of interest?***	***Yes***	***No***	specify:						
SECTION FIVE: HYDROLOGIC CONDITION AND INTEGRITY										
1	Is WL source of stream or headwater(wc order 1 or 2)	***Yes***	No	Specify:						
2	Is WL geographically isolated?	Yes	No	Specify:						
3	WL ability to maintain characteristic hydrologic regime	High		Med		Low				
4	Water Storage Depth (list % in each class)	>30cm	15-30cm	up to 15cm		No ponding				
5	Signs of surface water retention observed?	SW__cm, WSL__, WCD__, WM__cm, SM__cm, SD__, AD__, ID__, PMT_x_, AI__, BT__, AR__, Other:								
6	Describe observable/historical anthropogenic sediment delivery	Low		Med		High				
7	Disturbance of WL soils	Low		Med		High				
8	Predominant soils adjacent to WL	Sand		Silt/loam		Clay/bedrock				
9	Capacity of WL to alter/retard flows	High		Med		Low				
10	Roughness coefficient for surface water flow path	High		Med		Low				
11	Strormwater/Wastewater/Agricultural runoff detention	High		Med		Low				
12	Water Source	Natural		Mostly natural		Partly altered		Controlled		
13	Hydrology of tidal wetlands	Unrestricted		Reduced		Restricted		N/A		
14	Coastal storm surge	***Yes***	No							
SF13	***WL hydrologic condition***	***Natural***	***Modified***			**Significantly Modified**				
SF14	***WL important for maintaining stream flow?***	***Yes***	***No***							
SF15	***WL ability to detain surface water***	***High***	***Med***	**Low**						
SECTION SIX: WATER QUALITY										
1	Strormwater/Wastewater/Agricultural runoff as water source?	High		Med		Low				
2	Nutrients/sediments from surrounding land	High		Med		Low				
3	Significant flood/stormwater attenuation	***Yes***	***No***							
4	Vegetation capacity to settle suspended sediments	High		Med		Low				
5	WL type /landscape position holds/filters runoff?	***Yes***	***No***							
SF16	***Wetland improves water quality?***	***Yes***	***No***							
SF17	***Evidence of excess nutrient loading/contamination?***	***Low***	***Med***	***High***						
SF18	***WL contributes to water quality in downstream resources***	***High***	***Med***	***Low***						
SECTION SEVEN: GROUNDWATER INTERACTIONS										
1	Describe soils in wetland	Recharge		Discharge						
2	Land use / run off in subwatershed upstream	Recharge		Discharge						
3	Conditions of upland soils within 200m of wetland	Recharge		Discharge						
4	Hydroperiod of wetland	Recharge		Discharge						
5	Describe inlet/outlet configuration	Recharge		Discharge						
6	Characterize topographic relief surrounding wetland	Recharge		Discharge						

SF19	***WL serves as a recharge site***	***Yes***	***No***								
SF20	***WL serves as a discharge site***	***Yes***	***No***								
SECTION EIGHT: SHORELINE STABILIZATION AND INTEGRITY											
1	Wetland fringing ocean/estuary/lake/pond/river/stream?	***Yes***	No	streamwidth >4m		streamwidth<4m		WB Exposed		WB Sheltered	
2	% cover of rooted vegetation in shallow water zone	H >50%	M 10-50	L <10%							
3	Avg veg WL width b/w shoreline/streambank & 2 m depth contour	H >10m	M 3-10	L <3m							
4	Prevalence of strong-stemmed emerg. veg (shoreline marshes and fens only)	High	Med	Low							
5	Describe shoreline erosion potential	High	Med	Low							
6	Shoreline/streambank veg condition upslope of water level	Low	Med	High	Artificial						
SF21	***WL ability to stabilize shoreline***	***H***	***M***	***L***	N/A						
SECTION NINE: PLANT COMMUNITY											
1	Vegetation diversity	High	Med	Low							
1b	Dominant plant species and % cover in the WL	list: *Osmunda cinnamomea* (20%)/*Calamagrostis canadensis* (40%)/ *Eriophorum virginicum* (30%)/*Juncu effusus* (20%)									
3	Dominant Non-native or Invasive species and % cover	Yes	No	specify: %							
4	Vegetation Disturbance	H	M	L	specify type(s) below						
5	Disturbance Types	H___,ATV___,G___,,M___,In__, D/D___, Im___, OAH___, Ii___, Sd___,E___,,other___,									
7	Vegetative Integrity of plant community	E	H	M	L						
SF22	***Is the plant community unique or rare regionally or provincially?***	***Yes***	***no***	***specify:***							
SF23	***Does the WL contain a diversity of plant communities***	***H***	***M***	***L***							
SF24	***Rate the overall integrity/quality of plant community?***	***H***	***M***	***L***							
SF25	***Are there any observed rare or endangered plant species? Specify.***	***End***	***Thr***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***	
SECTION TEN: FISH AND WILDLIFE HABITAT AND INTEGRITY											
1	Interspersion of open water and vegetation (open water types only)	H	M	L							
1b	% cover in vegetation verus open water	__100___%									
2	Interspersion that best fits entire wetland	H	M	L	N/A						
3	Wetland condition related to detritus	H	M	L	N/A						
4	Interspersion of other wetlands in vicinity	H	M	L							
6	Barriers/restriction between wetland and other habitat	L	M	H							
7	Noteworthy wildlife or evidence (birds, mammals, amphibians,etc)	Yes	No	list: Passerines, Deer tracks and pellets							
8	Connected to permanent water (accessible to fish)?	Exceptional	High	Med	Low	N/A					
9	Fish species observed or evidence seen (list)	Yes	No	list:							
10	Wetland part of contiguous upland or wetland:	>50ha	25-50ha	10-25ha	<10ha						
11	WL provides habitat for:	Amphibians	Reptiles	Waterfowl	Waterbirds	Mammals	Fish	R/E species			
SF26	***Does wetland support fish/fish habitat?***	***Yes***	***No***	***specify:***							
SF27	***Rare or endangered fish/wildlife species found in the wetland?***	***End***	***Thr-SARA***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***	
SF28	***Overall fish and wildlife habitat quality***	***H***	***M***	L							
SECTION ELEVEN: COMMUNITY USE/VALUE											
1	Describe community use	VV__,CP__,CO__,PO__,PA__,,AV__,GB__,E__,HI__, WV__, BO__,HU__, PG__, BP__,F__, E__, R__, Other:									
SF29	***Rate the wetland's community use/value***	***H***	***M***	***L***							

SF ratings highlighted in red indicate critical wetland functions or watershed conditions that are highly degraded. Whenever a wetland is found to have red-highlighted **SFs** the proponent

APPENDIX D: WL22	**Nova Scotia Wetland Evaluation Technique Field Data Sheet**									
Project Name: Black Point Quarry		Evaluator: Scott Burley			GPS Coordinates: 645630 E x 5023728 N					
PID:35212497, 35212505, 35212521, 35212513, 35044056, 35214014, 35214022, 35214022 and 35213990			Site Address: Black Point, Guysborough County, NS							
Sources and Dates of Mapping/Images: NS Wetlands Inventory (2012); NS Forest Inventory (Current Forest Data - 2004); Google Earth (2003)										
Evaluation Date: 10-Sep-14		Site Visit Date: 20-Aug-14								
Weather Conditions (past 48 hours): Sun and Clouds										
Seasonal Weather Conditions: Typical										
SECTION ONE: WATERSHED CHARACTERISTICS										
1	Watershed Name (tertiary): 1EQ-SD	Size: 518 km^2								
2	% Watershed Land Cover	For: 43	Nat: 36	Past/Hay: <1	Crop: <1	Urb/Com: 2	Road: <1	Other Dev: <1 (Gravel Pit, Landfill, Industrial		
3	% Watershed WL Cover and by Class	Total: 10%	SM: <1	BO: 6	FE: 1	FM: 2	FS: 1	SS: 1	CP: <1	VP: Present
SF1	***Watershed condition***	***H***	***M***	***L***						
SF2	***Proportion of WL area in watershed & opportunity for floodwater detention***	***H***	***M***	***L***						
SECTION TWO: WETLAND CHARACTERISTICS										
Wetland Type: Fen		WL size: 0.1 hectares			Landform: Slope			Landscape Position: Lotic Stream Confined		
Water flow path: Throughflow		Wetland Origin: Natural								
1	Water Regime	PF	SF	TF	SS	PS	RfT	IfT	AF	
2	# WL's within 30m project area	Total# 0	SM:	BO:	FE:	FM:	FS:	SS:	CP:	VP:
3	Is WL part of complex	Yes	No							
4	% each wetland type in complex	SM:	BO:	FE: 100	FM:	FS:	SS:	CP:	VP:	
5	Is WL bordering or associated with a lake or pond?	bordering		within 100m		N/A		specify		
6	Standing water?	Yes	Avg Dep:		% Inundated:		No			
7	Inlet or Outlet (circle all that apply)?	Inlet	Outlet							
8	Adjacent Upland Land Use within 100m (%)	For: 95	Nat:	PasHay:	Crop:	UrbCm:	Road:	Other Dev: 5% beach		
9	Are there stressors in WL or WL buffer area? Circle primary stressor(s).	DD__, CW__, WcS__, O/C__,EB__,DP__,F__,M__, ES__,NE__,DwP__,								
		M__,GC__,ATV__,DG__,EA__, R__,Rr__,U/CD__,F__,FA__, other (specify): Skidder trail through wetland								
10	Hydrology Altered (circle all that apply)?	Ditching	Dams	Tiles	Culvert	Well	Diversion	Other Specify:		
SF3	***Rate the general wetland condition/integrity***	**H**	**M**	**L**						
SECTION THREE: ADJACENT LAND CONDITION AND INTEGRITY										
1	Average width of adjacent naturalized buffer	>1000__m								
2	Widths for water quality	H >15	M 8-15	L <8						
3	Widths for wildlife habitat	H >100	M 15-100	L <15						
4	Adjacent area vegetation condition (list % in each category)	H 100%	M	L						
5	Adjacent area diversity and structure (list % in each category)	H 100%	M	L						
6	Adjacent Upland Slope (list % in each category)	Steep 70%	Mod 25%	Gentle 5%						
7	Adjacent land supports water quality	*Yes*	*No*	Specify:						
8	Adjacent land supports wildlife habitat	*Yes*	*No*	Specify:						
SF4	***Rate the overall condition and integrity land adjacent to wetland***	***H***	***M***	***L***	**is buffer required to maintain red flag functions of wetland? If yes if no**					
SECTION FOUR: DOCUMENTED IMPORTANT FEATURES										
SF5	***Is the WL a WSS?***	***Yes***	***No***							

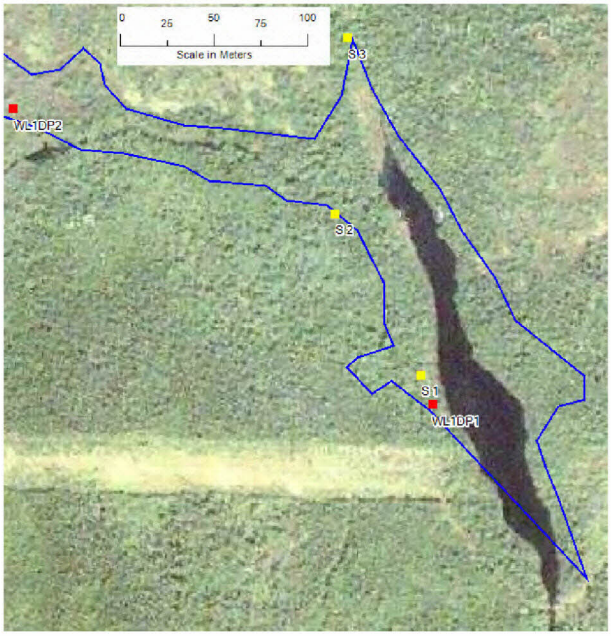
SF6	***Does the WL support commercial/recreational fish/shellfish?***	***Yes***	***No***						
SF7	***Species of concern (Fed/Prov)? Specify.***	***End***	***Thr - SARA***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF8	***Wetland has conservation/compensation agreements/activity?***	***Yes***	***No***	specify:					
SF9	***Wetland is calcerous fen, black ash or cedar swamp?***	***Yes***	***No***						
SF10	***Within Drinking Water Protected Area (designated watershed/wellfield)***	***Yes***	***No***	specify:					
SF11	***WL within a floodplain and upstream of or within of a populated area?***	***Yes***	***No***						
SF12	***Fed/Prov/Municipal area of interest?***	***Yes***	***No***	specify:					
SECTION FIVE: HYDROLOGIC CONDITION AND INTEGRITY									
1	Is WL source of stream or headwater(wc order 1 or 2)	***Yes***	No	Specify:					
2	Is WL geographically isolated?	Yes	No	Specify:					
3	WL ability to maintain characteristic hydrologic regime	High		Med		Low			
4	Water Storage Depth (list % in each class)	>30cm	15-30cm	up to 15cm		No ponding			
5	Signs of surface water retention observed?	SW_20_cm, WSL__, WCD__, WM__cm, SM__cm, SD__, AD__, ID__, PMT_x_, AI__, BT__, AR__, Other:							
6	Describe observable/historical anthropogenic sediment delivery	Low		Med		High			
7	Disturbance of WL soils	Low		Med		High			
8	Predominant soils adjacent to WL	Sand		Silt/loam		Clay/bedrock			
9	Capacity of WL to alter/retard flows	High		Med		Low			
10	Roughness coefficient for surface water flow path	High		Med		Low			
11	Strormwater/Wastewater/Agricultural runoff detention	High		Med		Low			
12	Water Source	Natural		Mostly natural		Partly altered		Controlled	
13	Hydrology of tidal wetlands	Unrestricted		Reduced		Restricted		N/A	
14	Coastal storm surge	***Yes***	No						
SF13	***WL hydrologic condition***	***Natural***	***Modified***			***Significantly Modified***			
SF14	***WL important for maintaining stream flow?***	***Yes***	***No***						
SF15	***WL ability to detain surface water***	***High***	***Med***	***Low***					
SECTION SIX: WATER QUALITY									
1	Strormwater/Wastewater/Agricultural runoff as water source?	High		Med		Low			
2	Nutrients/sediments from surrounding land	High		Med		Low			
3	Significant flood/stormwater attenuation	***Yes***	***No***						
4	Vegetation capacity to settle suspended sediments	High		Med		Low			
5	WL type /landscape position holds/filters runoff?	***Yes***	***No***						
SF16	***Wetland improves water quality?***	***Yes***	***No***						
SF17	***Evidence of excess nutrient loading/contamination?***	***Low***	***Med***	***High***					
SF18	***WL contributes to water quality in downstream resources***	***High***	***Med***	***Low***					
SECTION SEVEN: GROUNDWATER INTERACTIONS									
1	Describe soils in wetland	Recharge		Discharge					
2	Land use / run off in subwatershed upstream	Recharge		Discharge					
3	Conditions of upland soils within 200m of wetland	Recharge		Discharge					
4	Hydroperiod of wetland	Recharge		Discharge					
5	Describe inlet/outlet configuration	Recharge		Discharge					
6	Characterize topographic relief surrounding wetland	Recharge		Discharge					

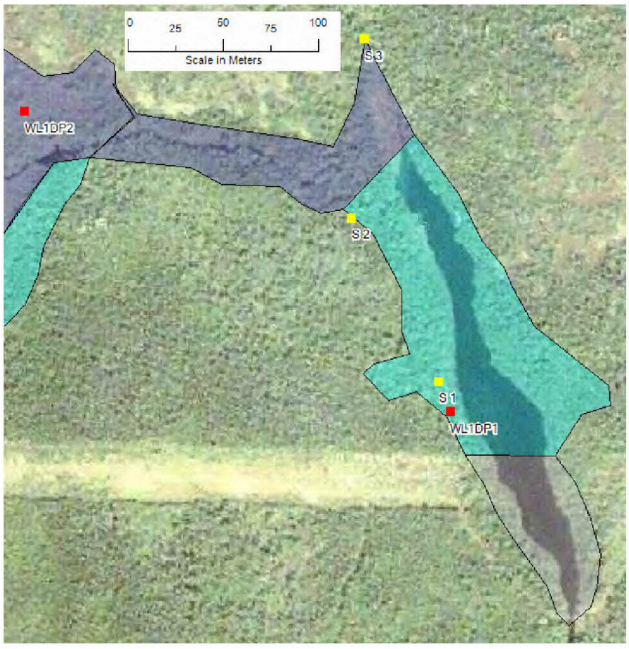
SF19	***WL serves as a recharge site***	***Yes***	***No***							
SF20	***WL serves as a discharge site***	***Yes***	***No***							
SECTION EIGHT: SHORELINE STABILIZATION AND INTEGRITY										
1	Wetland fringing ocean/estuary/lake/pond/river/stream?	***Yes***	No	streamwidth >4m	streamwidth<4m	WB Exposed	WB Sheltered			
2	% cover of rooted vegetation in shallow water zone	H >50%	M 10-50	L <10%						
3	Avg veg WL width b/w shoreline/streambank & 2 m depth contour	H >10m	M 3-10	L <3m						
4	Prevalence of strong-stemmed emerg. veg (shoreline marshes and fens only)	High	Med	Low						
5	Describe shoreline erosion potential	High	Med	Low						
6	Shoreline/streambank veg condition upslope of water level	Low	Med	High	Artificial					
SF21	***WL ability to stabilize shoreline***	***H***	***M***	***L***	N/A					
SECTION NINE: PLANT COMMUNITY										
1	Vegetation diversity	High	Med	Low						
1b	Dominant plant species and % cover in the WL	list: *Osmunda cinnamomea* (30%)/*Calamagrostis* (40%)/ *Oclemena nemoralis* (20%)								
3	Dominant Non-native or Invasive species and % cover	Yes	No	specify: %						
4	Vegetation Disturbance	H	M	L	specify type(s) below					
5	Disturbance Types	H___,ATV___,G___,,M___,In__, D/D___, Im___, OAH___, Ii___, Sd___,E___,,other___,								
7	Vegetative Integrity of plant community	E	H	M	L					
SF22	***Is the plant community unique or rare regionally or provincially?***	***Yes***	***no***	***specify:***						
SF23	***Does the WL contain a diversity of plant communities***	***H***	***M***	***L***						
SF24	***Rate the overall integrity/quality of plant community?***	***H***	***M***	***L***						
SF25	***Are there any observed rare or endangered plant species? Specify.***	***End***	***Thr***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SECTION TEN: FISH AND WILDLIFE HABITAT AND INTEGRITY										
1	Interspersion of open water and vegetation (open water types only)	H	M	L						
1b	% cover in vegetation verus open water	__95___%								
2	Interspersion that best fits entire wetland	H	M	L	N/A					
3	Wetland condition related to detritus	H	M	L	N/A					
4	Interspersion of other wetlands in vicinity	H	M	L						
6	Barriers/restriction between wetland and other habitat	L	M	H						
7	Noteworthy wildlife or evidence (birds, mammals, amphibians,etc)	Yes	No	list: Passerines, Deer tracks, Leapard Frog						
8	Connected to permanent water (accessible to fish)?	Exceptional	High	Med	Low	N/A				
9	Fish species observed or evidence seen (list)	Yes	No	list:						
10	Wetland part of contiguous upland or wetland:	>50ha	25-50ha	10-25ha	<10ha					
11	WL provides habitat for:	Amphibians	Reptiles	Waterfowl	Waterbirds	Mammals	Fish	R/E species		
SF26	***Does wetland support fish/fish habitat?***	***Yes***	***No***	***specify:***						
SF27	***Rare or endangered fish/wildlife species found in the wetland?***	***End***	***Thr-SARA***	***SpC***	***Red***	***Yellow***	***S1***	***S2***	***S3***	***N/A***
SF28	***Overall fish and wildlife habitat quality***	***H***	***M***	L						
SECTION ELEVEN: COMMUNITY USE/VALUE										
1	Describe community use	VV__,CP__,CO__,PO__,PA__,,AV__,GB__,E__,HI__, WV__, BO__,HU__, PG__, BP__,F__, E__, R__, Other:								
SF29	***Rate the wetland's community use/value***	***H***	***M***	L						

SF ratings highlighted in red indicate critical wetland functions or watershed conditions that are highly degraded. Whenever a wetland is found to have red-highlighted **SFs** the proponent

APPENDIX E
Additional Delineation Data Sheets

Wetland 1





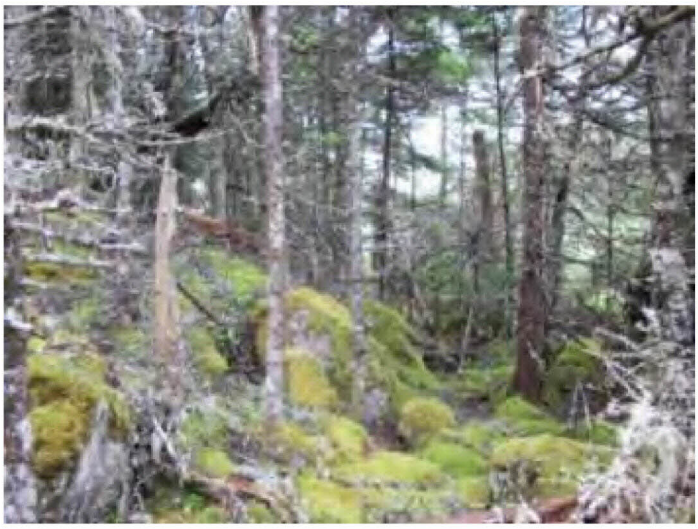
Two streams feed into this large beaver pond from the north. The wetland surrounding the pond is narrow and in some cases non-existent due to steep rock outcrops at the edge of the water. The beaver dam is at the southern end of the open water. Forested wetland is present at the bottom of a steep slope in the southern quadrant near the power line and riparian shrub wetland is associated with both streams.

Open water seen from the south with some riparian Shrub Wetland

Beaver dam seen from the north.

Beaver lodge

Forested Wetland at Wetland 1



Upland habitat adjacent to Forested Wetland at the base of the steep incline at Wetland 1

Shrub Riparian Wetland where Wetland 1 joins Wetland 17

Project Site:	Point Black				Date:	July, 2011		Sample Point:	WL1DP1	Job #:	
Client/owner:					Field Investigator(s):	Theo Popma, Candice, Carrie B.					
County:	Guysborough				Coordinates:	645779 5022433					
PID 35092063					Do normal environmental conditions exist on-site?			Yes	x	No	
If no, explain:											
Atypical Situation?	Yes x	No	Explain: Beaver Dam								
Is this a potential **Problem Area?**		Yes	No x	Explain:							

Wetland Determination
(Check One Only For Each Criteria)

Dominant Hydrophytic Vegetation (50/20 rule)	Yes	x	No	
Wetland Hydrology	Yes	x	No	
Hydric Soils	Yes	x	No	

Wetland Determination

x **YES** **NO**

Wetland Type: Riparian |Forested Wetland

Rational for Determination:

Vegetation

	Tree Stratum: (Plot size: 9m2)	%Cover		Dominant Species	Indicator Status
1	*Osmunda cinnamomea*	5		x	*FACW*
2	*Oxalis montana*	5		x	*FAC-*
3	*Carex trisperma*	5		x	*OBL*
4	*Aralia nudicaulis*	5		x	*FACU*
5					
6					
		20	=	**Total Cover**	

	Shrub Stratum: (Plot size: 5m2)				
1	*Nemopanthus mucronatus*	5		x	*OBL*
2	*Abies balsamea*	10		x	*FAC*
3					
4					
5					
		15	=	**Total Cover**	

	Herb Stratum: (Plot Size: 1m2)				
1	*Abies balsamea*	50		x	*FAC*
2	*Picea mariana*	20			
3	*Larix laricina*	10			
4					
5					
		80	=	**Total Cover**	

Comments

Sphagnum common

Dominance Test Worksheet:

# of Dominant Species that are OBL,FACW,FAC:	6
Total # of Dominant Species across all strata:	7
% of Dominant Species that are OBL,FACW,FAC:	85.7

Prevalence Index Worksheet:

	Total %Cover of:	Multiply by:	
OBL Species		x 1 =	0
FACW Species		x 2 =	0
FAC Species		x 3 =	0
FACU Species		x 4 =	0
ULP Species		x 5 =	0
Column Totals:	0		0

Prevalence Index = B/A = ##

Hydrophytic Vegetation Indicators:

x	Rapid Test for Hydrolic Vegetation
x	Dominance Test is >50%
	Prevalence Index is ≤3.0 [1]
	Morphological Adaptations[1] (explain)
	Problematic Hydrophytic Vegetation[1](explain)

[1]Indicators of hydric soil and weland hydrology must be present, unless disturbed or problematic

Hydrophytic Vegetation Present? **Yes** x **No**

Hydrology

Primary Hydrological Indicators: (minimum of one is required;check all that apply)

___	Surface Water (A1)	___	Water Stained Leaves (B9)
x	High Water Table (A2)	___	Aquatic Fauna (B13)
x	Saturation (A3)	___	Marl Deposits (B15)
___	Watermarks	___	Hydrogen Sulfide Odor (C1)
___	Sediment Deposits (B2)	___	Oxidized Rhizospheres on Living Roots (C3)
___	Drift Deposits (B3)	___	Presence of Reduced Iron (C4)
___	Algal Mat of Crust (B4)	___	Recent Iron reduction in tilled Soils (C6)
___	Iron Deposits (B5)	___	Thin Muck Surface (C7)
___	Inundation Visible on Aerial Imagery (B7)	___	Other (Explain in Remarks)
___	Sparsely Vegetated Concave Surface (B8)		

Secondary Indicators: (minimum of two required)

___	Surface Soil Cracks (B6)	___	Stunted or Stressed Plants (D1)
___	Drainage Patterns (B10)	___	Geomorphic Position (D2)
___	Moss Trim Lines (B16)	___	Shallow Aquitard (D3)
___	Dry-Season Water Table (C2)	___	Microtopographic Relief (D4)
___	Crayfish Burrows (C8)	___	FAC-Neutral Test (D5)
___	Saturation Visible on Aerial Imagery (C9)		

Field Observations:

Surface Water Present?	Yes ___	No x	Depth ___						
Water Table Present?	Yes x	No ___	Depth 10	**Wetland Hydrology Present?**	**Yes**	x	**No**	___	
Saturation Present?	Yes x	No ___	Depth 0						

Comments:

Soil Profile

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators)

Depth(cm)	Matrix		Redox Features					
	Color(moist)	%	Color(moist)	%	Type[1]	Loc[2]	Texture	Remarks
			Organic to 30cm					

[1]Type:C=Concentration,D=Depletion,RM=Reduced Matrix,CS=Covered or Coated Sand Grains.[2]Location:PL=Pore Lining,M=Matrix

Hydric Soil Indicators:

x	Histosol (A1)	___	Sandy Redox (S5)
___	Histic Epipedon (A2)	___	Stripped Matrix (S6)
___	Black Histic (A3)	___	Dark Surfaces (S7)
___	Hydrogen Sulfide (A4)	___	Polyvalue Below Surface (S8)
___	Stratified Layers (A5)	___	Thin Dark Surface (S9)
___	Depleted Below Dark Surface (A11)	___	Loamy Gleyed Matrix (F2)
___	Thick Dark Surface (A12)	___	Depleted Matrix (F3)
___	Sandy Mucky Mineral (S1)	___	Redox Dark Surface (F6)
___	5cm Mucky Peat or Peat (S3)	___	Depleted Dark Surface (F7)
___	Sandy Gleyed Matrix (S4)	___	Redox Depressions (F8)

Restrictive Layer Type (if observed ___ Depth: **Hydric Soil Present?** **Yes** x **No** ___

Comments:

Raining

Project Site:	Point Black		Date:	July, 2011	Sample Point:	WL1DP2	Job #:
Client/owner:			Field Investigator(s):	Theo Popma, Candice, Carrie B.			
County:	Guysborough		Coordinates:	645555 5022591			
PID 35092063			Do normal environmental conditions exist on-site?		Yes	x	No
If no, explain:							
Atypical Situation?	Yes		No	x	Explain:		
Is this a potential **Problem Area?**			Yes		No	x	Explain:

Wetland Determination
(Check One Only For Each Criteria)

Dominant Hydrophytic Vegetation (50/20 rule)	Yes	x	No	
Wetland Hydrology	Yes	x	No	
Hydric Soils	Yes	x	No	

Wetland Determination

x **YES** **NO**

Wetland Type: Riparian Shrub Wetland

Rational for Determination:

Vegetation

	Tree Stratum: (Plot size: 9m2)	%Cover		Dominant Species	Indicator Status
1	*Sarracenia purpurea*	5		x	*OBL*
2	*Maianthemum trifolium*	5		x	*FACW+*
3	*Kalmia angustifolia*	5		x	*FAC*
4	*Aster radula*	5		x	*OBL*
5					
6					
		20	=	**Total Cover**	
	Shrub Stratum: (Plot size: 5m2)				
1	*Viburnum nudum*	10		x	*OBL*
2	*Nemopanthus mucronatus*	15		x	*OBL*
3	*Abies balsamea*	15		x	*FAC*
4					
5					
		40	=	**Total Cover**	
	Herb Stratum: (Plot Size: 1m2)				
1	*Larix laricina*	20		x	*FACW*
2	*Abies balsamea*	20		x	*FAC*
3					
4					
5					
		40	=	**Total Cover**	

Comments

Dominance Test Worksheet:

# of Dominant Species that are OBL,FACW,FAC:	9
Total # of Dominant Species across all strata:	9
% of Dominant Species that are OBL,FACW,FAC:	100

Prevalence Index Worksheet:

Total %Cover of:	Multiply by:	
OBL Species	x 1 =	0
FACW Species	x 2 =	0
FAC Species	x 3 =	0
FACU Species	x 4 =	0
ULP Species	x 5 =	0
Column Totals: 0		0

Prevalence Index = B/A = ##

Hydrophytic Vegetation Indicators:

- x Rapid Test for Hydrolic Vegetation
- x Dominance Test is >50%
- ___ Prevalence Index is ≤3.0 [1]
- ___ Morphological Adaptations [1] (explain)
- ___ Problematic Hydrophytic Vegetation [1] (explain)

[1] Indicators of hydric soil and weland hydrology must be present, unless disturbed or problematic

Hydrophytic Vegetation Present? **Yes** x **No**

Hydrology

Primary Hydrological Indicators: (minimum of one is required;check all that apply)

___	Surface Water (A1)	___	Water Stained Leaves (B9)
x	High Water Table (A2)	___	Aquatic Fauna (B13)
x	Saturation (A3)	___	Marl Deposits (B15)
___	Watermarks	___	Hydrogen Sulfide Odor (C1)
___	Sediment Deposits (B2)	___	Oxidized Rhizospheres on Living Roots (C3)
___	Drift Deposits (B3)	___	Presence of Reduced Iron (C4)
___	Algal Mat of Crust (B4)	___	Recent Iron reduction in tilled Soils (C6)
___	Iron Deposits (B5)	___	Thin Muck Surface (C7)
___	Inundation Visible on Aerial Imagery (B7)	___	Other (Explain in Remarks)
___	Sparsely Vegetated Concave Surface (B8)		

Secondary Indicators: (minimum of two required)

___	Surface Soil Cracks (B6)	___	Stunted or Stressed Plants (D1)
___	Drainage Patterns (B10)	___	Geomorphic Position (D2)
___	Moss Trim Lines (B16)	___	Shallow Aquitard (D3)
___	Dry-Season Water Table (C2)	___	Microtopographic Relief (D4)
___	Crayfish Burrows (C8)	___	FAC-Neutral Test (D5)
___	Saturation Visible on Aerial Imagery (C9)		

Field Observations:

Surface Water Present?	Yes	___	No	x	Depth	___		
Water Table Present?	Yes	x	No	___	Depth	20	**Wetland Hydrology Present?**	**Yes** x **No** ___
Saturation Present?	Yes	x	No	___	Depth	0		

Comments:

Soil Profile

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators)

Depth(cm)	Matrix		Redox Features					
	Color(moist)	%	Color(moist)	%	Type[1]	Loc[2]	Texture	Remarks
			Organic for 30cm					

[1]Type:C=Concentration,D=Depletion,RM=Reduced Matrix,CS=Covered or Coated Sand Grains.[2]Location:PL=Pore Lining,M=Matrix

Hydric Soil Indicators:

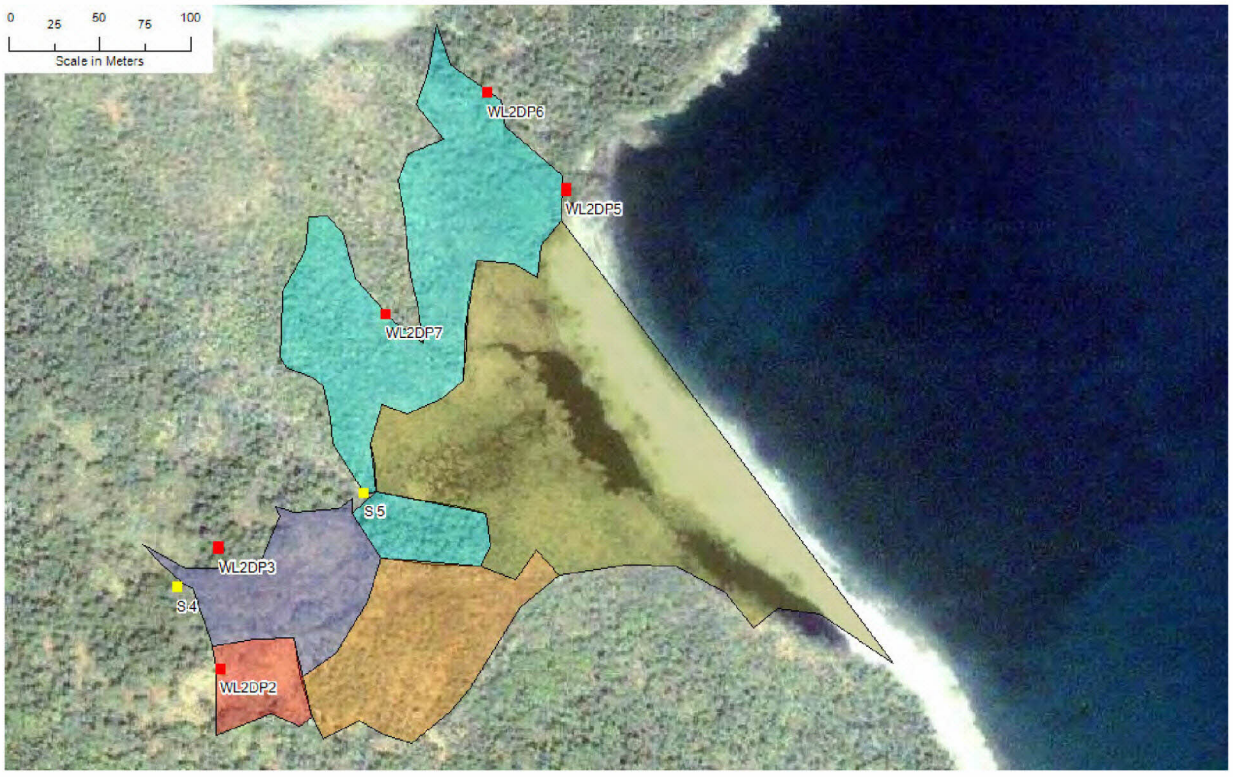
x	Histosol (A1)	___	Sandy Redox (S5)
___	Histic Epipedon (A2)	___	Stripped Matrix (S6)
___	Black Histic (A3)	___	Dark Surfaces (S7)
___	Hydrogen Sulfide (A4)	___	Polyvalue Below Surface (S8)
___	Stratified Layers (A5)	___	Thin Dark Surface (S9)
___	Depleted Below Dark Surface (A11)	___	Loamy Gleyed Matrix (F2)
___	Thick Dark Surface (A12)	___	Depleted Matrix (F3)
___	Sandy Mucky Mineral (S1)	___	Redox Dark Surface (F6)
___	5cm Mucky Peat or Peat (S3)	___	Depleted Dark Surface (F7)
___	Sandy Gleyed Matrix (S4)	___	Redox Depressions (F8)

Restrictive Layer Type (if observed | Depth: | **Hydric Soil Present?** | **Yes** x **No** ___

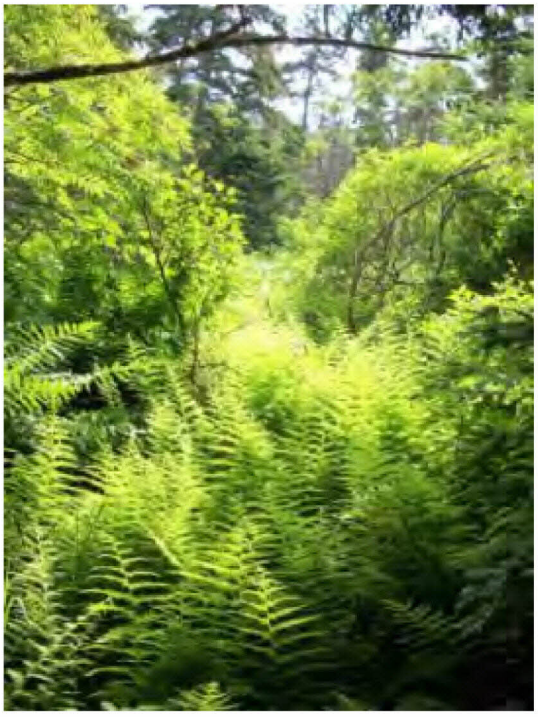
Comments:

Wetland 2

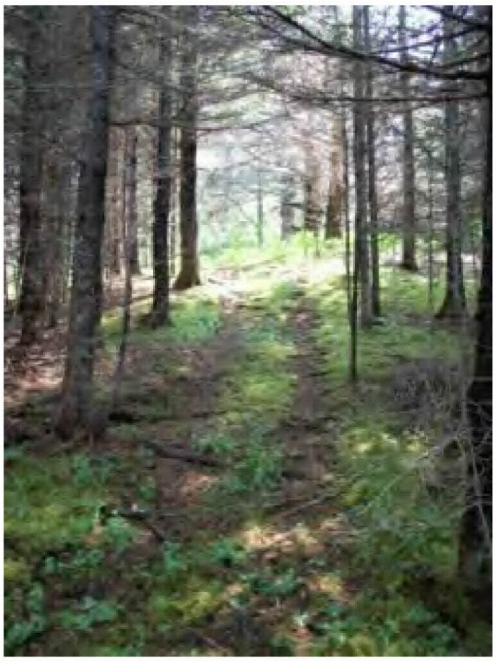
0
25
50
75
100
Scale in Meters
WL2DP6
WL2DP5
WL2DP7
S 5
WL2DP3
S 4
WL2DP2


0
25
50
75
100
Scale in Meters
WL2DP6
WL2DP5
WL2DP7
S 5
WL2DP3
S 4
WL2DP2

Wetland 2 is a complex of habitat types including marsh, swamp, forested wetland and riparian wetland. This delineation was problematic because of transitional habitat which stretched between the two coastlines behind the headland. Historic habitation was also present but had little effect on wetland habitat although some fern-dominated wet meadow habitat was identified in isolated areas. Some microtopographical relief was present along the western and southern edges of the complex. Open water was found not to be brackish.



Seepy fern-dominated slope near western wetland edge



Upland habitat near wetland 2 dominated by coniferous forest

Transitional wetland habitat dominated by shrubs and blown down conifers behind the headland west of the main estuary

Upland near Wetland 2

Marshy fen portion of the Wetland 2 complex

Project Site:	Point Black	Date:	July, 2011	Sample Point:	CBWL2DP1	Job #:
Client/owner:		Field Investigator(s):	Theo Popma, Candice, Carrie B.			
County:	Guysborough	Coordinates:	645276 5024015			
PID 35092063		Do normal environmental conditions exist on-site?	Yes [x]	No [ ]		

If no, explain:

Atypical Situation? Yes [x] No [ ] Explain: Post-Settlement clearing on slope and probably in wetland

Is this a potential **Problem Area?** Yes [ ] No [x] Explain:

Wetland Determination
(Check One Only For Each Criteria)

Dominant Hydrophytic Vegetation (50/20 rule)	Yes [x]	No [ ]
Wetland Hydrology	Yes [x]	No [ ]
Hydric Soils	Yes [x]	No [ ]

Wetland Determination

[x] **YES** [ ] **NO**

Wetland Type: Shrub Swamp

Rational for Determination:

Vegetation

	Tree Stratum: (Plot size: 9m2)	%Cover	Dominant Species	Indicator Status
1	*Osmunda cinnamomea*	20	x	*FACW*
2	*Carex nigra*	20	x	*FACW+*
3	*thelypteris noveboracensis*	15	x	*FAC*
4				
5				
6				
		55	= **Total Cover**	

	Shrub Stratum: (Plot size: 5m2)			
1	*Nemopanthus mucronatus*	10	x	*OBL*
2	*Kalmia angustifolia*	5	x	*FAC*
3	*Alnus crispa*	5	x	*FAC*
4	*Rubus allegheniensis*	5	x	*FACU-*
5	*Ilex verticillata*	5	x	*FACW+*
		30	= **Total Cover**	

	Herb Stratum: (Plot Size: 1m2)			
1	*none*			
2				
3				
4				
5				
		0	= **Total Cover**	

Comments

Sphagnum - 100%

Dominance Test Worksheet:

# of Dominant Species that are OBL, FACW, FAC:	9
Total # of Dominant Species across all strata:	10
% of Dominant Species that are OBL, FACW, FAC:	90

Prevalence Index Worksheet:

Total %Cover of:	Multiply by:	
OBL Species	x 1 =	0
FACW Species	x 2 =	0
FAC Species	x 3 =	0
FACU Species	x 4 =	0
ULP Species	x 5 =	0
Column Totals: 0		0

Prevalence Index = B/A = ##

Hydrophytic Vegetation Indicators:

- [x] Rapid Test for Hydrolic Vegetation
- [x] Dominance Test is >50%
- [ ] Prevalence Index is ≤3.0 [1]
- [ ] Morphological Adaptations[1] (explain)
- [ ] Problematic Hydrophytic Vegetation[1](explain)

[1]Indicators of hydric soil and weland hydrology must be present, unless disturbed or problematic

Hydrophytic Vegetation Present? **Yes** x **No**

Hydrology

Primary Hydrological Indicators: (minimum of one is required;check all that apply)

___	Surface Water (A1)	___	Water Stained Leaves (B9)
x	High Water Table (A2)	___	Aquatic Fauna (B13)
x	Saturation (A3)	___	Marl Deposits (B15)
___	Watermarks	___	Hydrogen Sulfide Odor (C1)
___	Sediment Deposits (B2)	___	Oxidized Rhizospheres on Living Roots (C3)
___	Drift Deposits (B3)	___	Presence of Reduced Iron (C4)
___	Algal Mat of Crust (B4)	___	Recent Iron reduction in tilled Soils (C6)
___	Iron Deposits (B5)	___	Thin Muck Surface (C7)
___	Inundation Visible on Aerial Imagery (B7)	___	Other (Explain in Remarks)
___	Sparsely Vegetated Concave Surface (B8)		

Secondary Indicators: (minimum of two required)

___	Surface Soil Cracks (B6)	___	Stunted or Stressed Plants (D1)
___	Drainage Patterns (B10)	___	Geomorphic Position (D2)
___	Moss Trim Lines (B16)	___	Shallow Aquitard (D3)
___	Dry-Season Water Table (C2)	___	Microtopographic Relief (D4)
___	Crayfish Burrows (C8)	___	FAC-Neutral Test (D5)
___	Saturation Visible on Aerial Imagery (C9)		

Field Observations:

Surface Water Present?	Yes ___	No x	Depth	___			
Water Table Present?	Yes x	No ___	Depth	22	**Wetland Hydrology Present?**	**Yes** x	**No** ___
Saturation Present?	Yes x	No ___	Depth	0			

Comments:

Soil Profile

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators)

Depth(cm)	Matrix		Redox Features					
	Color(moist)	%	Color(moist)	%	Type[1]	Loc[2]	Texture	Remarks
30cm							Organic	

[1]Type:C=Concentration,D=Depletion,RM=Reduced Matrix,CS=Covered or Coated Sand Grains.[2]Location:PL=Pore Lining,M=Matrix

Hydric Soil Indicators:

x	Histosol (A1)	___	Sandy Redox (S5)
___	Histic Epipedon (A2)	___	Stripped Matrix (S6)
___	Black Histic (A3)	___	Dark Surfaces (S7)
___	Hydrogen Sulfide (A4)	___	Polyvalue Below Surface (S8)
___	Stratified Layers (A5)	___	Thin Dark Surface (S9)
___	Depleted Below Dark Surface (A11)	___	Loamy Gleyed Matrix (F2)
___	Thick Dark Surface (A12)	___	Depleted Matrix (F3)
___	Sandy Mucky Mineral (S1)	___	Redox Dark Surface (F6)
___	5cm Mucky Peat or Peat (S3)	___	Depleted Dark Surface (F7)
___	Sandy Gleyed Matrix (S4)	___	Redox Depressions (F8)

Restrictive Layer Type (if observed ___ Depth: **Hydric Soil Present?** **Yes** x **No** ___

Comments:

Project Site:	Point Black		Date:	July, 2011	Sample Point:	CBWL2DP2	Job #:
Client/owner:			Field Investigator(s):	Theo Popma, Candice, Carrie B.			
County:	Guysborough		Coordinates:				
PID 35092063			Do normal environmental conditions exist on-site?		Yes [ ]	No [x]	

If no, explain:

Atypical Situation? Yes [x] No [ ] Explain: Slope was habitated/cleared

Is this a potential **Problem Area?** Yes [ ] No [x] Explain:

Wetland Determination

(Check One Only For Each Criteria)

Dominant Hydrophytic Vegetation (50/20 rule)	Yes [x]	No [ ]
Wetland Hydrology	Yes [ ]	No [x]
Hydric Soils	Yes [ ]	No [x]

Wetland Type:

Rational for Determination:

Wetland Determination

[ ] **YES** [x] **NO**

Vegetation

	Tree Stratum: (Plot size: 9m2)	%Cover		Dominant Species	Indicator Status
1	*Dennstaedtia punctilobula*	##		x	*FAC*
2	*Rubus allegheniensis*	20		x	*FACU-*
3	*Calamagrostis canadensis*	10		x	*FACW+*
4					
5					
6					
		##	=	**Total Cover**	

	Shrub Stratum: (Plot size: 5m2)				
1	*Alnus crispa*	5		x	*FAC*
2	*Picea glauca*	5		x	*FACU*
3	*Betula papyrifera*	10			*FACU*
4					
5					
		20	=	**Total Cover**	

	Herb Stratum: (Plot Size: 1m2)				
1					
2					
3					
4					
5					
		0	=	**Total Cover**	

Comments

Dominance Test Worksheet:

# of Dominant Species that are OBL,FACW,FAC:	3
Total # of Dominant Species across all strata:	6
% of Dominant Species that are OBL,FACW,FAC:	50

Prevalence Index Worksheet:

	Total %Cover of:	Multiply by:	
OBL Species		x 1 =	0
FACW Species		x 2 =	0
FAC Species		x 3 =	0
FACU Species		x 4 =	0
ULP Species		x 5 =	0
Column Totals:	0		0

Prevalence Index = B/A = ##

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrolic Vegetation
- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0 [1]
- ___ Morphological Adaptations[1] (explain)
- ___ Problematic Hydrophytic Vegetation[1] (explain)

[1] Indicators of hydric soil and weland hydrology must be present, unless disturbed or problematic

Hydrophytic Vegetation Present? **Yes** **No** x

Hydrology

Primary Hydrological Indicators: (minimum of one is required;check all that apply)

___	Surface Water (A1)	___	Water Stained Leaves (B9)
___	High Water Table (A2)	___	Aquatic Fauna (B13)
___	Saturation (A3)	___	Marl Deposits (B15)
___	Watermarks	___	Hydrogen Sulfide Odor (C1)
___	Sediment Deposits (B2)	___	Oxidized Rhizospheres on Living Roots (C3)
___	Drift Deposits (B3)	___	Presence of Reduced Iron (C4)
___	Algal Mat of Crust (B4)	___	Recent Iron reduction in tilled Soils (C6)
___	Iron Deposits (B5)	___	Thin Muck Surface (C7)
___	Inundation Visible on Aerial Imagery (B7)	___	Other (Explain in Remarks)
___	Sparsely Vegetated Concave Surface (B8)		

Secondary Indicators: (minimum of two required)

___	Surface Soil Cracks (B6)	___	Stunted or Stressed Plants (D1)
___	Drainage Patterns (B10)	___	Geomorphic Position (D2)
___	Moss Trim Lines (B16)	___	Shallow Aquitard (D3)
___	Dry-Season Water Table (C2)	___	Microtopographic Relief (D4)
___	Crayfish Burrows (C8)	___	FAC-Neutral Test (D5)
___	Saturation Visible on Aerial Imagery (C9)		

Field Observations:

Surface Water Present?	Yes ___	No x	Depth ___				
Water Table Present?	Yes ___	No x	Depth ___	**Wetland Hydrology Present?**	**Yes** ___	**No** x	
Saturation Present?	Yes ___	No x	Depth ___				

Comments:

Soil Profile

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators)

Depth(cm)	Matrix		Redox Features					
	Color(moist)	%	Color(moist)	%	Type[1]	Loc[2]	Texture	Remarks

[1]Type:C=Concentration,D=Depletion,RM=Reduced Matrix,CS=Covered or Coated Sand Grains.[2]Location:PL=Pore Lining,M=Matrix

Hydric Soil Indicators:

___	Histosol (A1)	___	Sandy Redox (S5)
___	Histic Epipedon (A2)	___	Stripped Matrix (S6)
___	Black Histic (A3)	___	Dark Surfaces (S7)
___	Hydrogen Sulfide (A4)	___	Polyvalue Below Surface (S8)
___	Stratified Layers (A5)	___	Thin Dark Surface (S9)
___	Depleted Below Dark Surface (A11)	___	Loamy Gleyed Matrix (F2)
___	Thick Dark Surface (A12)	___	Depleted Matrix (F3)
___	Sandy Mucky Mineral (S1)	___	Redox Dark Surface (F6)
___	5cm Mucky Peat or Peat (S3)	___	Depleted Dark Surface (F7)
___	Sandy Gleyed Matrix (S4)	___	Redox Depressions (F8)

Restrictive Layer Type (if observed | Depth: | **Hydric Soil Present?** | **Yes** ___ | **No** x

Comments:

No depletion

Project Site:	Point Black		Date:	July, 2011	Sample Point:	WL2DP3	Job #:
Client/owner:			Field Investigator(s):	Theo Popma, Candice, Carrie B.			
County:	Guysborough		Coordinates:				
PID 35092063			Do normal environmental conditions exist on-site?		Yes	x	No
If no, explain:							
Atypical Situation?	Yes		No	x	Explain:		
Is this a potential **Problem Area?**		Yes		No	x	Explain:	

Wetland Determination
(Check One Only For Each Criteria)

Dominant Hydrophytic Vegetation (50/20 rule)	Yes		No	x	***Wetland Determination***
Wetland Hydrology	Yes		No	x	
Hydric Soils	Yes		No	x	**YES** x **NO**

Wetland Type:
Rational for Determination:

Vegetation

	Tree Stratum: (Plot size: 9m2)		%Cover		Dominant Species	Indicator Status
1	*Maianthemum canadense*		80			*FAC-*
2	*Aralia nudicaulis*		20			*FACU*
3						
4						
5						
6						
			##	=	**Total Cover**	
	Shrub Stratum: (Plot size: 5m2)					
1	*Sorbus americana*		15			*FACU*
2	*Picea glauca*		5			*FACU*
3	*Abies balsamea*		5			*FAC*
4						
5						
			25	=	**Total Cover**	
	Herb Stratum: (Plot Size: 1m2)					
1	*Picea glauca*		60			*FACU*
2						
3						
4						
5						
			60	=	**Total Cover**	

Comments

Dominance Test Worksheet:

# of Dominant Species that are OBL, FACW, FAC:	2
Total # of Dominant Species across all strata:	6
% of Dominant Species that are OBL, FACW, FAC:	33.3

Prevalence Index Worksheet:

	Total %Cover of:	Multiply by:	
OBL Species		x 1 =	0
FACW Species		x 2 =	0
FAC Species		x 3 =	0
FACU Species		x 4 =	0
ULP Species		x 5 =	0
Column Totals:	0		0

Prevalence Index = B/A = ##

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrolic Vegetation
- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0 [1]
- ___ Morphological Adaptations[1] (explain)
- ___ Problematic Hydrophytic Vegetation[1](explain)

[1]Indicators of hydric soil and weland hydrology must be present, unless disturbed or problematic

Hydrophytic Vegetation Present? **Yes** **No** x

Hydrology

Primary Hydrological Indicators: (minimum of one is required;check all that apply)

___	Surface Water (A1)	___	Water Stained Leaves (B9)
___	High Water Table (A2)	___	Aquatic Fauna (B13)
___	Saturation (A3)	___	Marl Deposits (B15)
___	Watermarks	___	Hydrogen Sulfide Odor (C1)
___	Sediment Deposits (B2)	___	Oxidized Rhizospheres on Living Roots (C3)
___	Drift Deposits (B3)	___	Presence of Reduced Iron (C4)
___	Algal Mat of Crust (B4)	___	Recent Iron reduction in tilled Soils (C6)
___	Iron Deposits (B5)	___	Thin Muck Surface (C7)
___	Inundation Visible on Aerial Imagery (B7)	___	Other (Explain in Remarks)
___	Sparsely Vegetated Concave Surface (B8)		

Secondary Indicators: (minimum of two required)

___	Surface Soil Cracks (B6)	___	Stunted or Stressed Plants (D1)
___	Drainage Patterns (B10)	___	Geomorphic Position (D2)
___	Moss Trim Lines (B16)	___	Shallow Aquitard (D3)
___	Dry-Season Water Table (C2)	___	Microtopographic Relief (D4)
___	Crayfish Burrows (C8)	___	FAC-Neutral Test (D5)
___	Saturation Visible on Aerial Imagery (C9)		

Field Observations:

Surface Water Present?	Yes ___	No x	Depth ___					
Water Table Present?	Yes ___	No x	Depth ___	**Wetland Hydrology Present?**	**Yes** ___	**No** x		
Saturation Present?	Yes ___	No x	Depth ___					

Comments:

Soil Profile

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators)

Depth(cm)	Matrix		Redox Features					
	Color(moist)	%	Color(moist)	%	Type[1]	Loc[2]	Texture	Remarks
	5YR 4/4							

[1]Type:C=Concentration,D=Depletion,RM=Reduced Matrix,CS=Covered or Coated Sand Grains.[2]Location:PL=Pore Lining,M=Matrix

Hydric Soil Indicators:

___	Histosol (A1)	___	Sandy Redox (S5)
___	Histic Epipedon (A2)	___	Stripped Matrix (S6)
___	Black Histic (A3)	___	Dark Surfaces (S7)
___	Hydrogen Sulfide (A4)	___	Polyvalue Below Surface (S8)
___	Stratified Layers (A5)	___	Thin Dark Surface (S9)
___	Depleted Below Dark Surface (A11)	___	Loamy Gleyed Matrix (F2)
___	Thick Dark Surface (A12)	___	Depleted Matrix (F3)
___	Sandy Mucky Mineral (S1)	___	Redox Dark Surface (F6)
___	5cm Mucky Peat or Peat (S3)	___	Depleted Dark Surface (F7)
___	Sandy Gleyed Matrix (S4)	___	Redox Depressions (F8)

Restrictive Layer Type (if observed | Depth: | **Hydric Soil Present?** | **Yes** ___ | **No** x

Comments:

No depletion

Project Site:	Point Black	Date:	July, 2011	Sample Point:	WL2DP4	Job #:
Client/owner:		Field Investigator(s):	Theo Popma, Candice, Carrie B.			
County:	Guysborough	Coordinates:	645467 5024212			
PID 35092063		Do normal environmental conditions exist on-site?		Yes	x	No

If no, explain:

Atypical Situation? Yes [ ] No [x] Explain:

Is this a potential **Problem Area?** Yes [ ] No [x] Explain:

Wetland Determination

(Check One Only For Each Criteria)

Dominant Hydrophytic Vegetation (50/20 rule)	Yes	x	No	
Wetland Hydrology	Yes	x	No	
Hydric Soils	Yes	x	No	

Wetland Type:

Rational for Determination:

Wetland Determination

[x] **YES** [ ] **NO**

Vegetation

	Tree Stratum: (Plot size: 9m2)	%Cover		Dominant Species	Indicator Status
1	*Aster umbellatus*	20		x	*FACW*
2	*Rubus allegheniensis*	10			*FACU-*
3	*Rubus idaeus*	20		x	*FAC-*
4	*Calamagrostis canadensis*	20		x	*FACW+*
5	*Thalictrum pubescens*	10			*FACW+*
6					
		80	=	**Total Cover**	

	Shrub Stratum: (Plot size: 5m2)				
1	*Abies balsamea*	20		x	*FAC*
2	*Alnus viridis*	20		x	*FAC*
3	*Nemopanthus mucronatus*				*OBL*
4					
5					
		40	=	**Total Cover**	

	Herb Stratum: (Plot Size: 1m2)				
1	*Picea rubens*	50		x	*FACU*
2					
3					
4					
5					
		50	=	**Total Cover**	

Comments

Dominance Test Worksheet:

# of Dominant Species that are OBL,FACW,FAC:	7
Total # of Dominant Species across all strata:	9
% of Dominant Species that are OBL,FACW,FAC:	77.8

Prevalence Index Worksheet:

	Total %Cover of:	Multiply by:	
OBL Species		x 1 =	0
FACW Species		x 2 =	0
FAC Species		x 3 =	0
FACU Species		x 4 =	0
ULP Species		x 5 =	0
Column Totals:	0		0

Prevalence Index = B/A = ##

Hydrophytic Vegetation Indicators:

- [x] Rapid Test for Hydrolic Vegetation
- [x] Dominance Test is >50%
- [ ] Prevalence Index is ≤3.0 [1]
- [ ] Morphological Adaptations[1] (explain)
- [ ] Problematic Hydrophytic Vegetation[1](explain)

[1]Indicators of hydric soil and weland hydrology must be present, unless disturbed or problematic

Hydrophytic Vegetation Present? **Yes** x **No**

Hydrology

Primary Hydrological Indicators: (minimum of one is required;check all that apply)

x	Surface Water (A1)		Water Stained Leaves (B9)
x	High Water Table (A2)		Aquatic Fauna (B13)
x	Saturation (A3)		Marl Deposits (B15)
	Watermarks		Hydrogen Sulfide Odor (C1)
	Sediment Deposits (B2)		Oxidized Rhizospheres on Living Roots (C3)
	Drift Deposits (B3)		Presence of Reduced Iron (C4)
	Algal Mat of Crust (B4)		Recent Iron reduction in tilled Soils (C6)
	Iron Deposits (B5)		Thin Muck Surface (C7)
	Inundation Visible on Aerial Imagery (B7)		Other (Explain in Remarks)
	Sparsely Vegetated Concave Surface (B8)		

Secondary Indicators: (minimum of two required)

	Surface Soil Cracks (B6)		Stunted or Stressed Plants (D1)
	Drainage Patterns (B10)		Geomorphic Position (D2)
	Moss Trim Lines (B16)		Shallow Aquitard (D3)
	Dry-Season Water Table (C2)		Microtopographic Relief (D4)
	Crayfish Burrows (C8)		FAC-Neutral Test (D5)
	Saturation Visible on Aerial Imagery (C9)		

Field Observations:

Surface Water Present?	Yes	x	No		Depth	5			
Water Table Present?	Yes	x	No		Depth	0	**Wetland Hydrology Present?**	**Yes** x	**No**
Saturation Present?	Yes	x	No		Depth	0			

Comments:

Soil Profile

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators)

Depth(cm)	Matrix		Redox Features				
	Color(moist)	%	Color(moist)	%	Type[1]	Loc[2]	Texture	Remarks
			Histosol					

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators:

	Histosol (A1)		Sandy Redox (S5)
	Histic Epipedon (A2)		Stripped Matrix (S6)
	Black Histic (A3)		Dark Surfaces (S7)
x	Hydrogen Sulfide (A4)		Polyvalue Below Surface (S8)
	Stratified Layers (A5)		Thin Dark Surface (S9)
	Depleted Below Dark Surface (A11)		Loamy Gleyed Matrix (F2)
	Thick Dark Surface (A12)		Depleted Matrix (F3)
	Sandy Mucky Mineral (S1)		Redox Dark Surface (F6)
	5cm Mucky Peat or Peat (S3)		Depleted Dark Surface (F7)
	Sandy Gleyed Matrix (S4)		Redox Depressions (F8)

Restrictive Layer Type (if observed | Depth: | **Hydric Soil Present?** | **Yes** x | **No**

Comments:

Project Site:	Point Black		Date:	July, 2011	Sample Point:	WL2DP5	Job #:
Client/owner:			Field Investigator(s):	Theo Popma, Candice, Carrie B.			
County:	Guysborough		Coordinates:				
PID	35092063		Do normal environmental conditions exist on-site?		Yes	x	No
If no, explain:							
Atypical Situation?	Yes		No	x	Explain:		
Is this a potential **Problem Area?**		Yes	x	No	Explain:	Transitional habitat behind headland	

Wetland Determination
(Check One Only For Each Criteria)

Dominant Hydrophytic Vegetation (50/20 rule)	Yes	x	No	
Wetland Hydrology	Yes	x	No	
Hydric Soils	Yes	x	No	

Wetland Type:

Rational for Determination:

Wetland Determination

x **YES** **NO**

Vegetation

	Tree Stratum: (Plot size: 9m2)	%Cover		Dominant Species	Indicator Status
1	*Maianthemum trifolium*	25			*FACW*
2	*Aralia nudicaulis*	10			*FACU*
3	*Carex trisperma*	5			*OBL*
4					
5					
6					
		40	=	**Total Cover**	
	Shrub Stratum: (Plot size: 5m2)				
1	*Ilex verticillata*	15			*FACW+*
2					
3					
4					
5					
		15	=	**Total Cover**	
	Herb Stratum: (Plot Size: 1m2)				
1	*Larix laricina*	30			*FACW*
2	*Picea rubens*	5			*FACU*
3					
4					
5					
		35	=	**Total Cover**	

Comments

Sphagnum - 80%

Dominance Test Worksheet:

# of Dominant Species that are OBL,FACW,FAC:

Total # of Dominant Species across all strata:

% of Dominant Species that are OBL,FACW,FAC: ####

Prevalence Index Worksheet:

	Total %Cover of:	Multiply by:	
OBL Species		x 1 =	0
FACW Species		x 2 =	0
FAC Species		x 3 =	0
FACU Species		x 4 =	0
ULP Species		x 5 =	0
Column Totals:	0		0

Prevalence Index = B/A = ##

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrolic Vegetation
___ Dominance Test is >50%
___ Prevalence Index is ≤3.0 [1]
___ Morphological Adaptations [1] (explain)
___ Problematic Hydrophytic Vegetation [1] (explain)

[1] Indicators of hydric soil and weland hydrology must be present, unless disturbed or problematic

Hydrophytic Vegetation Present? **Yes** x **No**

Hydrology

Primary Hydrological Indicators: (minimum of one is required;check all that apply)

	Surface Water (A1)		Water Stained Leaves (B9)
x	High Water Table (A2)		Aquatic Fauna (B13)
x	Saturation (A3)		Marl Deposits (B15)
	Watermarks		Hydrogen Sulfide Odor (C1)
	Sediment Deposits (B2)		Oxidized Rhizospheres on Living Roots (C3)
	Drift Deposits (B3)		Presence of Reduced Iron (C4)
	Algal Mat of Crust (B4)		Recent Iron reduction in tilled Soils (C6)
	Iron Deposits (B5)		Thin Muck Surface (C7)
	Inundation Visible on Aerial Imagery (B7)		Other (Explain in Remarks)
	Sparsely Vegetated Concave Surface (B8)		

Secondary Indicators: (minimum of two required)

	Surface Soil Cracks (B6)		Stunted or Stressed Plants (D1)
	Drainage Patterns (B10)		Geomorphic Position (D2)
	Moss Trim Lines (B16)		Shallow Aquitard (D3)
	Dry-Season Water Table (C2)		Microtopographic Relief (D4)
	Crayfish Burrows (C8)		FAC-Neutral Test (D5)
	Saturation Visible on Aerial Imagery (C9)		

Field Observations:

Surface Water Present?	Yes		No	x	Depth			
Water Table Present?	Yes	x	No		Depth	10	**Wetland Hydrology Present?**	**Yes** x **No**
Saturation Present?	Yes	x	No		Depth	0		

Comments:

Soil Profile

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators)

Depth(cm)	Matrix		Redox Features					
	Color(moist)	%	Color(moist)	%	Type[1]	Loc[2]	Texture	Remarks
			Organic					

[1]Type:C=Concentration,D=Depletion,RM=Reduced Matrix,CS=Covered or Coated Sand Grains.[2]Location:PL=Pore Lining,M=Matrix

Hydric Soil Indicators:

x	Histosol (A1)		Sandy Redox (S5)
	Histic Epipedon (A2)		Stripped Matrix (S6)
	Black Histic (A3)		Dark Surfaces (S7)
	Hydrogen Sulfide (A4)		Polyvalue Below Surface (S8)
	Stratified Layers (A5)		Thin Dark Surface (S9)
	Depleted Below Dark Surface (A11)		Loamy Gleyed Matrix (F2)
	Thick Dark Surface (A12)		Depleted Matrix (F3)
	Sandy Mucky Mineral (S1)		Redox Dark Surface (F6)
	5cm Mucky Peat or Peat (S3)		Depleted Dark Surface (F7)
	Sandy Gleyed Matrix (S4)		Redox Depressions (F8)

Restrictive Layer Type (if observed | Depth: | **Hydric Soil Present?** | **Yes** x **No**

Comments:

Project Site:	Point Black		Date:	July, 2011	Sample Point:	WL2DP6	Job #:
Client/owner:			Field Investigator(s):	Theo Popma, Candice, Carrie B.			
County:	Guysborough		Coordinates:	645424 5024265			
PID 35092063			Do normal environmental conditions exist on-site?		Yes [x]	No [ ]	

If no, explain:

Atypical Situation? Yes [ ] No [x] Explain:

Is this a potential **Problem Area?** Yes [x] No [ ] Explain: Exposure and erosion of headland affecting drainage behind estuary

Wetland Determination

(Check One Only For Each Criteria)

Dominant Hydrophytic Vegetation (50/20 rule)	Yes [x]	No [ ]
Wetland Hydrology	Yes [x]	No [ ]
Hydric Soils	Yes [x]	No [ ]

Wetland Determination

[x] **YES** [ ] **NO**

Wetland Type:

Rational for Determination:

Vegetation

	Tree Stratum: (Plot size: 9m2)	%Cover		Dominant Species	Indicator Status
1	*Cornus canadensis*	20		x	*FAC-*
2	*Rubus pubescens*	30		x	*FACW*
3					
4					
5					
6					
		50	=	**Total Cover**	
	Shrub Stratum: (Plot size: 5m2)				
1	*Picea glauca*	20		x	*FACU*
2	*Betula papyrifera*	5		x	*FACU*
3	*Abies balsamea*	20		x	*FAC*
4					
5					
		45	=	**Total Cover**	
	Herb Stratum: (Plot Size: 1m2)				
1					
2					
3					
4					
5					
		0	=	**Total Cover**	

Dominance Test Worksheet:

# of Dominant Species that are OBL,FACW,FAC:	3
Total # of Dominant Species across all strata:	5
% of Dominant Species that are OBL,FACW,FAC:	60

Prevalence Index Worksheet:

	Total %Cover of:	Multiply by:	
OBL Species		x 1 =	0
FACW Species		x 2 =	0
FAC Species		x 3 =	0
FACU Species		x 4 =	0
ULP Species		x 5 =	0
Column Totals:	0		0

Prevalence Index = B/A = ##

Hydrophytic Vegetation Indicators:

- [x] Rapid Test for Hydrolic Vegetation
- [x] Dominance Test is >50%
- [ ] Prevalence Index is ≤3.0 [1]
- [ ] Morphological Adaptations[1] (explain)
- [ ] Problematic Hydrophytic Vegetation[1](explain)

[1]Indicators of hydric soil and weland hydrology must be present, unless disturbed or problematic

Comments

Abundant Sphagnum, deadwood

Hydrophytic Vegetation Present? **Yes** x **No**

Hydrology

Primary Hydrological Indicators: (minimum of one is required;check all that apply)

___	Surface Water (A1)	___	Water Stained Leaves (B9)
___	High Water Table (A2)	___	Aquatic Fauna (B13)
___	Saturation (A3)	___	Marl Deposits (B15)
___	Watermarks	___	Hydrogen Sulfide Odor (C1)
___	Sediment Deposits (B2)	___	Oxidized Rhizospheres on Living Roots (C3)
___	Drift Deposits (B3)	___	Presence of Reduced Iron (C4)
___	Algal Mat of Crust (B4)	___	Recent Iron reduction in tilled Soils (C6)
___	Iron Deposits (B5)	___	Thin Muck Surface (C7)
___	Inundation Visible on Aerial Imagery (B7)	___	Other (Explain in Remarks)
___	Sparsely Vegetated Concave Surface (B8)		

Secondary Indicators: (minimum of two required)

___	Surface Soil Cracks (B6)	___	Stunted or Stressed Plants (D1)
___	Drainage Patterns (B10)	___	Geomorphic Position (D2)
___	Moss Trim Lines (B16)	___	Shallow Aquitard (D3)
___	Dry-Season Water Table (C2)	___	Microtopographic Relief (D4)
___	Crayfish Burrows (C8)	___	FAC-Neutral Test (D5)
___	Saturation Visible on Aerial Imagery (C9)		

Field Observations:

Surface Water Present?	Yes ___	No x	Depth ___						
Water Table Present?	Yes x	No ___	Depth 20	**Wetland Hydrology Present?**	**Yes**	x	**No**	___	
Saturation Present?	Yes x	No ___	Depth 0						

Comments:

Soil Profile

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators)

Depth(cm)	Matrix		Redox Features					
	Color(moist)	%	Color(moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 to 10cm	organic							
refusal (gravel)								

[1]Type:C=Concentration,D=Depletion,RM=Reduced Matrix,CS=Covered or Coated Sand Grains.[2]Location:PL=Pore Lining,M=Matrix

Hydric Soil Indicators:

x	Histosol (A1)	___	Sandy Redox (S5)
___	Histic Epipedon (A2)	___	Stripped Matrix (S6)
___	Black Histic (A3)	___	Dark Surfaces (S7)
___	Hydrogen Sulfide (A4)	___	Polyvalue Below Surface (S8)
___	Stratified Layers (A5)	___	Thin Dark Surface (S9)
___	Depleted Below Dark Surface (A11)	___	Loamy Gleyed Matrix (F2)
___	Thick Dark Surface (A12)	___	Depleted Matrix (F3)
___	Sandy Mucky Mineral (S1)	___	Redox Dark Surface (F6)
___	5cm Mucky Peat or Peat (S3)	___	Depleted Dark Surface (F7)
___	Sandy Gleyed Matrix (S4)	___	Redox Depressions (F8)

Restrictive Layer Type (if observed | Depth: | **Hydric Soil Present?** | **Yes** | x | **No** | ___

Comments:

Soils are problematic due to historic erosion near coast in estuary behind headland.

Project Site:	Point Black			Date:	July, 2011	Sample Point:	WL2DP7	Job #:
Client/owner:				Field Investigator(s):	Theo Popma, Candice, Carrie B.			
County:	Guysborough			Coordinates:	645368 5024143			
PID	35092063			Do normal environmental conditions exist on-site?		Yes	x	No
If no, explain:								
Atypical Situation?	Yes		No x	Explain:				
Is this a potential **Problem Area?**		Yes x	No	Explain:	Erosion and sedimentation behind coastal headlands			

Wetland Determination
(Check One Only For Each Criteria)

Dominant Hydrophytic Vegetation (50/20 rule)	Yes x	No
Wetland Hydrology	Yes x	No
Hydric Soils	Yes	No x
Wetland Type:		
Rational for Determination:		

Wetland Determination

YES | x | **NO**

Vegetation

	Tree Stratum: (Plot size: 9m2)	%Cover	Dominant Species	Indicator Status
1	*Osmunda cinnamomea*	90	x	*FACW*
2	*Thelypteris noveboracensis*	5	x	*FAC*
3				
4				
5				
6				
		95	= **Total Cover**	

	Shrub Stratum: (Plot size: 5m2)			
1	*Alnus viridis*	5	x	*FAC*
2	*Abies balsamea*	5	x	*FAC*
3	*Picea glauca*	5	x	*FACU*
4	*Picea mariana*	5	x	*FACW-*
5				
		20	= **Total Cover**	

	Herb Stratum: (Plot Size: 1m2)			
1	*deadwood*			
2				
3				
4				
5				
		0	= **Total Cover**	

Comments

Dominance Test Worksheet:

# of Dominant Species that are OBL,FACW,FAC:	5
Total # of Dominant Species across all strata:	6
% of Dominant Species that are OBL,FACW,FAC:	83.3

Prevalence Index Worksheet:

Total %Cover of:	Multiply by:	
OBL Species	x 1 =	0
FACW Species	x 2 =	0
FAC Species	x 3 =	0
FACU Species	x 4 =	0
ULP Species	x 5 =	0
Column Totals: 0		0

Prevalence Index = B/A = ##

Hydrophytic Vegetation Indicators:

- x Rapid Test for Hydrolic Vegetation
- x Dominance Test is >50%
- ___ Prevalence Index is ≤3.0 [1]
- ___ Morphological Adaptations[1] (explain)
- ___ Problematic Hydrophytic Vegetation[1](explain)

[1]Indicators of hydric soil and weland hydrology must be present, unless disturbed or problematic

Hydrophytic Vegetation Present? **Yes** x **No**

Hydrology

Primary Hydrological Indicators: (minimum of one is required;check all that apply)

___	Surface Water (A1)	___	Water Stained Leaves (B9)
___	High Water Table (A2)	___	Aquatic Fauna (B13)
x	Saturation (A3)	___	Marl Deposits (B15)
___	Watermarks	___	Hydrogen Sulfide Odor (C1)
___	Sediment Deposits (B2)	___	Oxidized Rhizospheres on Living Roots (C3)
___	Drift Deposits (B3)	___	Presence of Reduced Iron (C4)
___	Algal Mat of Crust (B4)	___	Recent Iron reduction in tilled Soils (C6)
___	Iron Deposits (B5)	___	Thin Muck Surface (C7)
___	Inundation Visible on Aerial Imagery (B7)	___	Other (Explain in Remarks)
___	Sparsely Vegetated Concave Surface (B8)		

Secondary Indicators: (minimum of two required)

___	Surface Soil Cracks (B6)	___	Stunted or Stressed Plants (D1)
___	Drainage Patterns (B10)	___	Geomorphic Position (D2)
___	Moss Trim Lines (B16)	___	Shallow Aquitard (D3)
___	Dry-Season Water Table (C2)	___	Microtopographic Relief (D4)
___	Crayfish Burrows (C8)	___	FAC-Neutral Test (D5)
___	Saturation Visible on Aerial Imagery (C9)		

Field Observations:

Surface Water Present?	Yes ___	No x	Depth ___					
Water Table Present?	Yes x	No ___	Depth 30		**Wetland Hydrology Present?**	**Yes** x	**No** ___	
Saturation Present?	Yes x	No ___	Depth 0					

Comments:

Soil Profile

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators)

Depth(cm)	Matrix		Redox Features				
	Color(moist)	%	Color(moist)	%	Type[1]	Loc[2]	Texture	Remarks
o to 15cm	organic							
15 to 30cm	mineral	less than 50% depleted						

[1]Type:C=Concentration,D=Depletion,RM=Reduced Matrix,CS=Covered or Coated Sand Grains.[2]Location:PL=Pore Lining,M=Matrix

Hydric Soil Indicators:

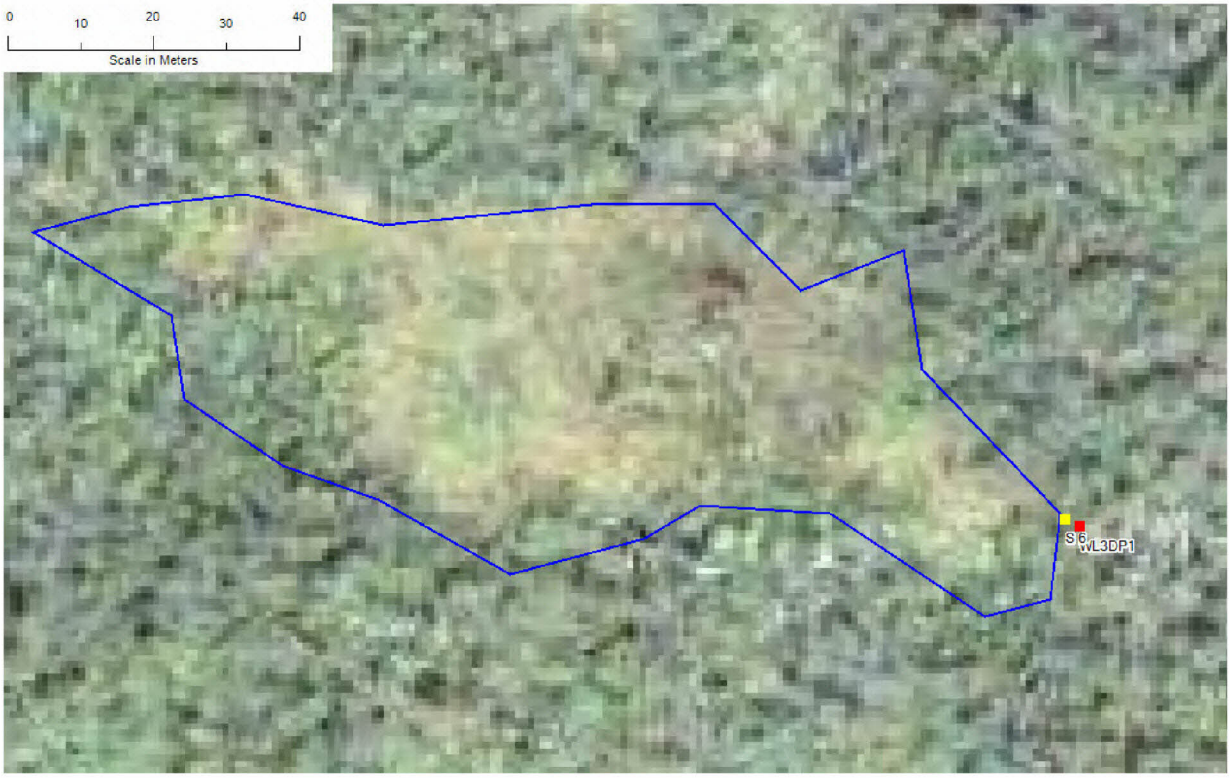
___	Histosol (A1)	___	Sandy Redox (S5)
___	Histic Epipedon (A2)	___	Stripped Matrix (S6)
___	Black Histic (A3)	___	Dark Surfaces (S7)
___	Hydrogen Sulfide (A4)	___	Polyvalue Below Surface (S8)
___	Stratified Layers (A5)	___	Thin Dark Surface (S9)
___	Depleted Below Dark Surface (A11)	___	Loamy Gleyed Matrix (F2)
___	Thick Dark Surface (A12)	___	Depleted Matrix (F3)
___	Sandy Mucky Mineral (S1)	___	Redox Dark Surface (F6)
___	5cm Mucky Peat or Peat (S3)	___	Depleted Dark Surface (F7)
___	Sandy Gleyed Matrix (S4)	___	Redox Depressions (F8)

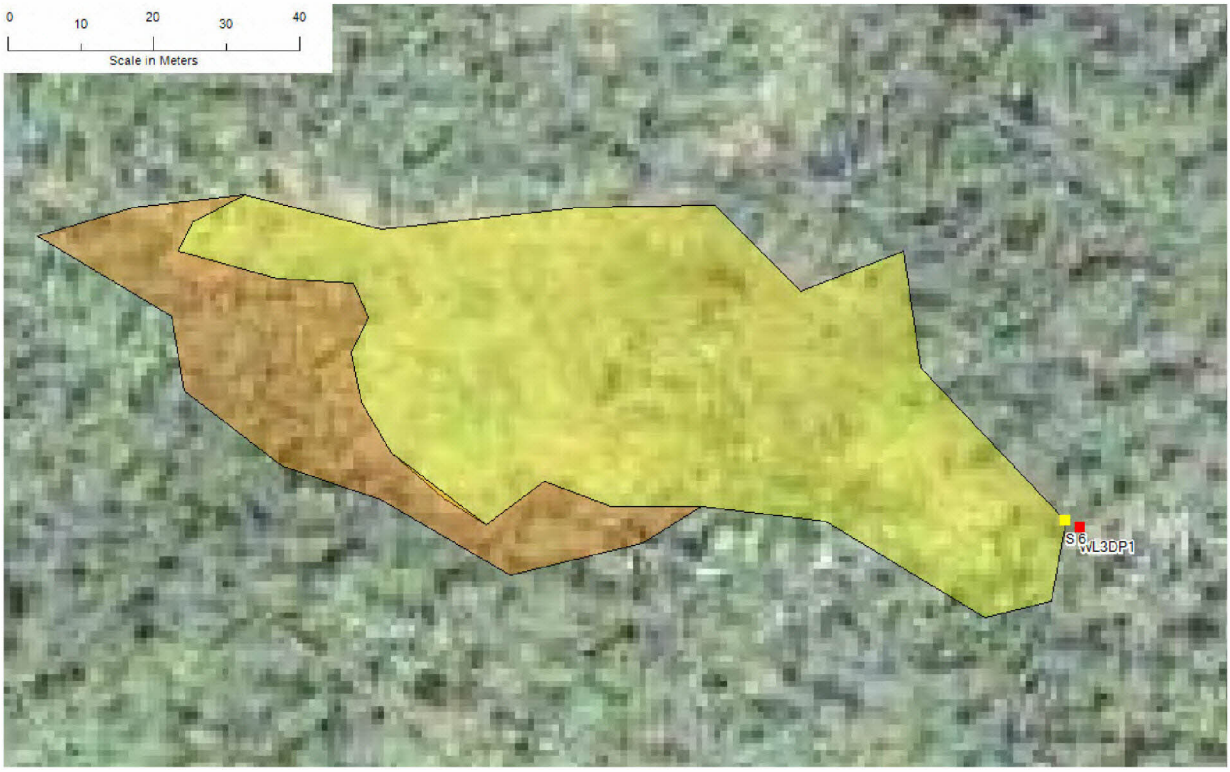
Restrictive Layer Type (if observed ___ Depth: ___ **Hydric Soil Present?** **Yes** ___ **No** x

Comments:

insufficient depletion

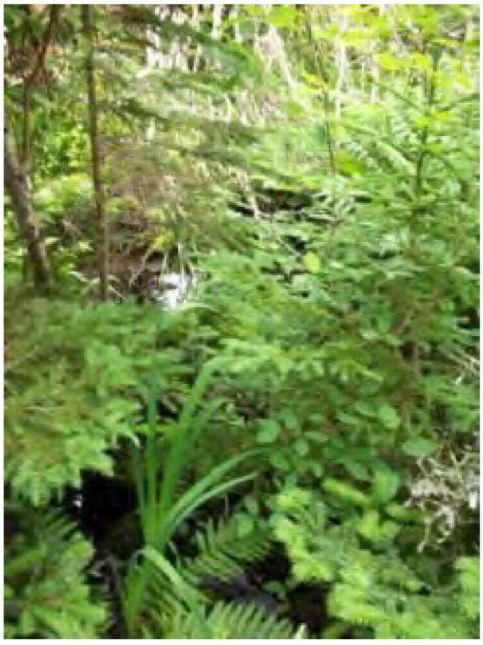
Wetland 3


0
10
20
30
40
Scale in Meters
S6
WL3DP1


0
10
20
30
40
Scale in Meters
S6
WL3DP1

Wetland 3 is a fen dominated by typical bog/fen species of wetland plants and surrounded by steep rock outcroppings covered with a thin layer of organic soil. A small stream runs along the side of the wetland at the base of one of these steep banks and some transitional shrub wetland occupies the edge of the clearing.

Open Fen at Wetland 3



Shrub cover and small stream flowing along the edge of wetland 3

Project Site:	Point Black			Date:	July, 2011	Sample Point:	WL3DP1	Job #:	
Client/owner:				Field Investigator(s):	Theo Popma, Candice				
County:	Guysborough			Coordinates:	645147 5024038				
PID 35092063				Do normal environmental conditions exist on-site?		Yes	x	No	

If no, explain:

Atypical Situation? Yes [ ] No [x] Explain:

Is this a potential **Problem Area?** Yes [ ] No [x] Explain:

Wetland Determination

(Check One Only For Each Criteria)

Dominant Hydrophytic Vegetation (50/20 rule)	Yes	[x]	No	[ ]
Wetland Hydrology	Yes	[x]	No	[ ]
Hydric Soils	Yes	[x]	No	[ ]

Wetland Type:

Rational for Determination:

Wetland Determination

[x] **YES** [ ] **NO**

Vegetation

	Tree Stratum: (Plot size: 9m2)	%Cover		Dominant Species	Indicator Status
1	*Arethusa bulbosa*	5		x	*OBL*
2	*Rhynchospora alba*	5		x	*OBL*
3					
4					
5					
6					
		10	=	**Total Cover**	
	Shrub Stratum: (Plot size: 5m2)				
1	*Picea mariana*	20		x	*FACW-*
2	*Larix laricina*	20		x	*FACW*
3					
4					
5					
		40	=	**Total Cover**	
	Herb Stratum: (Plot Size: 1m2)				
1					
2					
3					
4					
5					
		0	=	**Total Cover**	

Comments

Dominance Test Worksheet:

# of Dominant Species that are OBL,FACW,FAC:	4
Total # of Dominant Species across all strata:	4
% of Dominant Species that are OBL,FACW,FAC:	100

Prevalence Index Worksheet:

Total %Cover of:	Multiply by:	
OBL Species	x 1 =	0
FACW Species	x 2 =	0
FAC Species	x 3 =	0
FACU Species	x 4 =	0
ULP Species	x 5 =	0
Column Totals: 0		0

Prevalence Index = B/A = ##

Hydrophytic Vegetation Indicators:

- [x] Rapid Test for Hydrolic Vegetation
- [x] Dominance Test is >50%
- [ ] Prevalence Index is ≤3.0 [1]
- [ ] Morphological Adaptations[1] (explain)
- [ ] Problematic Hydrophytic Vegetation[1](explain)

[1]Indicators of hydric soil and weland hydrology must be present, unless disturbed or problematic

Hydrophytic Vegetation Present? **Yes** x **No**

Hydrology

Primary Hydrological Indicators: (minimum of one is required;check all that apply)

___	Surface Water (A1)	___	Water Stained Leaves (B9)
x	High Water Table (A2)	___	Aquatic Fauna (B13)
x	Saturation (A3)	___	Marl Deposits (B15)
___	Watermarks	___	Hydrogen Sulfide Odor (C1)
___	Sediment Deposits (B2)	___	Oxidized Rhizospheres on Living Roots (C3)
___	Drift Deposits (B3)	___	Presence of Reduced Iron (C4)
___	Algal Mat of Crust (B4)	___	Recent Iron reduction in tilled Soils (C6)
___	Iron Deposits (B5)	___	Thin Muck Surface (C7)
___	Inundation Visible on Aerial Imagery (B7)	___	Other (Explain in Remarks)
___	Sparsely Vegetated Concave Surface (B8)		

Secondary Indicators: (minimum of two required)

___	Surface Soil Cracks (B6)	___	Stunted or Stressed Plants (D1)
___	Drainage Patterns (B10)	___	Geomorphic Position (D2)
___	Moss Trim Lines (B16)	___	Shallow Aquitard (D3)
___	Dry-Season Water Table (C2)	x	Microtopographic Relief (D4)
___	Crayfish Burrows (C8)	___	FAC-Neutral Test (D5)
___	Saturation Visible on Aerial Imagery (C9)		

Field Observations:

Surface Water Present?	Yes ___	No x	Depth ___					
Water Table Present?	Yes x	No ___	Depth 15	**Wetland Hydrology Present?**	**Yes**	x	**No**	___
Saturation Present?	Yes x	No ___	Depth 0					

Comments:

Soil Profile

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators)

Depth(cm)	Matrix		Redox Features				
	Color(moist)	%	Color(moist)	%	Type[1]	Loc[2]	Texture	Remarks

[1]Type:C=Concentration,D=Depletion,RM=Reduced Matrix,CS=Covered or Coated Sand Grains.[2]Location:PL=Pore Lining,M=Matrix

Hydric Soil Indicators:

x	Histosol (A1)	___	Sandy Redox (S5)
___	Histic Epipedon (A2)	___	Stripped Matrix (S6)
___	Black Histic (A3)	___	Dark Surfaces (S7)
___	Hydrogen Sulfide (A4)	___	Polyvalue Below Surface (S8)
___	Stratified Layers (A5)	___	Thin Dark Surface (S9)
___	Depleted Below Dark Surface (A11)	___	Loamy Gleyed Matrix (F2)
___	Thick Dark Surface (A12)	___	Depleted Matrix (F3)
___	Sandy Mucky Mineral (S1)	___	Redox Dark Surface (F6)
___	5cm Mucky Peat or Peat (S3)	___	Depleted Dark Surface (F7)
___	Sandy Gleyed Matrix (S4)	___	Redox Depressions (F8)

Restrictive Layer Type (if observed | Depth: | **Hydric Soil Present?** | **Yes** | x | **No** | ___

Comments:

Wetland 4

0
7.5
15
22.5
30
Scale in Meters
WL4DP2

0
7.5
15
22.5
30
Scale in Meters
WL4DP2

Wetland 4 is a Forested Wetland dominated by Red Spruce (*Picea rubens*) and with an open understory dominated mostly by Sphagnum and by only a few species of herbs and shrubs. This is a relatively small wetland which has formed amongst the variable contours of bedrock and can be distinguished by the surrounding forest largely by the presence of Sphagnum and organic soils.

Forested Wetland with open understory dominated by few herbaceous plant species and abundant mosses

Forested Wetland and adjacent upland differ in hydrology, soil profile and bryophyte flora

APPENDIX F4
AMEC 2010 and 2014 Wetland Baseline Survey Report

FIGURES

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

FIGURES

TITLE:
Figure 1
Project Location

PROJECT: **2010 / 2011 / 2014 WETLAND FIELD SURVEY DELINEATION AND FUNCTIONAL ASSESSMENT REPORTBLACK POINT QUARRY GUYSBOROUGH COUNTY**

CLIENT:
Morien Resources Corp. (Morien)
Metropolitan Place
Suite 1480, 99 Wyse Road
Dartmouth, Nova Scotia,
Canada, B3A 4S5

LOCATION:
Guysborough County
Nova Scotia

DATE:
September 2014

DATUM & PROJECTION:
NAD83 CSRS UTM Zone 20N

AMEC PROJECT NO:
TV144003

LEGEND:
- Site Boundary
- Roads
- River / Stream
- Waterbody

AMEC Environment & Infrastructure
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Dartmouth, N.S., B3B 1Z1
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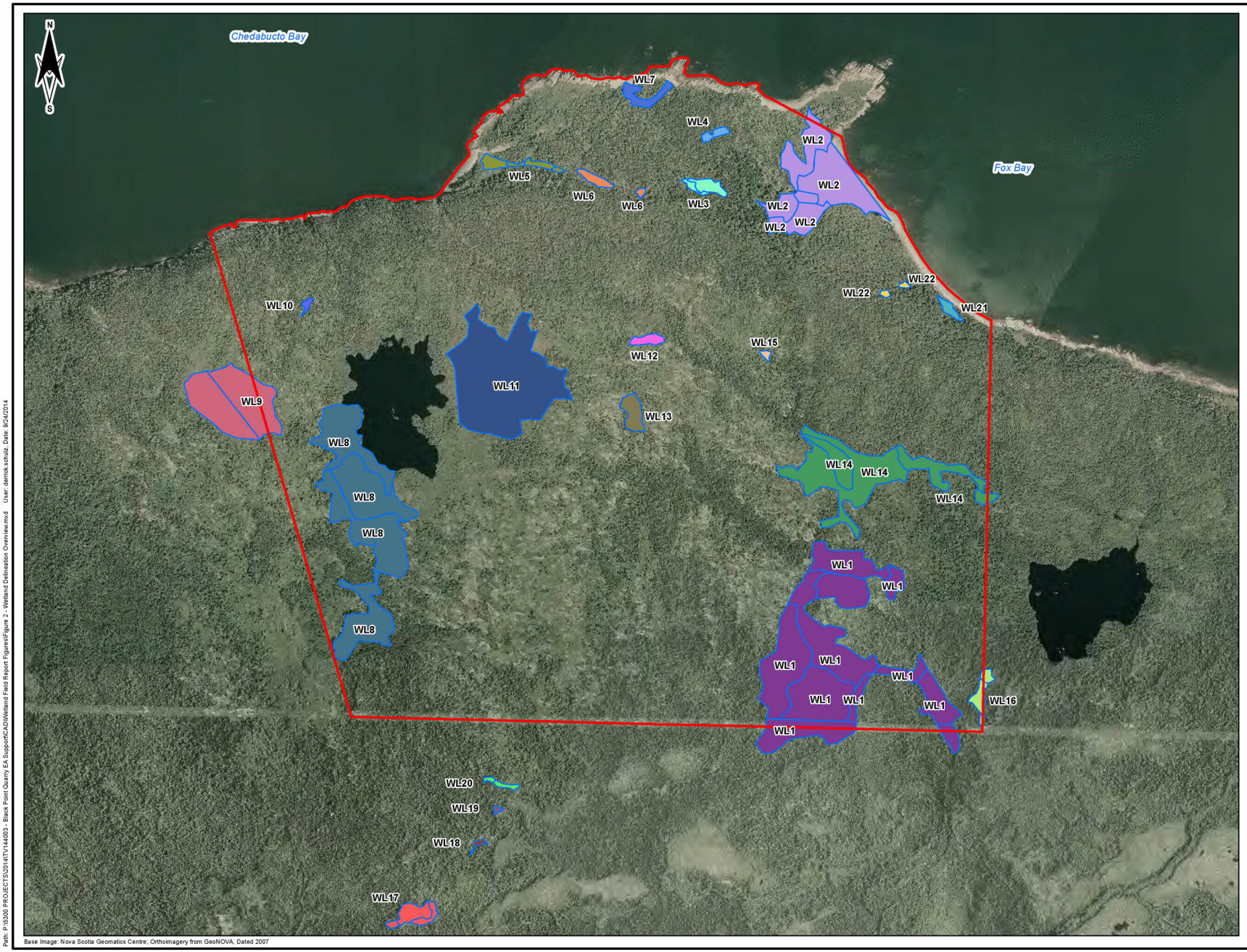

Base Image: Nova Scotia Geomatics Centre; Orthoimagery from GeoNOVA, Dated 2007

Path: P:\5300 PROJECTS\2014\TV144003 - Black Point Quarry EA Support\CAD\Wetland Field Report Figures\Figure 2 - Wetland Delineation Overview.mxd User: derrick.schulz Date: 9/24/2014

TITLE:
Figure 2
Wetland Delineation Overview

PROJECT: **2010 / 2011 / 2014 WETLAND FIELD SURVEY DELINEATION AND FUNCTIONAL ASSESSMENT REPORTBLACK POINT QUARRY GUYSBOROUGH COUNTY**

CLIENT:
Morien Resources Corp. (Morien)
Metropolitan Place
Suite 1480, 99 Wyse Road
Dartmouth, Nova Scotia,
Canada, B3A 4S5

LOCATION:
Guysborough County
Nova Scotia

DATE:
September 2014

DATUM & PROJECTION:
NAD83 CSRS UTM Zone 20N

AMEC PROJECT NO:
TV144003

LEGEND:
- Site Boundary

Wetlands
- WL1
- WL2
- WL3
- WL4
- WL5
- WL6
- WL7
- WL8
- WL9
- WL10
- WL11
- WL12
- WL13
- WL14
- WL15
- WL16
- WL17
- WL18
- WL19
- WL20
- WL21
- WL22

100 50 0 100 200 300 400
Meters

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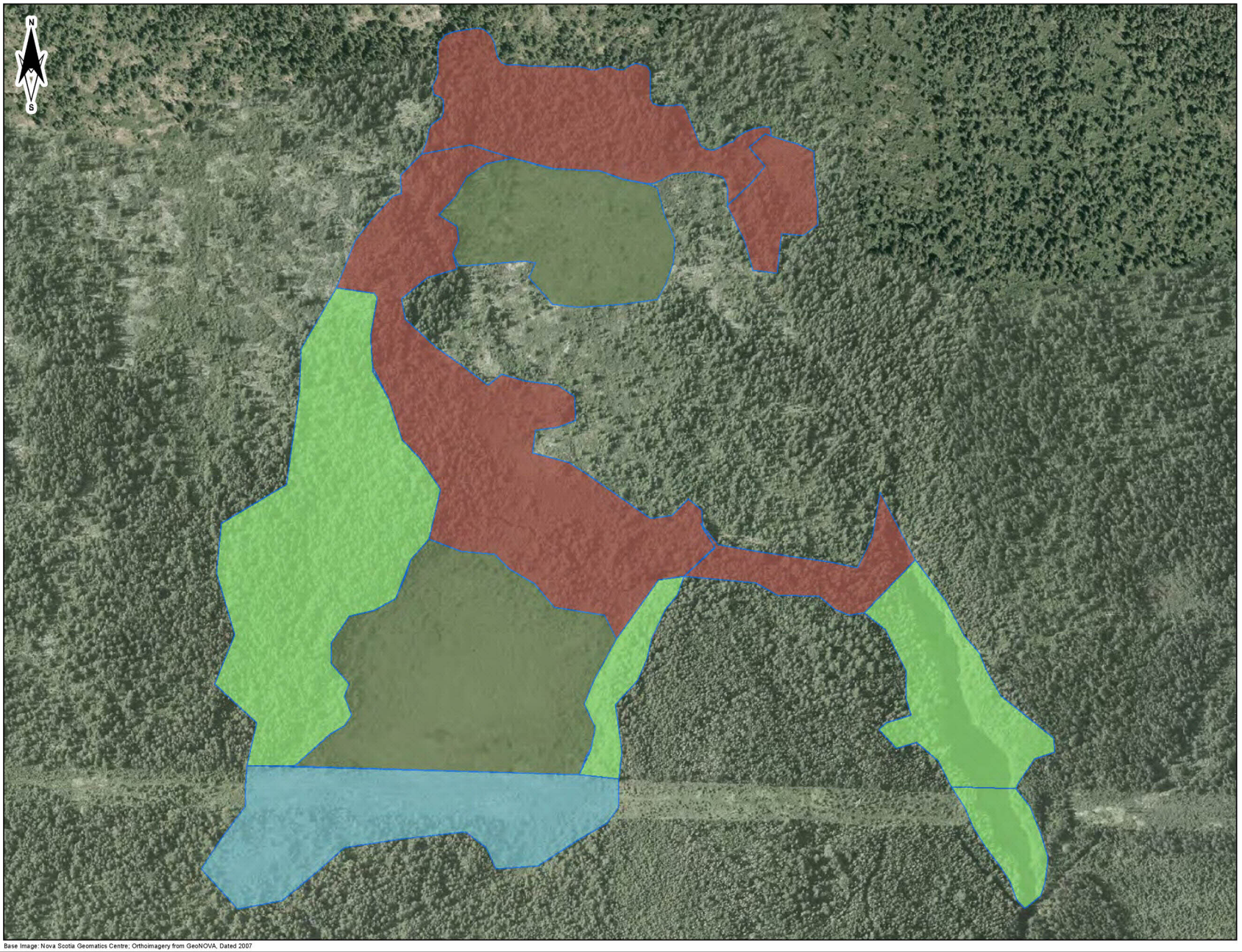
C 1340-1698



Base Image: Nova Scotia Geomatics Centre; Orthoimagery from GeoNOVA, Dated 2007

TITLE:
Figure 3
Wetland WL1

PROJECT: **2010 / 2011 / 2014 WETLAND FIELD SURVEY DELINEATION AND FUNCTIONAL ASSESSMENT REPORTBLACK POINT QUARRY GUYSBOROUGH COUNTY**

CLIENT:
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Metropolitan Place
Suite 1480, 99 Wyse Road
Dartmouth, Nova Scotia,
Canada, B3A 4S5

LOCATION:
Guysborough County
Nova Scotia

DATE:
September 2014

DATUM & PROJECTION:
NAD83 CSRS UTM Zone 20N

AMEC PROJECT NO:
TV144003

LEGEND:

Wetland 1
- Bog
- Forested Swamp
- Shrub Bog
- Shrub Swamp

20 10 0 20 40 60 80 100
Meters

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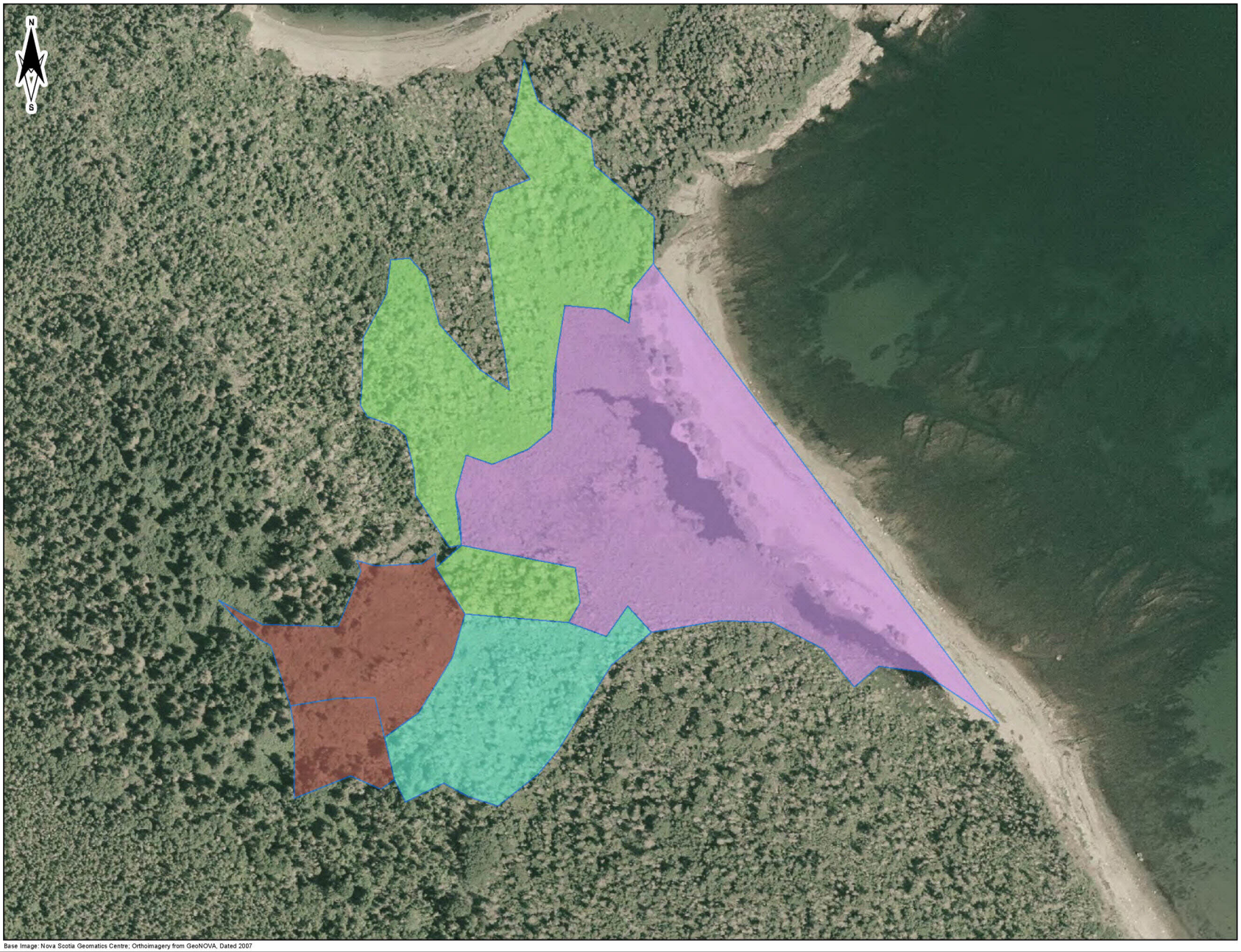

TITLE:
Figure 4
Wetland WL2

PROJECT: **2010 / 2011 / 2014 WETLAND FIELD SURVEY DELINEATION AND FUNCTIONAL ASSESSMENT REPORTBLACK POINT QUARRY GUYSBOROUGH COUNTY**

CLIENT:
Morien Resources Corp. (Morien)
Metropolitan Place
Suite 1480, 99 Wyse Road
Dartmouth, Nova Scotia,
Canada, B3A 4S5

LOCATION:
Guysborough County
Nova Scotia

DATE:
September 2014

DATUM & PROJECTION:
NAD83 CSRS UTM Zone 20N

AMEC PROJECT NO:
TV144003

LEGEND:

Wetland 2
- Fen
- Forested Swamp
- Fresh Marsh
- Shrub Swamp

10 5 0 10 20 30 40 50 60 70 80
Meters

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Base Image: Nova Scotia Geomatics Centre; Orthoimagery from GeoNOVA, Dated 2007

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Base Image: Nova Scotia Geomatics Centre; Orthoimagery from GeoNOVA, Dated 2007

TITLE:
Figure 5
Wetland WL3

PROJECT: **2010 / 2011 / 2014 WETLAND FIELD SURVEY DELINEATION AND FUNCTIONAL ASSESSMENT REPORTBLACK POINT QUARRY GUYSBOROUGH COUNTY**

CLIENT:
Morien Resources Corp. (Morien)
Metropolitan Place
Suite 1480, 99 Wyse Road
Dartmouth, Nova Scotia,
Canada, B3A 4S5

LOCATION:
Guysborough County
Nova Scotia

DATE:
September 2014

DATUM & PROJECTION:
NAD83 CSRS UTM Zone 20N

AMEC PROJECT NO:
TV144003

LEGEND:

Wetland 3
Fen

20 10 0 20 40 60 80
Meters

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Base Image: Nova Scotia Geomatics Centre; Orthoimagery from GeoNOVA, Dated 2007

TITLE:
Figure 6
Wetland WL4

PROJECT: **2010 / 2011 / 2014 WETLAND FIELD SURVEY DELINEATION AND FUNCTIONAL ASSESSMENT REPORTBLACK POINT QUARRY GUYSBOROUGH COUNTY**

CLIENT:
Morien Resources Corp. (Morien)
Metropolitan Place
Suite 1480, 99 Wyse Road
Dartmouth, Nova Scotia,
Canada, B3A 4S5

LOCATION:
Guysborough County
Nova Scotia

DATE:
September 2014

DATUM & PROJECTION:
NAD83 CSRS UTM Zone 20N

AMEC PROJECT NO:
TV144003

LEGEND:

Wetland 4
Treed Bog

10 5 0 10 20 30 40 50 60 70 80
Meters

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C 1340-1702

Base Image: Nova Scotia Geomatics Centre; Orthoimagery from GeoNOVA, Dated 2007

TITLE:
Figure 7
Wetland WL5

PROJECT: **2010 / 2011 / 2014 WETLAND FIELD SURVEY DELINEATION AND FUNCTIONAL ASSESSMENT REPORTBLACK POINT QUARRY GUYSBOROUGH COUNTY**

CLIENT:
Morien Resources Corp. (Morien)
Metropolitan Place
Suite 1480, 99 Wyse Road
Dartmouth, Nova Scotia,
Canada, B3A 4S5

LOCATION:
Guysborough County
Nova Scotia

DATE:
September 2014

DATUM & PROJECTION:
NAD83 CSRS UTM Zone 20N

AMEC PROJECT NO:
TV144003

LEGEND:

Wetland 5
Fen

10 5 0 10 20 30 40 50 60 70 80
Meters

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Base Image: Nova Scotia Geomatics Centre; Orthoimagery from GeoNOVA, Dated 2007

TITLE:
Figure 8
Wetland WL6

PROJECT: **2010 / 2011 / 2014 WETLAND FIELD SURVEY DELINEATION AND FUNCTIONAL ASSESSMENT REPORTBLACK POINT QUARRY GUYSBOROUGH COUNTY**

CLIENT:
Morien Resources Corp. (Morien)
Metropolitan Place
Suite 1480, 99 Wyse Road
Dartmouth, Nova Scotia,
Canada, B3A 4S5

LOCATION:
Guysborough County
Nova Scotia

DATE:
September 2014

DATUM & PROJECTION:
NAD83 CSRS UTM Zone 20N

AMEC PROJECT NO:
TV144003

LEGEND:

Wetland 6
- Bog
- Treed Bog

20 10 0 20 40 60 80
Meters

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Base Image: Nova Scotia Geomatics Centre; Orthoimagery from GeoNOVA, Dated 2007

TITLE:
Figure 9
Wetland WL7

PROJECT: **2010 / 2011 / 2014 WETLAND FIELD SURVEY DELINEATION AND FUNCTIONAL ASSESSMENT REPORTBLACK POINT QUARRY GUYSBOROUGH COUNTY**

CLIENT:
Morien Resources Corp. (Morien)
Metropolitan Place
Suite 1480, 99 Wyse Road
Dartmouth, Nova Scotia,
Canada, B3A 4S5

LOCATION:
Guysborough County
Nova Scotia

DATE:
September 2014

DATUM & PROJECTION:
NAD83 CSRS UTM Zone 20N

AMEC PROJECT NO:
TV144003

LEGEND:

Wetland 7
Forested Swamp

10 5 0 10 20 30 40 50 60 70
Meters

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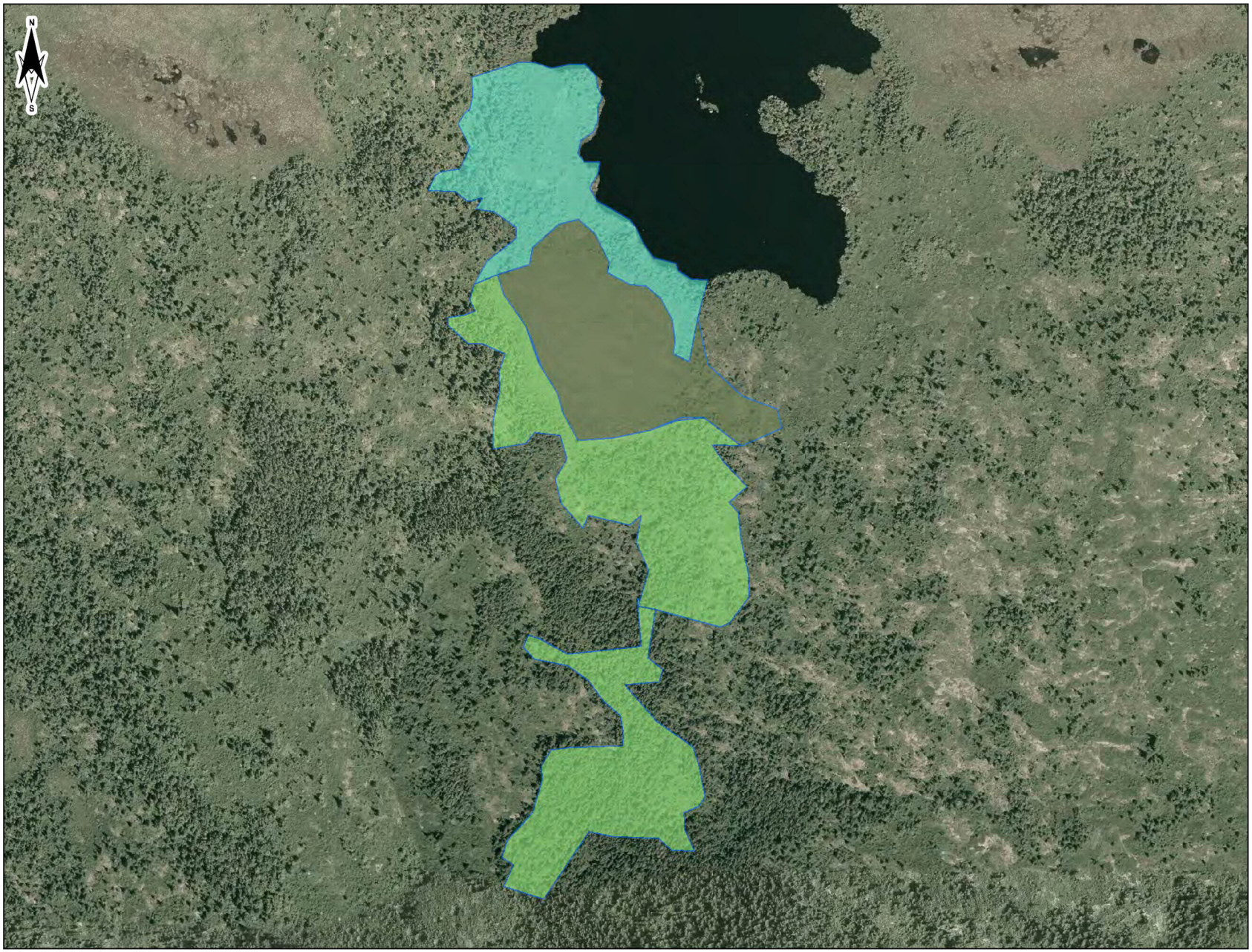

Base Image: Nova Scotia Geomatics Centre; Orthoimagery from GeoNOVA, Dated 2007

TITLE:
Figure 10
Wetland WL8

PROJECT: **2010 / 2011 / 2014 WETLAND FIELD SURVEY DELINEATION AND FUNCTIONAL ASSESSMENT REPORTBLACK POINT QUARRY GUYSBOROUGH COUNTY**

CLIENT:
Morien Resources Corp. (Morien)
Metropolitan Place
Suite 1480, 99 Wyse Road
Dartmouth, Nova Scotia,
Canada, B3A 4S5

LOCATION:
Guysborough County
Nova Scotia

DATE:
September 2014

DATUM & PROJECTION:
NAD83 CSRS UTM Zone 20N

AMEC PROJECT NO:
TV144003

LEGEND:

Wetland 8
- Bog
- Fen
- Forested Swamp

20 10 0 20 40 60 80 100 120 140
Meters

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Base Image: Nova Scotia Geomatics Centre; Orthoimagery from GeoNOVA, Dated 2007

TITLE:
Figure 11
Wetland WL9

PROJECT: **2010 / 2011 / 2014 WETLAND FIELD SURVEY DELINEATION AND FUNCTIONAL ASSESSMENT REPORTBLACK POINT QUARRY GUYSBOROUGH COUNTY**

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Morien Resources Corp. (Morien)
Metropolitan Place
Suite 1480, 99 Wyse Road
Dartmouth, Nova Scotia,
Canada, B3A 4S5

LOCATION:
Guysborough County
Nova Scotia

DATE:
September 2014

DATUM & PROJECTION:
NAD83 CSRS UTM Zone 20N

AMEC PROJECT NO:
TV144003

LEGEND:

Wetland 9
Bog

20 10 0 20 40 60 80 100 120
Meters

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Base Image: Nova Scotia Geomatics Centre; Orthoimagery from GeoNOVA, Dated 2007

TITLE:
Figure 12
Wetland WL10

PROJECT: **2010 / 2011 / 2014 WETLAND FIELD SURVEY DELINEATION AND FUNCTIONAL ASSESSMENT REPORTBLACK POINT QUARRY GUYSBOROUGH COUNTY**

CLIENT:
Morien Resources Corp. (Morien)
Metropolitan Place
Suite 1480, 99 Wyse Road
Dartmouth, Nova Scotia,
Canada, B3A 4S5

LOCATION:
Guysborough County
Nova Scotia

DATE:
September 2014

DATUM & PROJECTION:
NAD83 CSRS UTM Zone 20N

AMEC PROJECT NO:
TV144003

LEGEND:

Wetland 10
Forested Swamp

10 5 0 10 20 30 40 50 60 70 80
Meters

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Base Image: Nova Scotia Geomatics Centre; Orthoimagery from GeoNOVA, Dated 2007

TITLE:
Figure 13
Wetland WL11

PROJECT: **2010 / 2011 / 2014 WETLAND FIELD SURVEY DELINEATION AND FUNCTIONAL ASSESSMENT REPORTBLACK POINT QUARRY GUYSBOROUGH COUNTY**

CLIENT:
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Metropolitan Place
Suite 1480, 99 Wyse Road
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Canada, B3A 4S5

LOCATION:
Guysborough County
Nova Scotia

DATE:
September 2014

DATUM & PROJECTION:
NAD83 CSRS UTM Zone 20N

AMEC PROJECT NO:
TV144003

LEGEND:

Wetland 11
Bog

20 10 0 20 40 60 80
Meters

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Base Image: Nova Scotia Geomatics Centre; Orthoimagery from GeoNOVA, Dated 2007

TITLE:
Figure 14
Wetland WL12

PROJECT: **2010 / 2011 / 2014 WETLAND FIELD SURVEY DELINEATION AND FUNCTIONAL ASSESSMENT REPORTBLACK POINT QUARRY GUYSBOROUGH COUNTY**

CLIENT:
Morien Resources Corp. (Morien)
Metropolitan Place
Suite 1480, 99 Wyse Road
Dartmouth, Nova Scotia,
Canada, B3A 4S5

LOCATION:
Guysborough County
Nova Scotia

DATE:
September 2014

DATUM & PROJECTION:
NAD83 CSRS UTM Zone 20N

AMEC PROJECT NO:
TV144003

LEGEND:

Wetland 12
Fen

20 10 0 20 40 60 80
Meters

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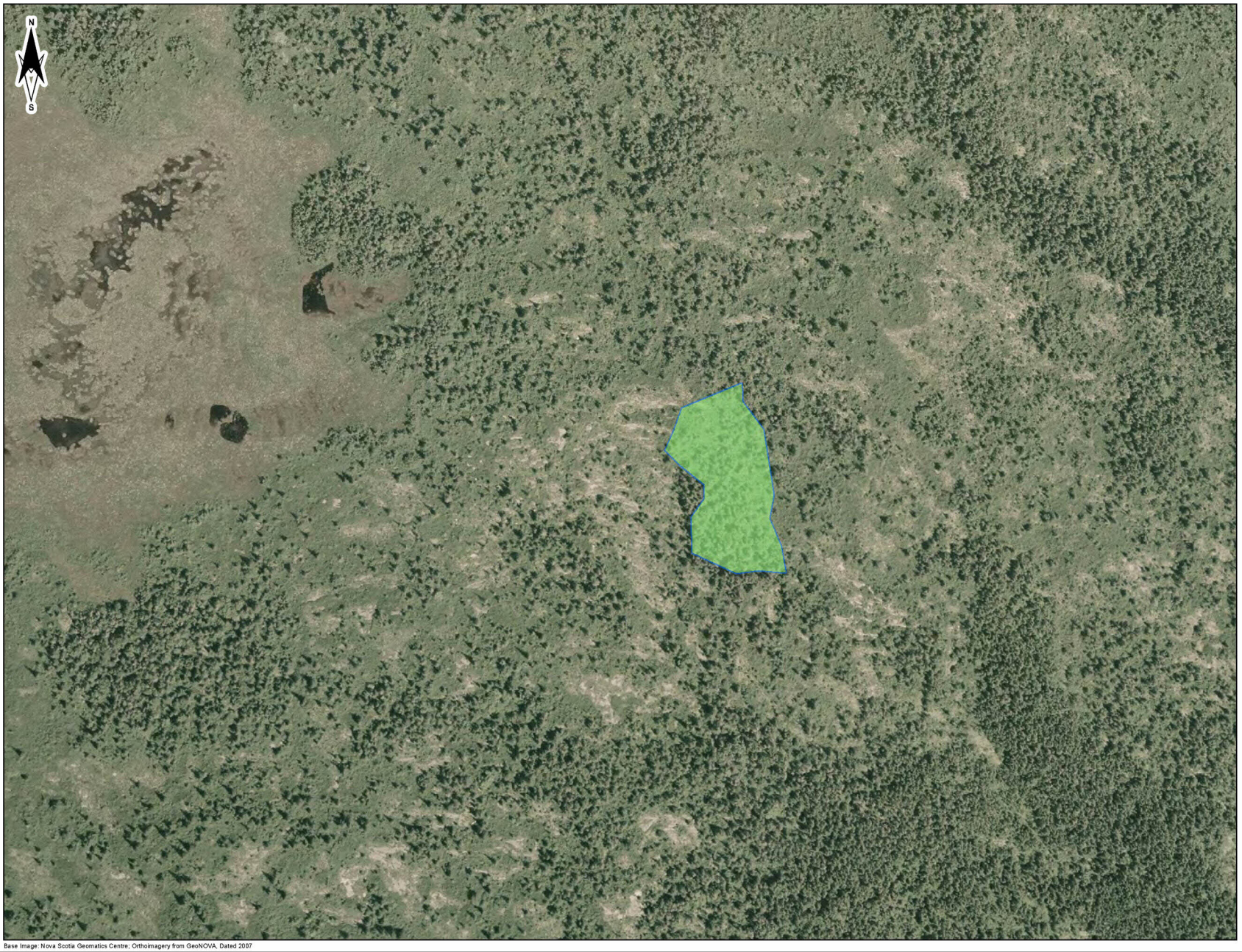

Base Image: Nova Scotia Geomatics Centre; Orthoimagery from GeoNOVA, Dated 2007

TITLE:
Figure 15
Wetland WL13

PROJECT: **2010 / 2011 / 2014 WETLAND FIELD SURVEY DELINEATION AND FUNCTIONAL ASSESSMENT REPORTBLACK POINT QUARRY GUYSBOROUGH COUNTY**

CLIENT:
Morien Resources Corp. (Morien)
Metropolitan Place
Suite 1480, 99 Wyse Road
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LOCATION:
Guysborough County
Nova Scotia

DATE:
September 2014

DATUM & PROJECTION:
NAD83 CSRS UTM Zone 20N

AMEC PROJECT NO:
TV144003

LEGEND:

Wetland 13
Forested Swamp

20 10 0 20 40 60 80
Meters

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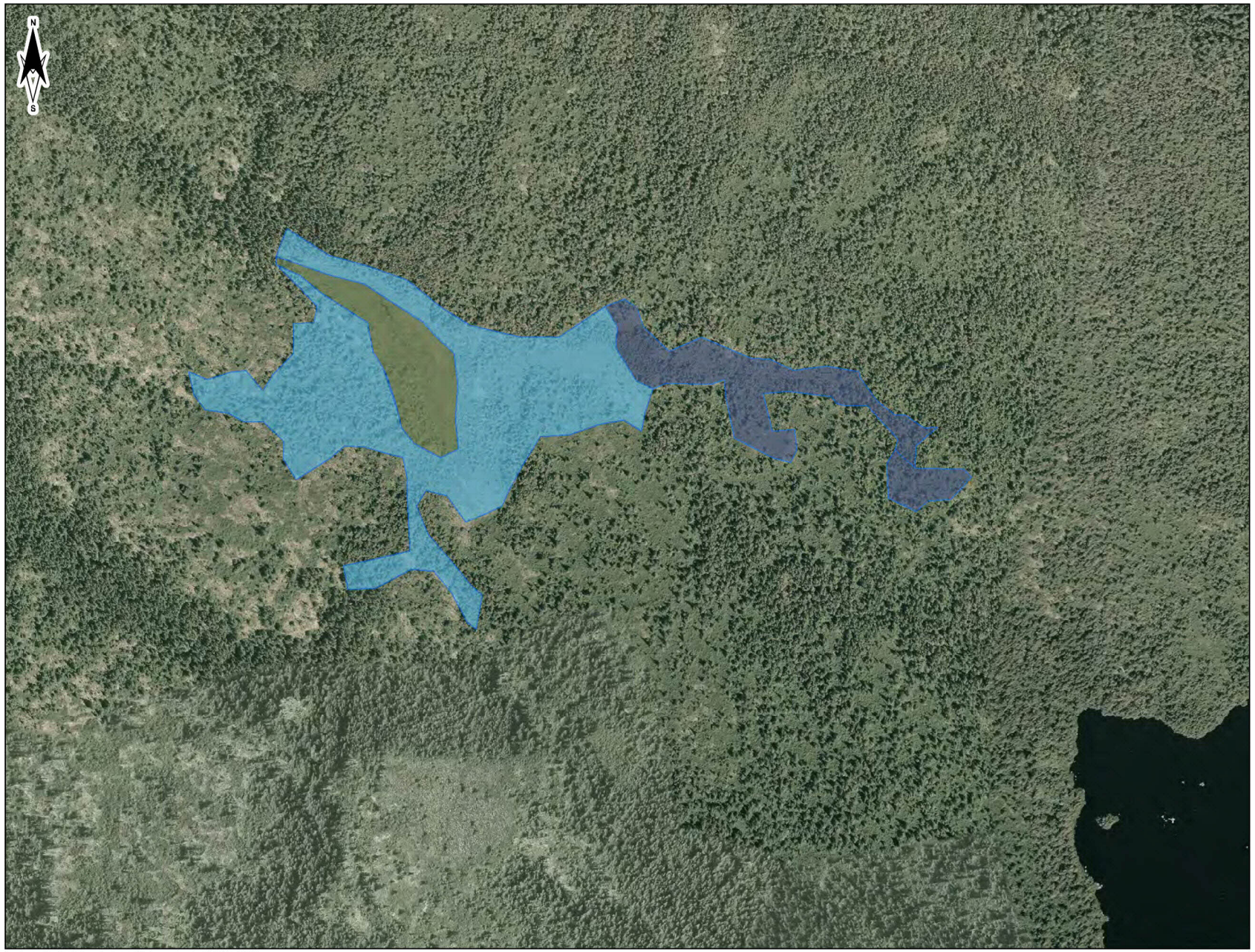

Base Image: Nova Scotia Geomatics Centre; Orthoimagery from GeoNOVA, Dated 2007

TITLE:
Figure 16
Wetland WL14

PROJECT: **2010 / 2011 / 2014 WETLAND FIELD SURVEY DELINEATION AND FUNCTIONAL ASSESSMENT REPORTBLACK POINT QUARRY GUYSBOROUGH COUNTY**

CLIENT:
Morien Resources Corp. (Morien)
Metropolitan Place
Suite 1480, 99 Wyse Road
Dartmouth, Nova Scotia,
Canada, B3A 4S5

LOCATION:
Guysborough County
Nova Scotia

DATE:
September 2014

DATUM & PROJECTION:
NAD83 CSRS UTM Zone 20N

AMEC PROJECT NO:
TV144003

LEGEND:

Wetland 14
- Bog
- Shrub Fen
- Treed Bog

20 10 0 20 40 60 80 100 120
Meters

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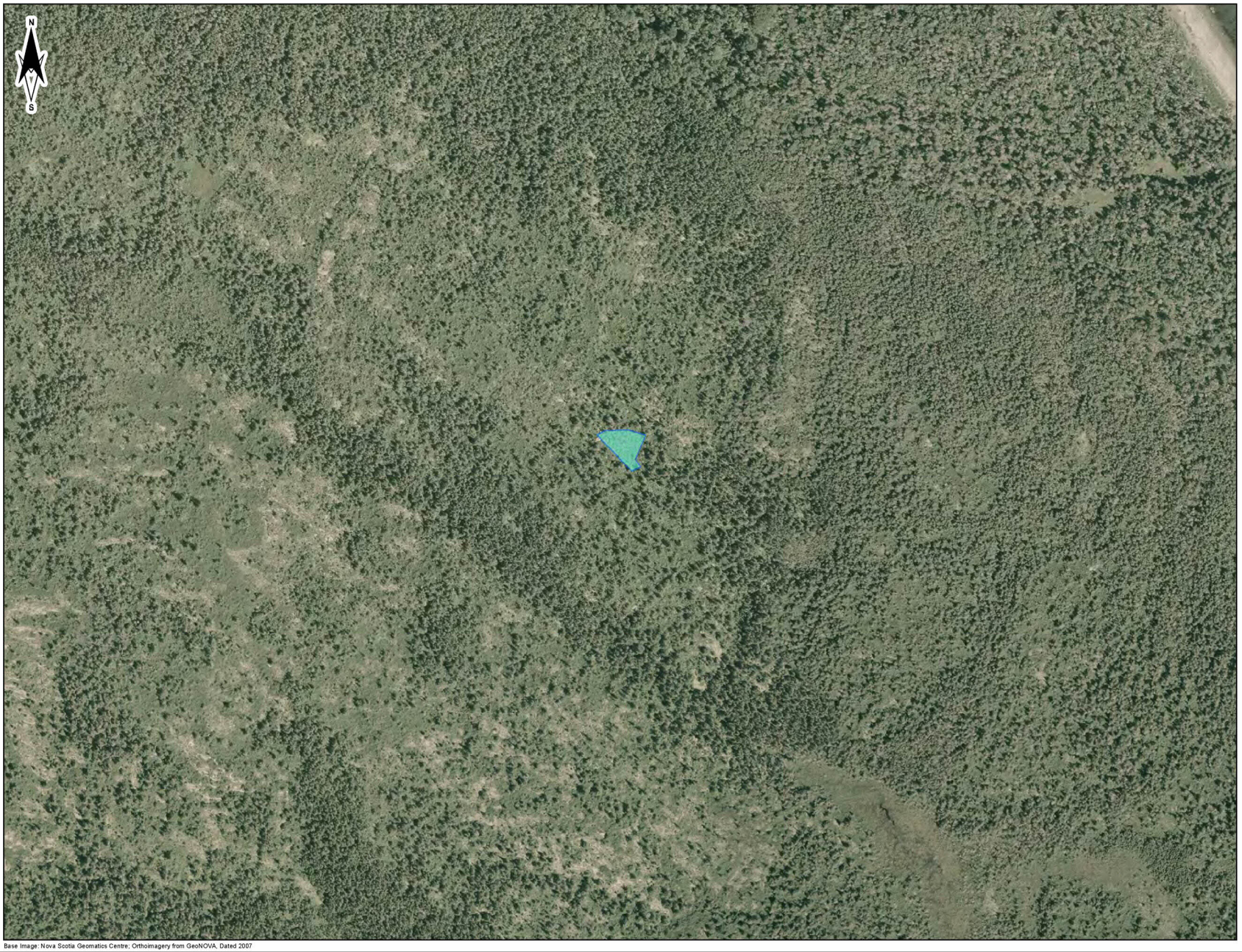

Base Image: Nova Scotia Geomatics Centre; Orthoimagery from GeoNOVA, Dated 2007

TITLE:
Figure 17
Wetland WL15

PROJECT: **2010 / 2011 / 2014 WETLAND FIELD SURVEY DELINEATION AND FUNCTIONAL ASSESSMENT REPORTBLACK POINT QUARRY GUYSBOROUGH COUNTY**

CLIENT:
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Metropolitan Place
Suite 1480, 99 Wyse Road
Dartmouth, Nova Scotia,
Canada, B3A 4S5

LOCATION:
Guysborough County
Nova Scotia

DATE:
September 2014

DATUM & PROJECTION:
NAD83 CSRS UTM Zone 20N

AMEC PROJECT NO:
TV144003

LEGEND:

Wetland 15
Fen

10 5 0 10 20 30 40 50 60 70 80 90 100 110 120
Meters

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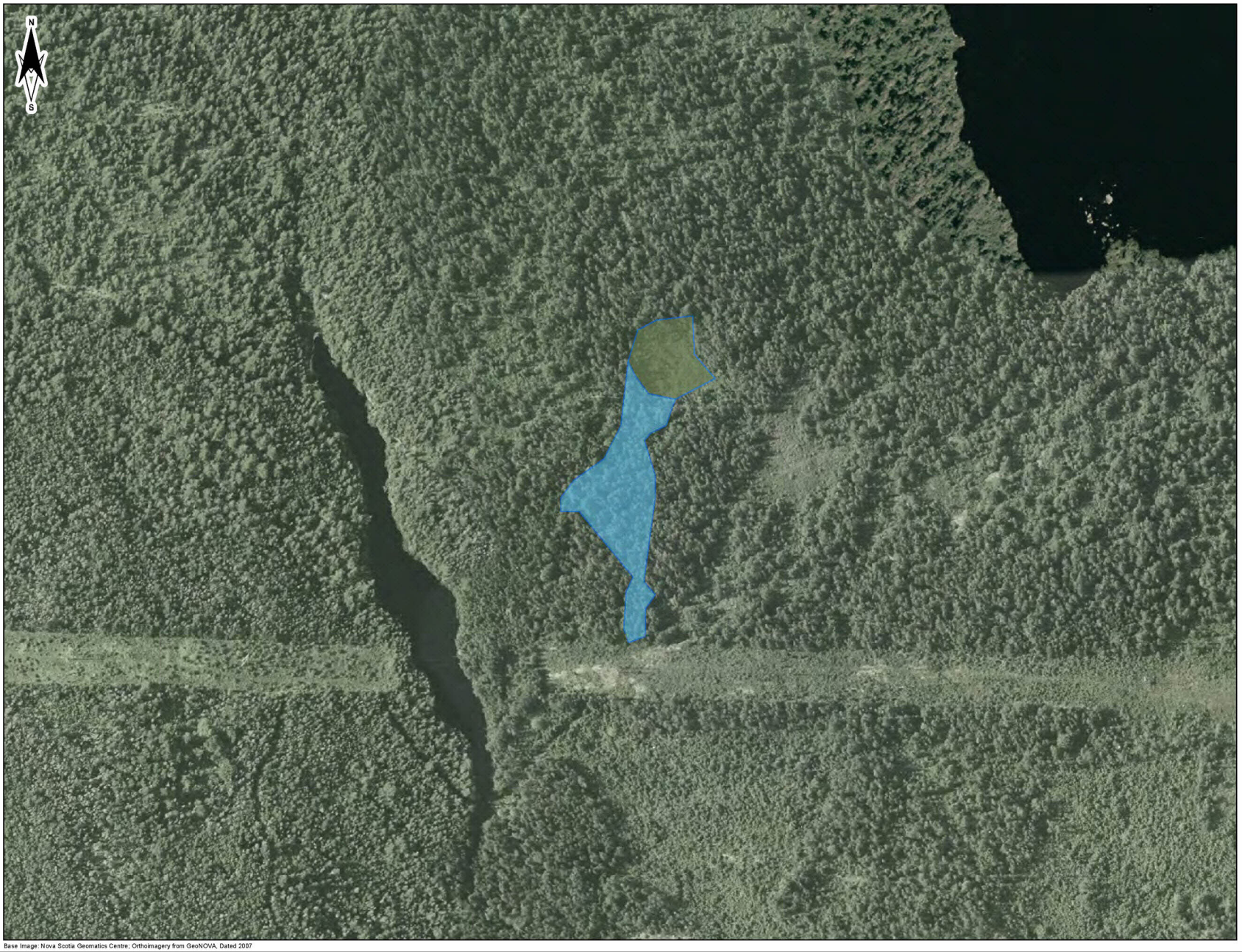

Base Image: Nova Scotia Geomatics Centre; Orthoimagery from GeoNOVA, Dated 2007

TITLE:
Figure 18
Wetland WL16

PROJECT: **2010 / 2011 / 2014 WETLAND FIELD SURVEY DELINEATION AND FUNCTIONAL ASSESSMENT REPORTBLACK POINT QUARRY GUYSBOROUGH COUNTY**

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Suite 1480, 99 Wyse Road
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Canada, B3A 4S5

LOCATION:
Guysborough County
Nova Scotia

DATE:
September 2014

DATUM & PROJECTION:
NAD83 CSRS UTM Zone 20N

AMEC PROJECT NO:
TV144003

LEGEND:

Wetland 16
- Bog
- Treed Bog

10 5 0 10 20 30 40 50 60 70 80
Meters

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Base Image: Nova Scotia Geomatics Centre; Orthoimagery from GeoNOVA, Dated 2007

TITLE:
Figure 19
Wetland WL17

PROJECT: **2010 / 2011 / 2014 WETLAND FIELD SURVEY DELINEATION AND FUNCTIONAL ASSESSMENT REPORTBLACK POINT QUARRY GUYSBOROUGH COUNTY**

CLIENT:
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Canada, B3A 4S5

LOCATION:
Guysborough County
Nova Scotia

DATE:
September 2014

DATUM & PROJECTION:
NAD83 CSRS UTM Zone 20N

AMEC PROJECT NO:
TV144003

LEGEND:

Wetland 17
- Bog
- Forested Swamp

10 5 0 10 20 30 40 50 60 70
Meters

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Base Image: Nova Scotia Geomatics Centre; Orthoimagery from GeoNOVA, Dated 2007

TITLE:
Figure 20
Wetland WL18

PROJECT: **2010 / 2011 / 2014 WETLAND FIELD SURVEY DELINEATION AND FUNCTIONAL ASSESSMENT REPORTBLACK POINT QUARRY GUYSBOROUGH COUNTY**

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LOCATION:
Guysborough County
Nova Scotia

DATE:
September 2014

DATUM & PROJECTION:
NAD83 CSRS UTM Zone 20N

AMEC PROJECT NO:
TV144003

LEGEND:

Wetland 18
Bog

10 5 0 10 20 30 40 50 60 70 80 90
Meters

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Base Image: Nova Scotia Geomatics Centre; Orthoimagery from GeoNOVA, Dated 2007

TITLE:
Figure 21
Wetland WL19

PROJECT: **2010 / 2011 / 2014 WETLAND FIELD SURVEY DELINEATION AND FUNCTIONAL ASSESSMENT REPORTBLACK POINT QUARRY GUYSBOROUGH COUNTY**

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Metropolitan Place
Suite 1480, 99 Wyse Road
Dartmouth, Nova Scotia,
Canada, B3A 4S5

LOCATION:
Guysborough County
Nova Scotia

DATE:
September 2014

DATUM & PROJECTION:
NAD83 CSRS UTM Zone 20N

AMEC PROJECT NO:
TV144003

LEGEND:

Wetland 19
Bog

10 5 0 10 20 30 40 50 60
Meters

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Base Image: Nova Scotia Geomatics Centre; Orthoimagery from GeoNOVA, Dated 2007

TITLE:
Figure 22
Wetland WL20

PROJECT: **2010 / 2011 / 2014 WETLAND FIELD SURVEY DELINEATION AND FUNCTIONAL ASSESSMENT REPORTBLACK POINT QUARRY GUYSBOROUGH COUNTY**

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Canada, B3A 4S5

LOCATION:
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Nova Scotia

DATE:
September 2014

DATUM & PROJECTION:
NAD83 CSRS UTM Zone 20N

AMEC PROJECT NO:
TV144003

LEGEND:

Wetland 20
Bog

10 5 0 10 20 30 40 50 60 70
Meters

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Base Image: Nova Scotia Geomatics Centre; Orthoimagery from GeoNOVA, Dated 2007

TITLE:
Figure 23
Wetland WL21

PROJECT: **2010 / 2011 / 2014 WETLAND FIELD SURVEY DELINEATION AND FUNCTIONAL ASSESSMENT REPORTBLACK POINT QUARRY GUYSBOROUGH COUNTY**

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Canada, B3A 4S5

LOCATION:
Guysborough County
Nova Scotia

DATE:
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DATUM & PROJECTION:
NAD83 CSRS UTM Zone 20N

AMEC PROJECT NO:
TV144003

LEGEND:
Fen

10 5 0 10 20 30 40 50 60
Meters

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Base Image: Nova Scotia Geomatics Centre; Orthoimagery from GeoNOVA, Dated 2007

TITLE:
Figure 24
Wetland WL22

PROJECT: **2010 / 2011 / 2014 WETLAND FIELD SURVEY DELINEATION AND FUNCTIONAL ASSESSMENT REPORTBLACK POINT QUARRY GUYSBOROUGH COUNTY**

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Canada, B3A 4S5

LOCATION:
Guysborough County
Nova Scotia

DATE:
September 2014

DATUM & PROJECTION:
NAD83 CSRS UTM Zone 20N

AMEC PROJECT NO:
TV144003

LEGEND:

Wetland 22
Fen

10 5 0 10 20 30 40 50
Meters

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APPENDIX G
AECOM 2011 Winter Bird Survey

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

AECOM

1701 Hollis Street, SH 400
PO Box 576 CRO
Halifax, NS, Canada B3J 3M8
www.aecom.com

902 428 2021 tel
902 428 2031 fax

Memorandum

To	Mark Davies, Erdene	Page	1
CC			
Subject	Winter Bird Study Results		
From	Shawn Duncan, Janice Ray, Carrie Bentley, Candace Harding		
Date	February 3, 2011	Project Number	60190702

Background

A desktop exercise to assess the potential for winter birds was conducted for the Erdene Resource Development Corp. (Erdene) Black Point Quarry Project (the 'Project'). Existing baseline data for overwintering and breeding winter birds was collected from the following databases and information sources:

- Atlantic Canada Conservation Data Center (ACCDC) (100 km radius around the proposed Project area);
- The Maritime Breeding Bird Atlas (Guysborough area);
- The Audubon Christmas Bird Count (The Strait of Canso, approximately 30 km from the proposed Project area);
- The Nova Scotia Department of Natural Resources, Wildlife Division Species at Risk; and
- The Nova Scotia Significant Species and Habitat Database.

The results indicated that over 100 bird species could potentially overwinter within or within proximity to the proposed Project area. Seven (7) rare or uncommon bird species returned in the ACCDC search requested in support of this Project which have potential to overwinter within or within proximity to the proposed Project area (Table 1) (ACCDC 2010). In addition to these seven, two winter nesting species, the red crossbill (*Loxia curvirostra*) and the white-winged crossbill (*Loxia leucoptera*) were also identified. Although not provincially or federally ranked, both of these species and their nests are protected under the *Migratory Bird Convention Act*.

Based on the results of the desktop review, a winter bird survey of the Project study area was recommended by AECOM and subsequently authorized by Erdene.

Table 1 Rare or Uncommon Bird Species Potentially Overwintering Within or Within Proximity to the Project Area

Scientific Name	Common Name	ACCDC SRank	NSDNR Rank	SARA Rank	Overwintering Habitat*
Accipiter gentilis	Northern Goshawk	S3S4	YELLOW	-	Forested landscapes
Bucephala clangula	Common Goldeneye	S2B,S5N	GREEN	-	Broad shallow bays and inlets
Calidris maritima	Purple Sandpiper	S3N	YELLOW	-	Rocky shores on the Atlantic and Fundy coasts, and even in the sheltered Minas Basin.
Histrionicus histrionicus	Harlequin Duck	S2N	YELLOW	Special Concern Schedule 1	Wave-lashed coasts and jetties
Icterus galbula	Baltimore Oriole	S2S3B	GREEN	-	Edges of deciduous and mixed wood forests.
Passerculus sandwichensis princeps	Ipswich Sparrow	S1B	YELLOW	-	Outer dune beaches with grass cover and sheltered areas (valleys).
Rissa tridactyla	Black-legged Kittiwake	S2B,S4S5N	GREEN	-	Winters out at sea mainly on offshore waters, but it occasionally comes inshore and even inland as a result of storms at sea.

*Sources: ACCDC 2010; Nova Scotia Museum of Natural History 1998; Species at Risk in Nova Scotia 2008

Notes:

S1 = Extremely rare throughout its range in the province (typically 5 or fewer occurrences or very few remaining individuals). May be especially vulnerable to extirpation; S2 = Rare throughout its range in the province (6 to 20 occurrences or few remaining individuals). May be vulnerable to extirpation due to rarity or other factors; S3 = Uncommon throughout its range in the province, or found only in a restricted range, even if abundant in at some locations. (21 to 100 occurrences); S4 = Usually widespread, fairly common throughout its range in the province, and apparently secure with many occurrences, but the Element is of long term concern (e.g. watch list). (100+ occurrences); S5 = Demonstrably widespread, abundant, and secure throughout its range in the province, S5 and essentially ineradicably under present conditions; S#S# = Numeric range rank: A range between two consecutive numeric ranks. Denotes range of uncertainty about the exact rarity of the Element (e.g., S1S2); SH = Historical: Element occurred historically throughout its range in the province (with expectation that it may be rediscovered), perhaps having not been verified in the past 20 - 70 years (depending on the species), and suspected to be still extant; SU = Unrankable: Possibly in peril throughout its range in the province, but status uncertain; need more information; SX = Extinct/Extirpated: Element is believed to be extirpated within the province; S? = Unranked.B = Breeding: Basic rank refers to the breeding population of the element in the province; N = Non-breeding: Basic rank refers to the non-breeding (usually wintering) population of the element in the province; M = Migratory: Basic rank refers to the migratory stopover population in the province.

Winter Bird Survey Results

Methods

AECOM conducted a winter bird survey within the Project study area on January 18 and 19, 2011 (Appendix A). The surveys were conducted between 8:00 am and 2:30 pm. A total of 13 sites were selected within and within close proximity of the study area (Appendix A: Figure 1). Sites were selected within the different habitat types of potential overwintering bird species within the study area. These habitats included: mature coniferous forest, rocky coast, forest edge, and small spruce and willow. For a minimum of 5 minutes, all species observed or heard were recorded representing 500 m on either side of the observer.

Results

Over the course of the survey, sixteen (16) different bird species were heard or observed (Table 2); none of which are red listed (i.e., known to be, or that is thought to be at risk) by Nova Scotia Department of Natural Resources (NSDNR). Two (2) species identified are yellow listed (i.e., sensitive to human activities or natural events) by NSDNR: the Gray Jay (*Perisoreus canadensis*) and the Boreal Chickadee (*Parus hudsonicus*). No winter breeding birds were observed or heard (i.e., red crossbill and white-winged crossbills).

Table 2 Birds and Mammals Observed or Heard within the Project Area

Scientific Name	Common Name	NSDNR Rank	AC CDC SRank	SARA Rank	Sign Type	Site Number*
Anas platyrhynchos	Mallard	GREEN	S5	-	Sound	S11
Corvus brachyrhynchos	American Crow	GREEN	S5	-	Sound	S2, S5
Corvus corax	Common Raven	GREEN	S5	-	Sound	S4
Haliaeetus leucocephalus	Bald Eagle	GREEN	S4	-	Observation	S11
Larus argentatus	Herring Gull	GREEN	S4S5	-	Sound	S11
Larus philadelphia	Bonaparte's Gull	GREEN	S5M	-	Observation	S11, S12
Melanitta fusca	White-winged Scoter	GREEN	S5N	-	Observation	S11, S13
Melanitta nigra	Black Scoter	GREEN	S5N	-	Observation	S11
Mergus serrator	Red-breasted Merganser	GREEN	S3B,S5N	-	Observation	S11, S12
Perisoreus canadensis	Gray Jay	YELLOW	S3S4	-	Observation	S6
Phalacrocorax carbo	Great Cormorant	GREEN	S3	-	Observation	S11, S12
Picoides pubescens	Downy Woodpecker	GREEN	S5	-	Sound	S2
Podiceps auritus	Horned Grebe	GREEN	S4N	-	Observation	S11
Poecile atricapillus	Black-capped Chickadee	GREEN	S5	-	Observation and Sound	S1, S9, S10
Poecile hudsonica	Boreal Chickadee	YELLOW	S3	-	Sound	S1, S8, S10
Spinus tristis	American Goldfinch	GREEN	S5	-	Sound	S3

*Please see Appendix A

Habitat Evaluation of Breeding Birds and Rare Birds

Habitats within the study area include: rocky coast, mature black and red spruce forest, forest edge, small spruce and willow with rocky outcrops, and wetlands (e.g. bog, fen, marsh, swamp, lake).

Although the study area contained adequate habitat for red and white-winged crossbills, the potential for these birds to occur and breed in the study area at the time of assessment was considered to be low due to the lack of adequate food sources (seed bearing cones). The habitat evaluation of rare or uncommon bird species occurring or potentially occurring within or within close proximity to the study area at the time of assessment is described in Table 3 below:

Table 3 Habitat Evaluation and Potential for Rare or Uncommon Bird Species Potentially Overwintering Within or Within Proximity to the Project Area*

Species	Habitat Evaluation in Study Area**	Potential to Occur in Study Area**
Gray Jay *(Perisoreus Canadensis)*	Good : Owing to the presence of coniferous forest	High: Observed in study area
Boreal Chickadee *(Poecile hudsonica)*	Good: Owing to the presence of coniferous forest	High: Heard in study area
Northern Goshawk (*Accipiter gentilis*)	Moderate to Good: Owing to the presence of mature coniferous forest	Low to Moderate: Due to low numbers of mammalian prey
Purple Sandpiper (*Calidris maritime*)	Moderate to Good: Owing to abundant rocky coast within the study area.	Moderate to High: Owing to sufficient habitat
Harlequin Duck (*Histrionicus histrionicus*)	Moderate: Owing to the presence of coastal habitat	Moderate: Owing to sufficient habitat
Common Goldeneye (*Bucephala clangula*)	Poor to Moderate: Due to the presence of some inlets and sheltered areas.	Low to Moderate: Due to only some preferred habitat.
Ipswich Sparrow (*Passerculus sandwichensis princeps*)	Poor to Moderate: Due to very few areas of sheltered grassy areas	Low to Moderate: Due to few areas of preferred habitat.
Baltimore Oriole (*Icterus galbula*)	Poor: Due to a lack of deciduous forests	Low: Due to lack of preferred habitat
Black-legged Kittiwake (*Rissa tridactyla*)	Poor: These birds occur at sea during the winter months and sometimes come to shore during bad weather.	Low: Due to lack of sufficient habitat

*Sources: ACCDC 2010; Nova Scotia Museum of Natural History 1998; Species at Risk in Nova Scotia 2008

**These rankings are based on the study area at the time of assessment.

Signs of Other Wildlife

AECOM observed a lot of coyote (*Canis latrans*) activity (tracks and scat) within the study area. There was little sign (tracks) of white-tailed deer (*Odocoileus virginianus*), snowshoe hare (*Lepus americanus*), red squirrel (*Tamiasciurus hudsonicus*), and vole (sp). No signs of mammal species at risk were observed (e.g. moose, lynx, and marten).

References

Atlantic Canada Conservation Data Center (ACCDC) 2010. Data report 4313: Black Point, NS. Prepared December 10, 2010.

Nova Scotia Museum of Natural History 1998. Birds of Nova Scotia. Available Online: http://museum.gov.ns.ca/mnh/nature/nsbirds/bons.htm#Categories. [Accessed January 27, 2011]

Species at Risk in Nova Scotia 2008. Species at risk in Nova Scotia: Identification & information guide. Available Online: http://www.speciesatrisk.ca/SARGuide/download/SAR%20Guide.pdf. [Accessed January 27, 2011]

Appendix A

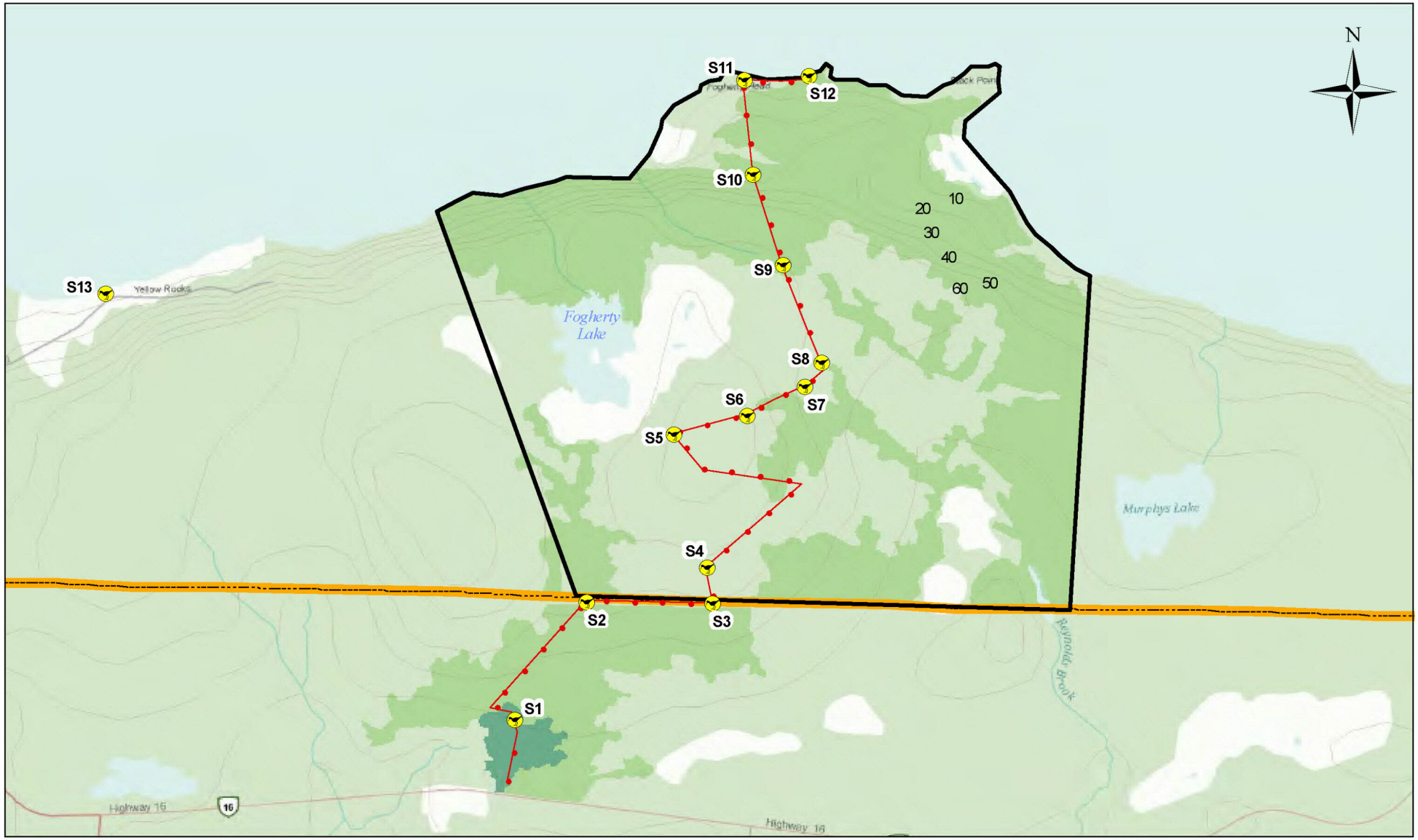
Addendum (2014 12 18)
Habitat Based Point Count Methodology

Point count surveys are a common and standard method of determining species abundance in various habitat types (EC and CWS 2007). A habitat-based point count survey was chosen to determine the abundance and presence/absence of bird species in and around the proposed Project site. AECOM conducted a winter bird survey between January 18 and 19, 2011 (Figure 1, Appendix A). On January, 18, twelve (12) point count locations were conducted within the Project study area between 8:00 am and 2:30 pm. On January 19, one point count location was conducted at 10:30 am along the coast within close proximity of the Project study area. Point count locations were selected within the different habitat types of potential overwintering bird species within the study area. These habitats included: mature coniferous forest, rocky coast, forest edge, and small spruce and willow (see photos and habitat map Figure 3). Each station was spaced at least 125m apart; however, a minimum distance of 250m between sites was targeted. For a minimum of 5 minutes, all species observed or heard were recorded.

At each station the following data additional was collected:

- UTM coordinates
- Start time and end time of point count survey
- Date
- Weather conditions (Point Count surveys were not conducted during rain or during wind speeds of >25 km/h).
- Habitat type
- A list of additional species that may have been heard before and after the survey
- Photograph of habitat type
- Name of surveyors

Environment Canada and Canadian Wildlife Service (EC and CWS) 2007. Recommended protocols for monitoring impacts of wind turbines on birds. Available Online: http://www.ec.gc.ca/Publications/C8CE090E-9F69-4080-8D47-0622E115A4FF%5CCWSWindTurbineAndBirdsMonitoringGuide2007.pdf



LEGEND

- Bird Survey Location
- Study Area Boundary
- Waterbody
- Forested Area (Black/Red Spruce)
- Forested Area (Unconfirmed Species)
- Bird Survey Track
- Transmission Line
- Rivers/Streams
- Highway
- Road
- Contour Line

Date: Jan 26, 2011
Job No.: 60190702
Revisions: 1
Drawn: MEF

1:20,000

0 0.5 1 Kilometres

0 250 500 Metres

Figure 1

Bird Survey Location Map

Erdene Resource Development Corp.
Black Point Quarry Project

AECOM

C 1340-1729

Project: Erdene: 60190702
Date: January 18 and 19, 2011
Crew: Maureen Flinn, Candace Harding, Carrie Bentley, Blair George
Distance Traveled:
Potential for Breeding Crossbills: Low due to no sign, not enough food source for breeding
Mammal Sign: Snowshoehare (2 tracks), Coyote (4 to 6, tracks and scat), White-tailed deer (1 track), Red Squirrel (3 tracks), vole (1 track)
General Comments: Fogerty Lake was iced over which elminates potneital for waterfowl species in the lake. Lots of coyote activity, likely a pack living in area. Low numbers of deer, hare, vole and squirrel. Not many cones on spruce trees.
Low potential for marten, lynx or couger due to low numbers of prey (hare, squirrel, deer). Moderate potential for moose owing to abundant willow

Species	#of Birds	NSDNR Rank	Date	Time	Elevation	Zone	Easting	Northing	Waypoint	Habitat	Sign	Photo #	Weather	Temperature	Comments
Boreal Chickadee	1	Yellow	18-Jan-11	8:07	82m	20	643835	5021994	29		sound	none	sunny, low wind (6 to 9 km/hr)	-12	
Black Capped Chickadee	3	Green	18-Jan-11	8:07	82m	20	643835	5021994	29		sound	none	sunny, low wind (6 to 9 km/hr)	-12	
Boreal Chickadee	1	Yellow	18-Jan-11	9:22	72m	20	644978	5023328	36	Spruce forest with willow	sound	3 to 4	sunny, low wind (6 to 9 km/hr)	-10	
Black Capped Chickadee	4	Green	18-Jan-11	12:00	77m	20	644837	5023688	37	mature spruce forest (dense)	observation	5 to 6	clouds with some sun, wind 13 to 17 km/hr	-5	
Boreal Chickadee	2	Yellow	18-Jan-11	9:51	43m	20	644725	5024024	38	mature spruce forest, steep incline	sound	7 to 9	sunny, low wind (6 to 9 km/hr)	-8	
Black Capped Chickadee	3	Green	18-Jan-11	9:45	43m	20	644725	5024024	38	mature spruce forest, steep incline	sound	7 to 9	sunny, low wind (6 to 9 km/hr)	-8	
Great Cormorant	2	Green	18-Jan-11	10:10	16m	20	644689	5024377	39	Rocky Coast	observation	10 to 11	sunny, low wind (6 to 9 km/hr)	-8	
Herring Gull	1	Green	18-Jan-11	10:10	16m	20	644689	5024377	39	Rocky Coast	observation	10 to 11	sunny, low wind (6 to 9 km/hr)	-8	
Red Breasted Merganser	2	Green	18-Jan-11	10:10	16m	20	644689	5024377	39	Rocky Coast	observation	10 to 11	sunny, low wind (6 to 9 km/hr)	-8	
Black Scoter	1	Green	18-Jan-11	10:10	16m	20	644689	5024377	39	Rocky Coast	observation	10 to 11	sunny, low wind (6 to 9 km/hr)	-8	
Bald Eagle	1	Green	18-Jan-11	10:10	16m	20	644689	5024377	39	Rocky Coast	observation	10 to 11	sunny, low wind (6 to 9 km/hr)	-8	
Mallard	2	Green	18-Jan-11	10:10	16m	20	644689	5024377	39	Rocky Coast	observation	10 to 11	sunny, low wind (6 to 9 km/hr)	-8	
White-winged scoter	2	Green	18-Jan-11	10:10	16m	20	644689	5024377	39	Rocky Coast	observation	10 to 11	sunny, low wind (6 to 9 km/hr)	-8	
Horned Grebe	2	Green	18-Jan-11	10:10	16m	20	644689	5024377	39	Rocky Coast	observation	10 to 11	sunny, low wind (6 to 9 km/hr)	-8	
Bonaparte's Gull	2	Green	18-Jan-11	10:10	16m	20	644689	5024377	39	Rocky Coast	observation	10 to 11	sunny, low wind (6 to 9 km/hr)	-8	
Bonaparte's Gull	2	Green	18-Jan-11	11:08	8m	20	644932	5024396	40	Rocky Coast	observation	none	sunny, low wind (6 to 9 km/hr)	-5	
Great Cormorant	1	Green	18-Jan-11	11:08	8m	20	644932	5024396	40	Rocky Coast	observation	none	sunny, low wind (6 to 9 km/hr)	-5	
Red Breasted Merganser	1	Green	18-Jan-11	11:08	8m	20	644932	5024396	40	Rocky Coast	observation	none	sunny, low wind (6 to 9 km/hr)	-5	
none	0	n/a	18-Jan-11	12:17	76m	20	644919	5023235	42	Edge habitat, spruce and willow	n/a	12 to 13	clouds with some sun, wind 13 to 17 km/hr	-5	
Gray Jay	2	Yellow	18-Jan-11	12:33	88m	20	644704	5023129	44	sparse stunted spruce and willow	observation	14 to 15	clouds with some sun, wind 13 to 17 km/hr	-5	
American Crow	1	Green	18-Jan-11	12:46	97m	20	644431	5023060	45	sparse stunted spruce and willow, overl	sound	16 to 18	clouds with some sun, wind 13 to 17 km/hr	-3	no signs of nests
Raven	1	Green	18-Jan-11	13:01	87m	20	644553	5022559	47	spruce and willow	sound	20 to 21	clouds with some sun, wind 13 to 17 km/hr	-3	red squirrel tracks
American Goldfinch	1	Green	18-Jan-11	13:13	78m	20	644572	5022427	48	spruce and willow	sound	none	clouds with some sun, wind 13 to 17 km/hr	-3	
American Crow	1	Green	18-Jan-11	1:25	70m	20	644105	5022434	49	spruce and willow	sound	none	clouds with some sun, wind 13 to 17 km/hr	-3	
Downy Woodpecker	1	Green	18-Jan-11	2:00	70m	20	644105	5022434	49	spruce and willow	pecking sound	none	clouds with some sun, wind 13 to 17 km/hr	-3	
White-winged scoter	3	Green	19-Jan-11	10:51	4m	20	642310	5023583	53	rocky gravel coast	observation		heavy rain, fog, wind 28 km/hr, waves	4	difficult to identify birds

PHOTOS

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

AECOM

Photo 1

AECOM

Photo 2

AECOM

Photo 3

AECOM

Photo 4

AECOM

Photo 5

AECOM

Photo 6

AECOM

Photo 7

AECOM

Photo 8

AECOM

Photo 9

AECOM

Photo 10

AECOM

Photo 11

AECOM

Photo 12

AECOM

Photo 13

AECOM

Photo 14

AECOM

Photo 15

AECOM

Photo 16

AECOM

Photo 17

AECOM

Photo 18

AECOM

Photo 20

AECOM

Photo 21

AECOM

Photo 22

APPENDIX H
AMEC 2014 Moose Survey

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

BLACK POINT
FALL 2014 MAINLAND MOOSE SURVEYS
SUMMARY REPORT

Prepared for:

Morien Resources Corp. (Morien)
Metropolitan Place
Suite 1480, 99 Wyse Road
Dartmouth, Nova Scotia,
Canada, B3A 4S5

Submitted by:

AMEC Earth & Environmental
a Division of AMEC Americas Ltd.
50 Troop Ave., Unit 300
Dartmouth, NS B3B 1Z1

October 2014

Project No.: TV144003

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APPENDIX A: Photos

1.0 INTRODUCTION AND BACKGROUND

Vulcan Materials Company and Morien Resources Corp. (the Proponent) proposes the development, operation, decommissioning and abandonment of a granite quarry and marine terminal at Black Point in Guysborough County, Nova Scotia. The Black Point Quarry Project consists of aggregate production (drilling, blasting, processing and stockpiling) on a 354.5 ha property, along with the construction and operation of a 200 m long marine terminal adjacent to the quarry in Chedabucto Bay. The aggregate will be loaded into bulk carriers up to 70,000 DWT and transported to ports along the US eastern and Gulf coasts and potentially to markets in Canada and the Caribbean.

The Black Point Quarry Project (the Project) is located on the south shore of Chedabucto Bay in the District of Guysborough, Nova Scotia. The proposed Project Site is approximately 2 km from the community of Half Island Cove in the west, and 2.5 km from Fox Island Main in the east. The Project is situated between Highway 16 and the Atlantic coast, in an area dominated by coniferous forests, coastal barrens, as well as various types of wetlands, including bog, fen, swamp and marsh. A power transmission line corridor runs along the south end of the property and with the exception of a few ATV trails, skidder tracks and property cut lines, the area is relatively undisturbed.

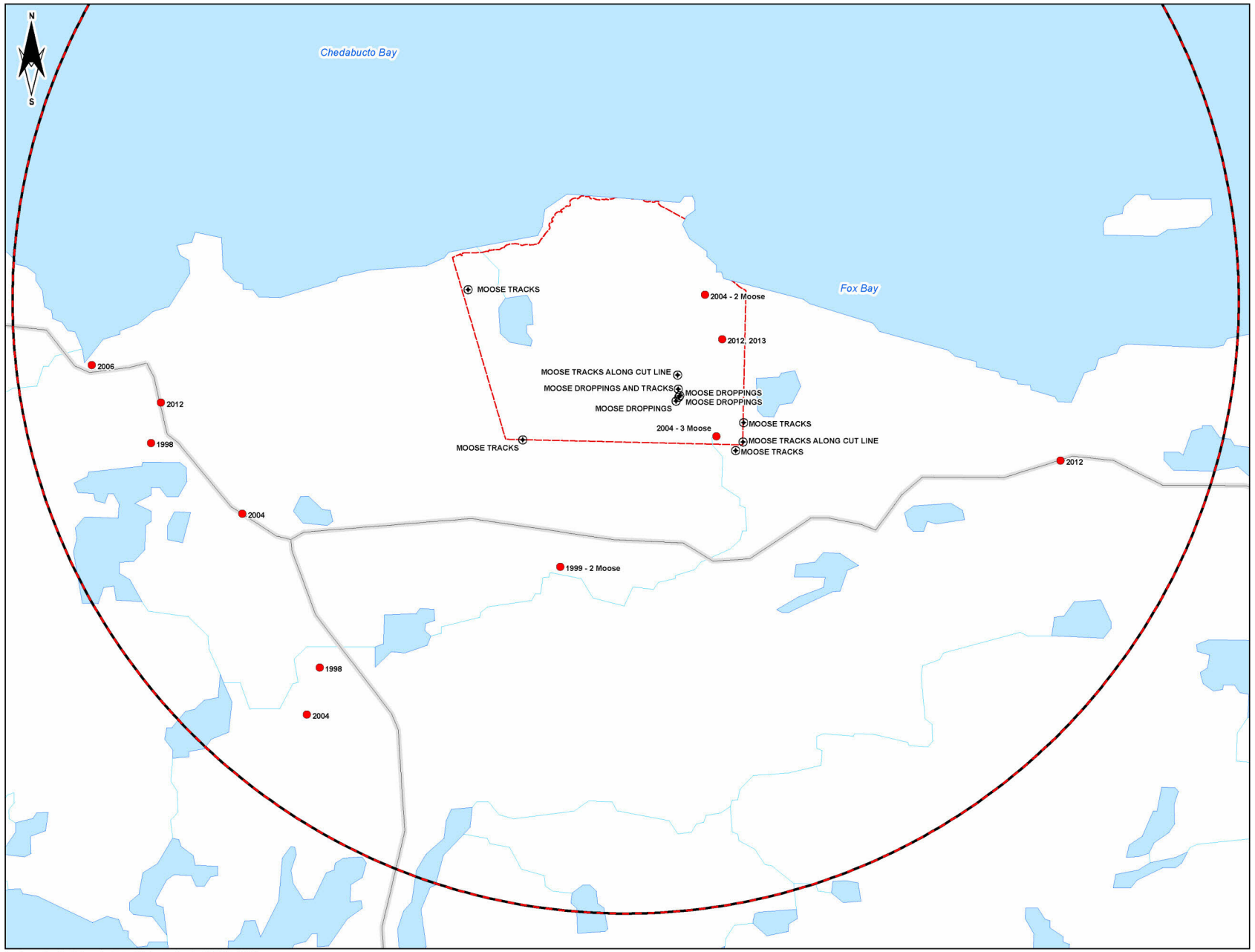
Following the discovery of moose sign (tracks and scat) during wetland surveys conducted by AMEC Environment & Infrastructure (AMEC) in August of 2014, discussions were initiated between Mr. Russell Dmytriw of SLR and NSDNR to design a survey plan for mainland moose (*Alces alces americana*). The purpose of the survey was to confirm presence of moose on the site and develop an understanding of the numbers and sex of moose present during the fall rutting season, including which areas and habitats they may be using. The survey is intended to supplement winter track surveys and spring pellet surveys that will be conducted in early 2015. This summary report presents the results of the fall survey for mainland moose conducted in late September 2014 by AMEC.

2.0 APPROACH AND METHODOLOGY

For the surveys, an AMEC field biologist familiar with the Project site was accompanied by an experienced moose hunter from the nearby Paq'tnkek First Nation, Mr. Kerry Prosper. Mr. Prosper is a member of the provincial Mainland Moose Recovery Team, who has hunted moose in Cape Breton Island since the mid-1990s and is very familiar with moose tracking and identification of moose sign. Prior to the survey, AMEC field staff reviewed the locations and nature of previous moose sightings reported by NSDNR as well as by AMEC during previous field surveys (August 2014) conducted on site (Figure 2.1 Previous Moose Sightings Within 5 km of Project LocationFigure 2.1). The layout of the Project site and the locations of likely suitable habitat were reviewed by all field personnel at the start of the survey program. Survey effort was focussed in areas of high-potential moose habitat on the site, particularly Fogherty Lake and the large bogs near Fogherty Lake (WL11) and on the east side of the property (WL1 and WL14), as well as in likely corridors for moose travel, particularly along the power transmission line and over the barrens between Fogherty Lake and the bogs on the east side of the property.

Surveyors accessed the site from the southwest corner and walked along likely areas of moose corridors, such as the power transmission line along the south of the Project site, carefully looking for signs of moose presence including (but not limited to) tracks, scat, evidence of browsing, and game trails. In areas of suitable moose habitat, including bog edges and the shore of Fogherty Lake, moose calling interspersed with a period of silent observation was conducted over a period of 30 to 90 minutes. Scent markers intended to attract moose were deployed in three locations on the first morning of the survey. Calling stations and scent markers were established in areas where tracks would be evident (e.g. in muddy areas), so that if these sites are visited by moose after the surveyors leave, evidence of moose presence would be obvious upon returning to the location.

In addition to signs of moose, incidental sightings and evidence of other terrestrial fauna were noted, including birds and other mammal species. Efforts were made to detect migrating shorebird species that may utilize the bog and barrens habitats for feeding and staging during high tide; shoreline surveys for shorebirds were conducted in 2010 (AMEC 2014).



Base Image: Nova Scotia Geomatics Centre; Orthoimagery from GeoNOVA, Dated 2007

Path: \\hfx1-fs1\projects$\5300 PROJECTS\2014\TV144003 - Black Point Quarry EA Support\CAD\Moose Survey\Figure 2.1 - Previous Moose Sightings Within 5 km of Project Location.mxd User: derrick.schulz Date: 10/8/2014

TITLE:
Figure 2.1
Previous Moose Sightings
Within 5 km of Project Location

PROJECT:
BLACK POINT
FALL 2014 MAINLAND MOOSE SURVEYS

CLIENT:
Morien Resources Corp. (Morien)
Metropolitan Place
Suite 1480, 99 Wyse Road
Dartmouth, Nova Scotia,
Canada, B3A 4S5

LOCATION:
Guysborough County
Nova Scotia

DATE:
September 2014

DATUM & PROJECTION:
NAD83 CSRS UTM Zone 20N

AMEC PROJECT NO:
TV144003

LEGEND:
- Site Boundary
- NSDNR Moose Sightings Within 5km of Project Location
- Moose Sightings (August 2014 AMEC)
- 5 km Radius
- Roads
- River / Stream
- Waterbody

250 125 0 250 500 750 1,000
Meters

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amec

3.0 RESULTS AND DISCUSSION

Surveys were conducted during the early and late parts of the day, when moose are most active. On September 24th, surveys were conducted from sunrise to early afternoon, and from late afternoon until shortly after sunset. On September 25th, additional surveys were conducted in the morning to early afternoon, and the previous day's scent marker stations and calling points were examined for evidence of recent moose presence. Weather conditions were favourable on both days of the survey, with cool morning temperatures (approximately 10ºC), no precipitation and calm to light breezes. Winds became fairly gusty in the later morning and early afternoon of September 24th; however, moose are less active at this time of day and as such survey effort was focussed on finding moose sign rather than on attempting to attract moose by calling and scent.

3.1 MOOSE OBSERVATIONS

A total of seven calling stations were established and three scent markers were deployed on the Project site (Figure 3.1); however, no moose were observed during the surveys, and no recent evidence of moose was noted when surveyors returned to the calling stations and scent markers. Evidence of past moose presence was noted in the Project site; tracks were observed at several locations, and there was some moose scat and possible scrapes (Figure 3.1). These observations are further discussed below.

Fogherty Lake and WL11

Two areas identified as possible moose scrapes were noted in the area between Fogherty Lake and WL11 (Appendix A, Photo 1); however, Mr. Prosper noted that a tree with rubbed bark would typically be seen in close proximity to a moose scrape, and no such trees were found near either of these locations. These possible scrapes were not recent, and no additional sign was noted in the area. Moose tracks were observed by AMEC northwest of Fogherty Lake in August 2014 (Figure 2.1), indicating that moose occasionally use this part of the Project site.

WL1 and WL14

Moose activity was evident in the bogs in the southeastern portion of the Project site. A trail made by moose was identified in WL1, running in a north-south direction and appearing to link WL1 and WL14 (Appendix A, Photo 2). Because the individual tracks could not be distinguished, the size and number of individuals using the trail could not be estimated; however, Mr. Prosper noted that the trail did not appear to be heavily used. Old moose scat (likely from the previous year) was observed in two locations near WL14 (Appendix A, Photo 3). Although the scat was fairly decomposed, one pile was identified by Mr. Prosper as being from a bull moose.

The majority of sightings of moose tracks and scat by AMEC field personnel in August 2014 were in this southeastern portion of the site (Figure 2.1). The scat observed in August was very recent, indicating that moose were present in the area in late summer.

TITLE:
Figure 3.1
September 2014 Moose
Survey Locations and Observations

PROJECT:
BLACK POINT
FALL 2014 MAINLAND MOOSE SURVEYS

CLIENT:
Morien Resources Corp. (Morien)
Metropolitan Place
Suite 1480, 99 Wyse Road
Dartmouth, Nova Scotia,
Canada, B3A 4S5

LOCATION:
Guysborough County
Nova Scotia

DATE:
September 2014

DATUM & PROJECTION:
NAD83 CSRS UTM Zone 20N

AMEC PROJECT NO:
TV144003

LEGEND:
- Calling Station
- Scent Marker
- Old track (3-4 year old male)
- Old track (adult male)
- Recent track (3-4 year old male)
- Possible scrape
- Scat (old)
- Moose Path
- Survey Tracks
- Site Boundary
- Delineated Wetlands

100 50 0 100 200 300
Meters

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amec

C 1340-1760

Barrens

Moose tracks were observed in a few locations in muddy parts of the trail that runs in a north-south direction through the barrens in the centre of the Project site. This open area of barrens could serve as a corridor for moose to move between the areas of potential habitat to the west (Fogherty Lake and associated wetlands) and east (WL1 and WL14) of the Project site. However, the tracks that were seen on the trail were all made by animals travelling along the trail, not across it in an east-west direction (Figure 3.1), suggesting that moose may not be using the barrens as a direct route between these two wetland areas. At least two distinct sets of tracks were observed, one made by an adult bull (Appendix A, Photo 4) and one by a 3 or 4 year old male, but none of the tracks appeared to be recent.

Power Transmission Line

Moose tracks were observed in many locations along the transmission line corridor, all from young (3 to 4 year old) bulls heading in a westerly direction. There were at least two distinct tracks, one set relatively recent (from within a week prior to the survey; Appendix A, Photo 5) and the other set much older. No other evidence of moose presence was observed in this part of the Project site. Notably, no moose trails were observed leading from the transmission line corridor northwards to the wetland areas on the western edge of the Project site (west of Fogherty Lake), suggesting that these wetlands are not frequented by moose.

3.2 INCIDENTAL OBSERVATIONS

White-tailed deer (*Odocoileus virginianus*) tracks and scat were observed at several locations along the transmission line, and a deer was observed in an area of low shrubs near the southwest corner of the Project site. Coyote (*Canis latrans*) scat (old and recent) was observed in several locations. Black bear (*Ursus americanus*) and bobcat (*Lynx rufus*) tracks were also observed along the transmission line, and bear scat was observed in forested habitat near WL14. Snowshoe hare (*Lepus americanus*) scat was seen along the transmission line, and a partial carcass was seen near the southwest corner of the Project site. Raccoon (*Procyon lotor*) tracks were seen along the transmission line, and possible scat was seen on the barrens. Red squirrel (*Tamiasciurus hudsonicus*) was frequently heard throughout the Project site.

The following bird species were seen and/or heard in several locations and are considered to be widespread on the Project site: American Crow (*Corvus brachyrhynchos*), American Goldfinch (*Spinus tristis*), American Robin (*Turdus migratorius*), Black-capped Chickadee (*Poecile atricapillus*), Boreal Chickadee (*Poecile hudsonicus*), Dark-eyed Junco (*Junco hyemalis*), Golden-crowned Kinglet (*Regulus satrapa*), Red-eyed Vireo (*Vireo olivaceus*) and White-throated Sparrow (*Zonotrichia albicollis*). In forested habitat, Blue Jay (*Cyanocitta cristata*), Gray Jay (*Perisoreus canadensis*), Hermit Thrush (*Catharus guttatus*) and Red-breasted Nuthatch (*Sitta canadensis*) were frequently heard, and a flock of 22 Cedar Waxwings (*Bombycilla cedrorum*) was observed near WL1. Near wetlands, Common Yellowthroat (*Geothlypis trichas*) was fairly abundant and Palm Warbler (*Dendroica palmarum*) was observed on a couple of occasions.

C 1340-1761

Downy Woodpecker (*Picoides pubescens*), Song Sparrow (*Melospiza melodia*) and Swainson's Thrush (*Catharus ustulatus*) were each heard on a single occasion. Common Raven (*Corvus corax*) was occasionally seen flying over the site. An Osprey (*Pandion haliaetus*) was seen flying to the south of the Project area, and two Bald Eagles (*Haliaeetus leucocephalus*; likely a pair) were observed to the northwest of the Project area. An American Kestrel (*Falco sparverius*) was seen hunting over the barrens near the centre of the Project site.

Six Great Cormorants (*Phalacrocorax carbo*) and a single Herring Gull (*Larus argentatus*) flew over the site on September 24th. Fogherty Lake was scanned on several occasions over the two days of the survey, and no waterfowl or shorebirds were observed on or near the waters. The lake does not appear to provide suitable habitat for breeding shorebirds, as the bank vegetation consists of dense low shrubs that overhang the water, and there is no shallow water for wading along the edges. No shorebirds were observed feeding in the barrens and bog habitat, despite the presence of some suitable berries. Fogherty Lake has a very low pH and, based on the results of AMEC surveys conducted in 2010, it does not appear to support fish; therefore it is unlikely to provide nesting habitat for piscivorous species such as loons or kingfishers. Suitable vegetation for dabbling duck species is also absent in the lake.

4.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the observations made during these preliminary surveys, as well as previous observations from NSDNR reports and previous AMEC field surveys, it is evident that moose are occasionally present in the Project area. Efforts to attract moose using auditory and scent attractants were unsuccessful, suggesting that moose may not be presently using the Project location. However, although the rutting season for moose in Nova Scotia is September to October, it is possible that due to the relatively warm temperatures in the days prior to the survey, the moose rutting season was not yet at its peak.

The preliminary survey work suggests that the Project site provides marginal moose habitat. There was very little young hardwood growth, which is a preferred food item for moose (NSDNR 2007), and no sign of browse was observed during the surveys. As well, the moderate ATV use that was evident along the power transmission line would likely discourage moose from the area. Mr. Prosper noted that there are areas of much more suitable habitat nearby (for example, from the higher portions of the site, large bogs could be seen to the south), therefore it is unlikely that moose would reside in the Project area. Most of the tracks seen on the Project site were from young (3 to 4 year old) male moose. Young bulls of this age tend to be driven away from prime habitats by territorial adult bulls.

Based on these preliminary results, it is recommended that winter track and pellet surveys be conducted in order to supplement the understanding of moose presence and abundance on the Project site in different times of year.

Additionally, Mr. Prosper noted that moose would be capable of crossing Chedabucto Bay; therefore, it may be possible that moose in the Project area are from the introduced Cape Breton population rather than the endangered native mainland population. There is evidence that the Cape Breton and mainland moose populations can be distinguished using genetic markers (Ball 2003; cited in NSDNR 2007). If feasible, it may be worthwhile to collect pellets from the Project site that may be used for genetic testing to better understand the knowledge and movement patterns of moose in this area.

5.0 REFERENCES

AMEC. 2014. Black Point Baseline Ecological Surveys Summary Report (2010 Surveys with Updates from 2014). Dated September 2014.

Ball, M. 2003. Genetic Analysis of the endangered Nova Scotia Moose Populations: Project Progress Report. Unpublished Report.

NSDNR: Nova Scotia Department of Natural Resources. 2007. Recovery Plan for Moose (*Alces alces Americana*) in Mainland Nova Scotia. Available online at: http://novascotia.ca/natr/wildlife/biodiversity/pdf/recoveryplans/MainlandMooseRecoveryPlan.pdf

APPENDIX A
PHOTOS

Photo 1: Possible old scrape

Photo 2: Moose trail between WL1 and WL14

Photo 3: Old moose droppings

Photo 4: Adult bull track

Photo 5: Young (3 to 4 year old) bull track

APPENDIX I
Freshwater Habitat Assessment Supporting Documentation

ATTACHMENT A – Watercourse Assessment Forms

ATTACHMENT B – Watercourse Photos

ATTACHMENT C – Water Quality Results

ATTACHMENT D – AGAT QA/QC Forms for Freshwater Samples

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

ATTACHMENT A
Watercourse Assessment Forms

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

11-06

DNR&E / DFO - NEW BRUNSWICK
STREAM SURVEY and HABITAT ASSESSMENT

Start Point: Fogherty Lake **End Point:** WPT 190

__of__

River: Unnamed Watercourse 1 - Fogherty Lake outflow.
Date: 24-Sep-10
Personnel: M. Cameron-MacMillan and B. Cameron

Stream/River No.
Stream Order No.

Unit No.	Stream Type	Channel Type	Chainage End	Length (m)	Ave Width (m)		Substrate (%)							Ave Depth – Wet Width (cm)	Undercut Bank 0-50%		Over-Hanging Bank Vegetation 0-50%		Large Woody Debris In-Stream (m)	Embedded (Criteria) 1: <20% 2: 20 - 35% 3: 35 - 50% 4: >50%	In-Stream Vegetation	Comments
					Wet	Bank Channel	Bedrock	Boulder	Rock	Rubble	Gravel	Sand	Fines		L	R	L	R				
1	13	1	187.0		12.0	30.0	0	0	0	0	0	0	100	70	0	0	40	40	3.0	4	✓	Photos 67 - 71
2	8	1	188.0		1.0	1.0	0	20	15	5	25	35	0	15	25	25	15	15	0.0	1		Photos 72,73
3	24	1	189.0		2.5	5.0	0	20	10	10	10	10	40	40	5	5	10	20	0.0	1		Photos 74,75
4	8	1	190.0		1.0	1.0	0	20	15	5	25	35	0	15	25	25	15	15	0.0	1		Photos 76,77. Debris dam at WPT189.
																						Photos 78,79 at WPT190 (start of steep dropoff). Habitat looks similar as far downstream as we can see.

STREAM TYPE						CHANNEL TYPE	SUBSTRATE	FLOW TYPE	POOL RATING (reverse side)	
FASTWATER		POOLS							CRITERIA (NO.)	% OF POOLS IN SITE (LETTER)
1 Fall	6 Sheet (ledge)	10 Midchannel	14 Trench	18 Eddy	22 Wood Debris	1 Main (if measurement refers to main area of river)	1 Bedrock, Ledge 2 Boulder = > 461 mm 3 Rock = 180 - 460 mm 4 Rubble = 54 - 179 mm 5 Gravel = 2.6 - 53 mm 6 Sand = 0.06 - 2.5 mm 7 Fines = 0.0005 - 0.05 mm	1 Survey Stream	Pool Depth > 1.5 m 1 - Instream Cover > 30% 2 - Instream Cover < 30%	a - > 30% b - 10% to 30% c - < 10%
2 Cascade	7 Chute	11 Convergence	15 Plunge	19 Gabion	23 Man-Made Dam	* 2 Side Channel (water diverted by islands)		2 Spring		
3 Riffle (GR/RB)	8 Run	12 Lateral	16	20 Log Structure	24 Natural Deadwater	* 3 Split (if river is split into various different stream types)		3 Brook/River Tributary	Pool Depth 0.5 to 1.5m 3 - Instream Cover 5 - 30% 4 - Instream Cover > 30%	e - > 30% f - < 30%
4 Riffle (RB)	9 Rapid	13 Beaver	17 Bogan	21 Road Crossing		* 4 Bogan		4 Spring Seep		
5 Riffle (Sand)						* - Specify Left (L), Right (R) or Middle (M)				

*For different left and right parameters, values are to be written as L/R.

Adobe form developed by Alison Johnson @ AMEC Fredericton

C 1340-1771

River: Unnamed Watercourse 1 - Fogherty Lake outflow.

Valley Slope L/M/H	Bank Height (m)	Flood Plain Width (m)	Shade (%)	Stream Banks: Vegetation (%)				Stream Banks: Erosion (%)						O^2 (Mg/L)	pH	Water Temperature (°C)	Fish Species	Pool Rating		Pool Tail			Turbulence (%)
								Left Bank (0-50%)			Right Bank (0-50%)							No.	Letter	Embedded (Criteria) 1: < 20% 2: 20 - 35% 3: 35 - 50% 4: > 50%	Mean Substrate Size(cm)	Fines (%)	
				Bare	Grasses	Shrubs	Trees	Stable	Bare Stable	Eroding	Stable	Bare Stable	Eroding										
L	0.1	>26	50	0	0	40	60	50	0	0	50	0	0				0						
L	0.3	>26	80	0	20	20	60	50	0	0	50	0	0										
L	0.2	>26	80	0	0	40	60	50	0	0	50	0	0										
L	0.3	>26	80	0	20	20	60	50	0	0	50	0	0										

NOTE: * For selected site study, these columns (reverse side) should be done for a habitat assessment

WATER FLOW MEASUREMENT

RIFFLE GRADIENT: LENGTH M	RIFFLE GRADIENT: DROP M	RIFFLE GRADIENT: GRADIENT %	UnitT No.	STREAM TYPE	WET WIDTH (m)	DEPTH (cm): 1/4 way	DEPTH (cm): 1/2 way	DEPTH (cm): 3/4 way	AVERAGE DEPTH SUM / 4: CENTIMETERS	AVERAGE DEPTH SUM / 4: METERS (m)	COEFFICIENT (0.0 - smooth) (0.9 - rough)	LENGTH (3m)	FLOAT TIME (sec): 1/4 way	FLOAT TIME (sec): 1/2 way	FLOAT TIME (sec): 3/4 way	FLOAT TIME (sec): AVERAGE	FLOW cm/s

Formula (CMS) = W (m) x D (m) x A x L (m) / T (sec) Where W = width, D = depth, L = length, A is a coefficient for the stream bottom (A= 0.8 for rough bottom, 0.9 for smooth)

CRITERIA

1 Chute - water depth equal to or greater than channel width
2 Rifle - GR/RB - is a rifle flowing over a gravel and/or rubble bottom
R/B - is a rifle flowing over & through large substrates (e.g. rock and/or boulder), some of which protrudes the surface
3 Side channels - treat as a separate stream type
4 Undercut Bank - % of bank overhang (above water edge for stream type Specify left (L) or right (R)
5 Over-ranging Bank Vegetation - % of vegetation overhang for stream type Specify L or R
6 Visual Embeddedness - % of sands or fines surrounding the larger substrates, up to 100%
7 Woody Debris - total width should be > 10 cm in diameter

*For different left and right parameters, values are to be written as L/R.

Adobe form developed by Alison Johnson @ AMEC Fredericton

C 1340-1772

11-06

DNR&E / DFO - NEW BRUNSWICK
STREAM SURVEY and HABITAT ASSESSMENT

__of__

River: Unnamed Watercourse 2 - North watercourse.
Date: 22-Sep-10
Personnel: M. Cameron-MacMillan and B. Cameron

Start Point: WPT 180 **End Point:** WPT 181

Stream/River No.
Stream Order No.

Unit No.	Stream Type	Channel Type	Chainage End	Length (m)	Ave Width (m)		Substrate (%)							Ave Depth – Wet Width (cm)	Undercut Bank 0-50%		Over-Hanging Bank Vegetation 0-50%		Large Woody Debris In-Stream (m)	Embedded (Criteria) 1: <20% 2: 20 - 35% 3: 35 - 50% 4: >50%	In-Stream Vegetation	Comments
					Wet	Bank Channel	Bedrock	Boulder	Rock	Rubble	Gravel	Sand	Fines		L	R	L	R				
1		1	179.0			15.0																Dry channel; very little standing water in places.
2	24	1	181.0		0.8	16.0	0	0	0	0	0	0	100	15	15	15	35	35	20.0	4		Photos 75,76. Intermittent flow.
3	8	1	181.0	10.0	0.5	16.0	0	10	10	30	40	5	5	10	15	15	35	35	20.0	1		Photos 77, 78. Survey ends at dropoff; habitat appears similar as far downstream as can be seen.

STREAM TYPE						CHANNEL TYPE	SUBSTRATE	FLOW TYPE	POOL RATING (reverse side)	
FASTWATER		POOLS							CRITERIA (NO.)	% OF POOLS IN SIZE (LETTER)
1 Fall 2 Cascade 3 Riffle (GR/RB) 4 Riffle (RB) 5 Riffle (Sand)	6 Sheet (ledge) 7 Chute 8 Run 9 Rapid	10 Midchannel 11 Convergence 12 Lateral 13 Beaver	14 Trench 15 Plunge 16 17 Bogan	18 Eddy 19 Gabion 20 Log Structure 21 Road Crossing	22 Wood Debris 23 Man-Made Dam 24 Natural Deadwater	1 Main (if measurement refers to main area of river) * 2 Side Channel (water diverted by islands) * 3 Split (if river is split into various different stream types) * 4 Bogan * - Specify Left (L) Right (R) or Middle (M)	1 Bedrock, Ledge 2 Boulder = > 461 mm 3 Rock = 180 - 460 mm 4 Rubble = 54 - 179 mm 5 Gravel = 2.6 - 53 mm 6 Sand = 0.06 - 2.5 mm 7 Fines = 0.0005 - 0.05 mm	1 Survey Stream 2 Spring 3 Brook/River Tributary 4 Seep/Seep	Pool Depth > 1.5 m 1 - Instream Cover > 30% 2 - Instream Cover < 30% Pool Depth 5 to 1.5m 3 - Instream Cover 5 - 30% 4 - Instream Cover > 30%	a - > 30% b - 10% to 30% c - < 10% a - > 50% b - < 50%

*For different left and right parameters, values are to be written as L/R.

Adobe form developed by Alison Johnson @ AMEC Fredericton

C 1340-1773

River: Unnamed Watercourse 2 - North watercourse.

Valley Slope L/M/H	Bank Height (m)	Flood Plain Width (m)	Shade (%)	Stream Banks												Pool Rating		Pool Tail			Turbulence (%)
				Vegetation (%)				Erosion (%)										Embedded (Criteria) 1: <20% 2: 20 - 35% 3: 35 - 50% 4: >50%	Mean Substrate Size(cm)	Fines (%)	
				Bare	Grasses	Shrubs	Trees	Left Bank (0-50%)			Right Bank (0-50%)					No.	Letter				
								Stable	Bare Stable	Eroding	Stable	Bare Stable	Eroding								
H																					
H	0.4	16	65	0	30	0	70	50	0	0	50	0	0		3.2	13.7	0				
H	0.4	16	65	0	10	30	60	50	0	0	50	0	0								

NOTE: * For selected site study, these columns (reverse side) should be done for a habitat assessment

WATER FLOW MEASUREMENT

RIFFLE GRADIENT			UNIT No.	STREAM TYPE	WET WIDTH (m)	DEPTH (cm)			AVERAGE DEPTH SUM / 4		COEFFICIENT (0.9 - smooth) (0.8 - rough)	LENGTH (3m)	FLOAT TIME (sec)				FLOW cm/s
LENGTH M	DROP M	GRADIENT %				1/4 way	1/2 way	3/4 way	CENTIMETERS	METERS (m)			1/4 way	1/2 way	3/4 way	AVERAGE	

Formula (CMS) = W ___ (m) x D ___ (m) x A ___ x L ___ (m) / T ___ (sec) Where W = width, D = depth, L = length, A is a coefficient for the stream bottom (A= 0.8 for rough bottom, 0.9 for smooth)

CRITERIA

1 Chute - water depth equal to or greater than channel width
2 Rifle GR/RB - is a riffle flowing over a gravel and/or rubble bottom
R/B - is a riffle flowing over &/through large substrates (e.g. rock and /or boulder), some of which protrudes the surface
3 Side channels - treat as a separate stream type
4 Undercut Bank - % of bank overhang (above water edge for stream type Specify left (L) or right (R)
5 Over-hanging Bank Vegetation - % of vegetation overhang for stream type Specify L or R
6 Visual Embeddedness - % of sands or finer surrounding the larger substrates, upto 100%
7 Woody Debris - total width should be > 10 cm in diameter

*For different left and right parameters, values are to be written as L/R.

Adobe form developed by Alison Johnson @ AMEC Fredericton

C 1340-1774

11-06

DNR&E / DFO - NEW BRUNSWICK
STREAM SURVEY and HABITAT ASSESSMENT

__of__

River: Unnamed Watercourse 3 - Eastern edge of property
Start Point: WPT 171 **End Point:** WPT 195
Date: 24-Aug-10
Personnel: M. Cameron-MacMillan and B. Cameron

Stream/River No.
Stream Order No.

Unit No.	Stream Type	Channel Type	Chainage End	Length (m)	Ave Width (m)		Substrate (%)							Ave Depth – Wet Width (cm)	Undercut Bank 0-50%		Over-Hanging Bank Vegetation 0-50%		Large Woody Debris In-Stream (m)	Embedded (Criteria) 1: < 20% 2: 20 - 35% 3: 35 - 50% 4: > 50%	In-Stream Vegetation	Comments
					Wet	Bank Channel	Bedrock	Boulder	Rock	Rubble	Gravel	Sand	Fines		L	R	L	R				
1	13	1			20.0	25.0	0	10	30	50	10	0	0	50	0	0	2	2	25.0	4	✓	Beaver pond at downstream end of unit 1.
-	-	-																				Remainder of survey completed 24 September.
2	8	1	193.0		1.4	2.2	0	0	0	0	0	30	70	80	0	0	10	10	5.0	4	✓	Unit starts at WPT192. Fen habitat. Photos 80,81
3	4/8	1	194.0		0.8	2.5	0	0	0	20	30	30	20	15	5	5	10	10	0.0	2		Photos 82,83
4	8	1	195.0		0.5	1.3	0	0	0	0	10	30	60	5	5	5	2	2	0.0	4		Photos 84, 85

STREAM TYPE						CHANNEL TYPE	SUBSTRATE	FLOW TYPE	POOL RATING (reverse side)	
FASTWATER		POOLS							CRITERIA (NO.)	% OF POOLS IN SITE (LETTER)
1 Fall	6 Sheet (ledge)	10 Midchannel	14 Trench	18 Eddy	22 Wood Debris	1 Main (if measurement refers to main area of river)	1 Bedrock, Ledge 2 Boulder = > 461 mm 3 Rock = 180 - 460 mm 4 Rubble = 54 - 179 mm 5 Gravel = 2.6 - 53 mm 6 Sand = 0.06 - 2.5 mm 7 Fines = 0.0005 - 0.05 mm	1 Survey Stream	Pool Depth > 1.5 m 1 - Instream Cover > 30% 2 - Instream Cover < 30%	a - > 30% b - 30% to 30% c - < 10%
2 Cascade	7 Chute	11 Convergence	15 Plunge	19 Gabion	23 Man-Made Dam	* 2 Side Channel (water diverted by islands)		2 Spring		
3 Riffle (GR/B)	8 Run	12 Lateral	16	20 Log Structure	24 Natural Deadwater	* 3 Split (river is split into various different stream types)		3 Brook/River Tributary	Pool Depth 5 to 1.5m 3 - Instream Cover 5 - 30% 4 - Instream Cover > 30%	a - > 50% b - < 50%
4 Riffle (R/B)	9 Rapid	13 Beaver	17 Began	21 Road Crossing		* 4 Began		4 Spring Seep		
5 Riffle (Sand)						* - Specify Left (L), Right (R) or Middle (M)				

*For different left and right parameters, values are to be written as L/R.

Adobe form developed by Alison Johnson @ AMEC Fredericton

C 1340-1775

River: Unnamed Watercourse 3 - Eastern edge of property

Valley Slope L/M/H	Bank Height (m)	Flood Plain Width (m)	Shade (%)	Stream Banks: Vegetation (%) Bare	Vegetation (%) Grasses	Vegetation (%) Shrubs	Vegetation (%) Trees	Erosion (%) Left Bank (0-50%) Stable	Left Bank Bare Stable	Left Bank Eroding	Right Bank (0-50%) Stable	Right Bank Bare Stable	Right Bank Eroding	O^2 (Mg/L)	pH	Water Temperature (°C)	Fish Species	Pool Rating No.	Pool Rating Letter	Pool Tail: Embedded (Criteria) 1: < 20% 2: 20 - 35% 3: 35 - 50% 4: > 50%	Pool Tail: Mean Substrate Size(cm)	Pool Tail: Fines (%)	Turbulence (%)
L	0	30	5	0	30	70	0	50	0	0	50	0	0	6.7	3.4	21.4	0						
L	0.2	30	30	0	60	30	10	50	0	0	50	0	0		3.3	12.1	n/a						
L	0.4	12	90	0	10	10	80	40	0	10	40	0	10				n/a						
L	0.3	30	90	0	10	0	90	50	0	0	50	0	0		3.0	11.9	n/a						

NOTE * For selected site study, these columns (reverse side) should be done for a habitat assessment

WATER FLOW MEASUREMENT

RIFFLE GRADIENT: LENGTH M	RIFFLE GRADIENT: DROP M	RIFFLE GRADIENT: GRADIENT %	UNIT No.	STREAM TYPE	WET WIDTH (m)	DEPTH (cm): 1/4 way	DEPTH (cm): 1/2 way	DEPTH (cm): 3/4 way	AVERAGE DEPTH SUM /4: CENTIMETERS	AVERAGE DEPTH SUM /4: METERS (m)	COEFFICIENT (0.9 - smooth) (0.8 - rough)	LENGTH (3m)	FLOAT TIME (sec): 1/4 way	FLOAT TIME (sec): 1/2 way	FLOAT TIME (sec): 3/4 way	FLOAT TIME (sec): AVERAGE	FLOW cm/s

Formula (CMS) = W (m) x D (m) x A x L (m) / T (sec) Where W = width, D = depth, L = length, A is a coefficient for the stream bottom (A= 0.8 for rough bottom, 0.9 for smooth)

CRITERIA

1 Chute: water depth equal to or greater than channel width
2 Riffle: GR/RB - is a rifle flowing over a gravel and/or rubble bottom
RB - is a rifle flowing over & through large substrates (e.g. rock and /or boulder), some of which protrudes the surface
3 Side channels: treat as a separate stream type
4 Undercut Bank - % of bank overhang (above water edge for stream type. Specify left (L) or right (R)
5 Over-hanging Bank Vegetation - % of vegetation overhang for stream type. Specify L or R
6 Visual Embeddedness - % of sands or fines surrounding the larger substrates, up to 100%
7 Woody Debris - total width should be >10 cm in diameter

*For different left and right parameters, values are to be written as L/R.

Adobe form developed by Alison Johnson @ AMEC Fredericton

C 1340-1776

ATTACHMENT B
Watercourse Photos

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

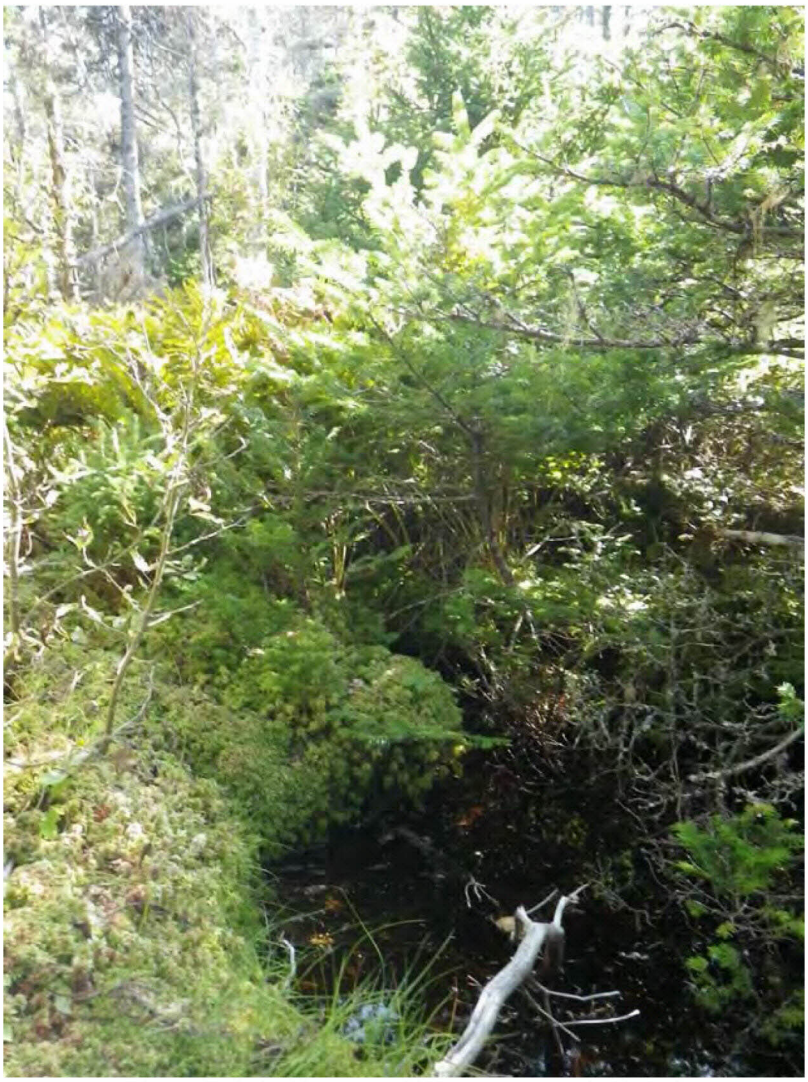

Photo D.2-1. Unnamed Watercourse 2, Unit 2

Photo D.2-2. Unnamed Watercourse 2, Unit 2

Photo D.2-3. Unnamed Watercourse 2, Unit 3

Photo D.2-4. Unnamed Watercourse 2, Unit 3

Photo D.2-5. Unnamed Watercourse 1, Unit 1

Photo D.2-6. Unnamed Watercourse 1, Unit 1

Photo D.2-7. Unnamed Watercourse 1, Unit 1

Photo D.2-8. Unnamed Watercourse 1, Unit 1

Photo D.2-9. Unnamed Watercourse 1, Unit 1

Photo D.2-10. Unnamed Watercourse 1, Unit 2

Photo D.2-11. Unnamed Watercourse 1, Unit 2

Photo D.2-12. Unnamed Watercourse 1, Unit 3

Photo D.2-13. Unnamed Watercourse 1, Unit 3

Photo D.2-14. Unnamed Watercourse 1, Unit 4

Photo D.2-15. Unnamed Watercourse 1, Unit 4

Photo D.2-16. Unnamed Watercourse 1, start of steep dropoff

Photo D.2-17. Unnamed Watercourse 1, start of steep dropoff

Photo D.2-18. Unnamed Watercourse 3, Unit 2

Photo D.2-19. Unnamed Watercourse 3, Unit 2

Photo D.2-20. Unnamed Watercourse 3, Unit 3

Photo D.2-21. Unnamed Watercourse 3, Unit 3

Photo D.2-22. Unnamed Watercourse 3, Unit 4

Photo D.2-23. Unnamed Watercourse 3, Unit 4

ATTACHMENT C
Water Quality Results

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

Table D.3-1. Analytical Results of Water Quality, Three Unnamed Watercourses and Fogherty Lake, 2010.

Sample Name				GRQ-1	GRQ-2	GRQ-3	GRQ-4
Location			CCME FWAL	Unnamed Watercourse 3 East stream	Fogherty Lake	Unnamed Watercourse 2 North stream	Unnamed Watercourse 1 Fogherty Lake outflow
Parameter	Unit	RDL	Guideline	24-Aug-10	27-Aug-10	22-Sep-10	22-Sep-10
Field Parameters							
pH			6.5-9	**3.41**	**2.94**	**3.15**	**2.95**
Water Temperature	ºC			21.4	22.7	14.9	16
Conductivity	µS/cm			62	43	91	53
% Dissolved Oxygen	%			79.2	100.6	79.8	47
Dissolved Oxygen	mg/L			6.67	8.67	8.47	4.52
General Chemistry							
pH			6.5-9	**4.3**	**4.3**	**3.9**	**4.2**
Reactive Silica as SiO2	mg/L	0.5		7.2	0.9	10.2	1.8
Chloride	mg/L	1		14	10	18	13
Fluoride	mg/L	0.1	0.12	<0.1	<0.1	**0.4**	<0.1
Sulphate	mg/L	2		<2	<2	<2	<2
Alkalinity	mg/L	5		<5	<5	<5	<5
True Color	TCU	5	Narrative	395	198	411	195
Turbidity	NTU	0.1	Narrative	1	0.7	2.8	0.7
Electrical Conductivity	umho/cm	1		59	52	102	61
Nitrate + Nitrite as N	mg/L	0.05		<0.05	<0.05	0.24	<0.05
Nitrate as N	mg/L	0.05	2.9	<0.05	<0.05	0.24	<0.05
Nitrite as N	mg/L	0.05	0.06	<0.05	<0.05	<0.05	<0.05
Ammonia as N	mg/L	0.03	Fact Sheet	<0.03	0.03	0.06	0.11
Total Organic Carbon	mg/L	0.5		35.6	15.4	46.6	17.5
Ortho-Phosphate as P	mg/L	0.01		<0.01	<0.01	0.02	<0.01
Total Sodium	mg/L	0.1		8.8	6.8	10	6.8
Total Potassium	mg/L	0.1		0.3	0.4	0.4	0.5
Total Calcium	mg/L	0.1		0.5	0.3	0.5	0.4
Total Magnesium	mg/L	0.1		0.7	0.6	1.1	0.6
Bicarb. Alkalinity (as CaCO3)	mg/L	5		<5	<5	<5	<5
Carb. Alkalinity (as CaCO3)	mg/L	10		<10	<10	<10	<10
Hydroxide	mg/L	5		<5	<5	<5	<5
Calculated TDS	mg/L	1		26	19	33	22
Hardness	mg/L			4.1	3.2	5.8	3.5
Langelier Index (@20C)	NA			-6.84	-7.05	-7.25	-7.03
Langelier Index (@ 4C)	NA			-7.16	-7.37	-7.57	-7.35
Saturation pH (@ 20C)	NA			11.1	11.3	11.1	11.2
Saturation pH (@ 4C)	NA			11.5	11.7	11.5	11.5
Anion Sum	me/L			0.39	0.28	0.52	0.37
Cation sum	me/L			0.68	0.47	0.84	0.49
% Difference/ Ion Balance (NS)	%			26.2	25.2	23.3	14.8
Total Suspended Solids	mg/L	5	Narrative	n/a	n/a	<5	<5
Total Phosphorous as P	mg/L	0.002	Fact Sheet	0.157	0.035	0.03	0.012

Table D.3-1. Analytical Results of Water Quality, Three Unnamed Watercourses and Fogherty Lake, 2010.

Sample Name				GRQ-1	GRQ-2	GRQ-3	GRQ-4
Location			CCME FWAL	Unnamed Watercourse 3 East stream	Fogherty Lake	Unnamed Watercourse 2 North stream	Unnamed Watercourse 1 Fogherty Lake outflow
Total Metals							
Total Aluminum	ug/L	5	5.0	**1050**	**335**	**1050**	**272**
Total Antimony	ug/L	2		<2	<2	<2	<2
Total Arsenic	ug/L	2	5.0	<2	<2	5	<2
Total Barium	ug/L	5		<5	<5	16	<5
Total Beryllium	ug/L	2		<2	<2	<2	<2
Total Bismuth	ug/L	2		<2	<2	<2	<2
Total Boron	ug/L	5		14	11	20	14
Total Cadmium	ug/L	0.017	0.017	**0.025**	**0.023**	**0.102**	<0.017
Total Chromium	ug/L	1		4	<1	<1	<1
Total Cobalt	ug/L	1		<1	<1	<1	<1
Total Copper	ug/L	2	2	<2	<2	<2	<2
Total Iron	ug/L	50	300	**976**	**319**	**936**	**415**
Total Lead	ug/L	0.5	1	**3.1**	**2.6**	**2.2**	0.7
Total Manganese	ug/L	2		37	16	87	15
Total Molybdenum	ug/L	2	73	<2	<2	<2	<2
Total Nickel	ug/L	2	25	<2	<2	<2	<2
Total Selenium	ug/L	1	1.0	1	<1	<1	<1
Total Silver	ug/L	0.1	0.1	<0.1	<0.1	<0.1	<0.1
Total Strontium	ug/L	5		<5	<5	9	<5
Total Thallium	ug/L	0.1	0.8	<0.1	<0.1	<0.1	<0.1
Total Tin	ug/L	2		<2	<2	<2	<2
Total Titanium	ug/L	2		5	2	5	<2
Total Uranium	ug/L	0.1		0.3	0.1	0.3	<0.1
Total Vanadium	ug/L	2		<2	<2	<2	<2
Total Zinc	ug/L	5	30	9	26	20	10
Mercury	mg/L	0.00005	0.000026	<0.00005	<0.00005	<0.00005	<0.00005

APPENDIX D

AGAT QA/QC Forms for Freshwater Samples

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

AGAT Laboratories

11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
http://www.agatlabs.com

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL
580 MAIN STREET, SUITE 105
SAINT JOHN, NB E2K1J5

ATTENTION TO: CHYANN KIRBY

PROJECT NO: GRQ

AGAT WORK ORDER: 10X432414

WATER ANALYSIS REVIEWED BY: Mike Earp, Operations Manager

DATE REPORTED: Sep 10, 2010

PAGES (INCLUDING COVER): 8

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (902) 468-8718, or at 1-888-468-8718

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

Member of: Association of Professional Engineers, Geologists and Geophysicists of Alberta (APEGGA)
Western Enviro-Agricultural Laboratory Association (WEALA)
Environmental Services Association of Alberta (ESAA)

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Certificate of Analysis

AGAT WORK ORDER: 10X432414

PROJECT NO: GRQ

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: CHYANN KIRBY

Standard Water Analysis + FWAL Metals (Total), Hg

DATE SAMPLED: Aug 24, 2010 | DATE RECEIVED: Sep 02, 2010 | DATE REPORTED: Sep 10, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	GRQ-1 1970509	GRQ-2 1970510
pH				4.3	4.3
Reactive Silica as SiO2	mg/L		0.5	7.2	0.9
Chloride	mg/L		1	14	10
Fluoride	mg/L		0.1	<0.1	<0.1
Sulphate	mg/L		2	<2	<2
Alkalinity	mg/L		5	<5	<5
True Color	TCU		5	395	198
Turbidity	NTU		0.1	1.0	0.7
Electrical Conductivity	umho/cm		1	59	52
Nitrate + Nitrite as N	mg/L		0.05	<0.05	<0.05
Nitrate as N	mg/L		0.05	<0.05	<0.05
Nitrite as N	mg/L		0.05	<0.05	<0.05
Ammonia as N	mg/L		0.03	<0.03	0.03
Total Organic Carbon	mg/L		0.5	35.6	15.4
Ortho-Phosphate as P	mg/L		0.01	<0.01	<0.01
Total Sodium	mg/L		0.1	8.8	6.8
Total Potassium	mg/L		0.1	0.3	0.4
Total Calcium	mg/L		0.1	0.5	0.3
Total Magnesium	mg/L		0.1	0.7	0.6
Bicarb. Alkalinity (as CaCO3)	mg/L		5	<5	<5
Carb. Alkalinity (as CaCO3)	mg/L		10	<10	<10
Hydroxide	mg/L		5	<5	<5
Calculated TDS	mg/L		1	26	19
Hardness	mg/L			4.1	3.2
Langelier Index (@20C)	NA			-6.84	-7.05
Langelier Index (@ 4C)	NA			-7.16	-7.37
Saturation pH (@ 20C)	NA			11.1	11.3
Saturation pH (@ 4C)	NA			11.5	11.7
Anion Sum	me/L			0.39	0.28
Cation sum	me/L			0.68	0.47
% Difference/ Ion Balance (NS)	%			26.2	25.2
Total Aluminum	ug/L		5	1050	335
Total Antimony	ug/L		2	<2	<2

Certified By:

Results relate only to the items tested

C 1340-1798

AGAT Laboratories
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http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 10X432414

PROJECT NO: GRQ

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: CHYANN KIRBY

Standard Water Analysis + FWAL Metals (Total), Hg

DATE SAMPLED: Aug 24, 2010 | DATE RECEIVED: Sep 02, 2010 | DATE REPORTED: Sep 10, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	GRQ-1 1970509	GRQ-2 1970510
Total Arsenic	ug/L		2	<2	<2
Total Barium	ug/L		5	<5	<5
Total Beryllium	ug/L		2	<2	<2
Total Bismuth	ug/L		2	<2	<2
Total Boron	ug/L		5	14	11
Total Cadmium	ug/L		0.017	0.025	0.023
Total Chromium	ug/L		1	4	<1
Total Cobalt	ug/L		1	<1	<1
Total Copper	ug/L		2	<2	<2
Total Iron	ug/L		50	976	319
Total Lead	ug/L		0.5	3.1	2.6
Total Manganese	ug/L		2	37	16
Total Molybdenum	ug/L		2	<2	<2
Total Nickel	ug/L		2	<2	<2
Total Selenium	ug/L		1	1	<1
Total Silver	ug/L		0.1	<0.1	<0.1
Total Strontium	ug/L		5	<5	<5
Total Thallium	ug/L		0.1	<0.1	<0.1
Total Tin	ug/L		2	<2	<2
Total Titanium	ug/L		2	5	2
Total Uranium	ug/L		0.1	0.3	0.1
Total Vanadium	ug/L		2	<2	<2
Total Zinc	ug/L		5	9	26
Mercury	mg/L		0.00005	<0.00005	<0.00005

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

Results relate only to the items tested

C 1340-1799

AGAT Laboratories

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http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 10X432414
PROJECT NO: GRQ

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: CHYANN KIRBY

Total Phosphorus (Low Level)

DATE SAMPLED: Aug 24, 2010 | DATE RECEIVED: Sep 02, 2010 | DATE REPORTED: Sep 10, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	GRQ-1 1970509	GRQ-2 1970510
Total Phosphorus	mg/L		0.002	0.157	0.035

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

Results relate only to the items tested

C 1340-1800

AGAT Laboratories

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Quality Assurance

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

AGAT WORK ORDER: 10X432414

PROJECT NO: GRQ

ATTENTION TO: CHYANN KIRBY

Water Analysis

RPT Date: Sep 10, 2010			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Standard Water Analysis + FWAL Metals (Total), Hg															
pH	1	1965945	6.9	7.0	1.4%	<	100%	80%	120%		80%	120%		80%	120%
Reactive Silica as SiO2	1	1976151	13.2	13.1	0.8%	< 0.5	103%	80%	120%		80%	120%	102%	80%	120%
Chloride	1	1962422	10	10	0.0%	< 1	94%	80%	120%		80%	120%	100%	80%	120%
Fluoride	1	1962422	< 0.1	< 0.1	0.0%	< 0.1	98%	80%	120%		80%	120%	87%	80%	120%
Sulphate	1	1962422	5	5	0.0%	< 2	100%	80%	120%		80%	120%	102%	80%	120%
Alkalinity	1	1965945	8	8	0.0%	< 5	99%	80%	120%		80%	120%	97%	80%	120%
True Color	1	1965027	< 5	< 5	0.0%	< 5	95%	80%	120%		80%	120%		80%	120%
Turbidity	1	1965027	0.3	0.3	0.0%	< 0.1	88%	80%	120%		80%	120%		80%	120%
Electrical Conductivity	1	1965945	184	187	1.6%	< 1	99%	80%	120%		80%	120%		80%	120%
Nitrate as N	1	1962422	0.08	0.09	11.8%	< 0.05	104%	80%	120%		80%	120%	83%	80%	120%
Nitrite as N	1	1962422	< 0.05	< 0.05	0.0%	< 0.05	110%	80%	120%		80%	120%	101%	80%	120%
Total Organic Carbon	1	1976101	2.4	2.1	13.3%	< 0.5	103%	80%	120%		80%	120%	93%	80%	120%
Ortho-Phosphate as P	1	1976151	<0.01	0.01		< 0.01	99%	80%	120%		80%	120%	94%	80%	120%
Total Sodium	90810	1977594	32.5	31.2	4.1%	< 0.1	115%	80%	120%	108%	90%	110%	97%	80%	120%
Total Potassium	90810	1977594	1.4	1.5	6.9%	< 0.1	103%	90%	110%	103%	90%	110%	82%	80%	120%
Total Calcium	90810	1977594	10.3	10.5	1.9%	< 0.1	102%	90%	110%	103%	90%	110%	117%	80%	120%
Total Magnesium	90810	1977594	1.7	1.6	6.1%	< 0.1	113%	80%	120%	104%	90%	110%	91%	80%	120%
Total Aluminum	90810	1977594	288	294	2.1%	< 5	117%	80%	120%	108%	90%	110%	114%	80%	120%
Total Antimony	90810	1977594	< 2	< 2	0.0%	< 2	83%	80%	120%	110%	90%	110%	98%	80%	120%
Total Arsenic	90810	1977594	74	73	1.4%	< 2	98%	90%	110%	95%	90%	110%	92%	80%	120%
Total Barium	90810	1977594	22	22	0.0%	< 5	99%	90%	110%	98%	90%	110%	83%	80%	120%
Total Beryllium	90810	1977594	< 2	< 2	0.0%	< 2	109%	90%	110%	106%	90%	110%	100%	80%	120%
Total Bismuth	90810	1977594	< 2	< 2	0.0%	< 2	95%	90%	110%	93%	90%	110%	93%	70%	130%
Total Boron	90810	1977594	53	53	0.0%	< 5	110%	90%	110%	110%	90%	110%	103%	80%	120%
Total Cadmium	90810	1977594	0.156	0.157	0.6%	< 0.017	97%	90%	110%	102%	90%	110%	98%	80%	120%
Total Chromium	90810	1977594	< 1	< 1	0.0%	< 1	105%	90%	110%	104%	90%	110%	87%	80%	120%
Total Cobalt	90810	1977594	< 1	< 1	0.0%	< 1	109%	90%	110%	103%	90%	110%	80%	80%	120%
Total Copper	90810	1977594	4	4	0.0%	< 2	105%	90%	110%	102%	90%	110%	84%	80%	120%
Total Iron	90810	1977594	282	274	2.9%	< 50	100%	90%	110%	100%	90%	110%	80%	80%	120%
Total Lead	90810	1977594	5.5	6.3	13.6%	< 0.5	100%	90%	110%	103%	90%	110%	104%	80%	120%
Total Manganese	90810	1977594	33	34	3.0%	< 2	104%	90%	110%	102%	90%	110%	85%	80%	120%
Total Molybdenum	90810	1977594	32	32	0.0%	< 2	93%	90%	110%	101%	90%	110%	103%	70%	130%
Total Nickel	90810	1977594	< 2	< 2	0.0%	< 2	106%	90%	110%	104%	90%	110%	85%	80%	120%
Total Selenium	90810	1977594	< 1	< 1	0.0%	< 1	97%	90%	110%	98%	90%	110%	90%	80%	120%
Total Silver	90810	1977594	< 0.1	< 0.1	0.0%	< 0.1	99%	90%	110%	90%	90%	110%	85%	80%	120%
Total Strontium	90810	1977594	74	73	1.4%	< 5	94%	90%	110%	97%	90%	110%	85%	80%	120%
Total Thallium	90810	1977594	< 0.1	< 0.1	0.0%	< 0.1	102%	90%	110%	104%	90%	110%	99%	80%	120%
Total Tin	90810	1977594	< 2	< 2	0.0%	< 2	91%	90%	110%	101%	90%	110%	98%	80%	120%
Total Titanium	90810	1977594	19	15	23.5%	< 2	104%	90%	110%	100%	90%	110%	91%	80%	120%

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Quality Assurance

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

AGAT WORK ORDER: 10X432414

PROJECT NO: GRQ

ATTENTION TO: CHYANN KIRBY

Water Analysis (Continued)

RPT Date: Sep 10, 2010			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Total Uranium	90810	1977594	16.9	17.0	0.6%	< 0.1	102%	90%	110%	106%	90%	110%	100%	80%	120%
Total Vanadium	90810	1977594	< 2	< 2	0.0%	< 2	104%	90%	110%	99%	90%	110%	80%	80%	120%
Total Zinc	90810	1977594	19	19	0.0%	< 5	103%	90%	110%	102%	90%	110%	84%	80%	120%
Mercury	1	1968366	< 0.00005	< 0.00005	0.0%	< 0.00005	103%	80%	120%		80%	120%	89%	80%	120%
Standard Water Analysis + FWAL Metals (Total), Hg															
Ammonia as N	1	1965026	<0.05	<0.05	0.0%	< 0.03	92%	80%	120%		80%	120%	102%	80%	120%
Total Phosphorus (Low Level)															
Total Phosphorus	1	1970509	0.157	0.136	14.3%	< 0.006	93%	90%	110%	96%	90%	110%	87%	80%	120%

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Method Summary

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

AGAT WORK ORDER: 10X432414

PROJECT NO: GRQ

ATTENTION TO: CHYANN KIRBY

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
pH	INOR-121-6001	SM 4500 H+B	PC-TITRATE
Reactive Silica as SiO2	INORG-121-6028	SM 4110 B	COLORIMETER
Chloride	INORG-121-6005	SM 4110 B	IC
Fluoride	INORG-121-6005	SM 4110 B	IC
Sulphate	INORG-121-6005	SM 4110 B	IC
Alkalinity	INORG-121-6001	SM 2320 B	PC-TITRATE
True Color	INORG-121-6014	EPA 110.2	NEPHELOMETER
Turbidity	INORG-121-6022	SM 2130 B	NEPHELOMETER
Electrical Conductivity	INOR-121-6001	SM 2510 B	PC-TITRATE
Nitrate + Nitrite as N	INORG-121-6005	SM 4110 B	IC
Nitrate as N	INORG-121-6005	SM 4110 B	IC
Nitrite as N	INORG-121-6005	SM 4110 B	IC
Ammonia as N	INORG-121-6003	SM 4500-NH3 G	COLORIMETER
Total Organic Carbon	INORG-121-6026	SM 5310 B	TOC ANALYZER
Ortho-Phosphate as P	INORG-121-6005	SM 4110 B	COLORIMETER
Total Sodium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Potassium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Calcium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Magnesium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Bicarb. Alkalinity (as CaCO3)	INORG-121-6001	SM 2320 B	PC-TITRATE
Carb. Alkalinity (as CaCO3)	INORG-121-6001	SM 2320 B	PC-TITRATE
Hydroxide	INORG-121-6001	SM 2320 B	PC-TITRATE
Calculated TDS			
Hardness			
Langelier Index (@20C)			CALCULATION
Langelier Index (@ 4C)			CALCULATION
Saturation pH (@ 20C)			CALCULATION
Saturation pH (@ 4C)			CALCULATION
Anion Sum			
Cation sum			
% Difference/ Ion Balance (NS)			
Total Aluminum	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Antimony	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Arsenic	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Barium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Beryllium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Bismuth	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Boron	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Cadmium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS

Results relate only to the items tested

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Method Summary

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

AGAT WORK ORDER: 10X432414

PROJECT NO: GRQ

ATTENTION TO: CHYANN KIRBY

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Total Chromium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Cobalt	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Copper	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Iron	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Lead	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Manganese	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Molybdenum	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Nickel	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Selenium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Silver	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Strontium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Thallium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Tin	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Titanium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Uranium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Vanadium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Zinc	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Mercury	INOR-121-6100 & INOR-121-6107	SM 3112 B	CVAAS
Total Phosphorus	INOR-93-1022	SM 4500-P B&E	SPECTROPHOTOMETER

Results relate only to the items tested

AGAT Laboratories

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Phone: 902-468-8718 • Fax: 902-468-8924
www.agatlabs.com
http://webearth.agatlabs.com

Arrival Condition: 15°C ✓Good ☐ Poor (complete 'notes')
Arrival Temperature: 15°C AGAT Job Number: 10X432414
Notes:
Drinking Water Sample (y/n): Reg. No.
Waterworks Number:

CHAIN OF CUSTODY RECORD

Report To:
Company: AMEC
Contact: Chyann Kirby
Address: Saint John, NB
Phone: (506) 652-9497 FAX:
PO#:
AGAT Quotation:
Client Project Name/ #: GRQ

Invoice To: Same (Y) / N) Circle
Company:
Contact:
Address:
Phone: FAX:
PO#/Credit Card #:

Report Information
1. Name: Chyann Kirby
Email: chyann.kirby@amec.com
2. Name: Maureen Cameron-MacMillan
Email: maureen.cameron@amec.com

Regulatory Requirements (Check)
✓List Guidelines on Report ☐ Do Not List Guidelines on Report
☐ PIRI
☐ Tier 1 ☐ Res.
☐ Tier 2 ☐ Com
☐ Gas ☐ Fuel ☐ Lube
☐ CCME ☐ CDWQ
☐ Ind ☐ NSDFOSP
☐ Com ☐ HRM 101 Storm Water
☐ Res/p
☐ Ag ☐ HRM 101 Waste Water
✓ WAL
☐ Sediment
☐ Other

Site Info (check all that apply):
☐ Pot. ☐ Coarse
☐ N/Pot. ☐ Fine

Report Format
☐ Single PDF sample per page
☐ Multiple PDF samples per page
✓ Excel format included

Turnaround Time (TAT) Business Days
Regular TAT:
✓ 5 - 7 days
Rush TAT:
☐ 1 day ☐ 2 days
☐ 3 - 4 days
Date Required:
Time Required:

Sample Identification	Date/Time Sampled	Sample Matrix	# of Containers	Comments - Site/Sample Info/Containment	Lab Filtration Required	Standard Water Analysis + MS	Metals	(circle - Total, Diss or Available)	Mercury	BOD	pH	TSS	TKN	Anions	Total Phosphorus	Phenols	TPH/BTEX (PIRI) Tier 1	TPH/BTEX - Fractionation Tier 2	VOC	THM	PAH	PCB	Other: Low-level phosphorus	Other:	Hazardous (Y/N)	Lab Sample #
GRQ-1	24 Aug	SW	6			✓	✓	✓	✓			✓											✓		N	
GRQ-2	27 Aug	SW	6			✓	✓	✓	✓			✓											✓		N	

Sample Relinquished by (print name): Maureen Cameron-MacMillan
Date/Time: 01 Sept.
Sample Received by (print name): A. Carmichael
Date/Time: Sept 2
Sample Relinquished by (sign):
Date/Time:
Sample Received by (sign):
Date/Time:

White Copy - AGAT
Yellow Copy - AGAT
Pink Copy - Client

PAGE 1 of 1
NO: 19868

C 1340-1805

AGAT Laboratories

11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
http://www.agatlabs.com

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL
580 MAIN STREET, SUITE 105
SAINT JOHN, NB E2K1J5

ATTENTION TO: CHYANN KIRBY

PROJECT NO: GRQ

AGAT WORK ORDER: 10X438935

WATER ANALYSIS REVIEWED BY: Jason Coughtrey, Inorganic Supervisor

DATE REPORTED: Oct 06, 2010

PAGES (INCLUDING COVER): 9

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (902) 468-8718, or at 1-888-468-8718

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

Member of: Association of Professional Engineers, Geologists and Geophysicists of Alberta (APEGGA)
Western Enviro-Agricultural Laboratory Association (WEALA)
Environmental Services Association of Alberta (ESAA)

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Results relate only to the items tested

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Certificate of Analysis

AGAT WORK ORDER: 10X438935
PROJECT NO: GRQ

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: CHYANN KIRBY

Standard Water Analysis + Metals (Total)

DATE SAMPLED: Sep 22, 2010 | DATE RECEIVED: Sep 28, 2010 | DATE REPORTED: Oct 06, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	GRQ-3 2018956	GRQ-4 2018959
pH		6.5-9		3.9	4.2
Reactive Silica as SiO2	mg/L		0.5	10.2	1.8
Chloride	mg/L		1	18	13
Fluoride	mg/L	0.12	0.1	0.4	<0.1
Sulphate	mg/L		2	<2	<2
Alkalinity	mg/L		5	<5	<5
True Color	TCU	Narrative	5	411	195
Turbidity	NTU	Narrative	0.1	2.8	0.7
Electrical Conductivity	umho/cm		1	102	61
Nitrate + Nitrite as N	mg/L		0.05	0.24	<0.05
Nitrate as N	mg/L	2.9	0.05	0.24	<0.05
Nitrite as N	mg/L	0.06	0.05	<0.05	<0.05
Ammonia as N	mg/L	Fact Sheet	0.03	0.06	0.11
Total Organic Carbon	mg/L		0.5	46.6	17.5
Ortho-Phosphate as P	mg/L		0.01	0.02	<0.01
Total Sodium	mg/L		0.1	10.0	6.8
Total Potassium	mg/L		0.1	0.4	0.5
Total Calcium	mg/L		0.1	0.5	0.4
Total Magnesium	mg/L		0.1	1.1	0.6
Bicarb. Alkalinity (as CaCO3)	mg/L		5	<5	<5
Carb. Alkalinity (as CaCO3)	mg/L		10	<10	<10
Hydroxide	mg/L		5	<5	<5
Calculated TDS	mg/L		1	33	22
Hardness	mg/L			5.8	3.5
Langelier Index (@20C)	NA			-7.25	-7.03
Langelier Index (@ 4C)	NA			-7.57	-7.35
Saturation pH (@ 20C)	NA			11.1	11.2
Saturation pH (@ 4C)	NA			11.5	11.5
Anion Sum	me/L			0.52	0.37
Cation sum	me/L			0.84	0.49
% Difference/ Ion Balance (NS)	%			23.3	14.8
Total Aluminum	ug/L	5.0	5	1050	272
Total Antimony	ug/L		2	<2	<2

Certified By:

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Certificate of Analysis

AGAT WORK ORDER: 10X438935
PROJECT NO: GRQ

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: CHYANN KIRBY

Standard Water Analysis + Metals (Total)

DATE SAMPLED: Sep 22, 2010 | DATE RECEIVED: Sep 28, 2010 | DATE REPORTED: Oct 06, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	GRQ-3 2018956	GRQ-4 2018959
Total Arsenic	ug/L	5.0	2	5	<2
Total Barium	ug/L		5	16	<5
Total Beryllium	ug/L		2	<2	<2
Total Bismuth	ug/L		2	<2	<2
Total Boron	ug/L		5	20	14
Total Cadmium	ug/L	0.017	0.017	0.102	<0.017
Total Chromium	ug/L		1	<1	<1
Total Cobalt	ug/L		1	<1	<1
Total Copper	ug/L	2	2	<2	<2
Total Iron	ug/L	300	50	936	415
Total Lead	ug/L	1	0.5	2.2	0.7
Total Manganese	ug/L		2	87	15
Total Molybdenum	ug/L	73	2	<2	<2
Total Nickel	ug/L	25	2	<2	<2
Total Selenium	ug/L	1.0	1	<1	<1
Total Silver	ug/L	0.1	0.1	<0.1	<0.1
Total Strontium	ug/L		5	9	<5
Total Thallium	ug/L	0.8	0.1	<0.1	<0.1
Total Tin	ug/L		2	<2	<2
Total Titanium	ug/L		2	5	<2
Total Uranium	ug/L		0.1	0.3	<0.1
Total Vanadium	ug/L		2	<2	<2
Total Zinc	ug/L	30	5	20	10
Mercury	mg/L	0.026	0.00005	<0.00005	<0.00005

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to NS - FWAL(ug/L)

Certified By:

Results relate only to the items tested

C 1340-1808

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Certificate of Analysis

AGAT WORK ORDER: 10X438935
PROJECT NO: GRQ

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: CHYANN KIRBY

Water Analysis - Various Inorganics

DATE SAMPLED: Sep 22, 2010 | DATE RECEIVED: Sep 28, 2010 | DATE REPORTED: Oct 06, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	GRQ-3 2018956	GRQ-4 2018959
Total Suspended Solids	mg/L	Narrative	5	<5	<5
Total Phosphorous as P	mg/L	Fact Sheet	0.002	0.030	0.012

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to NS-FWAL(mg/L)

Certified By:

Results relate only to the items tested

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Guideline Violation

AGAT WORK ORDER: 10X438935

PROJECT NO: GRQ

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: CHYANN KIRBY

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	GUIDEVALUE	RESULT
2018956	GRQ-3	NS - FWAL(ug/L)	Standard Water Analysis + Metals (Total)	Fluoride	0.12	0.4
2018956	GRQ-3	NS - FWAL(ug/L)	Standard Water Analysis + Metals (Total)	Total Aluminum	5.0	1050
2018956	GRQ-3	NS - FWAL(ug/L)	Standard Water Analysis + Metals (Total)	Total Cadmium	0.017	0.102
2018956	GRQ-3	NS - FWAL(ug/L)	Standard Water Analysis + Metals (Total)	Total Iron	300	936
2018956	GRQ-3	NS - FWAL(ug/L)	Standard Water Analysis + Metals (Total)	Total Lead	1	2.2
2018956	GRQ-3	NS - FWAL(ug/L)	Standard Water Analysis + Metals (Total)	pH	6.5-9	3.9
2018959	GRQ-4	NS - FWAL(ug/L)	Standard Water Analysis + Metals (Total)	Total Aluminum	5.0	272
2018959	GRQ-4	NS - FWAL(ug/L)	Standard Water Analysis + Metals (Total)	Total Iron	300	415
2018959	GRQ-4	NS - FWAL(ug/L)	Standard Water Analysis + Metals (Total)	pH	6.5-9	4.2

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Quality Assurance

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

AGAT WORK ORDER: 10X438935

PROJECT NO: GRQ

ATTENTION TO: CHYANN KIRBY

Water Analysis

RPT Date: Oct 06, 2010			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Standard Water Analysis + Metals (Total)															
pH	1	2017954	7.4	7.4	0.0%		100%	80%	120%		80%	120%		80%	120%
Reactive Silica as SiO2	1	2014611	13.4	13.3	0.7%	< 0.5	99%	80%	120%		80%	120%	102%	80%	120%
Chloride	1	2021445	8	7	13.3%	< 1	102%	80%	120%		80%	120%	106%	80%	120%
Fluoride	1	2021445	< 0.1	< 0.1	0.0%	< 0.1	94%	80%	120%		80%	120%	94%	80%	120%
Sulphate	1	2021445	14	15	6.9%	< 2	108%	80%	120%		80%	120%	105%	80%	120%
Alkalinity	1	2017954	18	17	5.7%	< 5	101%	80%	120%		80%	120%	95%	80%	120%
True Color	1	2016154	30	28	6.9%	< 5	90%	80%	120%		80%	120%		80%	120%
Turbidity	1	2016154	7.6	7.5	1.3%	< 0.1	87%	80%	120%		80%	120%		80%	120%
Electrical Conductivity	1	2017954	93	93	0.0%	< 1	98%	80%	120%		80%	120%		80%	120%
Nitrate as N	1	2021445	2.63	2.67	1.5%	< 0.05	110%	80%	120%		80%	120%	102%	80%	120%
Nitrite as N	1	2021445	< 0.05	< 0.05	0.0%	< 0.05	118%	80%	120%		80%	120%	105%	80%	120%
Ammonia as N	1	2023292	<0.05	<0.05	0.0%	< 0.05	98%	80%	120%		80%	120%	97%	80%	120%
Ortho-Phosphate as P	1	2016250	<0.01	<0.01	0.0%	< 0.01	97%	80%	120%		80%	120%	104%	80%	120%
Total Sodium	92920	2018917	6.0	6.3	4.9%	< 0.1	102%	90%	110%	92%	90%	110%	113%	80%	120%
Total Potassium	92920	2018917	1.4	1.3	7.4%	< 0.1	105%	90%	110%	103%	90%	110%	89%	80%	1020
Total Calcium	92920	2018917	481	427	11.9%	< 0.1	104%	90%	110%	103%	90%	110%	90%	80%	120%
Total Magnesium	92920	2018917	15.7	16.6	5.6%	< 0.1	100%	90%	110%	99%	90%	110%	117%	80%	120%
Total Aluminum	92920	2018917	206	212	2.9%	< 10	100%	90%	110%	100%	90%	110%	106%	80%	120%
Total Antimony	92920	2018917	< 2	< 2	0.0%	< 2	97%	90%	110%	104%	90%	110%	109%	80%	120%
Total Arsenic	92920	2018917	14	14	0.0%	< 2	97%	90%	110%	97%	90%	110%	113%	80%	120%
Total Barium	92920	2018917	13	11	16.7%	< 5	97%	90%	110%	100%	90%	110%	106%	80%	120%
Total Beryllium	92920	2018917	< 2	< 2	0.0%	< 2	103%	90%	110%	102%	90%	110%	110%	80%	120%
Total Bismuth	92920	2018917	< 2	< 2	0.0%	< 2	102%	90%	110%	87%	80%	120%	84%	80%	120%
Total Boron	92920	2018917	79	77	2.6%	< 5	102%	90%	110%	94%	90%	110%	120%	80%	120%
Total Cadmium	92920	2018917	< 0.3	< 0.3	0.0%	< 0.3	98%	90%	110%	100%	90%	110%	101%	80%	120%
Total Chromium	92920	2018917	< 2	< 2	0.0%	< 2	105%	90%	110%	104%	90%	110%	80%	80%	120%
Total Cobalt	92920	2018917	< 1	< 1	0.0%	< 1	105%	90%	110%	103%	90%	110%	91%	80%	120%
Total Copper	92920	2018917	3	3	0.0%	< 2	108%	90%	110%	106%	90%	110%	107%	80%	120%
Total Iron	92920	2018917	2270	2000	12.6%	< 50	106%	90%	110%	105%	90%	110%	89%	80%	120%
Total Lead	92920	2018917	< 0.5	< 0.5	0.0%	< 0.5	102%	90%	110%	100%	90%	110%	86%	80%	120%
Total Manganese	92920	2018917	105	91	14.3%	< 2	105%	90%	110%	104%	90%	110%	80%	80%	120%
Total Molybdenum	92920	2018917	5	5	0.0%	< 2	99%	90%	110%	92%	90%	110%	86%	80%	120%
Total Nickel	92920	2018917	< 2	< 2	0.0%	< 2	107%	90%	110%	106%	90%	110%	90%	80%	120%
Total Selenium	92920	2018917	< 2	< 2	0.0%	< 2	99%	90%	110%	99%	90%	110%	111%	80%	120%
Total Silver	92920	2018917	< 0.5	< 0.5	0.0%	< 0.5	98%	90%	110%	105%	90%	110%	98%	80%	120%
Total Strontium	92920	2018917	7750	7650	1.3%	< 5	98%	90%	110%	98%	90%	110%	96%	80%	120%
Total Thallium	92920	2018917	< 0.1	< 0.1	0.0%	< 0.1	101%	90%	110%	100%	90%	110%	90%	80%	120%
Total Tin	92920	2018917	< 2	< 2	0.0%	< 2	96%	90%	110%	100%	90%	110%	115%	80%	120%
Total Titanium	92920	2018917	20	21	4.9%	< 2	103%	90%	110%	100%	90%	110%	106%	80%	120%

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Quality Assurance

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

AGAT WORK ORDER: 10X438935

PROJECT NO: GRQ

ATTENTION TO: CHYANN KIRBY

Water Analysis (Continued)

RPT Date: Oct 06, 2010			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Total Uranium	92920	2018917	0.5	0.5	0.0%	< 0.1	102%	90%	110%	98%	90%	110%	84%	80%	120%
Total Vanadium	92920	2018917	< 2	< 2	0.0%	< 2	105%	90%	110%	98%	90%	110%	91%	80%	120%
Total Zinc	92920	2018917	< 5	< 5	0.0%	< 5	103%	90%	110%	103%	90%	110%	104%	80%	120%
Mercury	1	2016154	< 0.00005	< 0.00005	0.0%	< 0.00005	103%	80%	120%		80%	120%	96%	80%	120%
Water Analysis - Various Inorganics															
Total Suspended Solids	1	2020180	<5	<5	0.0%	< 5	100%	80%	120%		80%	120%	102%	80%	120%
Total Phosphorous as P	1		0.055	0.051	7.5%	< 0.002	90%	80%	120%	95%	80%	120%	94%	80%	120%

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Method Summary

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

AGAT WORK ORDER: 10X438935

PROJECT NO: GRQ

ATTENTION TO: CHYANN KIRBY

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
pH	INOR-121-6001	SM 4500 H+B	PC-TITRATE
Reactive Silica as SiO2	INORG-121-6028	SM 4110 B	COLORIMETER
Chloride	INORG-121-6005	SM 4110 B	IC
Fluoride	INORG-121-6005	SM 4110 B	IC
Sulphate	INORG-121-6005	SM 4110 B	IC
Alkalinity	INORG-121-6001	SM 2320 B	PC-TITRATE
True Color	INORG-121-6014	EPA 110.2	NEPHELOMETER
Turbidity	INORG-121-6022	SM 2130 B	NEPHELOMETER
Electrical Conductivity	INOR-121-6001	SM 2510 B	PC-TITRATE
Nitrate + Nitrite as N	INORG-121-6005	SM 4110 B	IC
Nitrate as N	INORG-121-6005	SM 4110 B	IC
Nitrite as N	INORG-121-6005	SM 4110 B	IC
Ammonia as N	INORG-121-6003	SM 4500-NH3 G	COLORIMETER
Total Organic Carbon	INORG-121-6026	SM 5310 B	TOC ANALYZER
Ortho-Phosphate as P	INORG-121-6005	SM 4110 B	COLORIMETER
Total Sodium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Potassium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Calcium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Magnesium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Bicarb. Alkalinity (as CaCO3)	INORG-121-6001	SM 2320 B	PC-TITRATE
Carb. Alkalinity (as CaCO3)	INORG-121-6001	SM 2320 B	PC-TITRATE
Hydroxide	INORG-121-6001	SM 2320 B	PC-TITRATE
Calculated TDS			
Hardness			
Langelier Index (@20C)			CALCULATION
Langelier Index (@ 4C)			CALCULATION
Saturation pH (@ 20C)			CALCULATION
Saturation pH (@ 4C)			CALCULATION
Anion Sum			
Cation sum			
% Difference/ Ion Balance (NS)			
Total Aluminum	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Antimony	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Arsenic	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Barium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Beryllium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Bismuth	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Boron	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Cadmium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS

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Method Summary

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

AGAT WORK ORDER: 10X438935

PROJECT NO: GRQ

ATTENTION TO: CHYANN KIRBY

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Total Chromium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Cobalt	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Copper	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Iron	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Lead	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Manganese	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Molybdenum	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Nickel	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Selenium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Silver	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Strontium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Thallium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Tin	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Titanium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Uranium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Vanadium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Zinc	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Mercury	INOR-121-6100 & INOR-121-6107	SM 3112 B	CVAAS
Total Suspended Solids	INOR-121-6024, 6025	SM 2540C, D	GRAVIMETRIC
Total Phosphorous as P	INORG-121-6009	SM 365.2	COLORIMETER

Results relate only to the items tested

C 1340-1815

AGAT Laboratories

Unit 122 - 11 Morris Dr.
Dartmouth, NS B3B 1M2
Phone: 902-468-8718 • Fax: 902-468-8924
www.agatlabs.com
http://webearth.agatlabs.com

Arrival Condition: 10 ☒ Good ☐ Poor (complete notes)
Arrival Temperature: 10 C AGAT Job Number: 10X432095
Notes:

Drinking Water Sample (y/n): _____ Reg. No. _____
Waterworks Number: _____

CHAIN OF CUSTODY RECORD

Report To:
Company: AMEC
Contact: Chyann Kirby
Address: Saint John, NB
Phone: (506)652-9497 FAX: _____
PO#: _____
AGAT Quotation: _____
Client Project Name/ #: GRQ

Invoice To: Same (Y) N) Circle
Company: _____
Contact: _____
Address: _____
Phone: _____ FAX: _____
PO#/Credit Card #: _____

Report Information
1. Name: Chyann Kirby
Email: chyann.kirby@amec.com
2. Name: Maureen Cameron-MacMillan
Email: maureen.cameron@amec.com

Report Format
☐ Single PDF sample per page
☐ Multiple PDF samples per page
☑ Excel format included

Turnaround Time (TAT) Business Days
Regular TAT:
☑ 5 - 7 days
Rush TAT:
☐ 1 day ☐ 2 days
☐ 3 - 4 days
Date Required: _____
Time Required: _____

Regulatory Requirements (Check)
☑ List Guidelines on Report ☐ Do Not List Guidelines on Report
☐ PIRI
☐ Tier 1 ☐ Res. ☐ Pot. ☐ Coarse
☐ Tier 2 ☐ Com ☐ N/Pot. ☐ Fine
☐ Gas ☐ Fuel ☐ Lube
☑ CCME ☐ CDWQ
☐ Ind ☐ NSDFOSP
☐ Com ☐ HRM 101
☐ Res/p Storm Water
☐ Ag ☐ HRM 101
☑ FWAL Waste Water
☐ Sediment
☐ Other _____
Site Info (check all that apply):

Sample Identification	Date/Time Sampled	Sample Matrix	# of Containers	Comments - Site/Sample Info/Containment	Lab Filtration Required	Standard Water Analysis + MS	Metals	(circle) Total / Diss or Available	Mercury	BOD	pH	TSS	TKN	Anions	Total Phosphorus	Phenols	TPH/BTEX (PIRI) Tier 1	TPH/BTEX Fractionation Tier 2	VOC	THM	PAH	PCB	Other: Lowry Total phosphorus	Other:	Hazardous (Y/N)	Lab Sample #
GRQ-3	22 Sept	SW	6			✓	✓	✓	✓			✓											✓		N	
GRQ-4	22 Sept	SW	6			✓	✓	✓	✓			✓											✓		N	

Sample Relinquished by (print name): Maureen Cameron-MacMillan
Sample Relinquished by (sign):
Date/Time: 27 Sept
Date/Time:
Sample Received by (print name): A. Carmichael
Sample Received by (sign):
Date/Time: Sept 29, 10
Date/Time: 3:15

White Copy - AGAT
Yellow Copy - AGAT
Pink Copy - Client

PAGE 1 of _____
NO: 19869

APPENDIX J
Marine Habitat Assessment Supporting Documentation

ATTACHMENT A – Video Transect Results

ATTACHMENT B –Fish Community

ATTACHMENT C – Benthic Invertebrate Sample Results

ATTACHMENT D – Marine Sediment Results

ATTACHMENT E – AGAT QA/QC Forms for Marine Sediment and Samples

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

ATTACHMENT A
Video Transect Results

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

Table E.1-1. 250m Transect – Transect T1, August 31-September 3, 2010

Transect Distance (m)	Transect Tag Numbers	Substrate (% Coverage)	Macrofaunal Life Observed (Estimated Abundances*)	Macrofloral Life Observed (% Coverage)
0-5	0-5	Sand (75%); Cobble (20%); Silt (5%)	Shell Hash	-----
5-10	5-10	Cobble (80%); Sand (10%); Silt (10%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Encrusting Red Alga (*Leptophyllum* sp.) (5%)
10-15	10-15	Cobble (80%); Sand (10%); Silt (10%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Waved Whelk (*Buccinum undatum*) (**U: 1 individual**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%)
15-20	15-20	Cobble (80%); Sand (10%); Silt (10%)	Waved Whelk (*Buccinum undatum*) (**O: 5-10 individuals**); Sea Cucumber (*Cucumaria frondosa*) (**U: 1 individual**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
20-25	20-25	Cobble (80%); Sand (10%); Silt (10%)	Deep Sea Scallop (*Placopecten magellanicus*) (**U: 2 individuals**); Sea Star (*Asterias* sp.) (**U: 1 individual**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Bladderwrack (*Fucus* sp.) (5%)
25-30	25-30	Cobble (65%); Sand (25%); Silt (10%)	Periwinkle (*Littorina* sp.) (**C**); Waved Whelk (*Buccinum undatum*) (**U: 2 individuals**); Blue Mussel (*Mytilus edulis*) (**U: 2 individuals**); American Oyster (*Crassostrea virginica*) (**U: 1 individual**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (15%); Sea Colander (*Agarum clathratum*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
30-35	30-35	Cobble (65%); Sand (25%); Silt (10%)	Blue Mussel (*Mytilus edulis*) (**O: 10-15 individuals**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
35-40	35-40	Cobble (65%); Sand (25%); Silt (10%)	Waved Whelk (*Buccinum undatum*) (**O: 10-15 individuals**); Deep Sea Scallop (*Placopecten magellanicus*) (**U: 1 individual**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%); Sea Colander (*Agarum clathratum*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
40-45	40-45	Cobble (65%); Sand (25%); Silt (10%)	Waved Whelk (*Buccinum undatum*) (**O: 10-15 individuals**); Sea Star (*Asterias* sp.) (**U: 1 individual**); Sea Cucumber (*Cucumaria frondosa*) (**U: 1 individual**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%); Sea Colander (*Agarum clathratum*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%); Bladderwrack (*Fucus* sp.) (5%)
45-50	45-50	Cobble (65%); Sand (25%); Silt (10%)	Periwinkle (*Littorina* sp.) (**C**); Lobster (*Homarus americanus*) (**U: 1 individual**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%)
50-55	50-55	Cobble (65%); Sand (25%); Silt (10%)	Barnacle (*Semibalanus balanoides*) (**C**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%)
55-60	55-60	Cobble (65%); Sand (25%); Silt (10%)	Barnacle (*Semibalanus balanoides*) (**C**); Shell Hash	Bladderwrack (*Fucus* sp.) (5%)
60-65	60-65	Cobble (65%); Sand (25%); Silt (10%)	Barnacle (*Semibalanus balanoides*) (**C**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%); Bladderwrack (*Fucus* sp.) (5%)
65-70	65-70	Cobble (65%); Sand (25%); Silt (10%)	Waved Whelk (*Buccinum undatum*) (U: **1 individual**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
70-75	70-75	Cobble (65%); Sand (25%); Silt (10%)	Lobster (*Homarus americanus*) (**U: 1 individual**); Shell Hash	Sea Colander (*Agarum clathratum*) (20%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
75-80	75-80	Cobble (65%); Sand (25%); Silt (10%)	Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%); Sea Colander (*Agarum clathratum*) (5%)
80-85	80-85	Cobble (75%); Sand (20%); Silt (5%)	Blue Mussel (*Mytilus edulis*) (**U: 1 individual**); Shell Hash	Encrusting Red Alga (*Leptophyllum* sp.) (5%); Bladderwrack (*Fucus* sp.) (5%)
85-90	85-90	Cobble (75%); Sand (20%); Silt (5%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O:5-10 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (20%)
90-95	90-95	Cobble (75%); Sand (20%); Silt (5%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O:5-10 individuals**); Lobster (*Homarus americanus*) (**U: 1 individual**); Shell Hash	Sea Colander (*Agarum clathratum*) (10%); Black Whip Weed (*Chordaria flagelliformis*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
95-100	95-100	Cobble (75%); Sand (20%); Silt (5%)	Blue Mussel (*Mytilus edulis*) (**O 15-20 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
100-105	100-105	Cobble (75%); Sand (20%); Silt (5%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O:5-10 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
105-110	105-110	Cobble (75%); Sand (20%); Silt (5%)	Barnacle (*Semibalanus balanoides*) (**C**); Deep Sea Scallop (*Placopecten magellanicus*) (**O:5-10 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (10%); Encrusting Red Alga (*Leptophyllum* sp.) (5%); Bladderwrack (*Fucus* sp.) (5%)
110-115	110-115	Cobble (75%); Sand (20%); Silt (5%)	Barnacle (*Semibalanus balanoides*) (**C**); Deep Sea Scallop (*Placopecten magellanicus*) (**O:5-10 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (10%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
115-120	115-120	Cobble (75%); Sand (20%); Silt (5%)	Shell Hash	Sea Colander (*Agarum clathratum*) (15%)
120-125	120-125	Cobble (75%); Sand (15%); Rock (5%); Silt (5%)	Barnacle (*Semibalanus balanoides*) (**C**); Shell Hash	Sea Colander (*Agarum clathratum*) (10%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)

Table E.1-1. 250m Transect – Transect T1, August 31-September 3, 2010

Transect Distance (m)	Transect Tag Numbers	Substrate (% Coverage)	Macrofaunal Life Observed (Estimated Abundances*)	Macrofloral Life Observed (% Coverage)
125-130	125-130	Cobble (90%); Sand (5%); Silt (5%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O:5-10 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%); Bladderwrack (*Fucus* sp.) (5%)
130-135	130-135	Cobble (90%); Sand (5%); Silt (5%)	Not visible	Sea Colander (*Agarum clathratum*) (5%)
135-140	135-140	Cobble (90%); Sand (5%); Silt (5%)	Not visible	Not visible
140-145	140-145	Cobble (85%); Boulder (5%); Sand (5%); Silt (5%)	Not visible	Not visible
145-150	145-150	Boulder (50%); Cobble (40%); Sand (5%); Silt (5%)	Frilled Anemone (*Metridium senile*) (**O:5-10 individuals**); Bowerbank's Halichonidria (*Halichondria bowerbanki*) (**O:5-10 individuals**)	Not visible
150-155	150-155	Boulder (75%); Cobble (20%); Sand (5%)	Not visible	Not visible
155-160	155-160	Boulder (50%); Cobble (40%); Sand (5%); Silt (5%)	Not visible	Black Whip Weed (*Chordaria flagelliformis*) (5%)
160-165	160-165	Cobble (85%); Sand (10%); Silt (5%)	Not visible	Black Whip Weed (*Chordaria flagelliformis*) (5%)
165-170	165-170	Cobble (85%); Sand (10%); Silt (5%)	Not visible	Black Whip Weed (*Chordaria flagelliformis*) (5%)
170-175	170-175	Cobble (85%); Sand (10%); Silt (5%)	-----	Black Whip Weed (*Chordaria flagelliformis*) (5%)
175-180	175-180	Cobble (85%); Sand (10%); Silt (5%)	Lobster (*Homarus americanus*) (**U: 1 individual**)	Black Whip Weed (*Chordaria flagelliformis*) (5%)
180-185	180-185	Cobble (85%); Sand (10%); Silt (5%)	Lobster (*Homarus americanus*) (**U: 1 individual**)	Black Whip Weed (*Chordaria flagelliformis*) (5%)
185-190	185-190	Cobble (85%); Sand (10%); Silt (5%)	-----	Black Whip Weed (*Chordaria flagelliformis*) (5%)
190-195	190-195	Cobble (85%); Sand (10%); Silt (5%)	-----	Black Whip Weed (*Chordaria flagelliformis*) (5%)
195-200	195-200	Cobble (85%); Sand (10%); Silt (5%)	-----	Black Whip Weed (*Chordaria flagelliformis*) (5%)
200-205	200-205	Cobble (85%); Sand (10%); Silt (5%)	-----	Black Whip Weed (*Chordaria flagelliformis*) (5%); Bladderwrack (*Fucus* sp.) (5%)
205-210	205-210	Cobble (85%); Sand (10%); Silt (5%)	-----	Black Whip Weed (*Chordaria flagelliformis*) (5%)
210-215	210-215	Cobble (85%); Sand (10%); Silt (5%)	-----	Black Whip Weed (*Chordaria flagelliformis*) (5%)
215-220	215-220	Cobble (85%); Sand (10%); Silt (5%)	Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%)
220-225	220-225	Cobble (80%); Boulder (5%); Sand (5%); Silt (5%)	-----	Bladderwrack (*Fucus* sp.) (5%)
225-230	225-230	Cobble (80%); Boulder (5%); Sand (5%); Silt (5%)	Waved Whelk (*Buccinum undatum*) (**U: 1 individual**)	Black Whip Weed (*Chordaria flagelliformis*) (5%)
230-235	230-235	Boulder (45%); Cobble (40%); Sand (10%); Silt (5%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%)
235-240	235-240	Boulder (45%); Cobble (40%); Sand (10%); Silt (5%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%)
240-245	240-245	Boulder (45%); Cobble (40%); Sand (10%); Silt (5%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Cunner (*Tautogolabrus adspersus*) (**U: 2 individuals**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%)
245-250	245-250	Boulder (45%); Cobble (40%); Sand (10%); Silt (5%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Sea Peach (*Holacynthia pyriformis*) (**O:5-10 individuals**); Bowerbank's Halichonidria (*Halichondria bowerbanki*) (**O:5-10 individuals**)	Black Whip Weed (*Chordaria flagelliformis*) (5%)

*Definitions:

A = Abundant (Numerous (not quantifiable) observations made throughout the entire 5 m segment)

C = Common (Numerous (not quantifiable) observations made intermittently along the 5 m segment)

= Occasional (Quantifiable observations made intermittently along the 5 m segment)

U = Uncommon (Quantifiable observations made infrequently along the 5 m segment)

----- denotes "no life observed".

Table E.1-2. 250m Transect – Transect T2, August 31-September 3, 2010

Transect Distance (m)	Transect Tag Numbers	Substrate (% Coverage)	Macrofaunal Life Observed (Estimated Abundances*)	Macrofloral Life Observed (% Coverage)
0-5	0-5	Cobble (85%); Sand (10%); Silt (5%)	Shorthorn Sculpin (*Myoxocephalus scorpius*) (**U: 1 individual**); American Oyster (*Crassostrea virginica*) (**U: 1 individual**); Shell Hash	-----
5-10	5-10	Cobble (85%); Sand (10%); Silt (5%)	Blue Mussel (*Mytilus edulis*) (**U: 1 individual**); Lobster (*Homarus americanus*) (**U: 1 individual**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%)
10-15	10-15	Cobble (85%); Sand (10%); Silt (5%)	Shell Hash	Sea Colander (*Agarum clathratum*) (5%)
15-20	15-20	Cobble (85%); Sand (10%); Silt (5%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%)
20-25	20-25	Cobble (85%); Sand (10%); Silt (5%)	Blue Mussel (*Mytilus edulis*) (**O: 5-10 individuals**)	Sea Colander (*Agarum clathratum*) (5%)
25-30	25-30	Cobble (85%); Sand (10%); Silt (5%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**)	Black Whip Weed (*Chordaria flagelliformis*) (5%)
30-35	30-35	Cobble (85%); Sand (10%); Silt (5%)	Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
35-40	35-40	Cobble (85%); Sand (10%); Silt (5%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Unidentified Fish Species (**U: 1 individual**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
40-45	40-45	Cobble (65%); Sand (30%); Silt (5%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Lobster (*Homarus americanus*) (**U: 1 individual**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
45-50	45-50	Cobble (65%); Sand (30%); Silt (5%)	Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
50-55	50-55	Cobble (65%); Sand (30%); Silt (5%)	Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
55-60	55-60	Cobble (65%); Sand (30%); Silt (5%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
60-65	60-65	Cobble (65%); Sand (30%); Silt (5%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
65-70	65-70	Cobble (90%); Sand (10%)	Shell Hash	-----
70-75	70-75	Cobble (90%); Sand (10%)	Deep Sea Scallop (*Placopecten magellanicus*) (**U: 2 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%)
75-80	75-80	Cobble (90%); Sand (10%)	Shell Hash	Sea Colander (*Agarum clathratum*) (10%)
80-85	80-85	Cobble (90%); Sand (10%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (10%)
85-90	85-90	Cobble (90%); Sand (10%)	Shell Hash	Sea Colander (*Agarum clathratum*) (10%)
90-95	90-95	Cobble (90%); Sand (10%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%); Kelp (*Laminaria saccharina*) (5%)
95-100	95-100	Cobble (90%); Sand (10%)	Shell Hash	Sea Colander (*Agarum clathratum*) (5%)
100-105	100-105	Cobble (90%); Sand (10%)	Blue Mussel (*Mytilus edulis*) (**U:1 individual**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%)
105-110	105-110	Cobble (90%); Sand (10%)	Shell Hash	Sea Colander (*Agarum clathratum*) (10%)
110-115	110-115	Cobble (90%); Sand (10%)	Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Bladderwrack (*Fucus* sp.) (5%)
115-120	115-120	Cobble (90%); Sand (10%)	Shell Hash	Sea Colander (*Agarum clathratum*) (20%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
120-125	120-125	Cobble (90%); Sand (10%)	Barnacle (*Semibalanus balanoides*) (**C**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
125-130	125-130	Cobble (90%); Sand (10%)	Shell Hash	Sea Colander (*Agarum clathratum*) (5%)
130-135	130-135	Cobble (90%); Sand (10%)	Shorthorn Sculpin (*Myoxocephalus scorpius*) (**U: 1 individual**); Shell Hash	Sea Colander (*Agarum clathratum*) (15%); Bladderwrack (*Fucus* sp.) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)

Table E.1-2. 250m Transect – Transect T2, August 31-September 3, 2010

Transect Distance (m)	Transect Tag Numbers	Substrate (% Coverage)	Macrofaunal Life Observed (Estimated Abundances*)	Macrofloral Life Observed (% Coverage)
135-140	135-140	Cobble (90%); Sand (10%)	Shell Hash	Sea Colander (*Agarum clathratum*) (15%); Bladderwrack (*Fucus* sp.) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
140-145	140-145	Cobble (90%); Sand (10%)	Shell Hash	Sea Colander (*Agarum clathratum*) (15%); Bladderwrack (*Fucus* sp.) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
145-150	145-150	Cobble (90%); Sand (10%)	Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (15%); Sea Colander (*Agarum clathratum*) (10%)
150-155	150-155	Cobble (90%); Sand (10%)	Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (15%); Sea Colander (*Agarum clathratum*) (10%)
155-160	155-160	Boulder (45%); Cobble (40%); Sand (5%); Silt (5%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Blue Mussel (*Mytilus edulis*) (**C**);	Sea Colander (*Agarum clathratum*) (5%)
160-165	160-165	Boulder (75%); Cobble (20%); Sand (5%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Blue Mussel (*Mytilus edulis*) (**C**); Lobster (*Homarus americanus*) (**U: 1 individual**)	-----
165-170	165-170	Cobble (90%); Sand (5%); Silt (5%)	Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
170-175	170-175	Cobble (90%); Sand (5%); Silt (5%)	Lobster (*Homarus americanus*) (**U: 2 individuals**)	Sea Colander (*Agarum clathratum*) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
175-180	175-180	Cobble (90%); Sand (5%); Silt (5%)	Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
180-185	180-185	Cobble (90%); Sand (5%); Silt (5%)	Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
185-190	185-190	Cobble (90%); Sand (5%); Silt (5%)	Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (15%); Sea Colander (*Agarum clathratum*) (5%)
190-195	190-195	Cobble (90%); Sand (5%); Silt (5%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5 individuals**)	Black Whip Weed (*Chordaria flagelliformis*) (5%); Sea Colander (*Agarum clathratum*) (5%)
195-200	195-200	Cobble (90%); Sand (5%); Silt (5%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5 individuals**)	Black Whip Weed (*Chordaria flagelliformis*) (5%); Sea Colander (*Agarum clathratum*) (5%)
200-205	200-205	Cobble (90%); Sand (5%); Silt (5%)	Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%); Sea Colander (*Agarum clathratum*) (5%)
205-210	205-210	Cobble (90%); Sand (5%); Silt (5%)	Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%); Sea Colander (*Agarum clathratum*) (5%)
210-215	210-215	Cobble (90%); Sand (5%); Silt (5%)	Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%); Sea Colander (*Agarum clathratum*) (5%)
215-220	215-220	Cobble (90%); Sand (5%); Silt (5%)	Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%); Sea Colander (*Agarum clathratum*) (5%)
220-225	220-225	Cobble (90%); Sand (5%); Silt (5%)	Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%); Sea Colander (*Agarum clathratum*) (5%)
225-230	225-230	Cobble (60%); Boulder (30%); Sand (5%); Silt (5%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**)	Green Fleece (*Codium fragile*) (5%)
230-235	230-235	Cobble (60%); Boulder (30%); Sand (5%); Silt (5%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**)	-----
235-240	235-240	Boulder (75%); Cobble (20%); Sand (5%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Lobster (*Homarus americanus*) (**U: 1 individual**)	-----
240-245	240-245	Boulder (75%); Cobble (20%); Sand (5%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Blue Mussel (*Mytilus edulis*) (**O: 5 individuals**); Deep Sea Scallop (*Placopecten magellanicus*) (**U: 1 individual**)	-----
245-250	245-250	Boulder (75%); Cobble (20%); Sand (5%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**)	-----

*Definitions:

A = Abundant (Numerous (not quantifiable) observations made throughout the entire 5 m segment)

C = Common (Numerous (not quantifiable) observations made intermittently along the 5 m segment)

= Occasional (Quantifiable observations made intermittently along the 5 m segment)

U = Uncommon (Quantifiable observations made infrequently along the 5 m segment)

----- denotes “no life observed”.

Table E.1-3. 250m Transect – Transect T3, August 31-September 3, 2010

Transect Distance (m)	Transect Tag Numbers	Substrate (% Coverage)	Macrofaunal Life Observed (Estimated Abundances*)	Macrofloral Life Observed (% Coverage)
0-5	0-5	Cobble (90%); Sand (10%)	Barnacle (*Semibalanus balanoides*) (**A**)	-----
5-10	5-10	Cobble (65%); Rock (30%); Sand (10%)	Barnacle (*Semibalanus balanoides*) (**A**); ShellHash	Sea Colander (*Agarum clathratum*) (20%)
10-15	10-15	Rock (50%); Cobble (30%); Boulder (15%); Sand (5%)	Barnacle (*Semibalanus balanoides*) (**A**); Blue Mussel (*Mytilus edulis*) (**C**); Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**O: 5-10 individuals**); Sea Star (*Asterias* sp.) (**U: 1 individual**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Bladderwrack (*Fucus* sp.) (5%)
15-20	15-20	Rock (50%); Cobble (30%); Boulder (15%); Sand (5%)	Barnacle (*Semibalanus balanoides*) (**C**); Blue Mussel (*Mytilus edulis*) (**C**); Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%)
20-25	20-25	Rock (50%); Cobble (30%); Boulder (15%); Sand (5%)	Barnacle (*Semibalanus balanoides*) (**C**); Blue Mussel (*Mytilus edulis*) (**C**); Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%)
25-30	25-30	Rock (50%); Cobble (30%); Boulder (15%); Sand (5%)	Barnacle (*Semibalanus balanoides*) (**C**); Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Lobster (*Homarus americanus*) (**U: 1 individual**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%)
30-35	30-35	Rock (50%); Cobble (30%); Boulder (15%); Sand (5%)	Barnacle (*Semibalanus balanoides*) (**C**); Blue Mussel (*Mytilus edulis*) (**C**); Unidentified Fish Species (**U: 1 individual**)	Bladderwrack (*Fucus* sp.) (15%)
35-40	35-40	Cobble (90%); Sand (10%)	Barnacle (*Semibalanus balanoides*) (**C**); Lobster (*Homarus americanus*) (**U: 1 individual**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Bladderwrack (*Fucus* sp.) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
40-45	40-45	Cobble (90%); Sand (10%)	Barnacle (*Semibalanus balanoides*) (**C**)	Bladderwrack (*Fucus* sp.) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
45-50	45-50	Cobble (90%); Sand (10%)	Barnacle (*Semibalanus balanoides*) (**C**); American Oyster (*Crassostrea virginica*) (**U: 1 individual**)	Bladderwrack (*Fucus* sp.) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
50-55	50-55	Cobble (85%); Sand (10%); Rock (5%)	Barnacle (*Semibalanus balanoides*) (**C**)	Bladderwrack (*Fucus* sp.) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
55-60	55-60	Cobble (90%); Sand (10%)	Barnacle (*Semibalanus balanoides*) (**C**)	Black Whip Weed (*Chordaria flagelliformis*) (15%); Sea Colander (*Agarum clathratum*) (5%)
60-65	60-65	Cobble (75%); Boulder (15%); Rock (5%); Sand (5%)	Barnacle (*Semibalanus balanoides*) (**C**)	Black Whip Weed (*Chordaria flagelliformis*) (5%)
65-70	65-70	Boulder (60%); Cobble (30%); Sand (10%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Sea Star (*Asterias* sp.) (**U: 2 individuals**); Lobster (*Homarus americanus*) (**U: 1 individual**)	-----
70-75	70-75	Boulder (80%); Cobble (15%); Sand (5%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Lobster (*Homarus americanus*) (**U: 1 individual**)	-----
75-80	75-80	Boulder (100%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%)
80-85	80-85	Boulder (80%); Rock (10%); Cobble (10%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Sea Star (*Asterias* sp.) (**U: 1 individual**)	-----
85-90	85-90	Boulder (80%); Rock (10%); Cobble (10%)	Barnacle (*Semibalanus balanoides*) (**C**); Blue Mussel (*Mytilus edulis*) (**C**); Sea Star (*Asterias* sp.) (**U: 1 individual**)	-----
90-95	90-95	Boulder (50%); Cobble (30%); Rock (20%)	Blue Mussel (*Mytilus edulis*) (**C**); Shell Hash	Bladderwrack (*Fucus* sp.) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
95-100	95-100	Boulder (50%); Cobble (30%); Rock (20%)	Barnacle (*Semibalanus balanoides*) (**C**); Cunner (*Tautogolabrus adspersus*) (**U: 1 individual**); Lobster (*Homarus americanus*) (**U: 1 individual**)	Bladderwrack (*Fucus* sp.) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%); Sea Colander (*Agarum clathratum*) (5%)
100-105	100-105	Cobble (100%)	Sea Star (*Asterias* sp.) (**U: 1 individual**)	Black Whip Weed (*Chordaria flagelliformis*) (20%)
105-110	105-110	Cobble (100%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Unidentified Fish Species (**U: 1 individual**)	Black Whip Weed (*Chordaria flagelliformis*) (60%); Bladderwrack (*Fucus* sp.) (10%)

Table E.1-3. 250m Transect – Transect T3, August 31-September 3, 2010

Transect Distance (m)	Transect Tag Numbers	Substrate (% Coverage)	Macrofaunal Life Observed (Estimated Abundances*)	Macrofloral Life Observed (% Coverage)
110-115	110-115	Cobble (100%)	-----	Black Whip Weed (*Chordaria flagelliformis*) (60%); Bladderwrack (*Fucus* sp.) (5%); Sea Colander (*Agarum clathratum*) (5%); Tube Weed (*Polysiphonia lanosa*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
115-120	115-120	Cobble (100%)	Cunner (*Tautogolabrus adspersus*) (**U: 3 individuals**)	Black Whip Weed (*Chordaria flagelliformis*) (40%); Bladderwrack (*Fucus* sp.) (25%); Tube Weed (*Polysiphonia lanosa*) (10%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
120-125	120-125	Boulder (100%)	Cunner (*Tautogolabrus adspersus*) (**U: 4 individuals**)	Bladderwrack (*Fucus* sp.) (50%); Black Whip Weed (*Chordaria flagelliformis*) (20%); Tube Weed (*Polysiphonia lanosa*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
125-130	125-130	Boulder (100%)	Unidentified Fish Species (**U: 1 individual**)	Bladderwrack (*Fucus* sp.) (40%); Black Whip Weed (*Chordaria flagelliformis*) (25%); Tube Weed (*Polysiphonia lanosa*) (10%)
130-135	130-135	Boulder (50%); Cobble (50%)	-----	Bladderwrack (*Fucus* sp.) (25%); Black Whip Weed (*Chordaria flagelliformis*) (25%); Tube Weed (*Polysiphonia lanosa*) (5%)
135-140	135-140	Boulder (50%); Cobble (50%)	-----	Bladderwrack (*Fucus* sp.) (60%); Kelp (*Laminaria saccharina*) (15%); Black Whip Weed (*Chordaria flagelliformis*) (10%)
140-145	140-145	Boulder (50%); Cobble (50%)	Cunner (*Tautogolabrus adspersus*) (**U: 3 individuals**); Sea Star (*Asterias* sp.) (**U: 4 individuals**)	Bladderwrack (*Fucus* sp.) (75%); Black Whip Weed (*Chordaria flagelliformis*) (10%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
145-150	145-150	Boulder (75%); Cobble (25%)	-----	Bladderwrack (*Fucus* sp.) (60%); Black Whip Weed (*Chordaria flagelliformis*) (20%); Tube Weed (*Polysiphonia lanosa*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
150-155	150-155	Boulder (75%); Cobble (25%)	-----	Bladderwrack (*Fucus* sp.) (60%); Black Whip Weed (*Chordaria flagelliformis*) (20%); Tube Weed (*Polysiphonia lanosa*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
155-160	155-160	Boulder (75%); Cobble (25%)	Unidentified Fish Species (**U: 2 individuals**)	Bladderwrack (*Fucus* sp.) (60%); Black Whip Weed (*Chordaria flagelliformis*) (20%); Tube Weed (*Polysiphonia lanosa*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
160-165	160-165	Boulder (75%); Cobble (25%)	Cunner (*Tautogolabrus adspersus*) (**O: 5-10 individuals**)	Bladderwrack (*Fucus* sp.) (60%); Black Whip Weed (*Chordaria flagelliformis*) (20%); Tube Weed (*Polysiphonia lanosa*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
165-170	165-170	Boulder (75%); Cobble (25%)	Unidentified Fish Species (**O: 5-10 individuals**)	Black Whip Weed (*Chordaria flagelliformis*) (45%); Bladderwrack (*Fucus* sp.) (25%); Tube Weed (*Polysiphonia lanosa*) (5%)
170-175	170-175	Boulder (75%); Cobble (25%)	Sea Star (*Asterias* sp.) (**U: 1 individual**)	Bladderwrack (*Fucus* sp.) (25%); Black Whip Weed (*Chordaria flagelliformis*) (15%)
175-180	175-180	Boulder (75%); Cobble (25%)	-----	Bladderwrack (*Fucus* sp.) (30%); Black Whip Weed (*Chordaria flagelliformis*) (5%); Tube Weed (*Polysiphonia lanosa*) (5%); Kelp (*Laminaria saccharina*) (15%); Irish Moss (*Chondrus crispus*) (5%)
180-185	180-185	Boulder (75%); Cobble (25%)	Cunner (*Tautogolabrus adspersus*) (**U: 2 individuals**)	Bladderwrack (*Fucus* sp.) (65%); Black Whip Weed (*Chordaria flagelliformis*) (15%); Tube Weed (*Polysiphonia lanosa*) (10%)
185-190	185-190	Boulder (75%); Cobble (25%)	Cunner (*Tautogolabrus adspersus*) (**U: 1 individual**); Lobster (*Homarus americanus*) (**U: 1 individual**)	Bladderwrack (*Fucus* sp.) (80%); Black Whip Weed (*Chordaria flagelliformis*) (5%); Tube Weed (*Polysiphonia lanosa*) (5%); Irish Moss (*Chondrus crispus*) (5%)
190-195	190-195	Boulder (75%); Cobble (25%)	Cunner (*Tautogolabrus adspersus*) (**U: 1 individual**)	Bladderwrack (*Fucus* sp.) (40%); Black Whip Weed (*Chordaria flagelliformis*) (10%); Tube Weed (*Polysiphonia lanosa*) (5%); Irish Moss (*Chondrus crispus*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
195-200	195-200	Cobble (80%); Boulder (20%)	-----	Black Whip Weed (*Chordaria flagelliformis*) (25%); Bladderwrack (*Fucus* sp.) (15%); Tube Weed (*Polysiphonia lanosa*) (5%); Brown alga (*Pilayella littoralis*) (5%)
200-205	200-205	Cobble (100%)	Deep Sea Scallop (*Placopecten magellanicus*); (**O: 5-10 individuals**)	Bladderwrack (*Fucus* sp.) (25%); Brown alga (*Pilayella littoralis*) (10%); Black Whip Weed (*Chordaria flagelliformis*) (5%)

Table E.1-3. 250m Transect – Transect T3, August 31-September 3, 2010

Transect Distance (m)	Transect Tag Numbers	Substrate (% Coverage)	Macrofaunal Life Observed (Estimated Abundances*)	Macrofloral Life Observed (% Coverage)
205-210	205-210	Cobble (80%); Boulder (20%)	Unidentified Fish Species (**U: 1 individual**); Sea Star (*Asterias* sp.) (**U: 1 individual**)	Bladderwrack (*Fucus* sp.) (20%); Black Whip Weed (*Chordaria flagelliformis*) (10%); Irish Moss (*Chondrus crispus*) (10%); Tube Weed (*Polysiphonia lanosa*) (5%); Brown alga (*Pilayella littoralis*) (5%)
210-215	210-215	Cobble (65%); Boulder (35%)	-----	Bladderwrack (*Fucus* sp.) (20%); Black Whip Weed (*Chordaria flagelliformis*) (10%); Irish Moss (*Chondrus crispus*) (10%); Tube Weed (*Polysiphonia lanosa*) (5%); Brown alga (*Pilayella littoralis*) (5%)
215-220	215-220	Cobble (100%)	-----	Bladderwrack (*Fucus* sp.) (20%); Black Whip Weed (*Chordaria flagelliformis*) (10%); Irish Moss (*Chondrus crispus*) (10%); Tube Weed (*Polysiphonia lanosa*) (5%); Brown alga (*Pilayella littoralis*) (5%)
220-225	220-225	Cobble (65%); Boulder (35%)	-----	Bladderwrack (*Fucus* sp.) (35%); Black Whip Weed (*Chordaria flagelliformis*) (10%); Irish Moss (*Chondrus crispus*) (10%); Brown alga (*Pilayella littoralis*) (10%); Tube Weed (*Polysiphonia lanosa*) (5%)
225-230	225-230	Cobble (65%); Boulder (35%)	Unidentified Fish Species (**U: 1 individual**)	Bladderwrack (*Fucus* sp.) (35%); Black Whip Weed (*Chordaria flagelliformis*) (10%); Irish Moss (*Chondrus crispus*) (10%); Brown alga (*Pilayella littoralis*) (10%); Tube Weed (*Polysiphonia lanosa*) (5%)
230-235	230-235	Cobble (65%); Boulder (35%)	-----	Bladderwrack (*Fucus* sp.) (35%); Black Whip Weed (*Chordaria flagelliformis*) (10%); Irish Moss (*Chondrus crispus*) (10%); Brown alga (*Pilayella littoralis*) (10%); Tube Weed (*Polysiphonia lanosa*) (5%)
235-240	235-240	Cobble (65%); Boulder (35%)	Cunner (*Tautogolabrus adspersus*) (**U: 1 individual**); Sea Star (*Asterias* sp.) (**U: 1 individual**); Deep Sea Scallop (*Placopecten magellanicus*); (**U: 1 individual**)	Bladderwrack (*Fucus* sp.) (35%); Black Whip Weed (*Chordaria flagelliformis*) (10%); Irish Moss (*Chondrus crispus*) (10%); Brown alga (*Pilayella littoralis*) (10%); Tube Weed (*Polysiphonia lanosa*) (5%)
240-245	240-245	Cobble (65%); Boulder (35%)	-----	Bladderwrack (*Fucus* sp.) (35%); Black Whip Weed (*Chordaria flagelliformis*) (10%); Irish Moss (*Chondrus crispus*) (10%); Brown alga (*Pilayella littoralis*) (10%); Tube Weed (*Polysiphonia lanosa*) (5%)
245-250	245-250	Cobble (65%); Boulder (35%)	Cunner (*Tautogolabrus adspersus*) (**O: 5-10 individuals**)	Bladderwrack (*Fucus* sp.) (35%); Black Whip Weed (*Chordaria flagelliformis*) (10%); Irish Moss (*Chondrus crispus*) (10%); Brown alga (*Pilayella littoralis*) (10%); Tube Weed (*Polysiphonia lanosa*) (5%)

*Definitions:

A = Abundant (Numerous (not quantifiable) observations made throughout the entire 5 m segment)

C = Common (Numerous (not quantifiable) observations made intermittently along the 5 m segment)

= Occasional (Quantifiable observations made intermittently along the 5 m segment)

U = Uncommon (Quantifiable observations made infrequently along the 5 m segment)

----- denotes “no life observed”.

Table E.1-4. 150m Transect – Transect T4, August 31-September 3, 2010

Transect Distance (m)	Transect Tag Numbers	Substrate (% Coverage)	Macrofaunal Life Observed (Estimated Abundances*)	Macrofloral Life Observed (% Coverage)
0-5	0-5	Cobble (70%); Sand (25%); Silt (5%)	Barnacle (*Semibalanus balanoides*) (**C**); Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Encrusting Red Alga (*Leptophyllum* sp.) (5%)
5-10	5-10	Cobble (70%); Sand (25%); Silt (5%)	Barnacle (*Semibalanus balanoides*) (**C**); Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Encrusting Red Alga (*Leptophyllum* sp.) (5%); Bladderwrack (*Fucus* sp.) (5%)
10-15	10-15	Cobble (70%); Sand (25%); Silt (5%)	Barnacle (*Semibalanus balanoides*) (**C**); Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%); Bladderwrack (*Fucus* sp.) (5%)
15-20	15-20	Cobble (70%); Sand (25%); Silt (5%)	Barnacle (*Semibalanus balanoides*) (**C**); Waved Whelk (*Buccinum undatum*) (**U: 1 individual**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%)
20-25	20-25	Cobble (70%); Sand (25%); Silt (5%)	Barnacle (*Semibalanus balanoides*) (**C**); Waved Whelk (*Buccinum undatum*) (**O: 5-10 individuals**); Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**)	-----
25-30	25-30	Cobble (70%); Sand (25%); Silt (5%)	Barnacle (*Semibalanus balanoides*) (**C**); Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%); Sea Colander (*Agarum clathratum*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
30-35	30-35	Cobble (70%); Sand (25%); Silt (5%)	Barnacle (*Semibalanus balanoides*) (**C**); Waved Whelk (*Buccinum undatum*) (**U: 1 individual**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (10%); Sea Colander (*Agarum clathratum*) (5%)
35-40	35-40	Cobble (70%); Sand (25%); Silt (5%)	Barnacle (*Semibalanus balanoides*) (**C**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
40-45	40-45	Cobble (70%); Sand (25%); Silt (5%)	Barnacle (*Semibalanus balanoides*) (**C**); Waved Whelk (*Buccinum undatum*) (**U: 1 individual**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
45-50	45-50	Cobble (70%); Sand (25%); Silt (5%)	Barnacle (*Semibalanus balanoides*) (**C**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
50-55	50-55	Cobble (70%); Sand (25%); Silt (5%)	Barnacle (*Semibalanus balanoides*) (**C**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%)
55-60	55-60	Cobble (70%); Sand (25%); Silt (5%)	Barnacle (*Semibalanus balanoides*) (**C**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%)
60-65	60-65	Cobble (70%); Sand (25%); Silt (5%)	Lobster (*Homarus americanus*) (**U: 1 individual**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%)
65-70	65-70	Cobble (70%); Sand (25%); Silt (5%)	Waved Whelk (*Buccinum undatum*) (**O: 5-10 individuals**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%)
70-75	70-75	Cobble (70%); Sand (25%); Silt (5%)	Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%)
75-80	75-80	Cobble (70%); Sand (25%); Silt (5%)	Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (10%)
80-85	80-85	Cobble (70%); Sand (25%); Silt (5%)	Shell Hash	Bladderwrack (*Fucus* sp.) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
85-90	85-90	Cobble (90%); Sand (10%)	Lobster (*Homarus americanus*) (**U: 1 individual**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%)
90-95	90-95	Cobble (60%); Boulder (30%); Sand (10%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**)	Green Alga (*Acrosiphonia arcta*) (5%); Red Alga (*Plumaria plumosa*) (5%)
95-100	95-100	Boulder (70%); Cobble (25%); Sand (5%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Blue Mussel (*Mytilus edulis*) (**O: 15-20 individuals**); Lobster (*Homarus americanus*) (**U: 1 individual**)	Green Alga (*Acrosiphonia arcta*) (5%); Red Alga (*Plumaria plumosa*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
100-105	100-105	Boulder (70%); Cobble (25%); Sand (5%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Sea Star (*Asterias* sp.) (**U: 1 individual**)	Green Alga (*Acrosiphonia arcta*) (5%); Red Alga (*Plumaria plumosa*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
105-110	105-110	Boulder (85%); Cobble (10%); Sand (5%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Lobster (*Homarus americanus*) (**U: 1 individual**); Shell Hash	Green Alga (*Acrosiphonia arcta*) (5%); Red Alga (*Plumaria plumosa*) (5%); Encrusting Red Alga (*Leptophyllum* sp.) (5%)
110-115	110-115	Boulder (90%); Sand (10%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Blue Mussel (*Mytilus edulis*) (**O: 25-30 individuals**); Sea Star (*Asterias* sp.) (**U: 1 individual**)	-----
115-120	115-120	Boulder (90%); Sand (10%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**)	Bladderwrack (*Fucus* sp.) (5%)

Table E.1-4. 150m Transect – Transect T4, August 31-September 3, 2010

Transect Distance (m)	Transect Tag Numbers	Substrate (% Coverage)	Macrofaunal Life Observed (Estimated Abundances*)	Macrofloral Life Observed (% Coverage)
120-125	120-125	Boulder (90%); Sand (10%)	Bowerbank's Halichonidria (*Halichondria bowerbanki*) (**O:5-10 individuals**); Cunner (*Tautogolabrus adspersus*) (**O: 10-15 individuals**)	Bladderwrack (*Fucus* sp.) (15%); Sea Colander (*Agarum clathratum*) (5%)
125-130	125-130	Boulder (90%); Sand (10%)	Sea Star (*Asterias* sp.) (**U: 1 individual**)	Bladderwrack (*Fucus* sp.) (15%); Green Alga (*Acrosiphonia arcta*) (5%); Red Alga (*Plumaria plumosa*) (5%)
130-135	130-135	Boulder (90%); Sand (10%)	Unidentified Fish Species (**U: 1 individual**)	Bladderwrack (*Fucus* sp.) (25%); Green Alga (*Acrosiphonia arcta*) (5%); Red Alga (*Plumaria plumosa*) (5%); Tube Weed (*Polysiphonia lanosa*) (10%); Irish Moss (*Chondrus crispus*) (5%)
135-140	135-140	Boulder (90%); Sand (10%)	Unidentified Fish Species (**O: 5-10 individuals**)	Bladderwrack (*Fucus* sp.) (60%); Black Whip Weed (*Chordaria flagelliformis*) (10%); Tube Weed (*Polysiphonia lanosa*) (5%)
140-145	140-145	Boulder (90%); Sand (10%)	Cunner (*Tautogolabrus adspersus*) (**O: 5-10 individuals**); Lobster (*Homarus americanus*) (**U: 1 individual**)	Bladderwrack (*Fucus* sp.) (75%); Irish Moss (*Chondrus crispus*) (10%); Tube Weed (*Polysiphonia lanosa*) (10%)
145-150	145-150	Boulder (90%); Sand (10%)	-----	Bladderwrack (*Fucus* sp.) (85%); Black Whip Weed (*Chordaria flagelliformis*) (10%); Kelp (*Laminaria saccharina*) (5%)

*Definitions:

A = Abundant (Numerous (not quantifiable) observations made throughout the entire 5 m segment)

C = Common (Numerous (not quantifiable) observations made intermittently along the 5 m segment)

= Occasional (Quantifiable observations made intermittently along the 5 m segment)

U = Uncommon (Quantifiable observations made infrequently along the 5 m segment)

----- denotes "no life observed".

Table E.1-5. 150m Transect – Transect T5, August 31-September 3, 2010

Transect Distance (m)	Transect Tag Numbers	Substrate (% Coverage)	Macrofaunal Life Observed (Estimated Abundances*)	Macrofloral Life Observed (% Coverage)
0-5	0-5	Not visible	Not visible	Not visible
5-10	5-10	Not visible	Not visible	Not visible
10-15	10-15	Cobble (80%); Sand (20%)	Shell Hash	-----
15-20	15-20	Cobble (80%); Sand (20%)	Shell Hash	Bladderwrack (*Fucus* sp.) (5%)
20-25	20-25	Cobble (80%); Sand (20%)	Shell Hash	Bladderwrack (*Fucus* sp.) (5%)
25-30	25-30	Cobble (90%); Sand (10%)	Deep Sea Scallop (*Placopecten magellanicus*) (**U: 2 individuals**); Shell Hash	-----
30-35	30-35	Cobble (90%); Sand (10%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	-----
35-40	35-40	Cobble (90%); Sand (10%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Sea Star (*Asterias* sp.) (**U: 1 individual**);Shell Hash	-----
40-45	40-45	Cobble (90%); Sand (10%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	-----
45-50	45-50	Cobble (90%); Sand (10%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Green Alga (*Acrosiphonia arcta*) (10%); Red Alga (*Plumaria plumosa*) (10%)
50-55	50-55	Cobble (90%); Sand (10%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Green Alga (*Acrosiphonia arcta*) (10%); Red Alga (*Plumaria plumosa*) (10%)
55-60	55-60	Cobble (90%); Sand (10%)	Shell Hash	Green Alga (*Acrosiphonia arcta*) (30%); Red Alga (*Plumaria plumosa*) (30%); Sea Colander (*Agarum clathratum*) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
60-65	60-65	Cobble (90%); Sand (10%)	Shell Hash	Green Alga (*Acrosiphonia arcta*) (20%); Red Alga (*Plumaria plumosa*) (20%); Sea Colander (*Agarum clathratum*) (5%)
65-70	65-70	Cobble (90%); Sand (10%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Green Alga (*Acrosiphonia arcta*) (20%); Red Alga (*Plumaria plumosa*) (20%)
70-75	70-75	Cobble (90%); Sand (10%)	Deep Sea Scallop (*Placopecten magellanicus*) (**U: 1 individual**); Shell Hash	Green Alga (*Acrosiphonia arcta*) (10%); Red Alga (*Plumaria plumosa*) (10%); Sea Colander (*Agarum clathratum*) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
75-80	75-80	Cobble (80%); Sand (20%)	Blue Mussel (*Mytilus edulis*) (**O: 15-20 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Bladderwrack (*Fucus* sp.) (5%); Kelp (*Laminaria saccharina*) (5%)
80-85	80-85	Cobble (80%); Sand (20%)	Shell Hash	Green Alga (*Acrosiphonia arcta*) (20%); Red Alga (*Plumaria plumosa*) (20%); Sea Colander (*Agarum clathratum*) (5%)
85-90	85-90	Cobble (80%); Sand (20%)	Shell Hash	Green Alga (*Acrosiphonia arcta*) (20%); Red Alga (*Plumaria plumosa*) (20%); Sea Colander (*Agarum clathratum*) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
90-95	90-95	Cobble (80%); Sand (20%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Green Alga (*Acrosiphonia arcta*) (15%); Red Alga (*Plumaria plumosa*) (15%); Sea Colander (*Agarum clathratum*) (5%); Kelp (*Laminaria saccharina*) (5%)
95-100	95-100	Cobble (90%); Sand (10%)	Shell Hash	Sea Colander (*Agarum clathratum*) (25%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
100-105	100-105	Cobble (90%); Sand (10%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (20%); Bladderwrack (*Fucus* sp.) (5%)
105-110	105-110	Cobble (90%); Sand (10%)	Shell Hash	Sea Colander (*Agarum clathratum*) (10%); Bladderwrack (*Fucus* sp.) (5%)
110-115	110-115	Cobble (90%); Sand (10%)	Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Bladderwrack (*Fucus* sp.) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
115-120	115-120	Cobble (90%); Sand (10%)	Shell Hash	Bladderwrack (*Fucus* sp.) (5%)
120-125	120-125	Cobble (90%); Sand (10%)	Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
125-130	125-130	Cobble (90%); Sand (10%)	Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (10%); Sea Colander (*Agarum clathratum*) (5%)

Table E.1-5. 150m Transect – Transect T5, August 31-September 3, 2010

Transect Distance (m)	Transect Tag Numbers	Substrate (% Coverage)	Macrofaunal Life Observed (Estimated Abundances*)	Macrofloral Life Observed (% Coverage)
130-135	130-135	Cobble (75%); Rock (20%); Sand (5%)	Bowerbank's Halichonidria (*Halichondria bowerbanki*) (**C**); Blue Mussel (*Mytilus edulis*) (**U: 1 individual**); Lobster (*Homarus americanus*) (**U: 1 individual**); Unidentified Fish Species (**U: 1 individual**)	Black Whip Weed (*Chordaria flagelliformis*) (35%); Bladderwrack (*Fucus* sp.) (15%)
135-140	135-140	Boulder (75%); Cobble (20%); Sand (5%)	Bowerbank's Halichonidria (*Halichondria bowerbanki*) (**C**); Unidentified Fish Species (**U: 1 individual**)	Black Whip Weed (*Chordaria flagelliformis*) (10%); Bladderwrack (*Fucus* sp.) (10%)
140-145	140-145	Boulder (100%)	Bowerbank's Halichonidria (*Halichondria bowerbanki*) (**C**)	Green Alga (*Acrosiphonia arcta*) (5%); Red Alga (*Plumaria plumosa*) (5%); Bladderwrack (*Fucus* sp.) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
145-150	145-150	Boulder (100%)	Bowerbank's Halichonidria (*Halichondria bowerbanki*) (**C**); Unidentified Fish Species (**U: 1 individual**)	Bladderwrack (*Fucus* sp.) (75%); Black Whip Weed (*Chordaria flagelliformis*) (5%); Tube Weed (*Polysiphonia lanosa*) (5%)

*Definitions:

A = Abundant (Numerous (not quantifiable) observations made throughout the entire 5 m segment)

C = Common (Numerous (not quantifiable) observations made intermittently along the 5 m segment)

= Occasional (Quantifiable observations made intermittently along the 5 m segment)

U = Uncommon (Quantifiable observations made infrequently along the 5 m segment)

----- denotes "no life observed".

Table E.1-6. 150m Transect – Transect T6, August 31-September 3, 2010

Transect Distance (m)	Transect Tag Numbers	Substrate (% Coverage)	Macrofaunal Life Observed (Estimated Abundances*)	Macrofloral Life Observed (% Coverage)
0-5	0-5	Cobble (65%); Sand (35%)	Deep Sea Scallop (*Placopecten magellanicus*) (**U: 1 individual**); Shell Hash	-----
5-10	5-10	Cobble (65%); Sand (35%)	Deep Sea Scallop (*Placopecten magellanicus*) (**U: 2 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%); Bladderwrack (*Fucus* sp.) (5%)
10-15	10-15	Cobble (65%); Sand (35%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%)
15-20	15-20	Cobble (65%); Sand (35%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**)	-----
20-25	20-25	Cobble (75%); Sand (25%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Black Whip Weed (*Chordaria flagelliformis*) (5%)
25-30	25-30	Cobble (65%); Sand (35%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	-----
30-35	30-35	Cobble (65%); Sand (35%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	-----
35-40	35-40	Cobble (65%); Sand (35%)	Shell Hash	-----
40-45	40-45	Cobble (65%); Sand (35%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (5%);
45-50	45-50	Cobble (75%); Sand (25%)	Shell Hash	-----
50-55	50-55	Cobble (75%); Sand (25%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (15%); Black Whip Weed (*Chordaria flagelliformis*) (5%)
55-60	55-60	Cobble (75%); Sand (25%)	Deep Sea Scallop (*Placopecten magellanicus*) (**O: 5-10 individuals**); Shell Hash	Sea Colander (*Agarum clathratum*) (15%); Black Whip Weed (*Chordaria flagelliformis*) (5%); Kelp (*Laminaria saccharina*) (5%)
60-65	60-65	Cobble (90%); Sand (10%)	Shell Hash	Sea Colander (*Agarum clathratum*) (15%); Green Alga (*Acrosiphonia arcta*) (10%); Red Alga (*Plumaria plumosa*) (10%)
65-70	65-70	Cobble (90%); Sand (10%)	Bowerbank's Halichonidria (*Halichondria bowerbanki*) (**C**); Shell Hash	Sea Colander (*Agarum clathratum*) (15%); Green Alga (*Acrosiphonia arcta*) (15%); Red Alga (*Plumaria plumosa*) (10%)
70-75	70-75	Cobble (70%); Rock (25%); Sand (5%)	Bowerbank's Halichonidria (*Halichondria bowerbanki*) (**C**); Shell Hash	Sea Colander (*Agarum clathratum*) (20%);
75-80	75-80	Cobble (85%); Sand (10%); Rock (5%)	Shell Hash	Green Alga (*Acrosiphonia arcta*) (10%); Red Alga (*Plumaria plumosa*) (10%); Sea Colander (*Agarum clathratum*) (5%); Bladderwrack (*Fucus* sp.) (5%)
80-85	80-85	Cobble (75%); Sand (25%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Deep Sea Scallop (*Placopecten magellanicus*) (**U: 1 individual**); Shell Hash	Sea Colander (*Agarum clathratum*) (15%); Black Whip Weed (*Chordaria flagelliformis*) (5%); Bladderwrack (*Fucus* sp.) (5%)
85-90	85-90	Rock (90%); Cobble (10%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**)	Bladderwrack (*Fucus* sp.) (5%)
90-95	90-95	Rock (90%); Cobble (5%); Sand (5%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Blue Mussel (*Mytilus edulis*) (**O: 5-10 individuals**)	-----
95-100	95-100	Rock (100%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**)	-----
100-105	100-105	Rock (100%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Blue Mussel (*Mytilus edulis*) (**O: 5-10 individuals**); Unidentified Fish Species (**U: 1 individual**)	-----
105-110	105-110	Rock (100%)	Green Sea Urchin (*Strongylocentrotus droebachiensis*) (**C**); Unidentified Fish Species (**U: 1 individual**)	Green Alga (*Acrosiphonia arcta*) (5%); Red Alga (*Plumaria plumosa*) (5%); Black Whip Weed (*Chordaria flagelliformis*) (5%); Kelp (*Laminaria saccharina*) (5%)
110-115	110-115	Rock (100%)	Bowerbank's Halichonidria (*Halichondria bowerbanki*) (**C**); Fish (**O: 5-10 individuals**)	Black Whip Weed (*Chordaria flagelliformis*) (25%); Bladderwrack (*Fucus* sp.) (15%); Green Alga (*Acrosiphonia arcta*) (5%); Red Alga (*Plumaria plumosa*) (5%)

Table E.1-6. 150m Transect – Transect T6, August 31-September 3, 2010

Transect Distance (m)	Transect Tag Numbers	Substrate (% Coverage)	Macrofaunal Life Observed (Estimated Abundances*)	Macrofloral Life Observed (% Coverage)
115-120	115-120	Rock (100%)	-----	Kelp (*Laminaria saccharina*) (5 Bladderwrack (*Fucus* sp.) (25%); %); Green Alga (*Acrosiphonia arcta*) (5%); Red Alga (*Plumaria plumosa*) (5%)
120-125	120-125	Rock (100%)	Unidentified Fish Species (**U: 1 individual**)	Bladderwrack (*Fucus* sp.) (75%); Tube Weed (*Polysiphonia lanosa*) (15%); Kelp (*Laminaria saccharina*) (5%)
125-130	125-130	Rock (90%); Cobble (10%)	Barnacle (*Semibalanus balanoides*) (**C**)	Bladderwrack (*Fucus* sp.) (75%); Irish Moss (*Chondrus crispus*) (15%); Tube Weed (*Polysiphonia lanosa*) (10%)
130-135	130-135	Rock (100%)	Barnacle (*Semibalanus balanoides*) (**C**)	Bladderwrack (*Fucus* sp.) (85%); Kelp (*Laminaria saccharina*) (15%)
135-140	135-140	Rock (100%)	Sea Star (*Asterias* sp.) (**U: 1 individual**)	Bladderwrack (*Fucus* sp.) (85%); Kelp (*Laminaria saccharina*) (5%); Tube Weed (*Polysiphonia lanosa*) (5%); Sea Lettuce (*Ulva* sp.) (5%)
140-145	140-145	Rock (85%); Cobble (15%)	Sea Star (*Asterias* sp.) (**U: 1 individual**)	Bladderwrack (*Fucus* sp.) (85%); Tube Weed (*Polysiphonia lanosa*) (5%); Dulse (*Palmaria palmata*) (5%)
145-150	145-150	Rock (80%); Cobble (20%)	-----	Bladderwrack (*Fucus* sp.) (85%); Tube Weed (*Polysiphonia lanosa*) (5%)

*Definitions:

A = Abundant (Numerous (not quantifiable) observations made throughout the entire 5 m segment)
C = Common (Numerous (not quantifiable) observations made intermittently along the 5 m segment)
= Occasional (Quantifiable observations made intermittently along the 5 m segment)
U = Uncommon (Quantifiable observations made infrequently along the 5 m segment)
----- denotes "no life observed".

Table E.1-7. List of Species Observed during Video Transect Survey of Benthic Habitat off Black Point, September 2010.

Marine Fauna	
American Oyster	*Crassostrea virginica*
Barnacle	*Semibalanus balanoides*
Blue Mussel	*Mytilus edulis*
Bowerbank's Halichonidria	*Halichondria bowerbanki*
Cunner	*Tautogolabrus adspersus*
Frilled Anemone	*Metridium senile*
Green Sea Urchin	*Strongylocentrotus droebachiensis*
Lobster	*Homarus americanus*
Periwinkle	*Littorina sp.*
Scallop	*Placopecten magellanicus*
Sea Cucumber	*Cucumaria frondosa*
Sea Peach	*Holacynthia pyriformis*
Sea Star	*Asterias sp.*
Shorthorn Sculpin	*Myoxocephalus scorpius*
Waved Whelk	*Buccinum undatum*
Marine Flora	
Black Whip Weed	*Chordaria flagelliformis*
Bladderwrack	*Fucus sp.*
Brown alga	*Pilayella littoralis*
Encrusting Red Alga	*Leptophyllum sp.*
Green Alga	*Acrosiphonia arcta*
Green Fleece	*Codium fragile*
Irish Moss	*Chondrus crispus*
Kelp	*Laminaria saccharina*
Red Alga	*Plumaria plumosa*
Sea Colander	*Agarum clathratum*
Tube Weed	*Polysiphonia lanosa*

ATTACHMENT B
Fish Community

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

Species	Preferred Habitat	Life History Strategies
Atlantic Cod *(Gadus morhua)*	From inshore regions to shelf break From surface to depths of 600 m → usually 150-200m Prefers temperatures between 3-8 deg C A variety of habitats	Spawns from March to December → winter and beginning of spring Spawning sites are in offshore water, at or near the bottom, 50-200m depth and 0-12 deg C Migrate between spawning, feeding and overwintering areas, usually within 200 km
Atlantic Haddock *(Melanogrammus aeglefinus)*	From inshore regions to shelf break Found in depths 10 – 450 m, usually 10-200 m → adults 80-200m Prefers temperatures between 4-10 deg C A variety of habitat, juveniles have higher survival rates when they settle on sand or gravel bottoms	Occasional year-round spawning activity Generally spawns in water less than 91 m → 50 -150 m depth
Thorny Skate *(Amblyraja radiate)*	Cool water fish – temperatures ranging from 50 deg F to near the freezing point of salt water Prefers water deeper than 18 m – majority between 65 m and 90 m likely due to the availability of food source Lives on the bottom partially buried in sand or mud	"Lay large eggs with blackish –sea green leathery shells, roughly oblong in outline, with a hollow tendril at each corner by which they become fastened to seaweeds or other objects" Egg cases can range from 3-3 ¼ inches in length → flat on one side and convex on the other Spawn throughout the year – incubation can last several months up to a year or more
Winter Skate *(Leucoraja ocellata)*	Depths from 45m to 65 m are preferred but can be found as shallow as 3-7m along banks and sandy beaches	Rock crab and squid are favoured prey "Lay large eggs with blackish

	Can be found on the icy bottom along the banks and shallower in the Southern portion of the Gulf of St. Lawrence – temperatures as high as 16 deg C or more	–sea green leathery shells, roughly oblong in outline, with a hollow tendril at each corner by which they become fastened to seaweeds or other objects" "Off the Atlantic coast of Nova Scotia this skate deposits its eggs from summer into autumn" Egg cases can range from 2 ½ to 2 ¾ inches by 1 ¾ inches
Sand Lance *(Ammodytes americanus)* (Auster and Stewart 1986)	Occur in estuarine, open coastal, and offshore habitats over sand substrates → schools during the day that increase in size as water depth increases → will bury themselves partly or fully in the sand for escape and rest → need relatively higher velocity bottom currents to keep interstitial water oxygenated Larvae common at the mouth of major estuaries but are commonly found right out to the edge of the continental shelf Most abundant between 3-6 deg C, as low as 0 deg C in bottom waters	Mature in 1-2 years Spawning occurs November to March → mainly inshore Eggs deposited on/in sand or gravel over a wide area Larvae 3-40 mm from hatching through planktonic stage to semidemersal stage where they start to exhibit schooling tendencies and burrow into the sand Sand Lance dominated by 1- to 2-year-old fish but can live to 9 years of age.
Cunner *(Tautogolabrus adsperus)* (Auster 1989)	Shallow inshore waters → on or near bottom Congregate around wharves, wrecks and seaweed	Spawning June – August Hibernates during the winter months under rocks Will return to home ranges when displaced
Shorthorn Sculpin *(Myoxocephalus scorpius)*	In shoal waters near bays and ledges → variety of substrates → prefers to hug the bottom closely Depths of 18-37 m → 55-60 deg F	Spawning November to February, main egg production in December Eggs stick together and sink and may be deposited in a variety of places

		By May-June at lengths 22-25 mm they go from drifting near the surface to living near the bottom
Atlantic Herring *(Clupea harengus)* *(Gromack 2010)*	Inhabit open sea and offshore banks Adults migrate hundreds of miles throughout their life During winter migrations they can form massive schools "Herring that spawn off the southwest coast of Nova Scotia near Yarmouth winter in Chedabucto Bay in northern Nova Scotia, a sea migration of over 500 kms" (http://www.gma.org/herring/biology/life_cycle/default.asp)	Travel from spawning sites (coastal, offshore, offshore banks) to feeding grounds in a migratory cycle → dependent on season and life history stage → spawning times late summer and early fall Eggs sink to the bottom to form dense carpets of eggs and hatch into larvae in 7-10 days (dependent on water temp) → larvae drift on ocean currents and eddies (7-29mm) Young juveniles (~40mm) are abundant in inshore waters through spring and summer → schools of juveniles will enter shallow bays and inlets→ late summer and fall they move offshore to winter near the bottom (also avoid the adults going to the spawning grounds) Maturity reached at about 3-4 years and 23-26 cm → migrate to feed, spawn and over-winter
Atlantic Mackerel *(Scomber scombrus)* *(Gromack 2010)*	Gather in dense schools of thousands of fish during the daytime (14-18 m) and night time (as deep as 27-46 m) Prefer the open sea, young can enter estuaries and harbours looking for food but never fresh water → not	Spawn in spring and early summer (June for outer Nova Scotia) anywhere along the coast from Cape Hatteras to the southern side of the Gulf of St. Lawrence → release eggs wherever, no particular

	dependent upon being near the coast nor the bottom → usually found from the inner half to outer part of the continental shelf but not usually beyond the upper part of the shelf Range from surface to as deep as 100 fathoms (183 m) → spring to autumn common in 25-30 fathoms (46-55 m) and shallower Temperatures of 7-20 deg C	substrate → drift with the currents Newly hatched larvae 3.1-3.3 mm, resemble parents at 50 mm Migrate from the coast to deeper waters by the end of December and return in the spring and early summer
Atlantic Bluefin Tuna *(Thunnus thynnus)* (DFO 2013)	Open water fish but sticks to the continental shelf during the warm seasons due to prey concentration being higher → 50-54 deg F lower temp range favoured, when sea temps start to drop in autumn the schools will migrate to warmer waters Travel in small schools of 6 – 40 fish sometimes much larger schools → schools are made up of fish of approximately the same age → very large fish can be solitary Congregate at or near the surface → lower depths vary depending on temperature and prey	Prey on smaller schooling fish Will chase prey into small harbours and bays along the outer coasts of Nova Scotia, including Bras D'or lake Migrate up from Jamaica and the Gulf of Mexico starting in May and are reported in the Gulf of St. Lawrence in June-July Adults spawn in the Gulf of Mexico (mainly the northern portion) in early spring (April and May) and then migrate up the Western Atlantic (east coasts of the US and Canada) for their fall feeding season Juvenile tuna tend to stick to the eastern coast of the US with depths ranging from surface up to 250 m → mainly between surface and 50m m from July to Sept, and deepening in range gradually from Oct to April and back up again from May to June

Species	Preferred Habitat	Life History Strategies
American Lobster *(Homarus americanus)* (Mackenzie and Moring 1985)	Relatively low concentrations live along the outer edge of the Nova Scotia shelf Two types: inshore and offshore Offshore lobsters migrate between the outer Continental Shelf and shallower Contintental Shelf seeking the optimum temperatures for growth and mating → migrations are triggered by water temperature changes, seek temps of 8-14 deg C → In spring they move to shallower water and return to the outer shelf starting in late summer through to Nov-Dec→ use mud or clay substrates to make bowl shaped depressions for shelter Inshore lobsters don't migrate and have a limited home range → will move to deeper water during a storm → subject to winter temperatures → prefer sand with overlying boulder substrates Canadian east coast lobsters will move to water 15-18 m deep in the winter, and 7-9 m deep in the summer	Spawning lobsters pair for about 2 weeks after the females have molted → eggs are extruded 11-13 months after mating and attach to the females bodies for 9-11 months → eggs hatch from May to October depending on water temperature (starts at 15 deg C and peaks at 20 deg C) → females release larvae at night Four larval stages where they are planktonic and positively photosensitive from May to October → part way through stage four they turn negatively photosensitive and retreat to the bottom and burrow into the substrate→ molt into juveniles while in their burrows Juveniles (<35 mm) rarely leave their burrows or shelters → 35-40 mm they start to venture outside → 45 mm they start to forage Juveniles and adults travel less than 300 m from their shelters Offshore lobsters molt more often than inshore lobsters → molting lobsters are more susceptible to low salinities Juveniles and adults are predators and catch live prey mostly → prefer rock crabs but will eat sea urchins, mussels, and sea stars Adults are preyed upon by many species including: Atlantic Cod, Skates, Cunners, and Haddock
Rock Crab *(Cancer irroratus)*	Inhabit near shore Atlantic regions from southern Labrador to Miami,	Mating occurs after females have moulted → can produce 4000-

(	Florida → shallow waters in bays on sandy or muddy bottoms → depths from 0-575m, Canada's east coast generally between 5-20m	330,000 eggs→ extruded mid-late autumn through to spring-early summer Larvae are planktonic for six stages of moulting before settling to the bottom → settle inshore on gravel or cobble substrates for juvenile stage Juvenile and adult diets include sea scallops, green sea urchin, sand shrimp, mussels, snails brittlestar and polychaete → Larger adults will prey on small lobsters
Snow Crab *(Chionoecetes opilio)* (DFO 2013)	Predators are: skates (primarily thorny skate), cod, seal, halibut, and the American plaice→ smaller and soft-shell crabs are highly vulnerable Prefer a temperature range of 3-4 deg C on muddy or sandy bottoms ranging from 50-600 m "mostly found in the estuary and the Gulf of St. Lawrence, around Cape Breton Island, on the Scotian Shelf..."	Females are much smaller than males → only males are allowed to be harvested Mating pairs migrate to shallow waters in the spring→ eggs are fertilized before being released→ females carry the eggs under their abdomen for 1-2 years (water temperature dependant) before they hatch Eggs hatch in the spring (April to late May) and are planktonic larvae for 3-5 months until settling to the bottom for their juvenile stage Males go through: juvenile (cannot reproduce), adolescent (reproductive organs work but no enlarged claws), and adult (enlarged claws) → moult every year until they develop enlarged claws (8-13 moults) Females go through: immature (narrow abdomen and no detectable ovaries), prepubescent

		(ovaries begin to develop), adult (broader abdomen and ability to reproduce)→ become sexually mature between 8-10 moults
Northern Shrimp *(Pandalus borealis)* (DFO 2014)	Prefers soft muddy bottoms between 150-600m deep Prefers water temperature of 2-6 deg C Migrate vertically and horizontally in the water column → egg-bearing females will migrate to shallower water and congregate → will migrate at night from the bottom through the water column in search of food (krill and copepods) → feed on the bottom during the day on annelids, small crustacean and detritus	Mating occurs in late summer-fall → eggs remain attached to the females until the following spring (7-8 months)→ hatch in April-May and larvae are planktonic for a few months before spending more time near the bottom Reach male sexual maturity at 2-3 years → transition to females over the winter when 4-5 years→ mating takes place the following fall
Sea Scallop *(Placopecten magellanicus)* *(Mullen et al. 1986)*	Occupy coastal waters rarely deeper than 110 m Do not compete well with other molluscs for food or space Young prefer shell fragments and other animals for settling due to the inability to survive on shifting sand bottoms and provides protection from predators Predators include: rock crab, adult and juvenile lobster, Atlantic cod, and sculpins, amoung others	Sea scallop eggs and larvae are planktonic → eggs hatch 30-40 hours after fertilization (at 12-18 deg C)→ larvae remain planktonic for over a month and may be transported by currents out of their spawning area before spatfall → spat crawl around on the bottom until they can find something hard to attach to → relatively active until about 8cm long and can swim away when under threat (predators or dredging) → adults >10mm detach from the epibenthic structures and settle to the bottom → adult scallops (> 9 cm) do not migrate Spawning occurs in Newfoundland at temps between 4-16 deg C → a rapid drop in temperature may trigger spawning Commercially viable when reach

		fifth or sixth year → the success/failure of a specific year class (affected by temperature and spawning success) can in turn have an effect on the commercial catch 5-6 years later
Green Sea Urchin *(Lytechinus variegates)* (DFO 2000-06)	Prefer shallow waters (<10 m) with rocky substrates (but will tolerate any substrate) → avoid areas of extreme wave action → can be found as deep as 1000 m "Found in highest concentration in feeding fronts bordering the deep edge of kelp beds" Thought to migrate seasonally	Crawl along the ocean floor feeding on fine algae, kelp and seaweeds Spawns in late winter/early spring → larvae planktonic for 8-12 weeks and then settle to the bottom→ growth dependent on temperature and food supply taking anywhere from 5-15 years to reach commercial size of 50 mm

References

Auster, P.J. 1989. Species and profiles: life histories and environmental requirements of coastal fishes and invertebrates (north Atlanti and Mid-Atlantic_ -- tautog and cunner. U.S. Fish and Wildlife Service Biological Reports 82(11.105). U.S. Army Corps of Engineers, TR EL-82-4. 13pp.

ATTACHMENT C
Benthic Invertebrate Sample Results

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

Table E.2-1. Species Presence and Abundance within Benthic Invertebrate Samples Collected off Black Point, September 2010.

PHYLUM	SPECIES	Abundance (# of individuals per sample)					
		GQ 02	GQ 25	GQ 27	GQ 31	GQ 47	GQ 50
CNIDARIA	*Metridium senile*	1	0	0	0	0	0
	Sertularia sp.	5	0	0	0	0	0
NEMERTEA	*Cerebratulus lacteus*	0	0	0	0	0	1
OLIGOCHAETA	*Peloscolex benedeni*	0	4	0	1	0	1
	Other Tubificidae	0	0	0	0	1	2
POLYCHAETA	*Acmira catherinae*	0	40	1	0	6	3
	Amphitrite johnstoni	0	0	0	0	0	1
	Anaitides groenlandica	1	0	0	0	0	0
	Anaitides maculata	0	5	0	0	0	2
	Capitella capitata	0	5	3	0	0	0
	Dexiospira spirillum	29	0	0	0	0	0
	Eualia bilineata	1	0	0	0	0	0
	Exogone sp.	0	2	2	1	0	0
	Glycera dibranchiata	2	10	1	6	2	2
	Harmothoe extenuata	2	7	0	2	0	6
	Harmothoe imbricata	1	1	3	0	2	2
	Lepidonotus squamatus	0	1	0	0	0	0
	Lumbrineris fragilis	5	4	2	13	5	1
	Micropthalamus sp.	0	0	1	0	0	0
	Naineris quadricuspida	1	0	0	0	0	1
	Neanthes virens	1	0	1	0	0	1
	Nephtys caeca	1	0	0	0	0	0
	Pectenaria granulata	0	2	5	1	5	0
	Pherusa sp.	0	0	0	0	1	0
	Pholoe minuta	1	8	9	0	3	1
	Polycirrus sp.	0	0	3	0	0	1
	Prionospio steenstrupi	0	0	1	0	0	0
	Schistomeringus caeca	0	0	4	3	0	0
	Scoloplos sp.	1	0	0	0	0	0
	Spio filicornis	0	0	0	0	0	1
	Spirorbis borealis	48	0	0	0	0	0
	Syllis cornuta	0	2	2	0	0	5
	Tharyx sp.	1	7	9	34	14	5
BRYOZOA	*Dendrobeania murryana*	2	0	0	0	0	0
	Electra pilosa	0	0	0	0	0	1
	Membranipora membranacea	0	0	0	8	0	0
POLYPLACOPHORA	*Ischnochiton albus*	2	0	0	0	0	0
	Ischnochiton rubra	4	2	0	1	8	0

Table E.2-1. Species Presence and Abundance within Benthic Invertebrate Samples Collected off Black Point, September 2010.

PHYLUM	SPECIES	Abundance (# of individuals per sample)					
		GQ 02	GQ 25	GQ 27	GQ 31	GQ 47	GQ 50
GASTROPODA	*Bittium alternatum*	7	0	0	0	0	0
	Euspira triseriata	0	0	0	0	1	0
	Lacuna vincta	0	2	1	0	3	3
	Margarites groenlandicus	2	0	0	0	0	0
	Moelleria costulata	2	0	0	0	0	0
	Nassarius trivittatus	1	4	3	0	8	0
	Oenopota sp.	5	0	1	0	0	0
	Onoba aculeus	2	2	2	0	3	2
	Tectura testudinalis	13	44	49	21	34	35
	Trichtropis borealis	1	0	0	0	0	0
	Turbonilla interrupta	4	4	73	10	6	2
BIVALVIA	*Anomia simplex*	1	0	2	1	1	0
	Arctica islandica	1	0	0	0	0	0
	Astarte undata	13	0	1	2	0	0
	Cerastoderma pinnulatum	6	0	2	0	1	2
	Clinocardium ciliatum	2	0	0	0	0	0
	Crenella glandula	9	0	0	0	1	0
	Hiatella arctica	2	2	0	0	1	0
	Modiolus modiolus	3	1	0	3	4	53
	Mysella planulata	0	0	1	0	0	4
	Mytilus edulis	2	0	0	0	0	0
	Nucula delphinodonta	3	0	0	0	0	0
	Thyasira gouldii	9	0	0	0	0	0
CIRRIPEDIA	*Semibalanus balanoides*	3	0	2	0	0	0
ISOPODA	*Idotea phosphorea*	0	0	0	0	0	2
AMPHIPODA	*Corophium sp.*	0	0	1	0	4	0
	Caprella linearis	0	0	0	0	0	3
	Caprella septentrionalis	5	2	0	0	16	5
	Dexamine thea	0	0	0	0	1	0
	Gammarus oceanicus	0	2	0	0	0	0
	Melita dentata	1	0	0	0	0	0
	Unciola irrorata	0	53	0	1	1	17
DECAPODA	*Cancer irroratus*	0	0	0	0	0	1
	Pagurus acadianus	0	3	2	0	4	0
INSECTA	Chironomidae	0	0	0	0	0	1
ASTEROIDEA	*Asterias* sp.	2	3	0	0	0	2
OPHIUROIDEA	*Amphipholis squamatus*	4	1	1	1	3	1
	Ophiopholis aculeata	2	1	1	0	6	1
ECHINOIDEA	*Echinarachnius parma*	2	0	0	0	0	0
	Strongylocentrotus droebachiensis	3	94	8	0	21	11
ASCIDIACEA	*Molgula sp.*	0	0	0	0	0	1
Total # individuals		**219**	**318**	**197**	**109**	**166**	**183**
Number of Taxa		**47**	**30**	**31**	**17**	**30**	**36**
Wet weight g.		**10.14**	**1.45**	**1.74**	**0.81**	**19.82**	**5.82**

ATTACHMENT D
Marine Sediment Results

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

Marine Sediment Sampling Parameters and Guidelines

Parameter	Units	CEPA Ocean Disposal Guidelines - Atlantic Region	CCME Probable Effects Levels, Rev. 2002	CCME Soil Quality Guidelines, Rev. 2008					
				Human Health	Environmental Health				Human Health
				Potable Water	Soil Contact		Soil and Food Ingestion	Freshwater Life	Direct Contact
PAHs			Maine/Estuarine Sediment	Agricultural, Residential/Parkland, Commercial, and Industrial Land Uses	Agricultural, Residential/Parkland Uses	Commercial/Industrial Land Uses	Agricultural, Residential/Parkland Uses	Agricultural, Residential/Parkland, Commercial, and Industrial Land Uses	
2-Methylnapthalene	mg/kg	-	0.201	-	-	-	-	-	
Acenaphthene	mg/kg	-	0.0889	-	-	-	-	0.28	
Acenaphthylene	mg/kg	-	0.128	-	-	-	21.5	320	
Anthracene	mg/kg	-	0.245	-	2.5	32	61.5	-	
Benz(a)anthracene	mg/kg	-	0.693	0.33	-	-	6.2	-	-
Benzo(a)pyrene	mg/kg	-	0.763	0.37	20	72	0.6	8800	-
Benzo(b)fluoranthene	mg/kg	-	-	-	-	-	-	-	
Benzo(b+j)fluoranthene	mg/kg	-	-	0.16	-	-	6.2	-	-
Benzo(g,h,i)perylene	mg/kg	-	-	6.8	-	-	-	-	-
Benzo(k)fluoranthene	mg/kg	-	-	0.034	-	-	6.2	-	-
Chrysene	mg/kg	-	0.846	2.1	-	-	6.2	-	-
Dibenz(a,h)anthracene	mg/kg	-	0.135	0.23	-	-	-	-	-
Fluoranthene	mg/kg	-	1.494	-	50	180	15.4	-	
Fluorene	mg/kg	-	0.144	-	-	-	15.4	0.25	
Indeno(1,2,3-cd)pyrene		-	-	2.7	-	-	-	-	-

	mg/kg								
Naphthalene	mg/kg	-	0.391	-	-	-	8.8	0.013	
Phenanthrene	mg/kg	-	0.544	-	-	-	43.0	0.046	
Pyrene	mg/kg	-	1.398	-	-	-	7.7	-	
Total PAH3	mg/kg	2.5	-	-	-	-	-	-	
IACR (Protection of Potable Water)4	-	-	-	1	-	-	-	-	
Benzo(a)pyrene TPE (10-5)5	mg/kg								5.3
Benzo(a)pyrene TPE (10-5) with UF6	mg/kg								

Parameter	Units	CEPA Ocean Disposal Guidelines - Atlantic Region	CCME Probable Effects Levels, Rev. 2002	CCME Soil Quality Guidelines, Rev. 2008			
Metals			Maine/Estuarine Sediment	Agricultural	Residential/Parkland	Commercial/Industrial	
Antimony	mg/kg	-		20	20	40	
Arsenic	mg/kg	-		12	12	12	
Barium	mg/kg	-	-	750	500	2000	
Beryllium	mg/kg	-	-	4	4	8	
Cadmium	mg/kg	0.6	4.2	1.4	10	22	
Chromium +6	mg/kg	-	-	0.4	0.4	1.4	
Chromium (Total)	mg/kg	-	160	64	64	87	
Cobalt	mg/kg	-	-	40	50	300	
Copper	mg/kg	81*	108	63	63	91	
Lead	mg/kg	66*	112	70	140	260	600
Mercury	mg/kg	0.75	0.7	6.6	6.6	24	50
Molybdenum	mg/kg	-	-	5	10	40	
Nickel	mg/kg	-	-	50	50	50	
Selenium	mg/kg	-	-	1	1	2.9	
Silver	mg/kg	-	-	20	20	40	
Thallium	mg/kg	-	-	1	1	1	
Tin	mg/kg	-	-	5	50	300	
Uranium	mg/kg			23	23	33	300
Vanadium	mg/kg	-	-	130	130	130	
Zinc	mg/kg	160*	271	200	200	360	
PCBs							
Aroclor 1254	mg/kg	-	0.709	-	-	-	
Total PCB Concentration	mg/kg	0.1	0.189	0.5	1.3	33	

DDTs						
2,4' - DDD + 4,4' - DDD	mg/kg	-	0.00781	-	-	-
2,4' - DDE + 4,4' - DDE	mg/kg	-	0.37400	-	-	-
2,4' - DDT + 4,4' - DDT	mg/kg	-	0.00477	-	-	-
Total DDT	mg/kg	-	-	0.7	0.7	12
Grain Size Results						
<PHI -4.00 (12.5 mm)	%	-	-	-	-	-
<PHI -3.00 (9.5 mm)	%	-	-	-	-	-
<PHI -2.00 (4.75 mm)	%	-	-	-	-	-
<PHI -1.00 (2.00 mm)	%	-	-	-	-	-
<PHI 0.00 (1.00 mm)	%	-	-	-	-	-
<PHI +1.0 (0.50 mm)	%	-	-	-	-	-
<PHI +2.0 (0.25 mm)	%	-	-	-	-	-
<PHI +3.0 (0.125 mm)	%	-	-	-	-	-
<PHI +4.0 (0.0625 mm)	%	-	-	-	-	-
<PHI +5.0 (0.031 mm)	%	-	-	-	-	-
<PHI +6.0 (0.0156 mm)	%	-	-	-	-	-
<PHI +7.0 (0.0078 mm)	%	-	-	-	-	-
<PHI +8.0 (0.0039 mm)	%	-	-	-	-	-
<PHI +9.0 (0.002 mm)	%	-	-	-	-	-
Gravel	%	-	-	-	-	-
Sand	%	-	-	-	-	-
Silt	%	-	-	-	-	-
Clay	%	-	-	-	-	-
Carbon and Moisture Results						
Total Carbon	g/kg	-	-	-	-	-

Total Organic Carbon	g/kg	-	-	-	-	-
Total Inorganic Carbon	g/kg	-	-	-	-	-
Moisture	%	-	-	-	-	-

Table E.3-1. PAH Results of the Sediment Samples Collected for Black Point Quarry Project

Parameter	Units	Sample Identification and Date			CEPA Ocean Disposal Guidelines - Atlantic Region	CCME Probable Effects Levels, Rev. 2002[1]	CCME Soil Quality Guidelines, Rev. 2008[2]				
							Human Health	Environmental Health			
							Potable Water	Soil Contact		Soil and Food Ingestion	Freshwater Life
		GQ 02	GQ 25	GQ 50			Agricultural, Residential / Parkland, Commercial, and Industrial Land Uses	Agricultural, Residential / Parkland Land Uses	Commercial / Industrial Land Uses	Agricultural, Residential / Parkland Land Uses	Agricultural, Residential / Parkland, Commercial, and Industrial Land Uses
		September 1, 2010				Marine / Estuarine Sediment					
Polycyclic Aromatic Hydrocarbons (PAH) Results											
2-Methylnapthalene	mg/kg	<0.02	<0.02	<0.02	-	0.201	-	-	-	-	-
Acenaphthene	mg/kg	<0.005	<0.005	<0.005	-	0.0889	-	-	-	-	0.28
Acenaphthylene	mg/kg	<0.005	<0.005	<0.005	-	0.128	-	-	-	21.5	320
Anthracene	mg/kg	<0.04	<0.04	<0.04	-	0.245	-	2.5	32	61.5	-
Benz(a)anthracene	mg/kg	<0.01	<0.01	<0.01	-	0.693	0.33	-	-	6.2	-
Benzo(a)pyrene	mg/kg	<0.01	<0.01	<0.01	-	0.763	0.37	20	72	0.6	8800
Benzo(b)fluoranthene	mg/kg	<0.05	<0.05	<0.05	-	-	-	-	-	-	-
Benzo(b+j)fluoranthene	mg/kg	<0.01	<0.01	<0.01	-	-	0.16	-	-	6.2	-
Benzo(g,h,i)perylene	mg/kg	<0.01	<0.01	<0.01	-	-	6.8	-	-	-	-
Benzo(k)fluoranthene	mg/kg	<0.01	<0.01	<0.01	-	-	0.034	-	-	6.2	-
Chrysene	mg/kg	<0.01	<0.01	<0.01	-	0.846	2.1	-	-	6.2	-
Dibenz(a,h)anthracene	mg/kg	<0.006	<0.006	<0.006	-	0.135	0.23	-	-	-	-
Fluoranthene	mg/kg	<0.05	<0.05	<0.05	-	1.494	-	50	180	15.4	-
Fluorene	mg/kg	<0.02	<0.02	<0.02	-	0.144	-	-	-	15.4	0.25
Indeno(1,2,3-cd)pyrene	mg/kg	<0.01	<0.01	<0.01	-	-	2.7	-	-	-	-
Naphthalene	mg/kg	<0.01	<0.01	<0.01	-	0.391	-	-	-	8.8	0.013
Phenanthrene	mg/kg	<0.04	<0.04	<0.04	-	0.544	-	-	-	43.0	0.046
Pyrene	mg/kg	<0.05	<0.05	<0.05	-	1.398	-	-	-	7.7	-
Total PAH[3]	mg/kg	0.168	0.168	0.168	2.5	-	-	-	-	-	-
IACR (Protection of Potable Water)[4]	-	0.225	0.225	0.225	-	-	1	-	-	-	-

[1] denotes Canadian Council of Ministers for the Environment (CCME) Canadian Environmental Quality Guidelines - Sediment Quality Guidelines, revised 2002.

[2] denotes Canadian Council of Ministers for the Environment (CCME) Canadian Environmental Quality Guidelines - Soil Quality Guidelines, revised 2008.

[3] Total PAH calculation based on the sum of 16 PAH compounds (acenapthene, acenapthylene, anthracene, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluorene, fluoranthene, ideno(1,2,3-cd)pyrene, napthalene, phenanthrene, and pyrene) as per guidance from Environment Canada, 2009.

[4] denotes Index of Additive Cancer Risk (IACR) = ([Benz(a)anthracene]/0.33mg/kg) + ([Chrysene]/2.1mg/kg) + ([Benzo(b+j)fluoranthene]/0.16mg/kg) + ([Benzo(k)fluoranthene]/0.034) + ([Benzo(a)pyrene]/0.37mg/kg) + ([Indeno(1,2,3-c,d)pyrene]/2.7mg/kg) + ([Dibenz(a,h)anthracene]/0.23mg/kg) + ([Benzo(g,h,i)perylene]/6.8mg/kg).

[5] denotes Total Potency Equivalent (TPE) SQG based on an incremental lifetime cancer risk (ILCR) of 1 in 100,000 (10^{-5}).

[6] "NA" denotes the Benzo(a)pyrene TPE has not been multiplied by an uncertainty factor (UF) of 3 as results from the lab indicate there is no evidence of creosote in the sample.

NOTE: All results below the laboratory detection limit were divided by 2 prior to further calculations.

Table E.3-2. PAH Results of the Sediment Samples Collected for Black Point Quarry Project, with Application of Benzo(a)pyrene Potency Equivalency Factors

Parameter	Units	Sample Identification and Date			Benzo(a)pyrene Potency Equivalency Factors	CCME Soil Quality Guidelines, Rev. 2008[1]
						Human Health
						Direct Contact
		GQ 02	GQ 25	GQ 50		Agricultural, Residential / Parkland, Commercial, and Industrial Land Uses
		July 22, 2010				
Polycyclic Aromatic Hydrocarbons (PAH) Results (with application of Benzo(a)pyrene Potency Equivalency Factors)						
Benz(a)anthracene	mg/kg	0.000500	0.000500	0.000500	0.1	-
Benzo(a)pyrene	mg/kg	0.005000	0.005000	0.005000	1	-
Benzo(b+j)fluoranthene	mg/kg	0.000500	0.000500	0.000500	0.1	-
Benzo(g,h,i)perylene	mg/kg	0.000050	0.000050	0.000050	0.01	-
Benzo(k)fluoranthene	mg/kg	0.000500	0.000500	0.000500	0.1	-
Chrysene	mg/kg	0.000050	0.000050	0.000050	0.01	-
Dibenz(a,h)anthracene	mg/kg	0.003000	0.003000	0.003000	1	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.000500	0.000500	0.000500	0.1	-
Benzo(a)pyrene TPE (10^{-5})[5]	mg/kg	0.010100	0.010100	0.010100	-	5.3
Benzo(a)pyrene TPE (10^{-5}) with UF[6]	mg/kg	NA	NA	NA		

[1] denotes Canadian Council of Ministers for the Environment (CCME) Canadian Environmental Quality Guidelines - Sediment Quality Guidelines, revised 2002.

[5] denotes Total Potency Equivalent (TPE) SQG based on an incremental lifetime cancer risk (ILCR) of 1 in 100,000 (10^{-5}).

Table E.3-3. Metal Concentrations in the Sediment Samples Collected for Black Point Quarry Project

Metals	Units	Sample Identification and Date			CEPA Ocean Disposal Guidelines-Atlantic Region	CCME Probable Effects Levels, Rev. 2002[1]	CCME Soil Quality Guidelines, Rev. 2008[2]		
		GQ 02	GQ 25	GQ 50			Agricultural	Residential/ Parkland	Commercial/ Industrial
		September 1, 2010				Marine / Estuarine Sediment			
Antimony	mg/kg	<2	<2	<2	-	-	20	20	40
Arsenic	mg/kg	3	<2	3	-	41.6	12	12	12
Barium	mg/kg	18	6	<5	-	-	750	500	2000
Beryllium	mg/kg	<2	<2	<2	-	-	4	4	8
Cadmium	mg/kg	<0.3	<0.3	<0.3	0.6	4.2	1.4	10	22
Chromium +6	mg/kg	<0.5	<0.5	<0.5	-	-	0.4	0.4	1.4
Chromium (Total)	mg/kg	10	11	11	-	160	64	64	87
Cobalt	mg/kg	3	3	3	-	-	40	50	300
Copper	mg/kg	4	4	4	81*	108	63	63	91
Lead	mg/kg	5.5	3.1	3	66*	112	70	140	260 / 600
Mercury	mg/kg	<0.05	<0.05	<0.05	0.75	0.7	6.6	6.6	24 / 50
Molybdenum	mg/kg	<2	<2	<2	-	-	5	10	40
Nickel	mg/kg	9	10	10	-	-	50	50	50
Selenium	mg/kg	<1	<1	<1	-	-	1	1	2.9
Silver	mg/kg	<0.5	<0.5	<0.5	-	-	20	20	40
Thallium	mg/kg	<0.1	<0.1	<0.1	-	-	1	1	1
Tin	mg/kg	<2	<2	<2	-	-	5	50	300
Uranium	mg/kg	0.6	0.5	0.3			23	23	33 / 300
Vanadium	mg/kg	12	12	12	-	-	130	130	130
Zinc	mg/kg	29	25	20	160*	271	200	200	360

*Former Interim Rejection Limits (1991) which are not currently used to screen for ocean based disposal permitting but may be considered in terms of further investigation prior to issuance of an Ocean Disposal Permit (Victor Li, Environment Canada, pers. comm., June 2002).

[1] denotes Canadian Council of Ministers for the Environment (CCME) Canadian Environmental Quality Guidelines - Sediment Quality Guidelines, revised 2002.

[2] denotes Canadian Council of Ministers for the Environment (CCME) Canadian Environmental Quality Guidelines - Soil Quality Guidelines, revised 2008.

Table E.3-4. Results Table for BTEX Compounds (mg/kg) and Individual TPH Carbon Segments (mg/kg) in the Sediment Samples Collected for Black Point Quarry Project

Sample Identification	Date	Benzene	Toluene	Ethylbenzene	Xylene (Total)	C_6-C_{10} Less BTEX	C_{10}-C_{16}	C_{16}-C_{21}	C_{21}-C_{32}	C_6-C_{10} Less BTEX	Modified TPH	Resemblance*
GQ 02	Sept 1, 2010	<0.005	<0.04	<0.01	<0.05	<3	<15	<15	<15	<3	<20	No resemblance to fuel products.
GQ 25		<0.005	<0.04	<0.01	<0.05	<3	<15	<15	<15	<3	<20	No resemblance to fuel products.
GQ 50		<0.005	<0.04	<0.01	<0.05	<3	<15	<15	<15	<3	<20	No resemblance to fuel products.

Atlantic RBCA Version 2.0 and CCME SQGs for Comparison with the Above Analytical Results (mg/kg)

Atlantic RBCA Tier I Risk-Based Screening Levels**			Benzene	Toluene	Ethylbenzene	Xylenes	Gasoline	Diesel #2	#6 Oil
Residential	Potable	Coarse-grained	0.03	0.38	0.08	11	39	140	690
		Fine-grained	0.01	0.08	0.02	2.3	140	220	970
	Non-Potable	Coarse-grained	0.16	14	58	17	39	140	690
		Fine-grained	1.5	120	430	160	330	4,400	8,300
Commercial	Potable	Coarse-grained	0.03	0.38	0.08	11	450	7,400	10,000
		Fine-grained	0.01	0.08	0.02	2.3	520	840	4,700
	Non-Potable	Coarse-grained	1.8	160	430	200	450	7,400	10,000
		Fine-grained	11	680	430	650	10,000	7,700	10,000
CCME SQGs for Surface Soils* **									
Agricultural		Coarse-grained	0.03[1] (0.0095[2])	0.37	0.082	11.0	-	-	-
		Fine-grained	0.0068[1,2]	0.08	0.018	2.4	-	-	-
Residential/Parkland		Coarse-grained	0.03[1] (0.0095[2])	0.37	0.082	11.0	-	-	-
		Fine-grained	0.0068[1,2]	0.08	0.018	2.4	-	-	-
Commercial		Coarse-grained	0.03[1,2]	0.37	0.082	11.0	-	-	-
		Fine-grained	0.0068[1,2]	0.08	0.018	2.4	-	-	-
Industrial		Coarse-grained	0.03[1,2]	0.37	0.082	11.0	-	-	-
		Fine-grained	0.0068[1,2]	0.08	0.018	2.4	-	-	-

*Modified TPH values reflect the sum of the individual carbon fractions that resembles gasoline, diesel #2, and lube oil. No guideline comparison required as results indicate no resemblance to fuel products observed in the samples.

**Atlantic RBCA Version 2.0 Reference Document for Petroleum Impacted Sites (2003, updated March 2007).

***A Protocol for the Derivation of Environmental and Human Health Soil Quality Guidelines. Report CCME-EPC-101E, March 1997 with updates to 2004.

"-" denotes no guideline available.

1 denotes guideline value based on "10-5 Incremental Risk". For the purposes of this report, an incremental risk of 10-5 is used.

2 denotes guideline value based on "10-6 Incremental Risk".

Table E.3-5. Analytical Results of the Sediment Samples Collected for Black Point Quarry Project

Parameter	Units	Sample Identification and Date			CEPA Ocean Disposal Guidelines- Atlantic Region	CCME Probable Effects Levels, Rev. 2002[1] Marine / Estuarine Sediment	CCME Soil Quality Guidelines, Rev. 2008[2]		
		GQ 02	GQ 25	GQ 50			Agricultural	Residential / Parkland	Commercial / Industrial
		September 1, 2010							
Polychlorinated Biphenyl (PCB) Results*									
Aroclor 1254	mg/kg	<0.1	<1.0	<1.0	-	0.709	-	-	-
Total PCB Concentration	mg/kg	<0.05	<0.5	<0.5	0.1	0.189	0.5	1.3	33
Dichloro-Diphenyl-Trichloroethane (DDT) Results*									
2,4' - DDD + 4,4' - DDD	mg/kg	<0.0015	<0.015	<0.015	-	0.00781	-	-	-
2,4' - DDE + 4,4' - DDE	mg/kg	<0.001	<0.010	<0.010	-	0.37400	-	-	-
2,4' - DDT + 4,4' - DDT	mg/kg	<0.001	<0.010	<0.010	-	0.00477	-	-	-
Total DDT	mg/kg	<0.0035	<0.035	<0.035	-	-	0.7	0.7	12
Grain Size Results									
<PHI -4.00 (12.5 mm)	%	100	100	100	-	-	-	-	-
<PHI -3.00 (9.5 mm)	%	87.3	86.3	100	-	-	-	-	-
<PHI -2.00 (4.75 mm)	%	53.4	46.6	34.3	-	-	-	-	-
<PHI -1.00 (2.00 mm)	%	48.9	23.6	17.6	-	-	-	-	-
<PHI 0.00 (1.00 mm)	%	45.9	16.5	13	-	-	-	-	-
<PHI +1.0 (0.50 mm)	%	40.5	11.1	7.6	-	-	-	-	-
<PHI +2.0 (0.25 mm)	%	28	7	3.6	-	-	-	-	-
<PHI +3.0 (0.125 mm)	%	12	5.3	2.3	-	-	-	-	-
<PHI +4.0 (0.0625 mm)	%	7.3	4.4	1.9	-	-	-	-	-
<PHI +5.0 (0.031 mm)	%	6.4	3.4	1.8	-	-	-	-	-
<PHI +6.0 (0.0156 mm)	%	5.1	2.5	1.2	-	-	-	-	-
<PHI +7.0 (0.0078 mm)	%	3.3	1.4	0.9	-	-	-	-	-
<PHI +8.0 (0.0039 mm)	%	2.8	1.2	0.6	-	-	-	-	-
<PHI +9.0 (0.002 mm)	%	1.9	0.6	<0.1	-	-	-	-	-
Gravel	%	51	76	82	-	-	-	-	-
Sand	%	42	19	16	-	-	-	-	-
Silt	%	5	3	1	-	-	-	-	-
Clay	%	3	1	<1	-	-	-	-	-
Carbon and Moisture Results									
Total Carbon	g/kg	1.62	0.60	1.10	-	-	-	-	-
Total Organic Carbon	g/kg	0.17	0.25	0.55	-	-	-	-	-
Total Inorganic Carbon	g/kg	1.45	0.35	0.55	-	-	-	-	-
Moisture	%	17	14	13	-	-	-	-	-

[1] denotes Canadian Council of Ministers for the Environment (CCME) Canadian Environmental Quality Guidelines - Sediment Quality Guidelines, revised 2002.

[2] denotes Canadian Council of Ministers for the Environment (CCME) Canadian Environmental Quality Guidelines - Soil Quality Guidelines, revised 2008.

*Standard laboratory detection limits were increased for samples GQ 25 and GQ 50 due to chromatographic interference.

NOTE: All results below the laboratory detection limit were divided by 2 prior to further calculations.

ATTACHMENT E
AGAT QA/QC Forms for Marine Sediment and Samples

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

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CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL
580 MAIN STREET, SUITE 105
SAINT JOHN, NB E2K1J5

ATTENTION TO: CHYANN KIRBY

PROJECT NO: GRQ - Marine

AGAT WORK ORDER: 10X432562

SOIL ANALYSIS REVIEWED BY: Jason Coughtrey, Inorganic Supervisor

TRACE ORGANICS REVIEWED BY: Kelly Hogue, Senior Organic Chemist

DATE REPORTED: Sep 15, 2010

PAGES (INCLUDING COVER): 16

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (902) 468-8718, or at 1-888-468-8718

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

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Western Enviro-Agricultural Laboratory Association (WEALA)
Environmental Services Association of Alberta (ESAA)

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Results relate only to the items tested

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Certificate of Analysis

AGAT WORK ORDER: 10X432562

PROJECT NO: GRQ - Marine

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: CHYANN KIRBY

Available Metals in Soil

DATE SAMPLED: Sep 01, 2010 | DATE RECEIVED: Sep 02, 2010 | DATE REPORTED: Sep 15, 2010 | SAMPLE TYPE: Soil

Parameter	Unit	G / S	RDL	GQ 02 1971606	GQ 25 1971621	GQ 50 1971639
Aluminum	mg/kg		10	5550	4760	4300
Antimony	mg/kg		2	<2	<2	<2
Arsenic	mg/kg		2	3	<2	3
Barium	mg/kg		5	18	6	<5
Beryllium	mg/kg		2	<2	<2	<2
Boron	mg/kg		5	<5	<5	<5
Cadmium	mg/kg		0.3	<0.3	<0.3	<0.3
Chromium	mg/kg		2	10	11	11
Cobalt	mg/kg		1	3	3	3
Copper	mg/kg		2	4	4	4
Iron	mg/kg		50	14100	12100	11600
Lead	mg/kg		0.5	5.5	3.1	2.9
Manganese	mg/kg		2	413	267	213
Molybdenum	mg/kg		2	<2	<2	<2
Nickel	mg/kg		2	9	10	10
Selenium	mg/kg		1	<1	<1	<1
Silver	mg/kg		0.5	<0.5	<0.5	<0.5
Strontium	mg/kg		5	60	69	155
Thallium	mg/kg		0.1	<0.1	<0.1	<0.1
Tin	mg/kg		2	<2	<2	<2
Uranium	mg/kg		0.1	0.6	0.5	0.3
Vanadium	mg/kg		2	12	12	12
Zinc	mg/kg		5	29	25	20

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

1971606-1971639 Results are based on the dry weight of the sample.

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Results relate only to the items tested

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AGAT WORK ORDER: 10X432562

PROJECT NO: GRQ - Marine

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: CHYANN KIRBY

Grain Size Analysis (Sieve & Pipette)

DATE SAMPLED: Sep 01, 2010 | DATE RECEIVED: Sep 02, 2010 | DATE REPORTED: Sep 15, 2010 | SAMPLE TYPE: Soil

Parameter	Unit	G / S	RDL	GQ 02 1971606	GQ 25 1971621	GQ 50 1971639
Particle Size Distribution (<12.5mm, -4 PHI)	%		0.1	100.0	100.0	100.0
Particle Size Distribution (<9.5mm, -3 PHI)	%		0.1	87.3	86.3	100.0
Particle Size Distribution (<4.75mm, -2 PHI	%		0.1	53.4	46.6	34.3
Particle Size Distribution (<2mm, -1 PHI)	%		0.1	48.9	23.6	17.6
Particle Size Distribution (<1mm, 0 PHI)	%		0.1	45.9	16.5	13.0
Particle Size Distribution (<1/2mm, 1 PHI)	%		0.1	40.5	11.1	7.6
Particle Size Distribution (<1/4mm, 2 PHI)	%		0.1	28.0	7.0	3.6
Particle Size Distribution (<1/8mm, 3 PHI)	%		0.1	12.0	5.3	2.3
Particle Size Distribution (<1/16mm, 4 PHI)	%		0.1	7.3	4.4	1.9
Particle Size Distribution (<1/32mm, 5 PHI)	%		0.1	6.4	3.4	1.8
Particle Size Distribution (<1/64mm, 6 PHI)	%		0.1	5.1	2.5	1.2
Particle Size Distribution (<1/128mm, 7 PHI)	%		0.1	3.3	1.4	0.9
Particle Size Distribution (<1/256mm, 8 PHI)	%		0.1	2.8	1.2	0.6
Particle Size Distribution (<1/512mm, 9 PHI)	%		0.1	1.9	0.6	<0.1
Particle Size Distribution (Gravel)	%		1	51	76	82
Particle Size Distribution (Sand)	%		1	42	19	16
Particle Size Distribution (Silt)	%		1	5	3	1
Particle Size Distribution (Clay)	%		1	3	1	<1
Particles >75um	%		1	92	95	98
Classification	Coarse/Fine			Coarse	Coarse	Coarse

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

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C 1340-1858

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AGAT WORK ORDER: 10X432562

PROJECT NO: GRQ - Marine

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: CHYANN KIRBY

Mercury and Hexavalent Chromium Analysis in Soil

DATE SAMPLED: Sep 01, 2010 | DATE RECEIVED: Sep 02, 2010 | DATE REPORTED: Sep 15, 2010 | SAMPLE TYPE: Soil

Parameter	Unit	G / S	RDL	GQ 02 1971606	GQ 25 1971621	GQ 50 1971639
Mercury	mg/kg		0.05	<0.05	<0.05	<0.05
Chromium, Hexavalent	mg/kg		0.5	<0.5	<0.5	<0.5

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

1971606-1971639 Results are based on the dry weight of the soil.

Certified By:

Results relate only to the items tested

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AGAT WORK ORDER: 10X432562

PROJECT NO: GRQ - Marine

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: CHYANN KIRBY

Soil Analysis - Total Organic Carbon (W-B Wet Oxidation)

DATE SAMPLED: Sep 01, 2010 | DATE RECEIVED: Sep 02, 2010 | DATE REPORTED: Sep 15, 2010 | SAMPLE TYPE: Soil

Parameter	Unit	G / S	RDL	GQ 02 1971606	GQ 25 1971621	GQ 50 1971639
Total Organic Carbon	%		0.15	0.17	0.25	0.55
Total Inorganic Carbon	%		0.01	1.45	0.35	0.55

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

Results relate only to the items tested

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AGAT WORK ORDER: 10X432562

PROJECT NO: GRQ - Marine

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: CHYANN KIRBY

Atlantic RBCA Tier 1 Hydrocarbons in Soil - Low Level HC (Version 3.0)

DATE SAMPLED: Sep 01, 2010 | DATE RECEIVED: Sep 02, 2010 | DATE REPORTED: Sep 15, 2010 | SAMPLE TYPE: Soil

Parameter	Unit	G / S	RDL	GQ 02 1971606	GQ 25 1971621	GQ 50 1971639
Benzene	mg/kg		0.005	<0.005	<0.005	<0.005
Ethylbenzene	mg/kg		0.01	<0.01	<0.01	<0.01
Toluene	mg/kg		0.04	<0.04	<0.04	<0.04
Xylene (Total)	mg/kg		0.05	<0.05	<0.05	<0.05
C6-C10 (less BTEX)	mg/kg		3	<3	<3	<3
>C10-C16 Hydrocarbons	mg/kg		15	<15	<15	<15
>C16-C21 Hydrocarbons	mg/kg		15	<15	<15	<15
>C21-C32 Hydrocarbons	mg/kg		15	<15	<15	<15
Modified TPH (Tier 1)	mg/kg		20	<20	<20	<20
Return to Baseline at C32				Y	Y	Y
% Moisture	%		1	17	14	13
Surrogate	**Unit**	**Acceptable Limits**				
Isobutylbenzene - EPH	%	60-140		99	92	95
Isobutylbenzene - VPH	%	60-140		113	112	111
n-Dotriacontane - EPH	%	60-140		112	94	102

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

1971606-1971639 Results are based on the dry weight of the soil.
Resemblance: No resemblance.

Certified By: Kelly Hogue

Results relate only to the items tested

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AGAT WORK ORDER: 10X432562

PROJECT NO: GRQ - Marine

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: CHYANN KIRBY

OC Pesticides and PCBs in Soil

DATE SAMPLED: Sep 01, 2010 | DATE RECEIVED: Sep 02, 2010 | DATE REPORTED: Sep 15, 2010 | SAMPLE TYPE: Soil

Parameter	Unit	G / S	RDL	GQ 02 1971606	RDL	GQ 25 1971621	GQ 50 1971639
alpha-BHC	mg/Kg		0.005	<0.005	0.050	<0.050	<0.050
beta-BHC	mg/Kg		0.005	<0.005	0.050	<0.050	<0.050
Gamma-BHC (Lindane)	mg/Kg		0.0003	<0.0003	0.0030	<0.0030	<0.0030
delta-BHC	mg/Kg		0.005	<0.005	0.050	<0.050	<0.050
Heptachlor	mg/Kg		0.005	<0.005	0.050	<0.050	<0.050
Aldrin	mg/Kg		0.005	<0.005	0.050	<0.050	<0.050
Heptachlor Epoxide	mg/Kg		0.0006	<0.0006	0.0060	<0.0060	<0.0060
Alpha-Chlordane	mg/Kg		0.002	<0.002	0.020	<0.020	<0.020
Gamma-Chlordane	mg/Kg		0.002	<0.002	0.020	<0.020	<0.020
Endosulfan I	mg/Kg		0.005	<0.005	0.050	<0.050	<0.050
Endosulfan II	mg/Kg		0.005	<0.005	0.050	<0.050	<0.050
Endosulfan Sulfate	mg/Kg		0.005	<0.005	0.050	<0.050	<0.050
Dieldrin	mg/Kg		0.0007	<0.0007	0.0070	<0.0070	<0.0070
p,p'-DDE	mg/Kg		0.001	<0.001	0.010	<0.010	<0.010
o,p'-DDE	mg/Kg		0.001	<0.001	0.010	<0.010	<0.010
Endrin	mg/Kg		0.002	<0.002	0.020	<0.020	<0.020
DDD (o,p')	mg/Kg		0.002	<0.002	0.020	<0.020	<0.020
p,p'-DDD	mg/Kg		0.001	<0.001	0.010	<0.010	<0.010
p,p'- DDT	mg/Kg		0.001	<0.001	0.010	<0.010	<0.010
o,p'-DDT	mg/Kg		0.001	<0.001	0.010	<0.010	<0.010
Endrin Aldehyde	mg/Kg		0.005	<0.005	0.050	<0.050	<0.050
Endrin ketone	mg/Kg		0.005	<0.005	0.050	<0.050	<0.050
Methoxychlor	mg/Kg		0.005	<0.005	0.050	<0.050	<0.050
Mirex	mg/Kg		0.005	<0.005	0.050	<0.050	<0.050
Hexachlorobenzene	mg/Kg		0.05	<0.05	0.50	<0.50	<0.50
PCBs	mg/Kg		0.05	<0.05	0.50	<0.50	<0.50
Aroclor 1254	mg/Kg		0.1	<0.1	1.0	<1.0	<1.0
Surrogate	Unit	Acceptable Limits					
Decachlorobiphenyl	%	50-130		100		89	101

Certified By: Kelly Hogue

Results relate only to the items tested

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AGAT WORK ORDER: 10X432562
PROJECT NO: GRQ - Marine

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: CHYANN KIRBY

OC Pesticides and PCBs in Soil

DATE SAMPLED: Sep 01, 2010	DATE RECEIVED: Sep 02, 2010	DATE REPORTED: Sep 15, 2010	SAMPLE TYPE: Soil

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

1971606 Results are based on the dry weight of the soil.
Due to the high moisture content the sample was air dried prior to extraction.

1971621-1971639 Results are based on the dry weight of the soil.
Due to the high moisture content the sample was air dried prior to extraction.
Sample was diluted and Reporting Detection Limit raised due to chromatographic interference.

Certified By: Kelly Hogue

Results relate only to the items tested

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PROJECT NO: GRQ - Marine

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: CHYANN KIRBY

Polycyclic Aromatic Hydrocarbons in Soil (CCME)

DATE SAMPLED: Sep 01, 2010 | DATE RECEIVED: Sep 02, 2010 | DATE REPORTED: Sep 15, 2010 | SAMPLE TYPE: Soil

Parameter	Unit	G / S	RDL	GQ 02 1971606	GQ 25 1971621	GQ 50 1971639
1-Methylnaphthalene	mg/kg		0.05	<0.05	<0.05	<0.05
2-Methylnaphthalene	mg/kg		0.02	<0.02	<0.02	<0.02
Acenaphthene	mg/kg		0.005	<0.005	<0.005	<0.005
Acenaphthylene	mg/kg		0.005	<0.005	<0.005	<0.005
Acridine	mg/Kg		0.05	<0.05	<0.05	<0.05
Anthracene	mg/kg		0.04	<0.04	<0.04	<0.04
Benzo(a)anthracene	mg/kg		0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene	mg/kg		0.01	<0.01	<0.01	<0.01
Benzo(b)fluoranthene	mg/kg		0.05	<0.05	<0.05	<0.05
Benzo(b+j)fluoranthene	mg/kg		0.01	<0.01	<0.01	<0.01
Benzo(e)pyrene	mg/kg		0.05	<0.05	<0.05	<0.05
Benzo(ghi)perylene	mg/kg		0.01	<0.01	<0.01	<0.01
Benzo(k)fluoranthene	mg/kg		0.01	<0.01	<0.01	<0.01
Chrysene	mg/kg		0.01	<0.01	<0.01	<0.01
Dibenzo(a,h)anthracene	mg/kg		0.006	<0.006	<0.006	<0.006
Fluoranthene	mg/kg		0.05	<0.05	<0.05	<0.05
Fluorene	mg/kg		0.02	<0.02	<0.02	<0.02
Indeno(1,2,3)pyrene	mg/kg		0.01	<0.01	<0.01	<0.01
Naphthalene	mg/kg		0.01	<0.01	<0.01	<0.01
Perylene	mg/kg		0.05	<0.05	<0.05	<0.05
Phenanthrene	mg/kg		0.04	<0.04	<0.04	<0.04
Pyrene	mg/kg		0.05	<0.05	<0.05	<0.05
Quinoline	mg/Kg		0.05	<0.05	<0.05	<0.05
% Moisture	%			17	14	13
Surrogate	**Unit**	**Acceptable Limits**				
Nitrobenzene-d5	%	50-140		101	113	106
2-Fluorobiphenyl	%	50-140		85	90	83
Terphenyl-d14	%	50-140		94	101	93

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

1971606-1971639 Results are based on the dry weight of the soil.

Certified By: Kelly Hogue

Results relate only to the items tested

AGAT Laboratories

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Quality Assurance

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

AGAT WORK ORDER: 10X432562

PROJECT NO: GRQ - Marine

ATTENTION TO: CHYANN KIRBY

Soil Analysis

RPT Date: Sep 15, 2010			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Available Metals in Soil															
Aluminum	90920	1964787	4770	5070	6.1%	< 10	101%	90%	110%	96%	90%	110%	106%	70%	130%
Antimony	90920	1964787	< 2	< 2	0.0%	< 2	100%	90%	110%	99%	90%	110%	86%	70%	130%
Arsenic	90920	1964787	7	8	13.3%	< 2	97%	90%	110%	96%	90%	110%	111%	70%	130%
Barium	90920	1964787	18	18	0.0%	< 5	96%	90%	110%	103%	90%	110%	107%	70%	130%
Beryllium	90920	1964787	< 2	< 2	0.0%	< 2	99%	90%	110%	102%	90%	110%	99%	70%	130%
Boron	90920	1964787	16	20	22.2%	< 5	102%	90%	110%	91%	90%	110%	88%	70%	130%
Cadmium	90920	1964787	0.8	0.8	0.0%	< 0.3	98%	90%	110%	102%	90%	110%	103%	70%	130%
Chromium	90920	1964787	11	12	8.7%	< 2	104%	90%	110%	108%	90%	110%	97%	70%	130%
Cobalt	90920	1964787	3	4	28.6%	< 1	108%	90%	110%	104%	90%	110%	92%	70%	130%
Copper	90920	1964787	36	42	15.4%	< 2	107%	90%	110%	103%	90%	110%	91%	70%	130%
Iron	90920	1964787	12500	16400	27.0%	< 50	105%	90%	110%	104%	90%	110%	99%	70%	130%
Lead	90920	1964787	749	624	18.2%	< 0.5	99%	90%	110%	102%	90%	110%	102%	70%	130%
Manganese	90920	1964787	813	763	6.3%	< 2	108%	90%	110%	108%	90%	110%	106%	70%	130%
Molybdenum	90920	1964787	< 2	< 2	0.0%	< 2	98%	90%	110%	87%	80%	120%	94%	70%	130%
Nickel	90920	1964787	9	11	20.0%	< 2	108%	90%	110%	109%	90%	110%	95%	70%	130%
Selenium	90920	1964787	< 1	< 1	0.0%	< 1	101%	90%	110%	97%	90%	110%	99%	70%	130%
Silver	90920	1964787	< 0.5	< 0.5	0.0%	< 0.5	100%	90%	110%	88%	80%	120%	101%	70%	130%
Strontium	90920	1964787	16	15	6.5%	< 5	96%	90%	110%	98%	90%	110%	105%	70%	130%
Thallium	90920	1964787	0.1	0.1	0.0%	< 0.1	100%	90%	110%	103%	90%	110%	104%	70%	130%
Tin	90920	1964787	13	15	14.3%	< 2	95%	90%	110%	100%	90%	110%	97%	70%	130%
Uranium	90920	1964787	1.0	1.0	0.0%	< 0.1	95%	90%	110%	104%	90%	110%	117%	70%	130%
Vanadium	90920	1964787	11	12	8.7%	< 2	99%	90%	110%	102%	90%	110%	97%	70%	130%
Zinc	90920	1964781	33	32	3.1%	< 5	109%	90%	110%	110%	90%	110%	98%	70%	130%
Mercury and Hexavalent Chromium Analysis in Soil															
Mercury	1	1971606	<0.05	<0.05	0.0%	< 0.05	113%	70%	130%		70%	130%	93%	70%	130%
Chromium, Hexavalent	1	1965291	<0.5	<0.5	0.0%	< 0.5	96%	80%	120%	93%	80%	120%		80%	120%
Soil Analysis - Total Organic Carbon (W-B Wet Oxidation)															
Total Organic Carbon	6159	1606	0.17	0.15	12.5%	< 0.15	100%	90%	110%				106%	90%	110%

Certified By:

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Quality Assurance

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

AGAT WORK ORDER: 10X432562

PROJECT NO: GRQ - Marine

ATTENTION TO: CHYANN KIRBY

Trace Organics Analysis

RPT Date: Sep 15, 2010			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Atlantic RBCA Tier 1 Hydrocarbons in Soil - Low Level HC (Version 3.0)															
Benzene	1	1971639	< 0.005	<0.005	0.0%	< 0.005	87%	60%	140%	76%	60%	140%	92%	30%	130%
Ethylbenzene	1	1971639	< 0.01	<0.01	0.0%	< 0.01	83%	60%	140%	83%	60%	140%	95%	30%	130%
Toluene	1	1971639	< 0.04	< 0.04	0.0%	< 0.04	83%	60%	140%	80%	60%	140%	94%	30%	130%
Xylene (Total)	1	1971639	< 0.05	< 0.05	0.0%	< 0.05	85%	60%	140%	85%	60%	140%	96%	30%	130%
C6-C10 (less BTEX)	1	1971639	< 3	< 3	0.0%	< 3	94%	60%	140%	88%	60%	140%	74%	30%	130%
>C10-C16 Hydrocarbons	1		<15	<15	0.0%	< 15	101%	70%	130%	102%	60%	140%	122%	30%	130%
>C16-C21 Hydrocarbons	1		<15	<15	0.0%	< 15	87%	70%	130%	102%	60%	140%	122%	30%	130%
>C21-C32 Hydrocarbons	1		<15	<15	0.0%	< 15	86%	60%	140%	102%	60%	140%	122%	30%	130%
Polycyclic Aromatic Hydrocarbons in Soil (CCME)															
1-Methylnaphthalene	1	1971621	< 0.05	< 0.05	0.0%	< 0.05	76%	50%	140%	83%	50%	140%	78%	50%	140%
2-Methylnaphthalene	1	1971621	< 0.02	< 0.02	0.0%	< 0.02	102%	50%	140%	84%	50%	140%	75%	50%	140%
Acenaphthene	1	1971621	< 0.005	< 0.005	0.0%	< 0.005	103%	50%	140%	97%	50%	140%	96%	50%	140%
Acenaphthylene	1	1971621	< 0.005	< 0.005	0.0%	< 0.005	104%	50%	140%	91%	50%	140%	93%	50%	140%
Acridine	1	1971621	< 0.05	< 0.05	0.0%	< 0.05	118%	50%	140%	68%	50%	140%	70%	50%	140%
Anthracene	1	1971621	< 0.04	< 0.04	0.0%	< 0.04	90%	50%	140%	84%	50%	140%	82%	50%	140%
Benzo(a)anthracene	1	1971621	< 0.01	< 0.01	0.0%	< 0.01	93%	50%	140%	82%	50%	140%	79%	50%	140%
Benzo(a)pyrene	1	1971621	< 0.01	< 0.01	0.0%	< 0.01	94%	50%	140%	109%	50%	140%	83%	50%	140%
Benzo(b)fluoranthene	1	1971621	< 0.05	< 0.05	0.0%	< 0.05	79%	50%	140%	80%	50%	140%	96%	50%	140%
Benzo(b+j)fluoranthene	1	1971621	< 0.01	< 0.01	0.0%	< 0.01	87%	50%	140%	87%	50%	140%	91%	50%	140%
Benzo(e)pyrene	1	1971621	< 0.05	< 0.05	0.0%	< 0.05	113%	50%	140%	66%	50%	140%	64%	50%	140%
Benzo(ghi)perylene	1	1971621	< 0.01	< 0.01	0.0%	< 0.01	115%	50%	140%	107%	50%	140%	105%	50%	140%
Benzo(k)fluoranthene	1	1971621	< 0.01	< 0.01	0.0%	< 0.01	102%	50%	140%	69%	50%	140%	112%	50%	140%
Chrysene	1	1971621	< 0.01	< 0.01	0.0%	< 0.01	92%	50%	140%	117%	50%	140%	87%	50%	140%
Dibenzo(a,h)anthracene	1	1971621	< 0.006	< 0.006	0.0%	< 0.006	106%	50%	140%	96%	50%	140%	95%	50%	140%
Fluoranthene	1	1971621	< 0.05	< 0.05	0.0%	< 0.05	96%	50%	140%	86%	50%	140%	87%	50%	140%
Fluorene	1	1971621	< 0.02	< 0.02	0.0%	< 0.02	106%	50%	140%	101%	50%	140%	103%	50%	140%
Indeno(1,2,3)pyrene	1	1971621	< 0.01	< 0.01	0.0%	< 0.01	114%	50%	140%	108%	50%	140%	81%	50%	140%
Naphthalene	1	1971621	< 0.01	< 0.01	0.0%	< 0.01	107%	50%	140%	104%	50%	140%	96%	50%	140%
Perylene	1	1971621	< 0.05	< 0.05	0.0%	< 0.05	85%	50%	140%	80%	50%	140%	76%	50%	140%
Phenanthrene	1	1971621	< 0.04	< 0.04	0.0%	< 0.04	110%	50%	140%	87%	50%	140%	87%	50%	140%
Pyrene	1	1971621	< 0.05	< 0.05	0.0%	< 0.05	105%	50%	140%	92%	50%	140%	86%	50%	140%
Quinoline	1	1971621	< 0.05	< 0.05	0.0%	< 0.05	87%	50%	140%	105%	50%	140%	85%	50%	140%
OC Pesticides and PCBs in Soil															
alpha-BHC	1		< 0.050	< 0.050	0.0%	< 0.050	101%	60%	140%	102%	60%	140%	102%	60%	140%
beta-BHC	1		< 0.050	< 0.050	0.0%	< 0.050	96%	90%	110%	90%	80%	120%	112%	80%	120%
Gamma-BHC (Lindane)	1		< 0.0030	< 0.0030	0.0%	< 0.0030	98%	60%	140%	91%	60%	140%	114%	60%	140%
delta-BHC	1		< 0.050	< 0.050	0.0%	< 0.050	104%	80%	120%	85%	80%	120%	112%	80%	120%
Heptachlor	1		< 0.050	< 0.050	0.0%	< 0.050	102%	60%	140%	82%	60%	140%	96%	60%	140%

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Quality Assurance

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

AGAT WORK ORDER: 10X432562

PROJECT NO: GRQ - Marine

ATTENTION TO: CHYANN KIRBY

Trace Organics Analysis (Continued)

RPT Date: Sep 15, 2010			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Aldrin	1		< 0.050	< 0.050	0.0%	< 0.050	97%	60%	140%	97%	60%	140%	97%	60%	140%
Heptachlor Epoxide	1		< 0.0060	< 0.0060	0.0%	< 0.0060	98%	60%	140%	89%	60%	140%	112%	60%	140%
Alpha-Chlordane	1		< 0.020	< 0.020	0.0%	< 0.020	104%	60%	140%	90%	60%	140%	114%	60%	140%
Gamma-Chlordane	1		< 0.020	< 0.020	0.0%	< 0.020	96%	60%	140%	104%	60%	140%	97%	60%	140%
Endosulfan I	1		< 0.050	< 0.050	0.0%	< 0.050	98%	90%	110%	102%	90%	110%	96%	80%	120%
Endosulfan II	1		< 0.050	< 0.050	0.0%	< 0.050	104%	60%	140%	90%	60%	140%	97%	60%	140%
Endosulfan Sulfate	1		< 0.050	< 0.050	0.0%	< 0.050	104%	80%	120%	86%	80%	120%	114%	80%	120%
Dieldrin	1		< 0.0070	< 0.0070	0.0%	< 0.0070	97%	60%	140%	85%	60%	140%	114%	60%	140%
p,p'-DDE	1		< 0.010	< 0.010	0.0%	< 0.010	96%	60%	140%	97%	60%	140%	120%	60%	140%
o,p'-DDE	1		< 0.010	< 0.010	0.0%	< 0.010	120%	60%	140%	92%	60%	140%	114%	60%	140%
Endrin	1		< 0.020	< 0.020	0.0%	< 0.020	112%	60%	140%	91%	60%	140%	98%	60%	140%
DDD (o,p')	1		< 0.020	< 0.020	0.0%	< 0.020	102%	90%	110%	90%	90%	110%	96%	60%	140%
p,p'-DDD	1		< 0.010	< 0.010	0.0%	< 0.010	97%	60%	140%	87%	60%	140%	97%	60%	140%
p,p'- DDT	1		< 0.010	< 0.010	0.0%	< 0.010	97%	60%	130%	90%	60%	130%	96%	60%	130%
o,p'-DDT	1		< 0.010	< 0.010	0.0%	< 0.010	96%	60%	140%	85%	60%	140%	112%	60%	140%
Endrin Aldehyde	1		< 0.050	< 0.050	0.0%	< 0.050	104%	80%	120%	87%	80%	120%	114%	80%	120%
Endrin ketone	1		< 0.050	< 0.050	0.0%	< 0.050	102%	80%	120%	90%	80%	120%	120%	80%	120%
Methoxychlor	1		< 0.050	< 0.050	0.0%	< 0.050	96%	60%	140%	91%	60%	140%	120%	60%	140%
Mirex	1		< 0.050	< 0.050	0.0%	< 0.050	97%	70%	130%	92%	70%	130%	104%	70%	130%
Hexachlorobenzene	1		< 0.50	< 0.50	0.0%	< 0.50	104%	60%	140%	90%	60%	140%	102%	60%	140%
PCBs	1		< 0.50	< 0.50	0.0%	< 0.50	96%	60%	140%	112%	60%	140%		60%	140%

Certified By: Kelly Hogue

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Method Summary

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

AGAT WORK ORDER: 10X432562

PROJECT NO: GRQ - Marine

ATTENTION TO: CHYANN KIRBY

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Aluminum	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Antimony	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Arsenic	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Barium	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Beryllium	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Boron	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Cadmium	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Chromium	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Cobalt	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Copper	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Iron	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Lead	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP-MS
Manganese	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Molybdenum	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Nickel	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Selenium	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Silver	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Strontium	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Thallium	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Tin	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Uranium	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Vanadium	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Zinc	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Particle Size Distribution (<12.5mm, -4 PHI)	INOR-121-6034	ASTM D-422-63 & ODCA, 1976	SIEVE & PIPETTE
Particle Size Distribution (<9.5mm, -3 PHI)	INOR-121-6034	ASTM D-422-63 & ODCA, 1976	SIEVE & PIPETTE
Particle Size Distribution (<4.75mm, -2 PHI	INOR-121-6034	ASTM D-422-63 & ODCA, 1976	SIEVE & PIPETTE
Particle Size Distribution (<2mm, -1 PHI)	INOR-121-6034	ASTM D-422-63 & ODCA, 1976	SIEVE & PIPETTE
Particle Size Distribution (<1mm, 0 PHI)	INOR-121-6034	ASTM D-422-63 & ODCA, 1976	SIEVE & PIPETTE
Particle Size Distribution (<1/2mm, 1 PHI)	INOR-121-6034	ASTM D-422-63 & ODCA, 1976	SIEVE & PIPETTE
Particle Size Distribution (<1/4mm, 2 PHI)	INOR-121-6034	ASTM D-422-63 & ODCA, 1976	SIEVE & PIPETTE
Particle Size Distribution (<1/8mm, 3 PHI)	INOR-121-6034	ASTM D-422-63 & ODCA, 1976	SIEVE & PIPETTE

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Method Summary

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

AGAT WORK ORDER: 10X432562

PROJECT NO: GRQ - Marine

ATTENTION TO: CHYANN KIRBY

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Particle Size Distribution (<1/16mm, 4 PHI)	INOR-121-6034	ASTM D-422-63 & ODCA, 1976	SIEVE & PIPETTE
Particle Size Distribution (<1/32mm, 5 PHI)	INOR-121-6034	ASTM D-422-63 & ODCA, 1976	SIEVE & PIPETTE
Particle Size Distribution (<1/64mm, 6 PHI)	INOR-121-6034	ASTM D-422-63 & ODCA, 1976	SIEVE & PIPETTE
Particle Size Distribution (<1/128mm, 7 PHI)	INOR-121-6034	ASTM D-422-63 & ODCA, 1976	SIEVE & PIPETTE
Particle Size Distribution (<1/256mm, 8 PHI)	INOR-121-6034	ASTM D-422-63 & ODCA, 1976	SIEVE & PIPETTE
Particle Size Distribution (<1/512mm, 9 PHI)	INOR-121-6034	ASTM D-422-63 & ODCA, 1976	SIEVE & PIPETTE
Particle Size Distribution (Gravel)	INOR-121-6031	Canadian Society of Soil Science - SSMA	HYDROMETER
Particle Size Distribution (Sand)	INOR-121-6031	Canadian Society of Soil Science - SSMA	HYDROMETER
Particle Size Distribution (Silt)	INOR-121-6031	Canadian Society of Soil Science - SSMA	HYDROMETER
Particle Size Distribution (Clay)	INOR-121-6031	Canadian Society of Soil Science - SSMA	HYDROMETER
Particles >75um	INOR-121-6031, INOR-121-6034	ASTM D-422-63 & ODCA, 1976, SSMA	CALCULATED
Classification	INOR-121-6031, INOR-121-6031	Atlantic RBCA	CALCULATED
Mercury	INOR-121-6101 & INOR-121-6107	Based on EPA 245.5 & SM 3112B	CV/AA
Chromium, Hexavalent	INOR-121-6029	SSSA 5;25 p. 683	SPECTROPHOTOMETER
Total Organic Carbon	SOIL 0480; SOIL 0110; SOIL 0120	NELSON 1996; SHEPPARD 2007	COLOR
Total Inorganic Carbon		ASA 11 - 2.2	CVAAS

Results relate only to the items tested

AGAT Laboratories

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Dartmouth, Nova Scotia
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http://www.agatlabs.com

Method Summary

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

AGAT WORK ORDER: 10X432562

PROJECT NO: GRQ - Marine

ATTENTION TO: CHYANN KIRBY

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Trace Organics Analysis			
Benzene	VOL-120-5013	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/MS
Ethylbenzene	VOL-120-5013	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/MS
Toluene	VOL-120-5013	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/MS
Xylene (Total)	VOL-120-5013	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/MS
C6-C10 (less BTEX)	VOL-120-5013	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/MS/FID
>C10-C16 Hydrocarbons	ORG-120-5007	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/FID
>C16-C21 Hydrocarbons	ORG-120-5007	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/MS/FID
>C21-C32 Hydrocarbons	VOL-120-5007	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/FID
Modified TPH (Tier 1)	ORG-120-5007	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/MS/FID
Return to Baseline at C32	ORG-120-5007	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/FID
% Moisture	LAB-131-4024	Topp, G.C. 1993. Soil Water Content. CSSS	GRAVIMETRIC
Isobutylbenzene - EPH	VOL-120-5007	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/FID
Isobutylbenzene - VPH	VOL-120-5013	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/MS
n-Dotriacontane - EPH	VOL-120-5007	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/FID
alpha-BHC	ORG 5513	EPA SW-846 3541,3550B, 3620B,8081A,8082	GC/ECD
beta-BHC	ORG 5508	EPA SW-846 3541 & 8081A	GC/ECD
Gamma-BHC (Lindane)	ORG 5513	EPA SW-846 3541,3550B, 3620B,8081A,8082	GC/ECD
delta-BHC	TO 0110	EPA SW-846 355	GC/ECD
Heptachlor	ORG 5513	EPA SW-846 3541,3550B, 3620B,8081A,8082	GC/ECD
Aldrin	ORG 5513	EPA SW-846 3541,3550B, 3620B,8081A,8082	GC/ECD
Heptachlor Epoxide	ORG 5513	EPA SW-846 3541,3550B, 3620B,8081A,8082	GC/ECD
Alpha-Chlordane	ORG 5513	EPA SW-846 3541,3550B, 3620B,8081A,8082	GC/ECD
Gamma-Chlordane	ORG 5513	EPA SW-846 3541,3550B, 3620B,8081A,8082	GC/ECD
Endosulfan I	TO 0110	EPA SW-846 355	GC/ECD
Endosulfan II	ORG 5009	EPA SW-846 3550 & 8081	GC/MS & GC/ECD
Endosulfan Sulfate	TO 0110	EPA SW-846 355	GC/ECD
Dieldrin	ORG 5513	EPA SW-846 3541,3550B, 3620B,8081A,8082	GC/ECD
p,p'-DDE	ORG 5513	EPA SW-846 3541,3550B, 3620B,8081A,8082	GC/ECD
o,p'-DDE	ORG 5513	EPA SW-846 3541,3550B, 3620B,8081A,8082	GC/ECD
Endrin	ORG 5513	EPA SW-846 3541,3550B, 3620B,8081A,8082	GC/ECD

Results relate only to the items tested

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Method Summary

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

AGAT WORK ORDER: 10X432562

PROJECT NO: GRQ - Marine

ATTENTION TO: CHYANN KIRBY

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
DDD (o,p')	ORG-91-5113	EPA SW - 846 3541/8081	GC/ECD
p,p'-DDD	ORG 5513	EPA SW-846 3541,3550B, 3620B,8081A,8082	GC/ECD
p,p'- DDT	ORG 5513	EPA SW-846 3541,3550B, 3620B,8081A,8082	GC/ECD
o,p'-DDT	ORG 5513	EPA SW-846 3541,3550B, 3620B,8081A,8082	GC/ECD
Endrin Aldehyde	TO 0110	EPA SW-846 355	GC/ECD
Endrin ketone	TO 0110	EPA SW-846 355	GC/ECD
Methoxychlor	ORG 5513	EPA SW-846 3541,3550B, 3620B,8081A,8082	GC/ECD
Mirex	ORG 5009	EPA SW-846 3550 & 8081	GC/ECD
Hexachlorobenzene	ORG 5508	EPA SW-846 3510C & 8270	GC/MS
Decachlorobiphenyl	ORG-120-5106, ORG-120-5108	EPA SW846 3510C/8080/8010, 8081A	GC/ECD
PCBs	ORG-120-5107	EPA SW-846 8081A & 8082	GC/ECD
Aroclor 1254	ORG-91-5113	EPA SW-846 3541 & 8082	GC/ECD
1-Methylnaphthalene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
2-Methylnaphthalene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Acenaphthene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Acenaphthylene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Acridine	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Anthracene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Benzo(a)anthracene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Benzo(a)pyrene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Benzo(b)fluoranthene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Benzo(b+j)fluoranthene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Benzo(e)pyrene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Benzo(ghi)perylene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Benzo(k)fluoranthene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Chrysene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Dibenzo(a,h)anthracene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Fluoranthene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Fluorene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Indeno(1,2,3)pyrene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Naphthalene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Perylene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Phenanthrene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Pyrene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Quinoline	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
% Moisture			GRAVIMETRIC
Nitrobenzene-d5	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
2-Fluorobiphenyl	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Terphenyl-d14	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS

Results relate only to the items tested

AGAT Laboratories

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Laboratory use Only
Arrival Condition: ☑ Good ☐ Poor (complete 'notes')
Arrival Temperature: 7 C AGAT Job Number: 10-4325602
Notes:

Drinking Water Sample (y/n): No Reg. No.
Waterworks Number:

Report To:
Company: AMEC Earth & Environmental
Contact: Chyann Kirby
Address: 580 Main Street, Suite 105, Hilyard Place,
Building B, Saint John, New Brunswick E2K 1J5
Phone: 506.652.9497 FAX: 506.652.9517
PO#: TV01017
AGAT Quotation: 10 -192
Client Project #: GRQ - Marine

Invoice to: Same (Y/N) - Circle
Company:
Contact:
Address:
Phone: Fax:
PO#/Credit Card #:

Report Information
1. Name: Chyann Kirby
Email: chyann.kirby@amec.com
2. Name:
Email:

Regulatory Requirements (Check):
☐ List Guidelines on Report ■ Do Not List Guidelines on Report
■ PIRI Site Info (check all that apply):
■ Tier 1 ■ Res ☐ Pot ☐ Coarse
☐ Tier 2 ■ Com ☐ N/Pot ☐ Fine
■ Gas ■ Fuel ■ Lube
■ CCME ☐ CDWQ
■ Ind ☐ NSDFOSP
■ Com ☐ HRM 101
■ Res/P Storm Water
■ Ag ☐ HRM 101
■ FWAL Waste Water
■ Sediment
☐ Other

Report Format
☐ Single PDF sample per page
■ Multiple PDF samples per page
■ Excel Format Included

Turnaround Time (TAT) Business Days
Regular TAT:
■ 5 - 7 days
Rush TAT:
☐ 1 day ☐ 2 days
☐ 3 - 4 days
Date Required:
Time Required:

SAMPLE IDENTIFICATION	DATE / TIME SAMPLED	SAMPLE MATRIX	# OF CONTAINERS	COMMENTS - Site/Sample Info, Sample Containment	Metals (Code 121-349)	Hexavalent Chromium (Code 93-021)	Mercury (Code 121-325)	TPH/BTEX (PIRI) Tier 1 (Code 120-104)	PAH (low-level (CCME) Code 120-127)	PCB (Code 120-331)	Particle Size (Code 121-337)	TIC/TOC (Codes 121-376 and 58-109)				EXTRACT AND HOLD FOR THE FOLLOWING (ARCHIVE)	Metals (Code 121-349)	Hexavalent Chromium (Code 93-021)	Mercury (Code 121-325)	TPH/BTEX (PIRI) Tier 1 (Code 120-104)	Particle Size (Code 121-337)	TIC/TOC (Codes 121-376 and 58-109)		Hazardous (Y/N)	Lab Sample #
GQ 02	1-Sep-10	sed./soi	2 x 250mL	Sample jars labelled "A" and "B" for each sample.	√	√	√	√	√	√	√	√												N	
GQ 25	1-Sep-10	sed./soi	2 x 250mL		√	√	√	√	√	√	√	√												N	
GQ 27	1-Sep-10	sed./soi	2 x 250mL														√	√	√	√	√	√		N	
GQ 31	1-Sep-10	sed./soi	2 x 250mL														√	√	√	√	√	√		N	
GQ 47	1-Sep-10	sed./soi	2 x 250mL														√	√	√	√	√	√		N	
GQ 50	1-Sep-10	sed./soi	2 x 250mL		√	√	√	√	√	√	√	√												N	
					*SEE QUOTATION FOR SPECIFICS ON SEDIMENT ANALYSES REQUESTED																					

Sample Relinquished By (print name & sign)	Date/Time	Samples Received By (print name and sign)	Date/Time	Special Instructions
Beth Cameron	2-Sep-10	A. Cole-Yemen	02-Sep-10	
Sample Relinquished By (print name & sign)	Date/Time	Samples Received By (print name and sign)	Date/Time	
			17:15	Page 1 of 1

C 1340-1872

APPENDIX K
Mi'Kmaq Ecological Knowledge Study (2013)

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

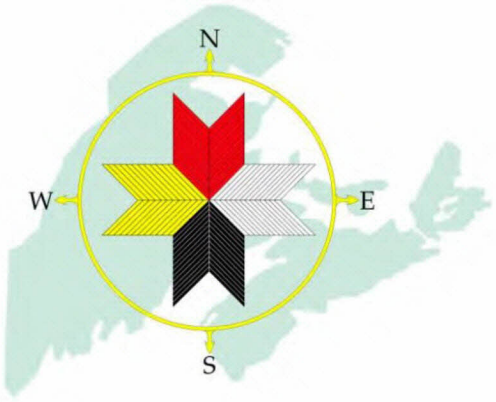
Mi'kmaw Ecological Knowledge Study

Black Point Quarry, Guysborough Co., NS,
Proposed by Erdene Resource Development Corp.

C 1340-1874

Mi'kmaw Ecological Knowledge Study

Black Point Quarry, Guysborough Co., NS, Proposed by Erdene Resource Development Corp.



Mi'kma'ki All Points Services, Inc.

P.O. Box 63
Shubenacadie, NS, B0N 1W0
Ph.: 902-236-MAPS (6277)
Authors: Michael H. Weiler & Jennifer Copage

January 2013

C 1340-1875

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This MEKS report does not and should not represent or be considered, in any manner in whole or in part, as consultation by government or other third party for purposes of justifying an infringement on any Mi'kmaq Aboriginal and Treaty rights that exist or will be found to exist in the future

1. Introduction: Project Description Summary

The Black Point Quarry Project is an initiative of Erdene Resource Development Corp (referred herein to as "Erdene") located in Dartmouth, Nova Scotia.
AMEC Earth & Environmental Ltd. (a division of AMEC Americas Ltd.), a sub-contractor of Erdene, contracted MAPS to undertake an MEKS on this project.

Erdene proposed the establishment of a new quarry on a property it acquired on the shore of Chedabucto Bay (see Appendix 1). The proposed Black Point Quarry is located on a 280 hectare parcel of land approximately 10 km west of the town of Canso, Guysborough County. The southern boundary of the project area runs along a high-voltage power transmission line, and a new access road of about 990 metres is planned from there southward to Provincial Highway 16 (Fig.2). This property contains a large tonnage of high-quality granite which Erdene seeks to extract.

Situated on sheltered ice-free tidal water, the location offers direct access to international shipping lanes, thus facilitating efficient transportation of the product to US and Caribbean markets via bulk carrier vessels.

Fig. 1: Black Point Quarry Project location

According to Erdene's calculations "the anticipated annual production rate will exceed 1.0 million tonnes with an anticipated peak production rate of 6.5 million tonnes per year. The anticipated operating schedule is 15 hrs/day, 7 days/week, on a year-round basis and weather permitting. Estimated rock reserves are in the order of 250 million

tonnes. Quarry operations are expected to take place over a period of approximately 50 years, depending on demand for aggregate" (Erdene, Project Information, Appendix 1). The Black Point Quarry project is expected to involve open-pit mining, the construction of facilities to process granite into aggregate (involving drilling, blasting, crushing/ processing and stockpiling). It will also include the construction and operation of a marine shipping terminal on Chedabucto Bay, adjacent to the quarry, where processed aggregate will be off-loaded onto Panamax-sized ships of up to 70,000 tonnes (Erdene, Project Information, Appendix 1).

The project study area as defined by the proponent covers a parcel of land on the Chedabucto Bay, about 10 kilometres west of Canso. It encompasses the quarry site and its immediate surroundings only (Fig.2) with no surrounding buffer zone, and does not include the access road from their study area's southern boundary to Highway 16. It is herein therefore referred to as the 'project area' in order to distinguish it from the study area of this MEKS.

The nature of this development has triggered both Federal and Provincial environmental protection legislation. Part of this legislation requires the project proponent to prepare an Environmental Impact Statement (EIS).
Apart from potential impacts on the natural environment, the EIS is also meant to evaluate potential effects on the social environment. This includes archaeological and heritage resources, the current use of traditional lands and resources by Aboriginal people, and possible impacts on the cultural integrity of the surrounding Aboriginal communities.

MAPS was mandated to conduct the research necessary to evaluate such potential impacts of the Projects on the Aboriginal community through this MEKS.

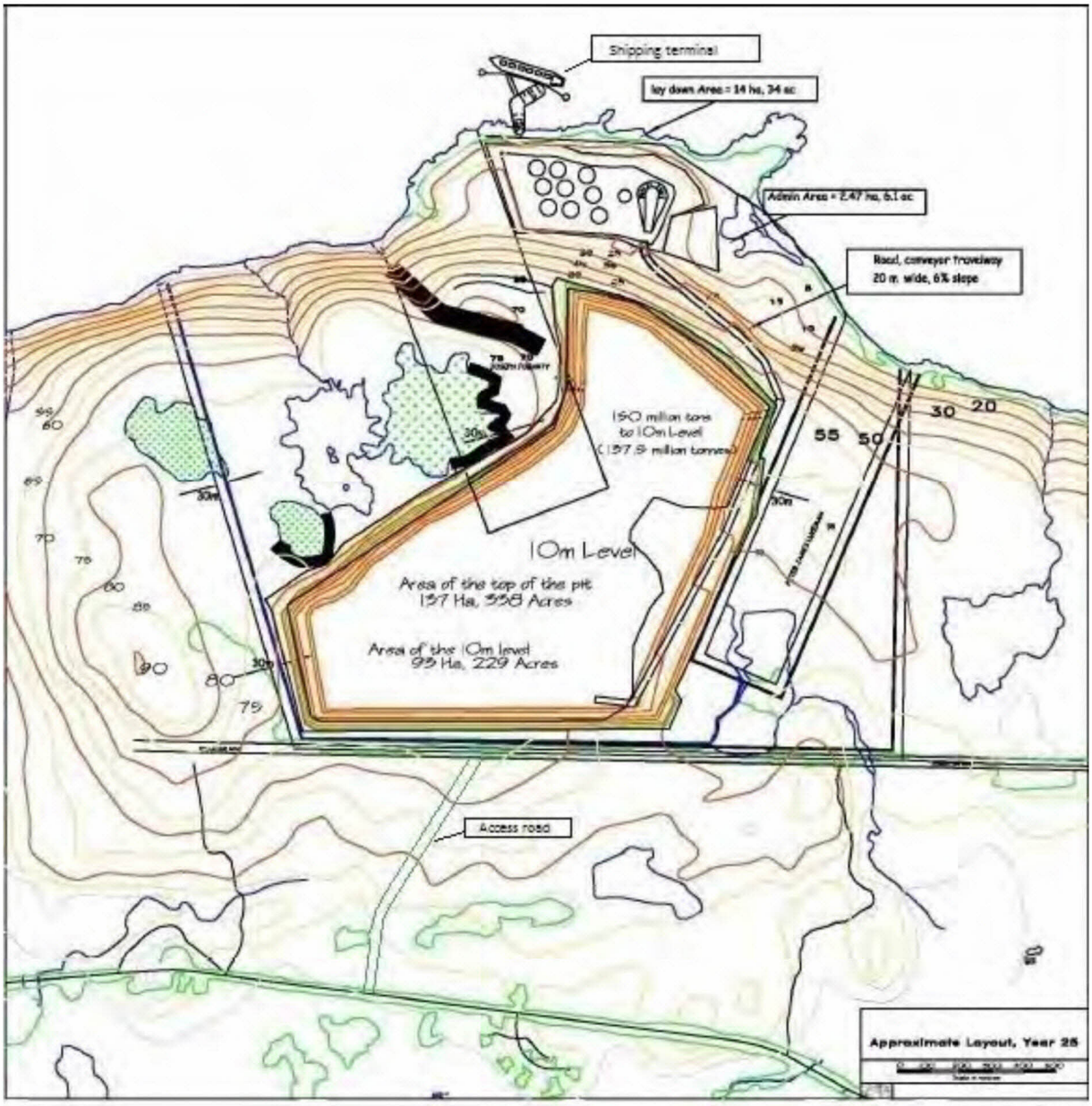

Fig 2: Conceptual Site Plan for Black Point Quarry[1]

[1] Adapted from AECOM 2011:15

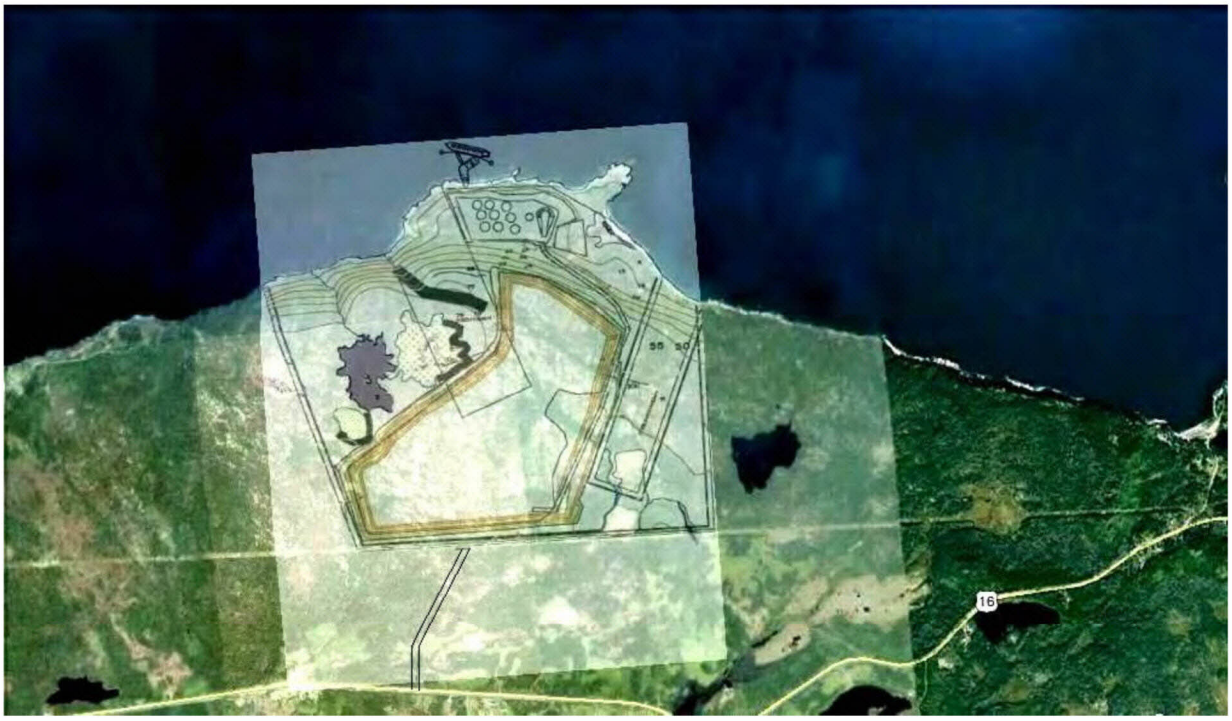

Fig 3: Project Area Overlay on Aerial View

2. Methodology

2.1. Purpose, Scope and Ethics of this MEKS

Mi'kmaw Ecological Knowledge (MEK) has been defined in the Mi'kmaq Ecological Knowledge Protocol (Protocol) as "…the collection and adaptation of knowledge that Mi'kmaq people have with all components of the natural environment and the interrelationships between all life forms from a unique historical, cultural and spiritual level." The Protocol was ratified by the Assembly of Nova Scotia Mi'kmaq Chiefs on November 22, 2007 and outlines specific guidelines and conditions on the development of a MEKS in the province.
The purpose of a MEKS is to identify and report any ecological concerns regarding the Project's impact on Mi'kmaq use of land, resources and special places within the Project Study Area.

MAPS' methodological approach includes the adherence to the Mi'kmaq Ecological Study Protocol, ratified in 2007 by the Assembly of Nova Scotia Mi'kmaw Chiefs (Appendix 2). Accordingly, this research initiative and its methodological approach were communicated to the Mi'kmaw Ethics Watch Committee in 2010 whose mandate is to ensure research activities with the Nova Scotia Mi'kmaw community comply with the Mi'kmaq Research Ethics Protocol of 1999.

MAPS informed the Union of Nova Scotia Indians as well as the Confederacy of Mainland Mi'kmaw and the Native Council of its intention to carry out this MEKS. MAPS undertook to publicize an announcement and description of the research initiative through its website, and information bulletin to all Nova Scotia First Nation Councils, and an article in the Mi'kmaq-Maliseet Nations News (Appendix 3) asking for public input.

A community meeting was held by MAPS in Paqtnkek, the Mi'kmaw community closest to the Project Site.

To insure the non-Aboriginal community was also informed, a similar article was published in the Guysborough Journal and the Guysborough Chamber of Commerce was notified.

2.2. Research Methodology

The research involved in the preparation of this MEKS is based on several components:

- An assessment of the study area's archaeological resources or potential based on existing reports;
- A survey of archival, published and unpublished material relating to historic Mi'kmaw land uses and occupancy in the study area;
- A two-season ground survey of local plant resources significant to the Mi'kmaw community;
- Community-based research in the surrounding Mi'kmaw communities of Paqtnkek, Millbrook and Chapel Island with Mi'kmaw knowledgeable about the Study Area, its resources and recent and current Mi'kmaw land uses.
  A detailed interview guide was developed specifically for this study in order to insure a consistent approach in the interviewing and recording of data by the three interviewers in the above-mentioned communities.

2.3. Limitations

- Very little archaeological work has been carried out so far in Guysborough County, and particularly along the Chedabucto coast. A scarcity of pre-contact archaeological evidence in this region does therefore not allow the conclusion of low Aboriginal use and occupancy during that period;
- The Centralization policy in Nova Scotia during the first half of the 20th century disrupted traditional patterns of Mi'kmaw land use and occupancy;

- Land and resource use data, both those stemming from MAPS' general data base as well as those collected for this study specifically, are based on interviews of samples of Mi'kmaw Elders and active land users. The land use data represented here therefore cannot be comprehensive. It serves as positive proof of Mi'kmaw land and resource use in the study region, but does not imply that locations or resources not mentioned here are indeed not utilized by Mi'kmaw.

2.4. Study Area

Mi'kmaw land use patterns are naturally wide-ranging in response to the seasonally and spatially fluctuating resources they depend on. With respect to historic and contemporary Mi'kmaw land use, the Black Point Quarry Project Area, can in the context of this MEKS, not be considered in isolation, but as an integral part of the wider Chedabucto shore resource area of the Mi'kmaw community.

The Study Area therefore stretches from Halfway Cove to Durells Island and Canso (Fig. 4) and includes the shore, the adjacent strip of land of about 5 kilometres in width, and near-shore waters of the Chedabucto Bay. Information outside this study may also be considered when it serves to illustrate wider-ranging patterns of Mi'kmaw land use.

Fig 4: Study and Project Areas

3. Section I: THE SETTING

3.1. Biophysical Environment

3.1.1. Geology

From the Chedabucto Bay shoreline and the base of the low-lying Fogherty Head (with its Black Point peninsula) at the northern end of the project area the terrain rises sharply to the plateau where the quarry site is situated (Figs.5-7).

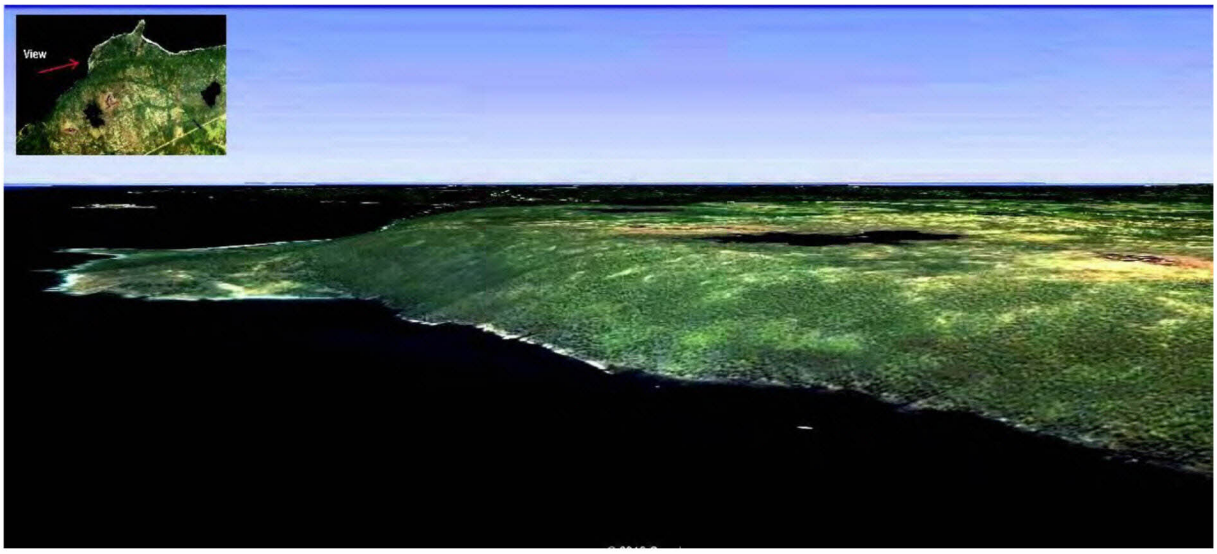

Fig 5: Fogherty Head and Fogherty Lake, Easterly View from Chedabucto Bay

While Figure 5 offers a simulated view of the natural landscape based on satellite imagery, figures 6 and 7 illustrate the area's relief more clearly through contour lines and a LIDAR image modelling the surface structure underneath the vegetation cover. The hill featuring the resource to be quarried has an elevation of about 103 m above mean sea level[2].

[2] AECOM 2011:7

Fig 6: Project area with contour lines[3]

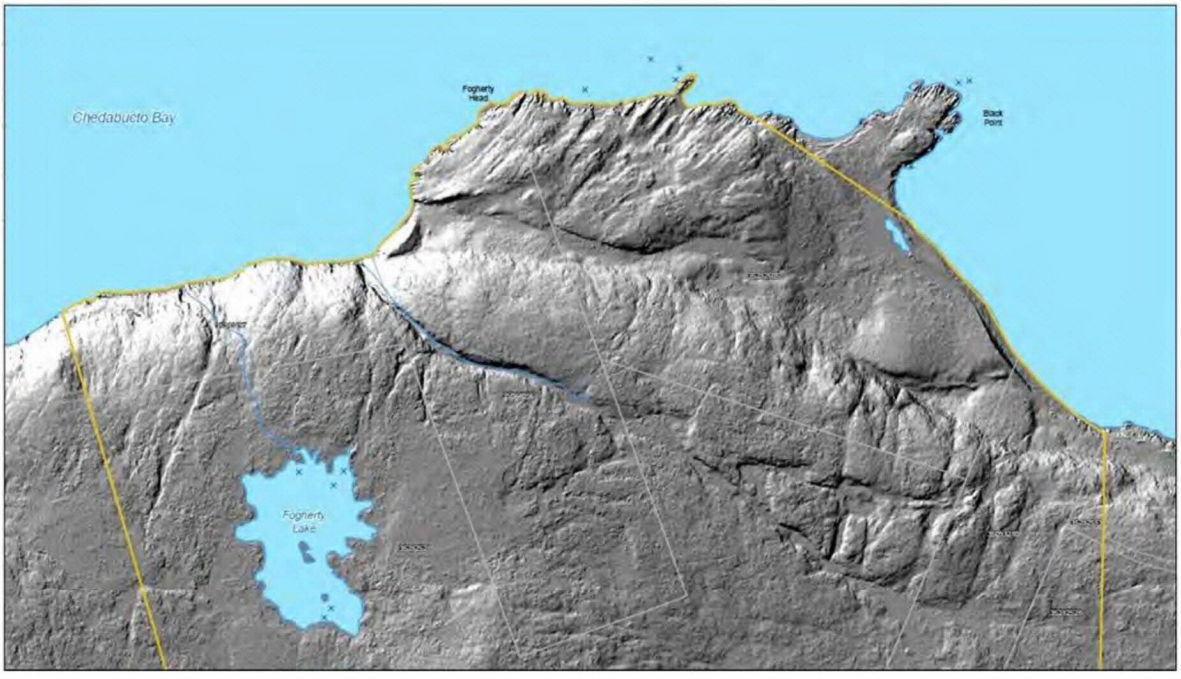

Fig 7: Relief Model of the Northern Portion of the Project Area[4]

[3] Project area inset adapted from AECOM 2011:7
[4] LIDAR image, source AECOM 2011:14

While the bedrock geology of the Fogherty Head consists of schist, medium-grade metamorphic rocks of the Goldenville (COMg) and Halifax (COMh) formations, that of the remainder of the project area features granite (M-LDmbmg) with very little overburden – the resource to be mined. The wider study area is made up of undulating bands and regions with primarily the same three geological features (Fig.8).

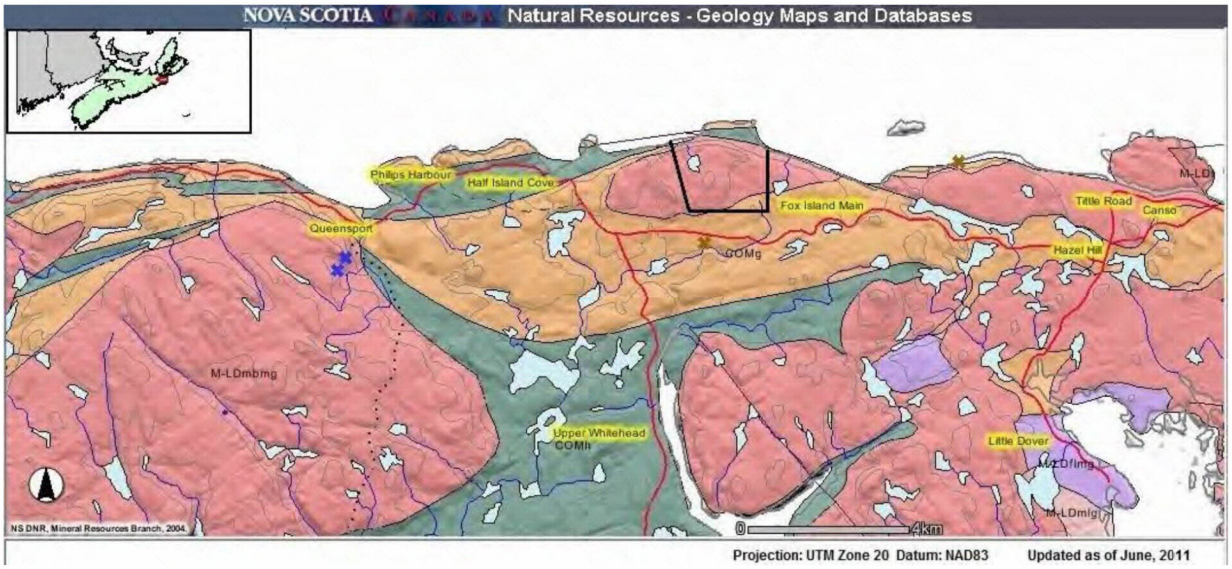

Fig. 8: Bedrock Geology of the Project and Study Areas[5]

The project area consists mostly of well drained, coarse textured soil, in the northern and western portion primarily on hilly terrain (WCKK), and in the central and eastern portion on hummocky terrain (WCHO). The central portion also contains a flat area of poorly drained, medium textured soil (WTLD), a bog, to the east of Fogherty Lake. A similar soil pattern is repeated in the Canso area. The region south of the project area is mostly hummocky, imperfectly drained and medium textured (IMHO), while to the west we mainly find well drained, medium to fine textured soil on hills and drumlins (WMKK, WFDM).

The particular soil and drainage pattern (Fig. 9), in combination with the underlying bedrock geology, produce a variety of ecological land classes which, again, allow or foster particular habitats.

The wider Study Area is located within what is called the Canso Barrens, a region generally characterized by exposed granite knolls and erratic and thin soil layers.

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[5] Adapted from NS DNR online map 'Geology Maps and Databases' (http://gis4.natr.gov.ns.ca/website/nsgeomap/viewer.htm

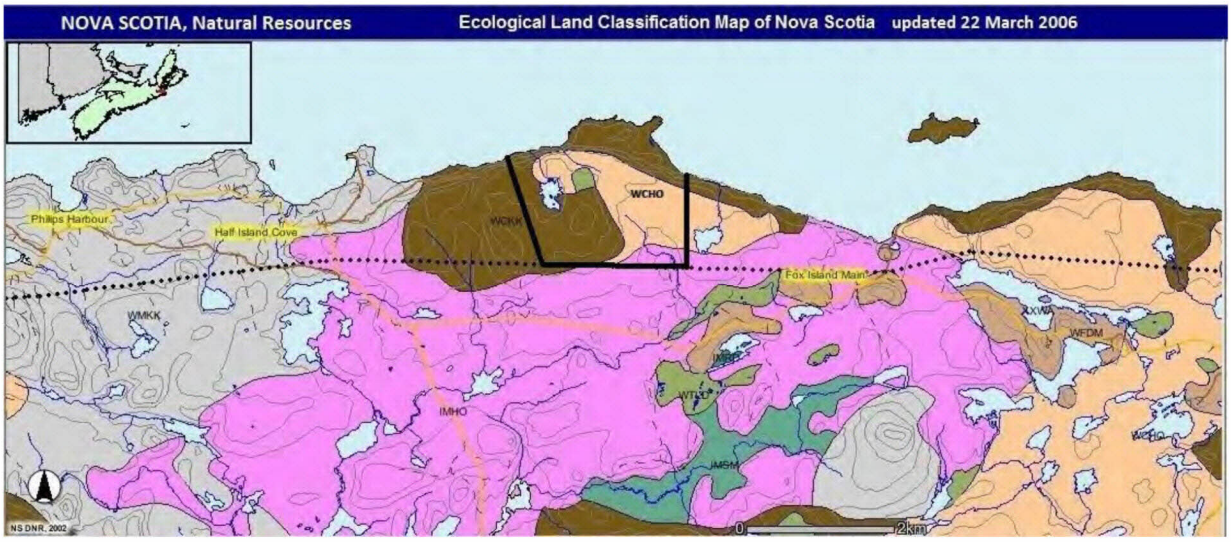

Fig 9: Ecologcal Land Classification[6]

3.1.2. Vegetation, Habitats and Wildlife Resources

These surface conditions produce distinct vegetation covers and habitats. Most of the plateau is blanketed with a patchwork of lichen (*Cladonia rangiferina* and others) and shrub dominated tundra-like ground cover interspersed with stands of open coniferous forest. The latter consists mainly of black spruce (*Picea mariana*), white spruce (*Picea glauca*), balsam fir (*Abies balsamea*), white birch (*Betula papyrifera*) and tamarack (*Larix laricina*). More densely and mixed forested habitats are sheltered slopes, stream channels and low-lying areas in general, and particularly the Fogherty Head area, where some mature balsam firs are found (Fig. 10).
Similar vegetation patterns are found to the south of the Project Area and, with varying proportions of lichen barrens to woodlands, throughout the Study Area.

The vegetation surrounding Fogherty Lake, for example, features black spruce and tamarack as the predominant tree species, shrubs and herbaceous plants such as leatherleaf (*Chaemodaphne calyculata*), sheep laurel (*Kamlia angustifolia*), chokeberry (*Photinia pyrifolia*), possum-haw viburnum (*Viburnum nudum*), rhodora (*Rhododendron canadiense*), Labrador tea (*Ledum groenlandicum*), and bunchberry (*Comus canadiensis*)[7].

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6 Adapted from online NS DNR online map 'Ecological Land Classification',(http://gis4.natr.gov.ns.ca/website/nselcmap/viewer.htm)

7 AECOM 2011:28

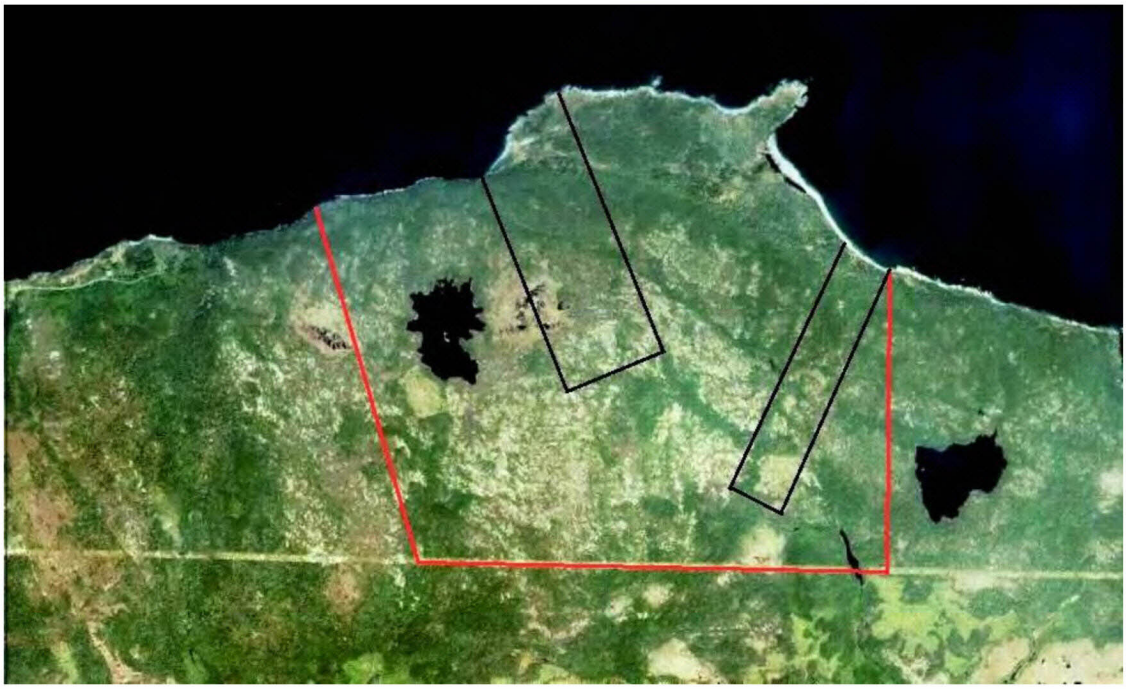

Fig 10: Vegetation Cover (Satellite Image), Project Area

Other habitats, throughout the Study Area, include coastal beaches, cliffs and barren headlands.

An initial vegetation survey conducted by AECOM reports the occurrence of one species of concern, *Peltigera leucophlebia*, a lichen commonly called Ruffled Freckled Pelt, in the eastern portion of the Project Area[8]. This species is listed as vulnerable by the Nova Scotia Department of Natural Resources. A second lichen also found in this area, *Ramalina thrausta* or Angel's Hair, was categorized as "uncommon" [9].

The entire Study Area, including the Project Area (Fig. 11), is interspersed with a variety of wetlands types from bogs and fens to streams and lakes. Important features in this landscape, they act as surface water reservoirs and filters, and provide habitat to a large variety of distinct aquatic, semi-aquatic, riparian and terrestrial plant and wildlife species.

Within the Project Area and along the access road leading to Highway 16, 26 wetlands were identified and briefly described by AECOM[10].

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8 Ibid:31
9 Ibid:31
10 Ibid:32-33

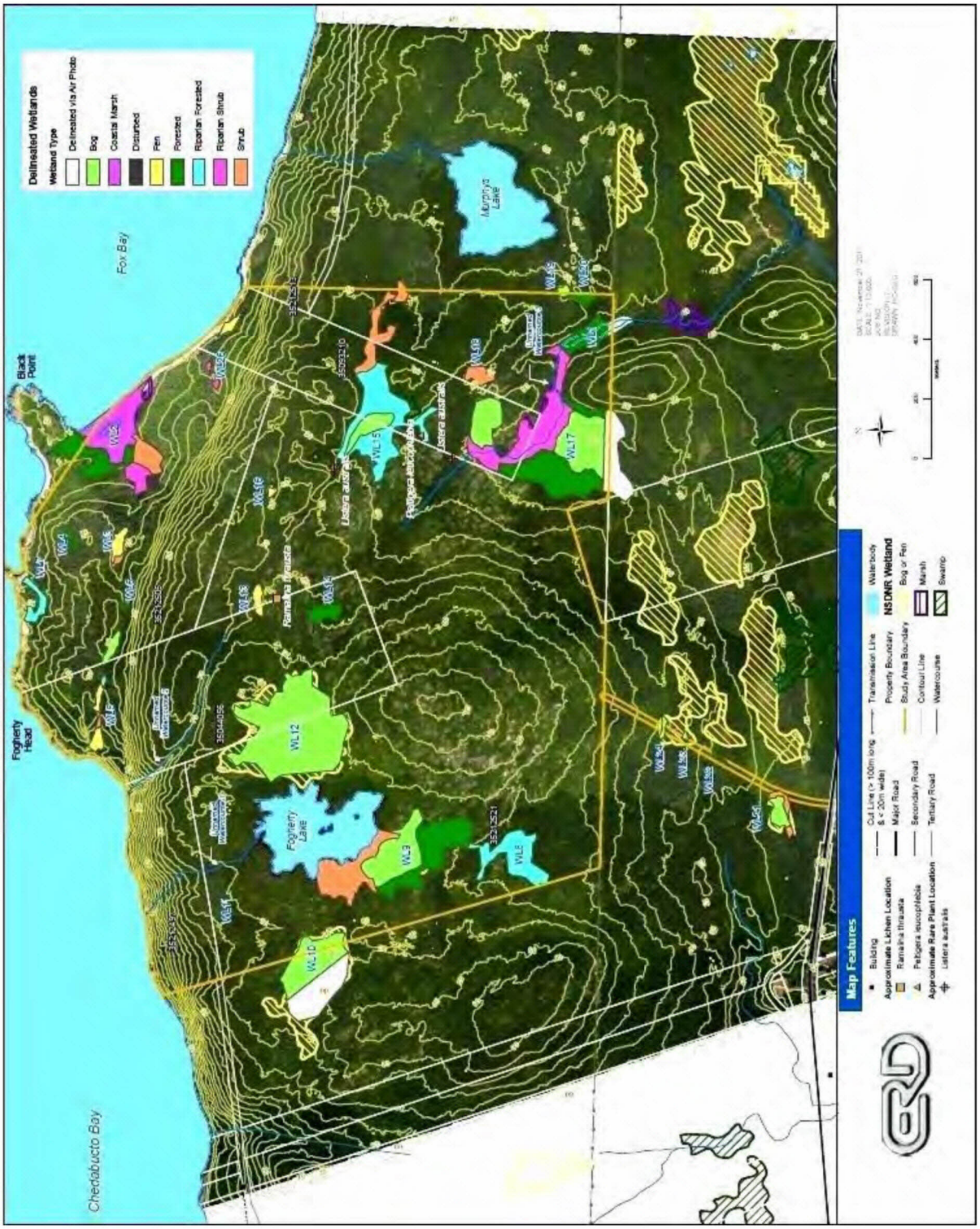

Fig. 11: Wetland Habitats and Locations of Species of Concern[11]

[11] Adapted from AECOM 2011:31

Several areas with habitats significant enough to be declared protected by the Province are located in the vicinity of the Project Area, and within the Study Area of this MEKS. Both Half Island and Lower Half Island coves as well as Fox Inland Main (Indian Cove) feature protected beaches. The Bonnet Lake Barrens and Canso Coastal Barrens wilderness areas encompass large areas located about 7 km southwest and 2 km south and southeast, respectively, of the Project Area. In addition, Third Lake Provincial Park is located about 5 km southwest of the Project Area and consists of several parcels surrounding Cooeycoff Lake (Fig. 12).

Fig. 12: Restricted and Limited Use Areas[12]

Wildlife species present in the study and project areas cover the spectrum of species found in most regions of Nova Scotia.

Among mammals these include Whitetail Deer (*Odocoileus virginianus*), Black Bear (*Ursus americanus*), Eastern Coyote (*Canis latrans thammers*), Red Fox (*Vulpes vulpes*), Bobcat (*Lynx rufus*), Beaver (*Castor canadiensis*), Muskrat (*Ontatra zibethicus*), Porcupine (*Erethizon dorsatum*), Snowshoe Hare (*Lepus Americana*), Red Squirrel (*Tamiasciurus hudsonius*), Racoon (*Procyon lotor*), Otter (*Lontra canadiensis*), Short-tailed Weasel (*Mustela erminia*), Mink (*Neovison vison*) and small rodents such as voles, mice and shrews.

[12] Adapted from NS DNR online map 'Restricted & Limited Use Areas' (http://gis4.natr.gov.ns.ca/website/rlul2b07/viewer.htm)

While not confirmed in AECOM's survey, Mi'kmaw report the presence of Mainland Moose (*Alces alces americana*), a threatened species .
Marine mammals reported present along the Study Area's shore are the Minke Whale (*Balaenoptera acutorostrata*) and Grey Seal (*Halichoerus grypus*)[13].

A bird survey in the Project Area, commissioned by AECOM, reported the following 11 species that are either classified as species of concern or known to be particularly sensitive to anthropogenic disturbances: Boreal Chickadee (*Poecile hudsonia*), Common Loon (*Gavia immer*), Gray Jay (*Perisoreus canadiensis*), Rusty Blackbird (*Euphagus carolinus*), Greater Yellowlegs (*Tringa melanoleuca*), Red-breasted Merganser (*Mergus serrator*), Semi-palmated Sandpiper (*Calidris mantilla*), Spotted Sandpiper (*Actitis macularius*), Least Sandpiper (*Calidris pusilla*), Semi-palmated Plover (*Charadrius semipalmatus*) and Great Cormorant (*Phalacorcorax carbo*). Two owl species were confirmed, the Northern Saw-whet Owl (*Aegolius acadicus*) and the Barred Owl (*Strix varia*). Even though it was not observed during this field survey, the Chedabucto Bay shoreline is known to also harbour Harlequin Ducks (*Histrionicus histrionicus*), another species of concern[14].

Of the reptilian and amphibian species commonly found within Nova Scotia, the Yellow Spotted Salamander (*Ambystoma maculata*), American Toad (*Bufo Americana*), Spring Peeper (*Pseudacris crucifer*), Green Frog (*Rana clamitans*), Northern Leopard Frog (*Rana pipiens*), Bullfrog (*Rana catesbeiana*), and the Maritime Garter Snake (*Thamnophis sirtalis pallidulus*) were confirmed to be present in the Project Area. No rare or sensitive species in those categories were reported[15].

From the family of dragon/damselflies (*Odonates*), however, a Spotwinged Glider (*Pantala hymenaea*), which is listed by the Province as being sensitive to anthropogenic or natural impacts, was observed to be present in the wetland area east of Fogherty Lake[16].

Results of the freshwater fish and fish habitat survey as reported by AECOM are based on brief fish samplings in Fogherty Lake and three unnamed streams. One of these streams is the northern outflow of Fogherty Lake, the second a brook originating in a narrow valley in the northern portion of the Project Area and emptying into Chedabucto Bay, a third a stream in the southwestern part of the Project Area flowing through softwood stands and fens before discharging into Hendsbee Lake, and a fourth one near the western edge of the Project Area.

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13 AECOM 2011:35
14 Ibid:34, 35
15 Ibid: 35
16 Ibid: 36

Being situated largely on a granite bedrock formation and being fed in part by surface runoff from surrounding bogs, Fogherty Lake is tea-coloured and fairly acidic, like many Nova Scotia lakes. Based on a survey employing two gillnets and four minnow traps for a total of six hours, AECOM's report reports that Fogherty Lake contains no significant fish populations due to the high acidity levels The same conclusion was reached with respect to the streams tested[17].

The near-shore underwater marine habitat along the Project Area consists mainly of cobble and rock substrate with lesser amounts of sand and silt supporting "a high diversity of both floral and faunal species"[18].
Algal cover increases from sparse in deeper water up to 90% along the shore and features Black Whip Weed (*Chordaria flagelliformis*), Bladderwrack (*Fucus vesiculosus*), Sea Colander (*Agarum clathratum*), and occurrences of the invasive species Green Fleece (*Codium fragile*).
Little information is given on faunal species. The presence of several species of annelid worms (Polchaetes) and two bivalves, the Common Tortoiseshell Limpet (Tectura testudinalis) and the Interrupted Turbonille (Turbonilla interrupta), are identified. No further observations of fish, crustaceans or other mollusk species are reported in this study.

Nevertheless, it can safely be assumed that this habitat supports a variety of fish and other marine species, and serves as a nursery habitat for a number of species which then spend the remainder of their life cycles in other areas and/or deeper waters.

3.2. Surrounding Mi'kmaw Communities

The Project Area is located in the Eskikewa'kik district of Mi'kma'ki[19]. The closest of the current Mi'kmaw reserves are Paqtnkek on the mainland, and Chapel Island on Cape Breton Island.
However, a number of Mi'kmaw families have, until very recently, resided seasonally or year-round in the adjacent communities of Half Island Cove, Fox Island, and in Cook Cove and Dorts Cove at the western end of the Chedabucto Shore.

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17 AECOM 2011:26, 28
18 Ibid:28-29
19 Mi'kma'ki (the Mi'kmaq territory) consists of seven districts encompassing all of Nova Scotia and Prince Edward Island, plus parts of New Brunswick, Quebec and Newfoundland

4. Section II: HISTORIC MI'KMAW USE & OCCUPATION

4.1. Pre-Contact Mi'kmaw Land Use and Occupancy

Nova Scotia has been progressively occupied by the ancestors of the Mi'kmaw as the regional glaciers of the last ice age retreated. This is evidenced by the hitherto earliest finds at Debert dating back to about 11,500 BP[20] and being classified as belonging to the Paleo Indian or Sa`qewe`k L`nuk Period[21].

A substantial cooling during the Younger Dryas period about 10,800-10,200 BP caused again minor glaciations with ice sheets covering again what is now Guysborough, Pictou, Antigonish counties, plus the Cape Breton highlands[22] .

At present, the archaeological record for Guysborough County, and the Study Area in particular, is very sparse which is primarily a reflection of the relative lack of archaeological research that has been carried out in this region so far[23]. The vast majority of archaeological discoveries in Nova Scotia have been incidental rather than the result of targeted archaeological surveys. More often than not they have been made in the context of some sort of development – residential, industrial or infrastructural construction or agricultural activities. The Study Area has not seen much of any of these activities. Much of the existing archaeological material relating to Mi'kmaw and their ancestors in this region consists of sporadic surface finds.

Reviews of the existing literature and the Provincial archaeological database nevertheless identify some archaeological sites or finds in Guysborough County. Not surprisingly, the majority cluster along the St. Marys and Country Harbour rivers, both important travel routes between the Eastern Shore and the Northumberland Strait/ St.George's Bay coast. Others are located to the west and east of the Study Area, that is on the lower Salmon River and Cooks Cove, and at the east end of Canso and on Grassy Island[24].

Two significant finds are a cache of projectile points on Grassy Island, dated to about 500 AD[25] .

In light of the aforesaid it is obvious that the lack of archaeological evidence in the Study Area cannot be construed as proof of a lack of Mi'kmaw occupancy[26].

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20 Robinson 2011

21 Mi`kmaq terms for pre-contact cultural periods as given in Lewis 2006, see also Lewis 2011, tab 2 (appendix 4)

22 Mott 2011:50; Stea & Mott 2006, fig.12, Sable & Francis 2012:72-73

23 Lewis 2011 (appendix 4); Sheldon 2000:12

24 Lewis 2011 (appendix 4); Ferguson 2012

25 Ferguson 2011

The three most significant factors for determining the archeological potential of a site or area are: food resources, access and suitability for habitation.

In general Mi'kmaw land use and occupancy involved semi-permanent and permanent settlement at resource-rich locations. Summer villages were usually situated at a navigable body of water. Preferred locations were the mouths of rivers with significant spawning runs of salmon, eel and other fish species. Such sites provided ready access to freshwater and marine resources, plus a waterway into the interior.

The richness in resources of both the land and sea along the Chedabucto shore (including the Study Area) and the ease of access made this an attractive region to the Mi'kmaw and their ancestors.

Early written records document that the first European explorers and settlers found the Chedabucto bay and coast extremely rich in fishery resources and established in the 16th century Grassy Islands Fort as a base in the centre of this rich fishing ground. During the 16th and 17th centuries the French controlled the commercial fishery in this area, to be taken over by the British during the first half of the 18th century. While cod was the Europeans' primary commercial fishery interest, salmon and eel also figured prominently in the Mi'kmaw economy.

The Nova Scotia coast was also rich in marine mammals such as walrus, grey seals, and minke whales. These were also hunted by Mi'kmaw for food, skins and other raw materials. This is evidenced, for example, by several ancient Mi'kmaw place names along the southern shore of Prince Edward Island that refer to seasonal walrus colonies and walrus hunting[27]. By the time Europeans entered the scene, it appears that regional walrus number had been declining for some time due to climatic changes and the associated seas level rise, but the additional hunting pressure by the newcomers for their ivory and oil accelerated their disappearance. The last populations of walrus in Nova Scotia were reported to exist on Sable Island in the late 1700s[28].

Regional pre-contact resource also included sea birds, among them the Great Aulk. With the arrival of Europeans, Great Aulks were hunted extensively, their feathers used in bedding, their meat and eggs for fish bait and food. Eventually, this bird met the same fate as the walrus, aulks disappeared from Nova Scotia, and soon thereafter became extinct.

Terrestrial wildlife resources during the pre-contact included woodland caribou and mainland moose, in addition to the other species we find in the Study Area today.

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[26] Lewis 2011 (appendix 4); Sheldon 2000:12

[27] Weiler 2008:17

[28] Gilpin 1869:126-127, COSEWIC 2006:12

Moose as well as the caribou herds roaming the open inland areas, and in particular the barrens, would have able to support relatively large groups during the winter months.

In general, Mi'kmaw place names are geographically descriptive or refer directly or indirectly to resource uses. It is generally accepted that such place names are very stable and long-lived, and their origins pre-date the arrival of Europeans. Indeed most of the Mi'kmaw place names known to date were recorded by missionaries during the early contact period.

This is also the case with the names of some locations in the study area thereby attesting to Mi'kmaw occupancy and land use since time immemorial.

Mi'kmaw Place Names in Guysborough County [29]*:*
Guysborough County – *Esigeoagig* (*Eskikewa'kik*[30]) - skin dressing place
Chedabucto – *Sedabuktook* - the deep extending harbour, or running far back[31]
Cooks Cove – *Notogtetoalneg* - small Indian village
Halfway Cove – *Oetonitjitjg (Wetuni'ji'jk*[32]*)* - at the small opening[33]
Philips Harbour – *Pilipgomimg* - Pilip's place, where Pilip was doing something
Half Island Cove – *Aoaganeg* - portage
Black Point – *Magteoatgeg* - black head
Indian Cove – *Elnoeigomi* - Indian cove
Fox Island – *Sebelogwokun* - where skins are stretched
Fox Island Cove – *Nasonigetjg* - rushy
Durells Island – *Siplogagneg* - narrow passage[34]
Canso – *Gamsog* – rock on the other side

This district's Mi'kmaw name, *Eskikewa'kik*, translates to 'skin-dressing country' (or 'skin dressers place') which may refer to the region's ample supply of sea mammal and possibly caribou skins during this period as its environment does not seem to have been exceptionally productive habitat for furbearers such as beaver, muskrat, otter, marten, mink, weasel, fox, etc.
The fact that the Mi'kmaw name for Fox Island, *Sebelogwokun*, identifies this small island as a 'place where skins are stretched' supports this interpretation. If Fox Island was used customarily by Mi'kmaw harvesters for stretching (and drying) a significant number of skins they may have stemmed from a resource that can be harvested locally

29 Unless otherwise noted: Allen 2006, vol.II. See also Appendix 5: Historical Records Review
30 Current spelling according to the Smith-Francis orthography of Mi'kmaw, B. Francis, p.c. Sept 2012
31 According to Hoffman 1955:537
32 Current spelling according to the Smith-Francis orthography of Mi'kmaw, B. Francis, p.c. Sept 2012
33 Preliminary translation by B. Francis, p.c. Sept 2012
34 Preliminary translation by B. Francis, p.c. Sept 2012

in considerable numbers at certain times of the year – as marine mammals were. And since the populations of these marine mammals appear to have been in decline at the time of, or following, the arrival of Europeans in the area, one can safely conclude that the origin of the name lies in the pre-contact era.

Moving along the shore of *Sedabuktok*, the 'deep and extending harbour' or Chedabucto, from west to east, Cooks Cove or *Notogtetoalneg* was named so because of the 'small Indian village' that was located there.

Oetonitjitjg (Wetuni'ji'jk) refers to 'small opening', the bay at Halfway Cove which represents the entry to a travel route into the interior that eventually cuts across to Tor Bay on the Eastern Shore[35].

Just as it does in the English version of the placename, the location called *Pilipgomimg* was named so after an individual, Pilip, who once lived there.

Half Island Cove was called *Aoaganeg*, referring to a portage, the beginning of the route southward to the Northwest Branch and Whitehead Harbour on the Eastern Shore[36].

Magteoatgeg, the Mi'kmaw name for Black Point, translates to 'black head' describing both its shape and dark colouring when viewed from the shore or a passing canoe.

Elnoeigomi, Indian Cove on the eastern side of Black Point clearly attests to Mi'kmaw occupancy at this location.

As indicated earlier, *Sebelogwokun*, or Fox Island, was and is known to Mi'kmaw as the place where they processed skins they had been harvesting in the area.

The Mikmaq toponym for Durells Island is *Siplogagneg*, a narrow channel. It provides specific descriptive information about the geographic feature that separates it from the mainland (now called The Tittle), which is useful to canoeists travelling along the shore or crossing over to the island.

These toponyms are but one piece of evidence of regular, consistent Mi'kmaw occupancy and land use of the Study Area reaching back into the pre-contact period.

As the economic cycle of the Mi'kmaw and their ancestors was inextricably tied to the seasonal and spatial ebb and flow of natural resources, the same plentiful marine resources that lured the Europeans would also have attracted during the pre-contact period the Aboriginal inhabitants from the surrounding region (that is the northeastern mainland and southeastern Cape Breton Island) to the Chedabucto shore.

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35 See fig. 13

36 See fig. 13

Access to the Study Area and its resources during pre-contact times was principally by sea or land/river route.

The Strait of Canso provided a connection to and from the Georges Bay region, and the waters of Chedabucto Bay allowed canoe travel to and from southeastern Cape Breton Island. While the shores of the Northumberland Strait, Georges Bay and the Gulf of St.Lawrence would have been unnavigable due to the wide belt of drift ice that usually forms along these stretches of coast during the winter due to the prevailing wind conditions, Chedabucto Bay remains virtually ice-free and navigable.

Overland, a combination of waterways and trails/portages such as the Salmon and South River route or Milford Haven and Tracadie River offered links between the Study Area and St. Georges Bay. From the mouths of both Salmon and Milford Haven rivers at the west end of Chedabucto Bay an old trail existed that ran from there eastward along the shore all the way to today's community of Canso, with a spur line leading from Halfway Cove south to Whitehead Harbour[37]. Research in other parts of Nova Scotia has shown that these ancient travel routes have remained remarkably stable through the centuries[38] and most can be expected to predate the arrival of Europeans.

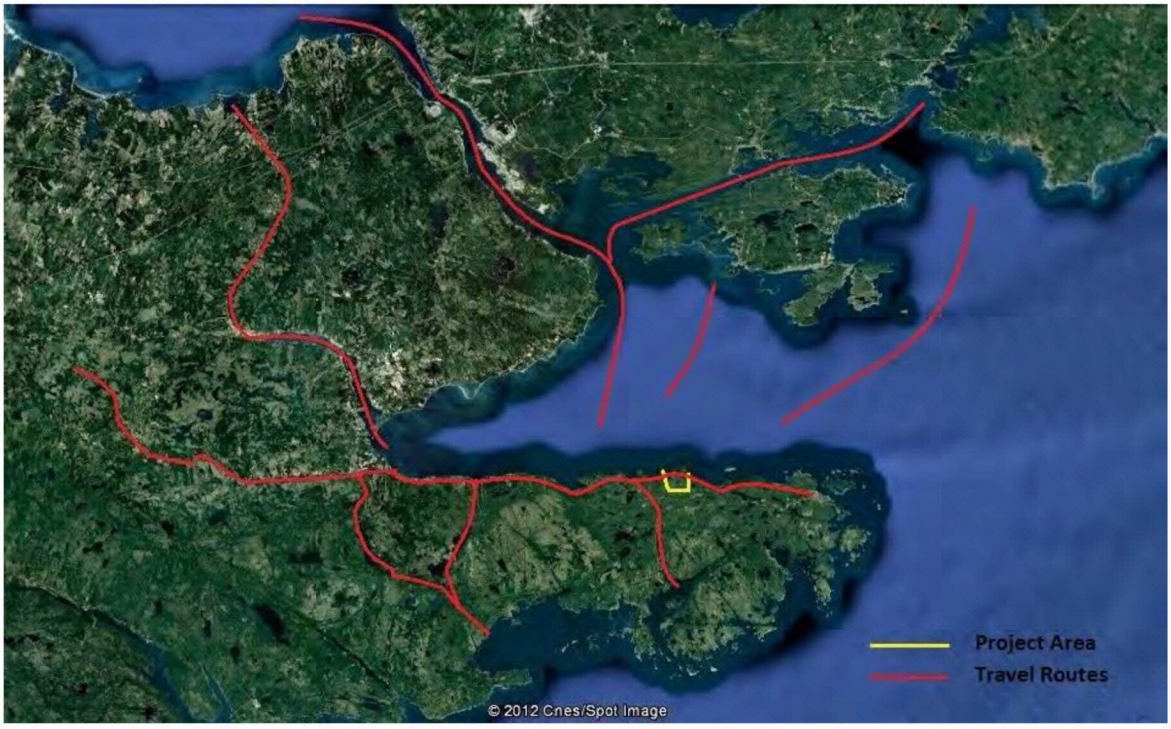

Fig 13: Travel Routes

[37] The early settlers roughly followed the same route in constructing what was called the Old Coach Road, and later the current Hwy 316

[38] Lewis 2012; also Weiler 2008

With accessibility and the availability of food resources in place, a habitation site requires dry ground for wigwam construction, shelter from the elements, and a source of fresh water. Along the Study Area's shore, such attractive habitation sites are found at Halfway Cove, the mouth of Peas Brook, the Queensport Bay, Philips Harbour, Half Island Cove, Indian Cove, and The Tittle at Durell's Island[39]. The archaeological potential of these locations can expected to be high. During the winter months, suitable inland locations would have been used at some of the numerous lakes or streams.

To sum up, even though there is currently little archaeological data at hand to confirm pre-contact Aboriginal land use and occupancy in the Study Area, it is highly unlikely that the region would not have been occupied and used extensively given the rich resources and easy accessibility from other areas of the mainland as well as Cape Breton Island.

4.2. Post-Contact Historic Mi'kmaw Land Use & Occupancy prior to 1900

While historical records documenting Mi'kmaw presence in the Study Area are not plentiful, they do reach back to the early contact period, that is the early 1600s when the French were operating seasonal fishing stations at Canso[40].

One of the earliest references is found in a 1607 letter from Canso to the French habitation of Port Royal with the news that Indian graves had been opened and beaver skins removed from the deceased by Dutch fishermen, upon which the Indians responded with killing the person who had revealed the location of the graves. When in 1609 Henry Hudson entered Canso harbour to repair his ship, he mentions the existence of an Indian village there whose residents received him kindly[41].

In the early contact years, the Study Area was rich enough in resources to lure French and English traders into the area for the specific purpose of trading with the local Mi'kmaw. Most of this trade was in furs and salmon.

A copper-kettle burial that eroded out of the bank at the mouth of the Salmon River in 2005 and was dated to about 1620 AD is both a confirmation of Mi'kmaw presence there as well as a testimony of early trading contacts between them and early European fishermen on this coast[42].

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39 Not surprisingly, these locations were attractive to the newcomers as well and eventually became settled

40 For details, see Appendix 5: Historical Records Review

41 Haynes 2007:9; Appendix 5: Historical Records Review

42 Lewis 2012; Rosenmeier 2012

In 1629, Captain Charles Daniel built a trading post at Chedabucto, the present location of Guysborough[43]. This post was later taken over by Isaac de Razilly and in 1636 by Nicolas Denys, and became known as Fort St. Louis or Chédabouctou Fort. In 1650 Denys moved his post to the site of St. Peters (Fort Toulouse) in the hope of benefitting from protection by the Fortress of Louisbourg[44]. Both those sites were chosen because they were located on traditional Mi'kmaw travel routes that lead from the Chedabucto Bay to the St. Georges Bay in the case of Fort St. Louis, and to southeastern Cape Breton Island in the case of Fort Toulouse.

Further to the south, a trading post was established on the Mary's River in the 1650s where French trader La Giraudiere supplied Mi'kmaw with spears, nets and other supplies for the salmon fishery in the St. Mary's River and the Gelneg Lakes areas.

Another indicator of a stable presence of Mi'kmaw in the Study Region is the fact that the Catholic Church found it appropriate to establish several missions in the area: In Canso in 1642, in Chedabucto in 1657, in Afton (today Paqtnkek) in 1717.

The trading establishments were generally located at major estuaries along the coast (on primary travel routes, that is) to take advantage of the fact that the fishery, especially for cod, mackerel and herring around Canso and salmon at Chedabucto, was a crucial element in the Mi'kmaw economy. However, the resource areas of the Mi'kmaw families trading at these posts reached far into the interior. The entire St. Mary's River watershed appears to have been particularly rich in fish (salmon and trout) and other wildlife and extensively used by Mi'kmaw, and historical documents report numerous camp site locations and a large burial ground[45]. Heavily-frequented villages or camp sites were located at Country Harbour and Indian Harbour on the Eastern Shore, the south end of the travel route from the Chedabucto Shore. At Indian Harbour "there were once many villages of wigwams in the area as it was an ideal fishing and hunting area that provided all that the Micmac needed"[46].

In 1684 Frenchman La Valiliere robbed Nigascouet, a Mi'kmaq, who was on his way to Chedabucto with his season's harvest of 70 moose skins and 60 martin, 4 beaver and 2 otter pelts[47]. These reports testify to the richness of the region and its economic significance to the Mi'kmaw.

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43 Jones 1986:vi; Appendix 5: Historical Records Review
44 Lewis 2012
45 Hart 1975:154-158, PANS RG1, vol.380, pp.1-40, m/f 15,441
46 Hart 1975:157-158; Appendix 5: Historical Records Review
47 Haynes 2007:45, Appendix 5: Historical Records Review

The one and only census of Acadians by French colonial officials in 1688 recorded 52 Mi'kmaw individuals at Chedabucto, or Guysborough (town)[48].

The 'Canso tribe of Indians', as they were called at the time, were highly mobile travelling between the Chedabucto coast and Afton along what became known as the 'Roman Valley'[49]. Generally they tended to spend winters in Afton and spring, summer and fall at Chedabucto and smaller fishing camps along the coast eastward up to Canso[50]. In the 1680s a Mi'kmaw village was reported to exist one mile west of Chedabucto/Fort St. Louis. The post "flourished with 51 [non-Mi'kmaw] inhabitants and 52 Indians"[51].
At Canso, a continuous Mi'kmaw presence is clearly documented. An archaeological find of a cache of projectile points on Grassy Island was dated to about 500 AD[52] . Early historical documents attest to the continuation of Mi'kmaw occupancy here with references to a Mi'kmaw village just across from the Canso gut[53]. Another seasonal Mi'kmaw encampment that had persisted until the 1960s was located at Indian Cove on Durells Island.

During the 1700s the Mi'kmaw were increasingly drawn into the struggle between the French and English colonists over lands and resources, in particular the lucrative Canso fishery. In 1720, Gov. Phillips described Canso as "by far the most important commercial centre in Nova Scotia"[54].

Generally siding with the French, the Mi'kmaw suffered severely loosing many lives and access to their coastal harvesting areas. The repression of the aboriginal population culminated in Gov. Edward Cornwallis' orders to "annoy, distress & destroy the Indians every where" and that "a Premium be promised of ten guineas for every Micmac killed or taken prisoner"[55].

Nevertheless, the first two settlers to settle in the early 1760s at Chedabucto Bay, Elias and John Cook were welcomed by the Mi'kmaw and received assistance from them[56].

During the early 1700s, the Province began issuing licences of occupation to some of the Mi'kmaw in response to petitions. These were granted initially for harvesting timber or the use of shoreline sections for fishing, then after 1782 for homestead lots as well[57].

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48 Wicken 1994: 95, 107-109; Rosenmeier 2012
49 Still a local place name for a community located on the river bearing the same name
50 Prosper 2012, Haynes, 2007:45; Appendix 5: Historical Records Review
51 Haynes 2007:64; Morse 1935:140; Appendix 5: Historical Records Review
52 Ferguson 2011
53 Haynes 2007:90; Appendix 5: Historical Records Review
54 Jones 1986:ix; Appendix 5: Historical Records Review
55 PANS (Nova Scotia Archives) RG1, vol.186, p.22-23, n/f 15310
56 Hart 1975:54, 144; Appendix 5: Historical Records Review
57 Robertson 2000

However, no licences of occupation are known to have been granted within the Study Area.

Historical documents attest to a sharp increase of Mi'kmaw in the study area as a response to the small pox, whooping cough and measles outbreaks in 1801 and 1802. Many Mi'kmaw families were fleeing larger settlements and reserves for the relative isolation of the Guysborough area. Fourteen families from Antigonish (now Paqtnkek) and five from Pictou (now Pictou Landing) were reported to have moved to the "Salmon River encampment"[58]. How many of those families remained in the area once the outbreak subsided is unclear.

During the 1800s, increasing pressures through the expanding commercial fishery and improving fishing technology, as well as the growing numbers of settlers in the Study Area took a toll on the area's fish, wildlife and forestry resources[59]. Competition for declining resources, land grants to settlers, fishing privileges granted to commercial interests, and government policies pressuring Mi'kmaw to adopt agriculture increasingly marginalized the Mi'kmaw population[60].

Over decades, Mi'kmaw as well as concerned Indian Agents such as Abraham Gesner and John McKinnon submitted a series of petitions to the House of Assembly requesting aid and the protection of Mi'kmaw lands and livelihoods.

On April 6, 1845, for example, a petition by John Battist, Joseph Battist and Francis Cope was presented asking for land "in the neighbourhood of which they have many years sojourned. Each year their hunting ground and subsistence there from are more scanty and precarious"[61].

Indian Commissioner Abraham Gesner submitted on February 2, 1848 a petition signed by eleven Mi'kmaw Chiefs and Captains "to prevent the Hunting of Moose by Dogs and to Secure to Them Their Fisheries". The letter stated that the white man's hunting style was threatening the moose population as they only take the skins leaving the rest behind. It requested Mi'kmaw be allowed to spear salmon in any of the rivers in the province[62].

On December 8, 1848 another petition was submitted by Newel Joe and Newel Dennis asking for relief on behalf of the families Joe, Dennis, Grigwell, Lewie, Toney, Cristifer, Glema, Louland, Michel, Potet, Forit, French, Caber, Prosper and Sabia on the St. Mary's River. 200-300 moose were taken by white people in the St. Mary's area in the

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58 PANS/CPR, RG1, vol.430, no. 84, no.86, no.88, no.112, Prosper 2012

59 PANS RG5 Series P, vol. 52 #95 m/f 15616; Appendix 5: Historical Records Review

60 Haigh 2000

61 PANS MG15, vol. 3, #81 m/f 15106; Appendix 5: Historical Records Review

62 Haigh 2000:63; Appendix 5: Historical Records Review

previous spring alone. Fish and game for the Mi'kmaw families were getting scarce and a crop failure that year added to their precarious situation[63].

In 1872 Indian Agent John McKinnon reports to Secretary of State Hon. Joseph Howe on the condition of the Mi'kmaw in the District of Guysborough, listing the families: Gabril, Prosper, Joe, Sallome, Pictob, Scotchman, Marble, Batist, Fraser, Marshal, Nicholas, Cope, Lafford, Newl, Tony, Brassay, Meuse, Tom, Phillip, Paul, McKeugir and McMillan. Even though they had cultivated large tracts of land with hay, potatoes and oats their condition was poor since their fishery was not successful[64].

On August 23, 1872 Angus Cameron writes a letter to Hon. Joseph Howe reporting that the Mi'kmaw are being deprived of their burial ground in St. Mary's that they had been using for 150 years, located at Sheep Island at the Forks or Glenelg Lake[65].

Between 1861 and 1900, Nova Scotia census and Indian Affairs records report the Mi'kmaw population of Guysborough County to range between 88 and 180, with the exception of the years 1872-73 and 1898-1900 when numbers register between 33 and 48[66]. It is known, however, that census records are not reliable when it comes to the Mi'kmaw population generally understating actual numbers of residents[67].

Beginning in the 1820, the Province began establishing small reserves across Nova Scotia, 46 in total. None however were set up within the Study Area even though Mi'kmaw communities existed in Canso, Salmon River (or Cooks Cove as it is known today), Dort's Cove, and seasonal encampments at various other places.

After Confederation, the federal Indian Affairs Branch maintained an official Centralization Policy during the 1940s and 1950s, partly as a way of reducing administrative costs in the province and partly in "response to complaints about the presence of Mi'kmaw near non-aboriginal communities"[68]. The goal of this policy to centralize the Mi'kmaw population in the two reserves of Shubenacadie on the mainland and Eskasoni on Cape Breton Island ultimately failed. Many families resisted the pressure to relocate or ended up moving back to their previous homes or reserves.

However, the Centralization Policy "did fundamentally alter the geographic distribution of Mi'kmaw in the province"[69] and left a number of reserves unoccupied.
With the failure of the policy evident, another reorganization in 1957-58 brought about and confirmed the current pattern of Mi'kmaw First Nation communities.

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63 Haigh 2000:63; Appendix 5: Historical Records Review
64 NAC RG10, vol. 2134, file 27,046-1, Appendix 5: Historical Records Review
65 NAC RG10, vol. 2134, file 27,046-1, Appendix 5: Historical Records Review
66 See Appendix 5: Historical Records Review, pp.14-17
67 Rosenmeier 2012
68 Kenny & Parenteau Research Assoc. 2000:i-ii,67.
69 Kenny & Parenteau Research Assoc. 2000:v

These events caused considerable disruptions in traditional settlement and land use patterns and further restricted access to resources for several generations of Mi'kmaw. Through the growing use of motorized transportation since the mid-20th century Mi'kmaw families were able to re-capture some of their traditional harvesting areas, as far as they had not become subject to competing uses by the dominant society such as municipal, agricultural or industrial development, parks and protected areas.

5. Section III: CONTEMPORARY MI'KMAW LAND AND RESOURCE USES

Following the generally accepted definition, the term 'contemporary land use' is used here to describe land and resource uses, and occupancy activities and locations, within living memory.

High mobility has always been a crucial characteristic of the land use patterns of Mi'kmaw individuals and families. However, as long as resources remained predictable, it was natural that hunters, fishers and harvesters of other natural resources tended to utilize areas that they are intimately familiar with and pass on this familiarity to their children. As a consequence, spatial land use patterns of Mi'kmaw families have in general remained fairly stable. However, the centralization policy, increasing settlement density, and motorized transportation and the associated infrastructure have brought about some adjustments.

John Prosper, Chief of Bayfield (Paqtnkek) in the early 1960s may serve as an example of a highly mobile Mi'kmaw harvester utilizing the resources of the entire region. He was born into the 'Canso band' and spent winters at Framboise Cove, Cape Breton, spearing eels and would come to Canso to fish in the spring[70].

Until the 1960s, the Study Area and its resources were extensively use by members of the three closest communities of Paqtnkek, Chapel Island and Eskasoni. But families with ties to Millbrook as well as the aforementioned also lived in the Mi'kmaw community of Salmon River, or Cooks Cove, on several locations in Guysborough Harbour, on Clam Pond and Black Pond at Clam Harbour Beach, and in Dort's Cove. On the south side of the mouth of the Salmon River was a small Mi'kmaw community, then known as the Mountain Road community. In addition to their subsistence harvesting they carried out small-scale commercial activities such as the manufacture

[70] Letter by archaeologist John Erskine to G.Campbell, Sydney Academy Principal, dated Feb 6, 1965; Appendix 5: Historical Records Review

and sale of axe handles, baskets, barrels and snowshoes to the area's non-native settlers and fishermen and the people of Guysborough town[71].

Also up to the 1960s, a number of families from Eskasoni, Chapel Island and even Isle Madame maintained a seasonal settlement at Indian Cove (hence the name) on the east side of Durells Island.
The Canso area, and Durells Island and Betsey's Beach in particular, were of the primary travel route between Cape Breton Island and the Nova Scotia mainland. Local residents recall Mi'kmaw, sometimes more than 100 individuals, arriving on Durells Island in March or April and staying until October. It was used during summers for fishing and making baskets which were then sold to the townspeople of Canso and some other mainland and Cape Breton communities[72].

The Mi'kmaw families of all those settlements, permanent and seasonal, utilized resources located within the study area[73]. These included marine fish and shellfish resources along the coast, coastal wildlife species (shorebirds, etc.), inland fish and wildlife species, specialty woods for basket making, tools (ax handles, snowshoe frames, barrels) and other crafts, food and medicinal plants, etc.

Even though these settlements and seasonal encampments were given up around the mid-twentieth century, harvesting activities by some members of the surrounding communities (Paqtnkek, Pictou Landing, Chapel Island, Millbrook) are still ongoing, albeit at a lower intensity[74]. Motorized transportation such as all-terrain vehicles, snowmobiles, pick-up trucks, engine-powered boats put the Study Area`s resources within relatively easy reach from any of these reserve communities.

The fact that the waters along the southern Chedabucto coastline, unlike the those of the St. George`s Bay, do generally not freeze or get clogged with ice flows[75] offers virtually unimpeded fishing during the winter months to fishers from Paqtnkek and Pictou Landing.

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71 Prosper 2012, Rosenmeier 2012

72 Martha Murphy, Canso Museum, personal communication June 2012, Davis Archaeological Consultants 2004: 24-26, Ferguson 2011, Rosenmeier 2012

73 Prosper 2012, Rosenmeier 2012

74 Prosper 2012

75 Due to the prevailing winds. Prosper 2012

The survey of current Mi'kmaw land use of the Study Area revealed the following activities and patterns[76]:

> Marine resources reported to be harvested along the Study Area portion of the Chedabucto coast include mackerel, herring, cod, haddock, urchins, mussels, oysters, clams, as well as snow crab in deeper waters. The sandbar extending between Fox Island and the mainland is known as a productive shellfish bed.
>
> Reported freshwater fishery resources are salmon, trout and eel. Moose and deer are harvested, as well as various small game species. General trapping activities were indicated to occur within the study area as well. Even though the region does not to be particularly attractive as a waterfowl staging or breeding area, Canada geese are indicated as a waterfowl species being harvested here.
>
> Plant resources include specialty woods such as maple, ash, birch as well as birch bark for tools, crafts and decorative items. Berries of various types are reported to be harvested in the study region. These include blueberries, cranberries, strawberries and fox berries. Several species of medicinal plants[77] are being collected here, as well as plants used for ceremonial purposes.

Within the Project Area itself, harvesting of the following types of resources are being reported:

> Cod, herring, mackerel, oyster and urchin fishing were indicated to occur along its shore.
>
> With respect to terrestrial harvesting activities, moose, deer and goose hunting were indentified, as well the trapping of furbearers.
>
> Plant resources harvested in this area consist of maple, various berry species, wild caraway seeds, and medicinal plants.

For the purpose of this assessment, Mi'kmaw land and resource use activities are grouped into five categories: Hunting/fishing, gathering food/medicinal plants, wood and wood products, ceremonial/spiritual sites, burial/birth places, and habitation/camp sites.

Reported activities are summarized in the following table (Table 1) and on the following map (Figures 14 & 15).

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[76] See map, appendix 6. Mi'kmaq land use activities may not be limited to the activities, species, and harvesting areas identified here.

[77] Specific plant names withheld upon informants' requests and for protection of species

LAND/RESOURCE USE CATEGORY	REPORTED ACTIVITIES/RESOURCES
Hunting/Fishing Sites/Areas	Moose, deer, hare, porcupine, furbearers, grouse, geese, trout, haddock, mackerel, herring, cod, eel, lobster, urchin, mussel, oyster, scallop
Food/Medicinal Plants Gathering	Caraway seeds, hazelnuts, chokecherries, strawberries, blueberries, cranberries, fox berries, Labrador tea, various medicinal plants
Wood, Wood Products	Maple, birch bark
Ceremonial/Spiritual Sites	Ceremonial plant, decoration plant
Burial/Birth Places	(None reported)
Habitation/Camp Sites	Camp site

Tab. 1: Summary of Reported Land/Resource Use Activities in the Study Area

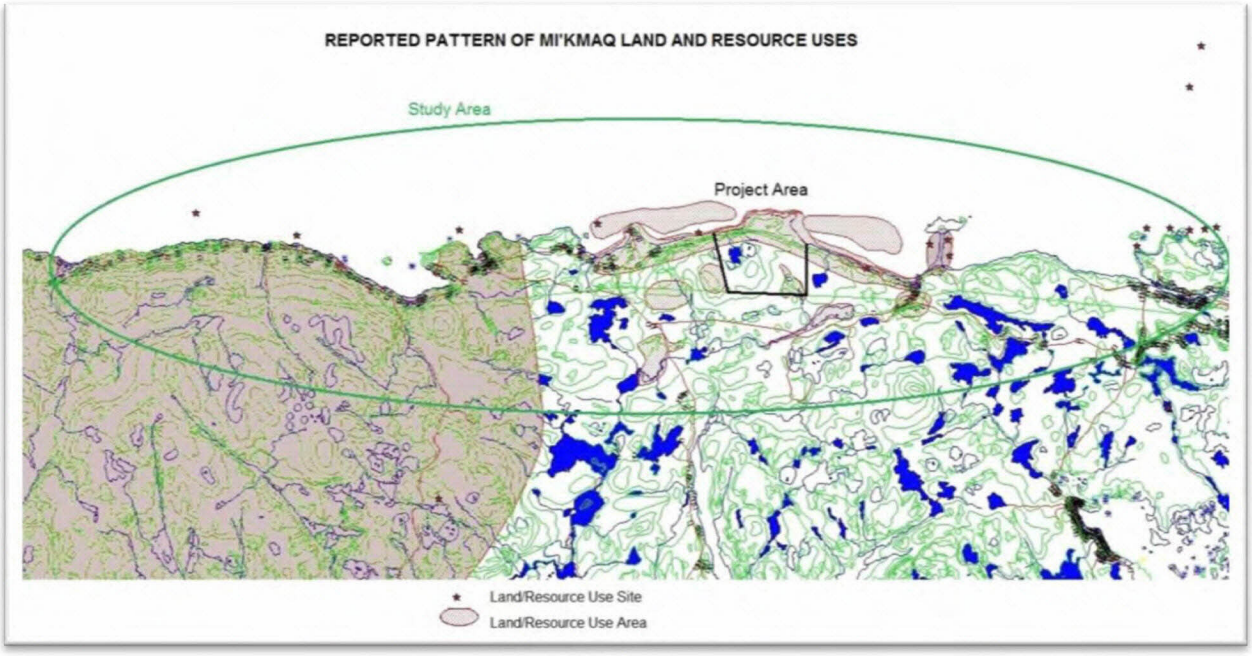

Fig. 14: Reported Pattern of Mi'kmaw Land and Resource Uses

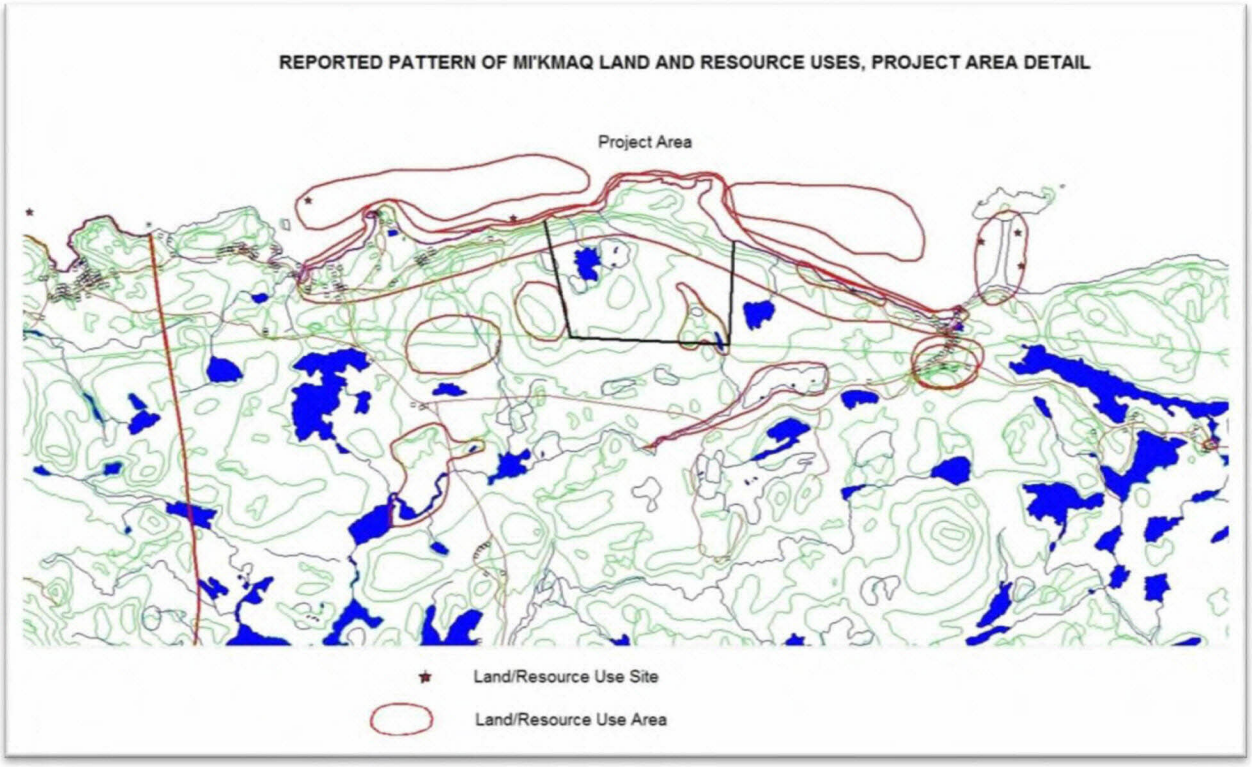

Fig. 15: Reported Pattern of Mi'kmaw Land and Resource Uses, Project Area Detail

6. Section IV: RESERVE LANDS AND SPECIFIC CLAIMS

There are no Indian reserves located within the Study Area or Project Area. The nearest reserves are Chapel Island IR 5, about 50 kilometres[78] to the northeast on Cape Breton Island, and Paqtnkek IR 23, approximately 55 kilometres to the northwest near St. George's Bay.

A review of outstanding specific claims was undertaken by MAPS.
No specific claims are pending within the Study Area. This does not imply, however, that a specific land claim may not arise in the future.

[78] Linear distance

7. Section V: IMPACTS AND MITIGATIONS

7.1. Potential Project Impacts on Mi'kmaw Land and Resource Uses

The review of historic and contemporary (within living memory) Mi'kmaw land use and occupancy in the Study and Project areas confirms and documents Mi'kmaw use and occupation.

Based on the above findings potential project impacts are expected on several levels:

1) There is a potential for the disturbance of hitherto unidentified archaeological resources during the construction of the infrastructure (access road, processing facility, shipping terminal) associated with the project, as well as the quarry operation itself.
2) The permanent loss of wildlife and plant resources within the immediate project footprint is inevitable. This may be as a result of the physical destruction, removal or displacement of specimens, or restriction of access to the location as a potential harvesting area.
3) Noise disturbance resulting from increased human presence, vehicular traffic, blasting, and general mining activities will adversely impacts local wildlife resources.
4) Dust and other airborne pollutants created during the mining, crushing and transport of the product are expected to settle on the vegetation, wetlands and water bodies within a certain corridor along the access road, and a certain radius of the quarry pit as well as the shipping terminal, depending on prevailing winds. This will depreciate the quality of local food and medicinal plants for human consumption as well as the quality of animal browse and water/wetland habitat.
5) The marine and shoreline habitats surrounding the shipping terminal are threatened by dust contamination, the potential for accidental aggregate spillage during loading, and possible contamination resulting from petroleum products associated with cargo vessels. The potential effects of these kinds of events on the near-shore fishery is undetermined.

The criteria for assessing the significance of potential impacts on Mi'kmaw land and resource uses in the Study Area are:

a) The nature and volume of current land and resource uses,
b) the uniqueness of the land and resources in question,
c) the cultural and spiritual significance of the land and resources, and
d) Mi'kmaw constitutionally protected rights and interests in lands and resources.

POTENTIAL IMPACTS	ASSESSMENT OF SIGNIFICANCE
1) Disturbance of archaeological resources	Being the only source of information on Mi'kmaw pre-contact history, land use, occupancy and culture. Archaeological resources are irreplaceable and of extreme importance.
2) Permanent loss of wildlife and plant resources within the immediate project footprint	The species of significance to Mi'kmaw identified within the Project Areas, in particular medicinal plants, are also present within the surrounding areas. The permanent loss of some of (or access to) these specimens within the Project Area is not expected to significantly limit Mi'kmaw use of these resources.
3) Noise disturbance will adversely impacts local wildlife resources	As the frequencies, sound levels and the radius of the noise harassment/injury threshold of 92 dBA[79] resulting from the project's blasting activities are undetermined, the spatial range of these impacts on wildlife is unknown. Because of the local nature of these impacts, their significance on local Mi'kmaw harvesting activities is limited.
4) Contamination of surrounding vegetation, wetlands and water bodies through dust and other airborne pollutants.	The level of depreciation of local food and medicinal plants for human consumption is undetermined, and so are the impacts of a deteriorating quality of animal browse and water/wetland habitats on local fish and wildlife. Even though the radius of these impacts will undoubtedly extend beyond the boundaries of the Project Area, their effects on Mi'kmaw resource activities is expected to be limited.
5) Contamination of marine and shoreline habitats surrounding the shipping terminal through dust, accidental aggregate spillage and possible fuel, oil or waste discharge associated with cargo vessels.	While dust contamination associated with the project activities seems unavoidable, the likelihood of aggregate spillage and fuel/oil/waste pollution is undetermined. Potential impacts of such occurrences on the surrounding marine and shoreline ecosystems are also unassessed, but may be wider-ranging depending on factors such as season and marine currents. The significance of such potential impacts on the Mi'kmaw fishery is undetermined.

Tab. 2: Significance of Potential Project Impacts of Mi'kmaw Land & Resource Uses

[79] Washington Sate Dept of Transportation 2012:, p. 7.11

7.2. Recommendations

1) It is recommended that, prior to construction, the archeological potential of the Project Area is assessed by a qualified archaeologist in adherence to the Nova Scotia Special Places Protection Act *R.S., c.438, s.l.*[80] and any area determined to be of high potential be excavated.
Should any archaeological artifacts be encountered during the construction or operation of the Project, all work should be halted and immediate contact be made with the Nova Scotia Museum of Natural History's Special Places Coordinator Laura Bennett (902-424-6425) or Archaeology Curator (902-424-6461), and the Confederacy of Mainland Mi'kmaq's History and Culture Coordinator Tim Bernard (902-895-6385).

2) During the construction and operation phase, particular attention should be paid towards minimizing the spread of airborne pollutants generated as a result of blasting, quarrying, crushing and aggregate transport, and their impacts on the surrounding areas' vegetation and water bodies, with the local average speed and direction of the prevailing winds determining the potentially affected zone.

3) During the operation phase, strict operations protocols need to be in place in order to minimize the potential for accidental spillage of aggregate and the associated fine-grained waste during loading at the shipping terminal in order to avoid seabed contamination. Depending on local tidal action and currents, the extent of potentially impacted area and associated marine and shoreline resources may be significant.

[80] http://nslegislature.ca/legc/statutes/specplac.htm ;
see also http://www.gov.ns.ca/cch/exploring/archaeology/

9. References

AECOM
2011 Erdene Resource Development Corp. – Project Description, Black Point Quarry Project. Project No. 60190702. Halifax, NS: AECOM

Allen, G.
2006 Preliminary Historical Research on Mi'kmaq Place-Names in Nova Scotia. Report prepared for the Aboriginal Title Project, Treaty and Aboriginal Rights Research Centre. 3vols. Halifax, NS

Assembly of Nova Scotia Indian Chiefs
2007 Mi'kmaq Ecological Knowledge Study Protocol, as Ratified on November 22, 2007. Sydney, NS: Assembly of Nova Scotia Indian Chiefs

Cooke F.
1976 History and Stories of Isaac's Harbour and Goldboro. Antigonish, NS: Formac

COSEWIC (Committee on the Status of Endangered Wildlife in Canada)
2006 COSEWIC Assessment and Update Status Report on the Atlantic Walrus *Odobenus rosmarus rosmarus* in Canada. Ottawa: COSEWIC Secretariat, Environment Canada

Davis Archaeological Consultants Ltd.
2004 Archaeological Resource Impact Assessment, Canso Wind Farm. Heritage Research Permit A2004NS53. Submitted to AMEC Earth and Environmental Ltd. Halifax, NS: Davis Archaeological Consultants Ltd.

Denys, Nicolas
1672 Concerning the Ways of the Indians – Their customs, dress, methods of hunting and fishing and their amusements. Reprint. Halifax, NS: Nova Scotia Department of Education

Erdene Resource Development Corp.
2011 Black Point Quarry Project, Project Information Sheet. Dartmouth, NS: Erdene Resource Development Corp.

Ferguson, R.
2011 Rob Ferguson, Archaeologist, Parks Canada, personal communication, Dec. 2011

Gilpin, J.B.
1869 'The Walrus' (read on May 10, 1869). Proceedings and Transactions of the Nova Scotia Institute of Science, vol.2, part 3, pp.123-127. Halifax, NS

Haigh, E.
2000 'They Must Cultivate the Land: Abraham Gesner as Indian Commissioner, 1847-1853'. In: Journal of the Royal Nova Scotia Historical Society, vol. 3

Hart, H.C.
1975 History of the County of Guysborough, Nova Scotia. Belleville, ON: No publisher

Haynes, M.
2007 The Forgotten Battle: A History of the Acadians of Canso/Chedabucto. Victoria, BC: Trafford Publishing (2nd ed.).

Hoffman, B.G.
1955 The Historical Ethnography of the Micmac of the Sixteenth and Seventeenth Centuries. Berkeley, CA: University of California

Jones, E.
1986 Gentlemen and Jesuits: Quests for Glory and Adventure in the Early Days of New France. Toronto, ON: University of Toronto Press

Kenny & Parenteau Research Assoc.
2000 Historical Report: Centralization of Nova Scotia's Mi'kmaq: 1918-1965. Prepared for the Specific Claims Branch, Dept. of Indian and Northern Affairs.

Lewis, R.
2012 Roger Lewis, archaeologist and Ethnology Assistant Curator, Nova Scotia Museum of Natural History, Halifax, NS. Personal Communication, June 2012

2011 Erdene Resources Development Corporation Black Point Quarry Project, Cultural Aspects Review. Report prepared for Mi'kma'ki All Points Services. Nov. 2011. Dartmouth, NS: R. Lewis

2006 Pre-Contact Fish Weirs: A Case Study From Southwestern Nova Scotia. M.A. Thesis. Archaeology Unit, Dept. of Anthropology, Memorial University, St.John's, NL, Feb. 20, 2006

Miller, R.F.
2011 'Late Glacial and Post-Glacial Fauna: Fossil Evidence from the Maritimes From the Last Glacial Maximum to the Holocene'. In: Bernard, T./ Rosenmeier, L./ Farrell, S. (eds), Ta'n Wetaeksik – Understanding From Where We Come. Proceedings of the 2005 Debert Research Workshop, Debert, Nova Scotia, Canada. Pp 77-90.Truro, NS: Confederacy of Mainland Mi'kmaq

Mott, R.J.
2011 'Paleoecology and Chronology of Nova scotia Relating to the Debert Archaeological Site'. In: Bernard, T./ Rosenmeier, L./ Farrell, S. (eds), Ta'n Wetaeksik – Understanding From Where We Come. Proceedings of the 2005 Debert Research Workshop, Debert, Nova Scotia, Canada. Pp 39-53.Truro, NS: Confederacy of Mainland Mi'kmaq

Patterson, L.L.
1985 Indian Affairs and the Nova Scotia Centralization Policy. MA thesis, Dalhousie University, Halifax, NS

Paul, K.
2006 ATK Scotian Shelf Project Report. Submitted to Oceans & Coastal Management, Department of Fisheries & Oceans by Unama'ki Institute Natural Resources. Eskasoni, NS

Prosper, K.
2012 Kerry Prosper, Paqtnkek First Nation, personal communication, May-Aug 2012

Robertson, A.B.
2000 Report on Licences of Occupation in Nova Scotia. Joint Research Initiative INAC, CMM, and Treaty Centre. Halifax

Robinson, B.S.
2011 Bull Brook and Debert: The Original Large Paleoindian Sites in Northeast North America'. In: Bernard, T./ Rosenmeier, L./ Farrell, S. (eds.), Ta'n Wetaeksik – Understanding From Where We Come. Proceedings of the 2005 Debert Research Workshop, Debert, Nova Scotia, Canada. Pp 133-143.Truro, NS: Confederacy of Mainland Mi'kmaq

Rosenmeier, L. M.
2012 Leah M. Rosenmeier, archaeologist, Confederacy of Mainland Mi'kmaq, Millbrook, NS. Personal communication June 2012

Sable, T.& B. Francis.
2012 The Language of This Land, Mi'kma'ki. Sydney, NS: Cape Breton University Press

Sheldon, H.
2000 Aboriginal Archaeological Sites of Nova Scotia: An Analysis. Aboriginal Archaeological Sites Project. Indian Brook, NS: Treaty and Aboriginal Rights Research Centre

Stea, R.R. & R.J. Mott
2006 'Younger Dryas Glacial Advance in the Southern Gulf of St. Lawrence, Canada: Analogue for Ice Age Inception?' in: Boreas, 34:345-362

Telfer, E.S.
2004 'Continuing Environmental Change – An Example from Nova Scotia'. In: Canadian Field Naturalist, 118/1:39-44

Tobin, A.M.
1999 The Effect of Centralization on the Social and Political Systems of the Mainland Nova Scotia Mi'kmaq (Case Studies: Millbrook-1916 & Indian Brook-1941). MA thesis, Atlantic Canada Studies. St. Mary's University, Halifax, NS

Washington State Dept. of Transportation
2012 Biological Assessment Preparation Advanced Training Manual, ver. 02-2012. Washington, DC: WSDOT

Weiler, M.H.
2008 Cultural Analysis of Mi'kmaq Toponyms of Prince Edward Island. Mi'kmaq Place Names Cultural Preservation Project. Final Report, Prepared for the Mi'kmaq Confederacy of PEI. Springfield

2004 'Our Footprint on Our Land – The Success Story of the Traditional Use Study (TUS) in Nova Scotia'. Presentation given at the National Claims Research Workshop, Halifax 23-26 Oct. 2004

Wicken, W.C.
1994 Encounters with Tall Sails and Tall Tales: Mi'kmaq Society, 1500-1760. Ph.D. Thesis, McGill University, Montreal, QC

9. APPENDICES

Appendix 1

Erdene Resource Development Corp.:

Black Point Quarry Project

Project Information Sheet

Erdene Resource Development Corp.
Black Point Quarry Project
Project Information Sheet

Project Overview

Erdene Resource Development Corp. (Erdene) of Dartmouth, Nova Scotia proposes development of the Black Point Aggregate Quarry within Guysborough County, Nova Scotia. The proposed project area is situated on a 280 hectare (ha) property located along the southern rim of the Chedabucto Bay approximately 10 kilometres (km) west of the Town of Canso (Figure 1) leased from the Municipality of the District of Guysborough (MODG). After an extensive five year aggregate exploration program conducted by Erdene, the Black Point site was selected as a top prospect for future quarry development. The property, which is currently zoned Heavy Industrial (M-2), hosts a large tonnage resource of high quality granite, immediately situated on sheltered, ice-free tidal water. This location provides direct access to international shipping lanes facilitating efficient transportation of the aggregate resource to US and Caribbean markets via bulk carrier vessels.

Project development will generally include pit development and aggregate production (drilling, blasting, processing, and stockpiling) along with the construction and operation of a marine terminal adjacent to the quarry in Chedabucto Bay, where processed aggregate will be off-loaded in Panamax-sized ships (up to 70,000 tonnes) and transported to ports along the eastern and Gulf coast markets of the US and potentially markets in Canada and the Caribbean.

The anticipated average annual production rate will exceed 1.0 million tonnes with an anticipated peak production rate of 6.5 million tonnes per year. The anticipated operating schedule is 15 hrs/day, 7 days/week; on a year-round basis and weather permitting. Estimated rock reserves in the proposed quarry area are in the order of 250 million tonnes. Quarry operations are expected to take place over a period of approximately 50 years, depending on the demand for aggregate.

The land to be developed is primarily owned by the MODG, as per a recent land transfer agreement with the Provincial Crown Lands Group. With the recent Cabinet approval of the land transaction and the unwavering local political support, Erdene feels that it is time to advance the Project.

Construction aggregates are comprised primarily of crushed stone, natural sands, and gravel. These resources are a necessity for the development and maintenance of modern infrastructure. Although construction aggregates have numerous end uses, their general application is in the production of building materials such as concrete and asphalt. The US consumed almost 10 metric tonnes of aggregate per person in 2007 (USGS) totalling a volume of more than 3 billion tonnes. Total volumes have decreased in the US post 2007 to 2 billion tonnes as a direct result of the global economic downturn. Recent statistics indicate US per capita usage averaged 7 tonnes in 2010 (USGS).

While construction aggregates are relatively abundant they must be located in accessible areas to be of economic value; as they are low priced, high volume commodities and the cost of transporting to the market can easily exceed the value of the material. Aggregates must also meet strict quality requirements related to the chemical and physical characteristics of the rock. Many rock types do not meet these quality specifications and cannot qualify as viable construction aggregate resources.

In the US market, the majority (80% or more) of aggregates are transported by truck from the quarried source to the consumer. This form of transport is expensive and limits the typical aggregate operation to a market radius of about 80 km. Coastal markets within the US are increasing the use of high volume modes of transportation such as rail and ship to minimize costs. The south eastern US aggregate market is a prime target for bulk transported aggregate due in part to the geologic absence of suitable aggregate resources in coastal areas. For example the Martin Marietta Materials' quarry at Aulds Cove, Nova Scotia shipped nearly 300 vessels of crushed stone to Florida ports between 2004 and 2009 (Eastern US Seaboard Market Study: Archibald Consulting Services, LLC; November 2009).

Economic Benefits

The proposed Black Point operation would provide many family-waged jobs to Guysborough and surrounding communities. An estimated 155 persons would be directly and indirectly employed in Guysborough County during the site development phase which would include wharf and aggregate plant construction. An estimated 123 direct and indirect full-time jobs would be created during the peak operation phase of the quarry with an estimated output of 6.5 million tonnes of material per year. Peak production is estimated to occur within approximately 10 years of quarry development. All employment estimates were determined by a third party consultant (Gardner Pinfold Economic Impact Analysis).

Environmental Assessment Triggers

Section 5(1) of the *Canadian Environmental Assessment Act* (*CEAA*) stipulates that a federal environmental assessment (EA) is required when a federal authority is involved in a project. There are at least two activities pursuant to the Law List Regulations that are anticipated to trigger a federal EA for the Black Point Quarry Project: the construction of a wharf in navigable waters as regulated by the *Navigable Waters Protection Act* (administered by Transport Canada), and the potential harmful alteration, disruption or destruction (HADD) of fish habitat as regulated by the *Fisheries Act* administered by Fisheries and Oceans Canada (DFO). A third potential trigger is for the potential storage and manufacture of explosives as regulated by the Explosives Act administered by Natural Resources Canada.

In accordance with Section 21(1) of *CEAA* and the *Comprehensive Study List Regulations* (*CSLR*), the Project will require a comprehensive study level assessment. Under the *CSLR*, a Comprehensive Study is required for a stone quarry with a production capacity of 1,000,000 t/yr or more. Furthermore, a marine terminal designed to handle vessels larger than 25,000 DWT also require a comprehensive study. As such, the Canadian Environmental Assessment Agency (CEA Agency) will exercise the powers and perform the duties and functions of the responsible authority, according to recent amendments to *CEAA*.

In consideration of the resource based nature of the Project, the level of environmental assessment required, and the multi-jurisdictional requirements, it is anticipated that the federal review of the Project may also be overseen and tracked by the Major Projects Management Office (MPMO).

In addition to the above federal EA requirements, the Project also requires completion of a provincial environmental assessment pursuant to Nova Scotia's *Environment Act* and Environmental Assessment Regulations. As a quarry that is larger than 4 ha and an undertaking that may disrupt wetlands in excess of 2 ha, the proposed Project is considered to be a Class 1 Undertaking, which will require the submission of an Environmental Assessment Registration Document. Further requirements for the provincial EA process have been established in the Guide to Preparing an EA Registration Document for Pit and Quarry Developments in Nova Scotia (NSE 2009).

It is desired and anticipated that a Federal-Provincial Environmental Assessment Agreement be negotiated by all relevant agencies such that the two EA processes would be harmonized.

Design and Component Studies

In support of the Project design and environmental assessment, Erdene has completed the following studies to date in an effort to advance the project:

- Fatal Flaw Study - AMEC (2007)
- Extensive core drilling & testing – Logan Drilling/AMEC (2007-08)
- Detailed chemical and physical testing of the resource – AMEC (2008)
- Conceptual wharf design & redesign, wind & wave analysis & capital estimates – Eastpoint Engineering & CBCL (2008 & 2010)
- Detailed US marketing studies NE and SE – Lampl Herbert & Archibald Consulting (2007 & 2009)
- Conceptual plant design & capital estimates – Mine Equipment & Design (2008)
- Communication strategy & plan - MT&L (2008)
- Economic Impact Study – Gardner Pinfold (2010)
- Conceptual mine plans – Minetech (2010)
- Baseline environmental studies (terrestrial and marine) – AMEC & AECOM (2010, 2011)
- Preliminary aboriginal consultation – AMEC (2011)
- Internal Scoping Study & financial modeling (on-going)

Additional studies to be completed include: wetland delineation; baseline noise data collection; hydrology and hydrogeology; and acquisition of LIDAR.

Consultation and Engagement

The Black Point Quarry is expected to be a project of regional significance. As such, Erdene will undertake a comprehensive and open communications campaign to engage and share information about the project with as many stakeholders as possible to make the project a reality. To aid in this endeavor, Erdene has retained MT&L Public Relations to provide guidance in the development and management of the communication campaign and to ensure consistent and accurate messaging. Some of the tools Erdene plans to use to effectively communicate the merits of the project are:

- A full time community development manager based in Guysborough so that an open door communication atmosphere exists.
- A project-specific web site to keep stakeholders current on all information and project specific material.
- Periodic newsletters to all stakeholders as new information becomes available.
- A Community Liaison Committee (CLC) comprised of interested citizens to meet periodically during construction and operation to address community concerns.
- Regular stakeholder meetings throughout the permitting process to ensure all interested parties are hearing the information first hand from company officials.

Furthermore, Erdene has retained AMEC to continue with First Nations engagement.

Environmental Impact Statement

Erdene has retained AECOM to prepare the Environmental Impact Statement (EIS) report for the Project. The EIS report will evaluate potential environmental effects of the Project and will focus on those aspects of the environment of most concern such as: rare and sensitive flora; wetlands; wildlife and wildlife habitat; fish and fish habitat (marine and fresh water); surface and groundwater resources; atmospheric resources (air quality and noise); archaeological and heritage resources; land use; commercial fisheries; and current use of traditional land and resources by Aboriginal People. The EIS report will identify appropriate mitigation and monitoring to minimize these effects and will assess the residual effects and their significance.

Project and Environmental Assessment Contacts:

If you have any questions or concerns please contact:

Project Manager
Mark R. Davies, P.G.
Erdene Resource Development Corp.
(561) 373-2988 cell
(561) 277-8272 office
Email: mdavies@erdene.com

Environmental Assessment Coordinator
Janice Ray
AECOM
Tel: (902) 428-2048
Fax: (902) 428-2031
Email: janice.ray@aecom.com

AECOM

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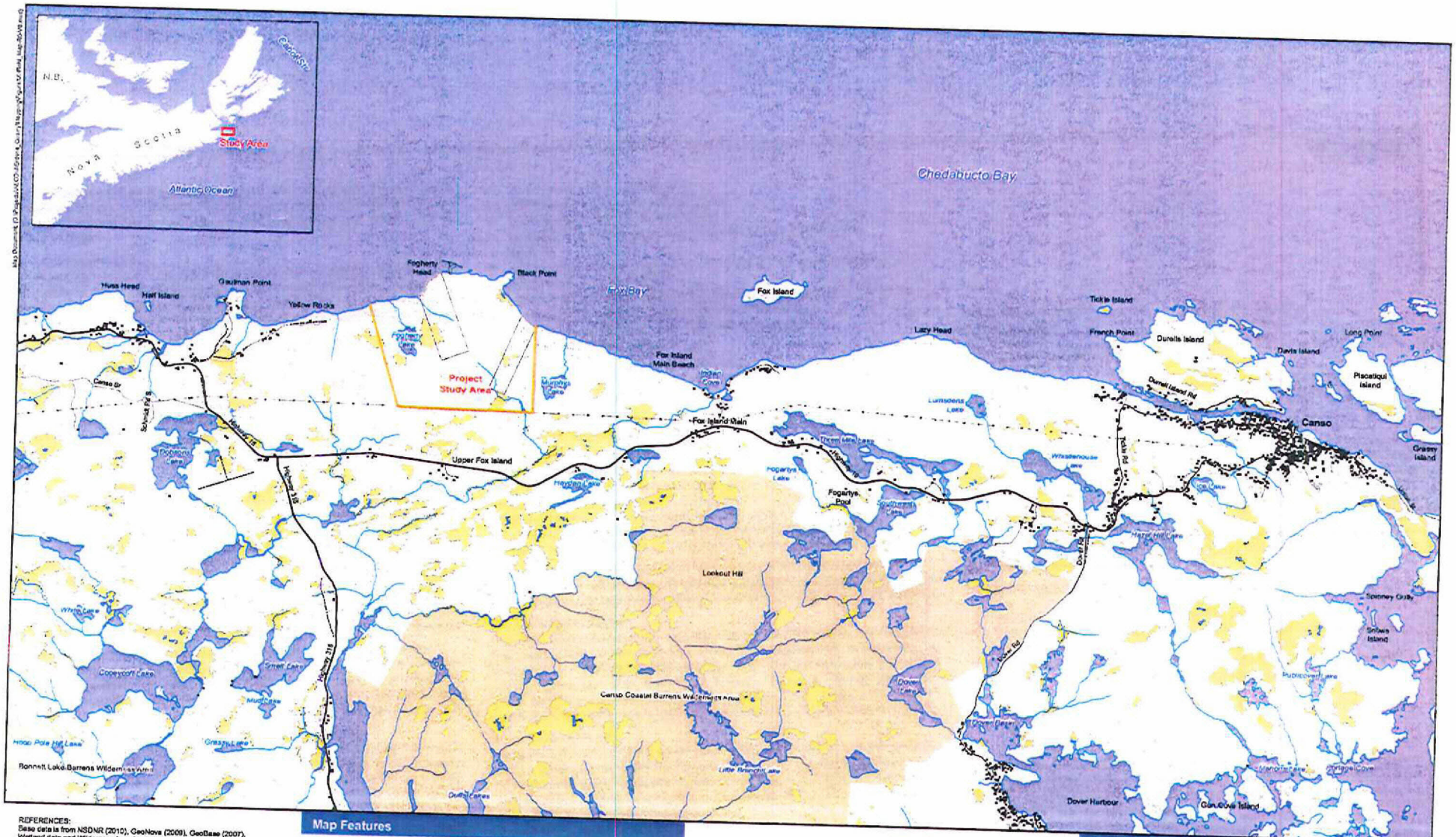

Figure 1
Project Location

Proposed Black Point Quarry Project
Erdene Resource Development Corp.

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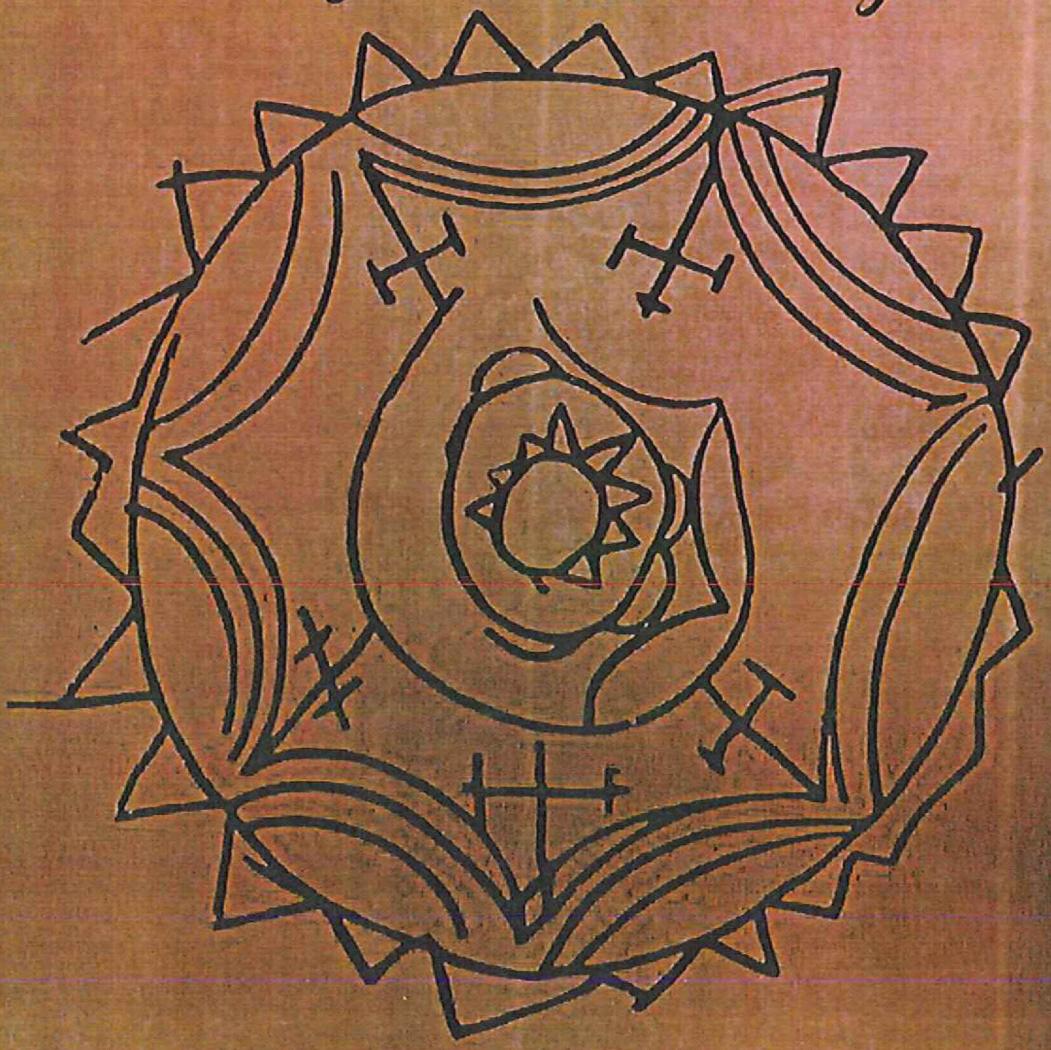
Appendix 2

Mi'kmaq Ecological Knowledge Study Protocol

Mi'kmaq

Ecological Knowledge



Study Protocol

1st Edition

C 1340-1921

ASSEMBLY OF NOVA SCOTIA MI'KMAQ CHIEFS

The Assembly of Nova Scotia Mi'kmaq Chiefs would like to recognize and commend the efforts of the following Mi'kmaq organizations who through their technical representatives, provided much guidance and support throughout the drafting stages of this Mi'kmaq Ecological Knowledge Study Protocol

Kwilmu'kw Maw klusuaqn
Mi'kmaq Rights Initiative

The Confederacy of Mainland Mi'kmaq

Union of Nova Scotia Indians

Membertou
A Mi'kmaq First Nation Community

Assembly of Nova Scotia Mi'kmaq Chiefs

Mi'kmaq Ecological Knowledge Study Protocol

As Ratified on November 22, 2007

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Foreword

The enclosed Mi'kmaq Ecological Knowledge Study Protocol (MEKS Protocol) represents an important milestone for the Nova Scotia Mi'kmaq to manage the collection and distribution of Mi'kmaq Ecological Knowledge throughout Nova Scotia. The protection of Mi'kmaq Ecological Knowledge[1] (MEK) has been highlighted as a key issue through the Assembly of Nova Scotia Mi'kmaq Chiefs (the "Assembly"). The Assembly exists as an institution of governance for the Mi'kmaq of Nova Scotia with respect to issues of common interest and concern. It includes representation from all the thirteen Mi'kmaq Bands located throughout the province of Nova Scotia.

The purpose of the MEKS Protocol is to identify the essential components of an MEKS in accordance with the concerns and aspirations of the Assembly. By enacting this MEKS Protocol, the Assembly trusts that it will contribute to the following objectives: acknowledgment and respect of Mi'kmaq cultural practices, values and traditions; preservation of a Mi'kmaq cultural identity; an open, transparent and accountable MEKS process that is receptive to the unique needs of the Nova Scotia Mi'kmaq.

Although this MEKS Protocol will serve as the primary basis for any proposed MEKS in Nova Scotia, it should not be read in isolation from other Mi'kmaq regional or provincial processes regarding MEKS. Furthermore, the MEKS Protocol does not operate as to replace other applicable Mi'kmaq research ethics practices or procedures that exist or may be created from time to time. Where said provincial and regional processes exist, this MEK Protocol shall be liberally interpreted for consistency with said regional and provincial processes. If in the event that there is a clear conflict between this MEKS Protocol and other provincial and regional processes, this MEKS Protocol shall take precedence and prevail.

The MEKS Protocol is also a working or rolling document that through the course of time will undergo further discussion and change. Therefore, when undertaking an MEKS in Nova Scotia, please check for the latest revised document to ensure that any proposed MEKS practices are in keeping with the most recent positions and perspectives of the Nova Scotia Mi'kmaq.

[1] Throughout this document, Mi'kmaq Ecological Knowledge is intended to reflect the concept and meaning of Aboriginal Traditional Knowledge. However, it should also be noted that Mi'kmaq Ecological Knowledge is also specific to the unique practices, culture, values and traditions that the Mi'kmaq people have to all components of the natural environment.

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Section I – Introduction

Since time immemorial, the Mi'kmaq have used and occupied their traditional territory known as Mi'kma'ki which includes Nova Scotia, Prince Edward Island, New Brunswick and parts of Quebec, Newfoundland and the northeastern part of Maine. Mi'kmaq Paleo-Indian sites in Nova Scotia provide archaeological evidence of Mi'kmaq occupation for over 10,500 years. Today, the Mi'kmaq continue to use and occupy Mi'kma'ki and share a deep and profound relationship with their traditional lands.[2]

In Mi'kmaq cultural tradition, the Mi'kmaq utilize Netukulimk – a Mi'kmawey concept which includes the use of the natural bounty provided by the Creator for the self-support and well-being of the individual and the community at large. Netukulimk also encompasses ecological beliefs through the interplay of collective and individual responsibilities of the Mi'kmaq to the natural world. Such relationships with the land are holistic in nature and consider many aspects of the natural and spiritual world. These include, but are not limited to, land/marine resource use, management, conservation and Mi'kmaq spiritual beliefs.

Throughout history and today, Mi'kmaq subsistence and spiritual practices encompass the natural world in a manner that is, at times, distinct from understandings inherent in western society. The Mi'kmaq do not perceive the natural and spiritual world as separate and distinct spheres. This long-standing relationship that the Mi'kmaq have maintained for centuries with their natural surroundings is the foundation for MEK. For the Mi'kmaq, MEK is not just simply an exercise in the examination of Mi'kmaq land and resource use; rather, it also involves a unique approach to the gaining of this information through Mi'kmaq cultural practices and tradition.

Secondly, MEK is not static. It is constantly reanalyzed and tested through the experiences of new generations of Mi'kmaq. This experience considers and incorporates new and emerging resource issues thus enabling reliable MEK data to emerge through a shared experience. In light of this cultural dialogue or practice, it is important that a guiding and interpretive framework be advanced to take into account these unique practices, beliefs and perspectives through a respect for cultural difference.

[2] Taken from confidential source material from: The Confederacy of Mainland Mi'kmaq, Membertou Corporate Inc., and the Unama'ki Institute of Natural Resources.

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Section II – Definitions

2.1 Within this Mi'kmaq Ecological Knowledge Study Protocol:

"**Assembly**" means the Assembly of Nova Scotia Mi'kmaq Chiefs which operates as an institution of governance for the Mi'kmaq of Nova Scotia.

"**Consultant**" means a company, group or individual that has primary responsibility to undertake and deliver a Mi'kmaq Ecological Study within the province of Nova Scotia.

"**Consultation**" means any Crown and Mi'kmaq government[3] discussion, negotiation or meeting used to justify Crown infringement of Aboriginal and treaty rights.

"**Government**" means any federal, provincial or municipal department, agent or representative.

"**MEK**" means Mi'kmaq Ecological Knowledge and includes the collection and adaptation of knowledge that Mi'kmaq people have with all components of the natural environment and the interrelationships that exist between all life forms from a unique historical, cultural and spiritual perspective.

"**MEKS Protocol**" means the Mi'kmaq Ecological Knowledge Study Protocol and includes all attached appendices and amendments that may be made from time to time.

"**Mi'kmaq Ecological Knowledge Study**" means all components related to the planning, collection, analysis, reporting and distribution of Mi'kmaq Ecological Knowledge in Nova Scotia.

"**MEK Report**" means any document that considers MEK data pursuant to any Project defined in this MEKS Protocol.

"**Mi'kmaq Community**" means any of the Mi'kmaq First Nation Bands, affiliated communities or other Mi'kmaq communities that exist throughout Nova Scotia.

"**Mi'kmaq Participant**" means any person of Mi'kmaq descent who has agreed to participate in an MEKS.

[3] Mi'kmaq Government is intended to mean any of the thirteen Nova Scotia Mi'kmaq Bands in whole or in part.

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"**Netukulimk**" means the Mi'kmaq use of the Creator's natural bounty for self-support and well-being and the interplay of collective and individual responsibilities that the Mi'kmaq have to the natural world.

"**Project**" means any undertaking that has triggered an MEKS to occur.

"**Proponent Company**" means a company, group or person responsible for undertaking a Project.

Section III – Interpretation

3.1 Nothing in this MEKS Protocol or any related discussions, communications or documentation shall be interpreted as to abrogate, derogate, or in any way, affect, limit or detract from the existing Aboriginal and treaty rights that the Mi'kmaq people individually and collectively enjoy throughout Nova Scotia.

3.2 For greater certainty to Section 3.1, nothing in this document shall be interpreted as Consultation for purposes of justifying an infringement on Mi'kmaq Aboriginal or Treaty rights that exist or may be found to exist in the future.

3.3 This MEKS Protocol shall be read to compliment any Mi'kmaq regional or provincial processes that pertain to MEK data collection and, in the event of a conflict between said process(s) and this Protocol, this Protocol shall take precedence and prevail.

Section IV – MEKS Methodology

4.1 MEKS methodology provides guidelines and standards[4] on suggested practices and procedures relevant to the planning/design, development, implementation and reporting stages of an MEKS.

Phase I - Planning and Design

This Phase includes all preliminary work specific to the development of an MEKS. Although Consultants may differ on the approach or substance of the components contained within this Phase, it is a requirement that an MEKS both consider and address each of the following elements:

[4] This MEKS Protocol provides both standards and recommended guidelines for all stages of an MEKS. For greater certainty, guidelines should be interpreted as general "rules of thumb" or "best practices." Standards exist as requirements or obligations that are to be followed at various stages of an MEKS.

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A) Communications:

Communication is a key activity to the Phase I component of the MEKS. At the front end of the MEKS process, the Consultant shall draft a letter outlining its intention to the proposed MEKS process. At a minimum, this letter should include the following:

- information on the Proponent Company
- outline the nature of the Project
- include background information on the Consultant
- outline the purpose of the MEKS
- specify the proposed MEKS process and related activities
- comment on the intended use of the MEKS
- provide relevant contact information
- provide an opportunity for feedback/input

The letter should be sent to the Assembly, Union of Nova Scotia Indians, The Confederacy of Mainland Mi'kmaq, Kwilmu'kw Maw-klusuaqn and the political leadership of each Mi'kmaq First Nation Band that the Consultant intends to collect MEKS data within. For a list of relevant contact persons and Mi'kmaq Bands see Appendix B.

B) Research Principles and Protocols – Mi'kmaw Ethics Watch:

The Research Principles and Protocols provides a prescribed approval process to the collection, analysis and reporting of research data generated from Mi'kmaq First Nation communities throughout the province of Nova Scotia. The Consultant should consider the Research Principles and Protocols as an additional research process requirement in the early planning stages of an MEKS. For a copy of the Mi'kmaq Research Ethics Protocol, see Appendix D.

Phase II - Delivery and Implementation:

This Phase includes all work specific to the delivery and implementation of a MEKS in Nova Scotia. As previously stated, although Consultants may differ on the approach or substance contained within this Phase, it is highly recommended that a MEKS both consider and address, at a minimum, each of the following elements:

A) Informed Consent and Confidentiality:

Before data collection of MEK data takes place, it is highly recommended that the Consultant first secure informed consent with the Mi'kmaq Participant. Two key elements to informed consent involve education and agreement. The Consultant should ensure that the interviewee is provided

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information and demonstrate a clear understanding of the following:

1) Education:

- proposed project specifics
- purpose of an MEKS
- use of MEKS data in the approval process(s)
- the MEKS is not intended to be Consultation for the purpose of justifying an infringement on Aboriginal and Treaty rights

2) Agreement:

- that participation is voluntary
- written Consent and Release form is explained and completed

B) Project Scoping:

The collection of MEK data is based on the concept of Netukulimk. When determining the study area, the Consultant should take into account the nature of MEK data which demands the inclusion of the following:

- MEK data is project and time specific and as such will require recent and updated MEK data
- collection of MEKS data within a buffer area may be considered to be more extensive than the proposed Project footprint
- the collection of Mi'kmaq use and occupation sites and their importance to Netukulimk
- the significance of the inclusion and recognition of Mi'kmaq historical, spiritual and cultural information

C) Developing a Relationship and Interviewing:

This MEKS Protocol does not restrict or define who does a MEKS. However, it does recognize that every Mi'kmaq community has the right to decide whether they should participate with a Consultant on a MEKS. When engaging a Mi'kmaq Participant through an MEKS interview process a number of areas should be considered in terms of developing an approach to the collection of MEK data. At a minimum, these areas should include the following:

- interviews are conducted in the Interviewee's language of preference
- interviews should be conducted at the place of preference to the interviewee

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- the interviewer should have appropriate materials including maps and recording devices
- tokens of Appreciation and Gratitude
- the interviewer should be knowledgeable and respectful of Mi'kmaq cultural norms
- the interviewer should take into account "response burden"
- first and second hand accounts should be considered in the collection of MEKS data

D) Sufficiency of MEK data:

It is important that the Consultant ensure that an adequate amount of MEKS data is collected within the proposed study area. The collection of MEK data is dependent on a number of factors. When conducting a MEKS, the Consultant shall make every effort to uncover MEK data from a target group of Mi'kmaq Participants. The target group, at a minimum, must include Mi'kmaq Participants who have specific MEK knowledge or have conducted land use activities in the proposed study area. It is recommended that the Consultant ensure that appropriate time, funding and resources are available to account for the collection of sufficient MEK data. In the event that the Consultant is not able to collect a sufficient amount of MEK data, the reasons or potential causes for this circumstance must be outlined in the MEK Report.

E) Historical Research and Ground Truthing:

The MEKS must include a historical review of Mi'kmaq activity both within and surrounding the proposed study area and an "on the ground" site visit. At a minimum, these activities should include the following:

- historical research from primary and secondary resource materials and oral accounts
- site visits identifying and confirming MEK data
- due regard to safety issues

Phase III - Finalizing the MEKS Report and Disclosure:

This Phase includes all work specific to the analysis of MEK data, reporting and disclosure of MEK information. It is recommended that a MEKS both consider and address, at a minimum, the following two key elements:

A) MEK Data Analysis:

- when reporting MEK data, the Consultants shall use a GIS software program
- when determining the significance of MEK Data the Consultant shall have due regard to both scientific and Mi'kmaq cultural practice and tradition

C 1340-1931

- the Consultant utilize the following factors when determining the significance of MEK data:
  - the uniqueness and nature of the land or resource use/occupation
  - the cultural use or spiritual meaning of the land or resource use/ occupation
  - the availability and the importance of the land or resource use/ occupation

B) Disclosure and Reporting of MEK Data:

- MEKS Report findings should contain MEK baseline information such as the type of use and species including numbers present
- only MEK of significance be outlined in the report through the use of a GIS
- consideration and due regard should granted to confidentiality of a Mi'kmaq Participant's MEK data
- the MEKS should provide suggestions on mitigation or remediation of potential impacts in a manner that reflects sound environmental practice from a scientific and Mi'kmaq cultural perspective
- the MEKS Report should be distributed in a timely manner to the Mi'kmaq political organizations as outlined in Appendix C
- the MEKS Report must account for the explicit reservation and protection of Intellectual Property Rights that the Mi'kmaq individually and collectively enjoy in Nova Scotia
- the Consultant shall make explicit reference in the MEKS Report that it is not intended nor is it to be interpreted as constituting Consultation for the purpose of justifying an infringement on the existing Aboriginal and Treaty rights of the Mi'kmaq in Nova Scotia

Section V – Amendments

6.1 This MEKS Protocol can be amended at any time by resolution through majority vote at a duly convened Assembly meeting.

6.2 In the event that an amendment is made to this MEKS Protocol, the said amendment shall be recorded in the Assembly minutes and a copy of the motion shall be attached to the MEKS Protocol as an Appendix.

C 1340-1932

Section VI – Appendices

See Attached

C 1340-1933

APPENDIX A

ASSEMBLY OF NOVA SCOTIA MI'KMAQ CHIEFS

Resolution Respecting:
A Mi'kmaq Protocol on Mi'kmaq Ecological Knowledge Studies in Nova Scotia

Whereas the Assembly of Nova Scotia Mi'kmaq Chiefs (hereinafter the "Assembly") exists as an institution of governance for the Mi'kmaq of Nova Scotia in respect of issues of common interests and concerns;

And Whereas the Assembly is, in part, responsible to communicate to Canada and Nova Scotia the common position of the Mi'kmaq of Nova Scotia on matters of concern to all the Mi'kmaq people in Nova Scotia;

And Whereas the Assembly, by motion at a duly convened meeting on January 25th 2007, have identified the need to undertake a Mi'kmaq Protocol specific to the design, development and implementation of Mi'kmaq Ecological Knowledge Studies (MEKS) within the province of Nova Scotia;

And Whereas the overall objective of the Protocol is to set up standards and understandings on items that the Assembly considers to be proper MEKS in Nova Scotia;

And Whereas for said purpose, the Assembly has mandated the composition of a committee of technical representatives from the various Mi'kmaq organizations throughout Nova Scotia;

And Whereas the technical committee has jointly developed the attached MEKS Protocol for consideration and approval by the Assembly;

Now Therefore The Assembly Resolves That:

The attached MEKS Protocol is formally adopted by the Assembly of Nova Scotia Mi'kmaq Chiefs.

Passed at Old Orchard Inn, Wolfville, Nova Scotia, this 22nd, day of November, 2007.

Moved By: Chief Wilbert Marshall, Chapel Island (Potloteck) First Nation

Seconded By: Councilor Ian Knockwood, Proxy, Shubenacadie (Indian Brook) First Nation

Decision: Carried by Consensus.

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APPENDIX B

List of Nova Scotia Mi'kmaq First Nation Bands and Designated Contact Persons

Acadia First Nation Band
RR#4 Box 5914-C Yarmouth, NS, B5A 4A8
Telephone (902) 742-0257
Fax (902) 742-8854
Contact Person: Chief Deborah Robinson

Annapolis Valley First Nation Band
P.O. Box 89, Cambridge Station Kings Co., NS, B0P 1G0
Telephone (902) 538-7149
Fax (902) 538-7734
Contact Person: Chief Brian Toney

Bear River First Nation Band
P.O. Box 210, Bear River, NS, B0S 1B0
Telephone (902) 467-3802
Contact Person: Chief Theresa Meuse

Eskasoni First Nation Band
Eskasoni, NS, B0A 1J0
Telephone (902) 379-2800
Fax (902) 379-2801
Contact Person: Chief Charlie Dennis

Glooscap First Nation Band
P.O. Box 449 Hantsport, NS, B0P 1P0
Telephone (902) 684-9788 Fax (902) 684-9890
Contact Person: Chief Shirley Clarke

Shubenacadie (Indian Brook) First Nation Band
MicMac Post Office, Indian Brook, NS, B0N 1W0
Telephone (902) 758-2049 Fax (902) 758-2017
Contact Person: Chief Jerry F. Sack

Membertou First Nation Band
111 Membertou Street, Membertou, NS, B1S 2M9
Telephone (902) 564-6466 Fax (902) 539-6645
Contact Person: Chief Terrance J. Paul

Millbrook First Nation Band
P.O. Box 634 Truro, NS, B2I 5E5
Telephone (902) 897-9199
Fax (902) 893-4785
Contact Person: Chief Lawrence Paul

Paq'tnkek First Nation Band
RR#1 Afton, Antigonish County, NS, B0H 1A0
Telephone (902) 386-2897
Fax (902) 386-2043
Contact Person: Chief M. Gerard Julian

Pictou Landing First Nation Band
Box 55, Site #6 Pictou Landing NS, B0K 1X0
Telephone (902) 752-4912
Fax (902) 755-4715
Contact Person: Chief Ann Francis- Muise

Chapel Island (Potlotek) First Nation Band
Box 538 Chapel Island, NS, B0E 3B0
Telephone (902) 535-3317
Fax (902) 535-3004
Contact Person: Chief Wilbert Marshall

Waycobah First Nation Band
P.O. Box 149, Whycocomagh, NS, B0E 3M0
Telephone (902) 756-2337
Fax (902) 295-3398
Contact Person: Chief Morley Googoo

Wagmatcook First Nation Band
P.O. Box 30001, Wagmatcook, NS. B0E 3N0
Telephone (902) 295-2598
Fax (902) 295-3398
Contact Person: Chief Lester Peck

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APPENDIX C

A List of Relevant Mi'kmaq Organizations and Designated Contact Persons

Assembly of Nova Scotia Mi'kmaq Chiefs
72 Church Rd. Truro, NS. B2N 6N4
Contact Person: Janice Maloney

Treaty and Aboriginal Rights Research Centre of Nova Scotia
Box 341 Shubenacadie, NS. B0N 2H0
Telephone (902) 758-1953
Fax (902) 758-1759
Contact Person: James Michael

Unama'ki Institute of Natural Resources
4123 Shore Rd. P.O. Box 8096 Eskasoni, NS. B1W 1C2
Telephone (902) 379-2163
Fax (902) 379-2250
Contact Person: Lisa Young

The Confederacy of Mainland Mi'kmaq
840 Willow St. Box 1590 Truro, NS. B2N 5V3
Telephone (902) 895-6385
Fax (902) 893-1520
Contact Person: Michael Cox

Union of Nova Scotia Indians
Box 961 Sydney, NS. B1P 6J4
Telephone (902) 539-4107
Fax (902) 564-2137
Contact Person: Kimberly Paul

Eskasoni Fish And Wildlife Commission
4123 Shore Road Eskasoni, NS. B1W 1A6
Telephone (902) 379-2024
Fax (902) 379-2159
Contact Person: Tom Johnson

Kwilmu'kw Maw-klusuaqn (Mi'kmaq Rights Initiative)
72 Church Rd. Truro, NS. B2N 6N4
Telephone (902) 843-3880
Fax (902) 843-3882
Contact Person: Janice Maloney

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APPENDIX D

Research Principles and Protocols - Mi'kmaw Ethics Watch

Background

Wla wjit Mi'kmaq kisutmi'tij Sante' Mawio'mi 1999 ek. Wla nekmokw Sante' Mawio'mi ika'lapni maw ni'kmnew koqoey.

Don Julian, Executive Director, Confederacy of Mainland Mi'kmaq
Eleanor Bernard, Executive Director, Mi'kmaw Kina'matnewey
Dr. Marie Battiste, Academic Director, Aboriginal Education Research Centre, Professor, Department of Education Foundations, University of Saskatchewan
Stephen J. Augustine, Curator of Ethnology Eastern Maritime, Canadian Museum of Civilization
Lindsay Marshall, Associate Dean, Mi'kmaq College Institute, Cape Breton University
Erik Zscheile, Legal Advisor, Confederacy of Mainland Mi'kmaq

Nike' wla Nipniku's 11, 2000 na elkitmi'tij Eskinuapimk ta'n kisutaq Sante' Mawio'mi wjit Mi'kmaq. Wla nike' ninen ewikasultiek kisi-te'tmek tlwisin "Ethics" *Eskinuapimk* weja'tekemk na tlwi'tisnen "Ethics" *Eskinuapimk*.

A Mi'kmaq Ethics Committee has been appointed by the Sante' Mawio'mi (Grand Council) to establish a set of principles and protocols that will protect the integrity and cultural knowledge of the Mi'kmaw people. These principles and protocols are intended to guide research and studies in a manner that will guarantee that the right of ownership rests with the various Mi'kmaw communities. These principles and protocols will guarantee only the highest standards of research. Interpretation and conclusions drawn from the research will be subject to approval to ensure accuracy and cultural sensitivity.

At Chapel Island on July 25, 1999, the Sante' Mawio'mi established a committee to study and develop principles and guidelines to protect Mi'kmaq people and their knowledge. The committee studied the issues involved in research among Indigenous peoples, and developed a set of standards so that Mi'kmaq people might be informed of research - its benefits and costs, be treated fairly and ethically in their participation in any research, and have an opportunity to benefit and gain from any research conducted among them. These principles and guidelines are now being disseminated broadly to each of the Mi'kmaw communities for their review, discussion, and ratification.

[Note: The author of this document is the Mi'kmaw Ethics Watch.]

C 1340-1937

Principles

Mi'kmaq people are the guardians and interpreters of their culture and knowledge system - past, present, and future.
Mi'kmaw knowledge, culture, and arts, are inextricably connected with their traditional lands, districts, and territories.
Mi'kmaq people have the right and obligation to exercise control to protect their cultural and intellectual properties and knowledge.
Mi'kmaw knowledge is collectively owned, discovered, used, and taught and so also must be collectively guarded by appropriate delegated or appointed collective(s) who will oversee these guidelines and process research proposals.
Each community shall have knowledge and control over their own community knowledge and shall negotiate locally respecting levels of authority.

Mi'kmaw knowledge may have traditional owners involving individuals, families, clans, associations, and societies which must be determined in accordance with these peoples' own customs, laws, and procedures.

Any research, study, or inquiry into collective Mi'kmaw knowledge, culture, arts, or spirituality which involves partnerships in research shall be reviewed by the Mi'kmaw Ethics Watch. (Partnerships shall include any of the following: researchers, members of a research team, research subjects, sources of information, users of completed research, clients, funders, or license holders.)

The Sante' Mawio'mi is the authorized body of the Mi'kmaq people and thus has to delegate authority as to how the Watch is composed.

All research, study, or inquiry into Mi'kmaw knowledge, culture, and traditions involving any research partners belongs to the community and must be returned to that community.

The Mi'kmaq Ethics Watch (Committee, etc.) shall conduct a fair and timely review of all research conducted among Mi'kmaq people and shall maintain control over all research processes.

Obligations and Protocols

For researchers/students/agencies/organizations/corporations conducting research involving Mi'kmaq people and whose research/inquiry enters the public domain (theses, dissertations, published journals, books, technical reports):

All research on the Mi'kmaq is to be approached as a negotiated partnership, taking into account all

C 1340-1938

the interests of those who live in the community(ies). Participants shall be recognized and treated as equals in the research process instead of as "informants" or "subjects".

All research partners must show respect for language, traditions, standards of the communities, and for the highest standards of scholarly research.

All research scholars shall assume responsibility to learn the protocols and traditions of the local people with whom they do research and to be knowledgeable and sensitive to cultural practices and issues that ensure respect and accommodation to local norms.

All research partners shall provide descriptions of research processes in the participant's own language (written and oral) which shall include detailed explanations of the usefulness of the study, potential benefits and possible harmful effects on individuals, groups and the environment. Researchers must clearly identify sponsors, purposes of the research, sources of financial support and investigators for the research (scholarly and corporate), tasks to be performed, information requested from Mi'kmaq people, participatory research processes, the publication plans for the results, and anticipated royalties for the research. All consent disclosures shall be written in both Mi'kmaq and English, depending on the community norms. No coercion, constraint, or undue inducements shall be used to obtain consent. All individuals and communities have the right to decline or withdraw from participating at any time without penalties.

All research involving children (under the age of 14) or information obtained about personal histories of children will involve informed consent of parents or guardians.

All research partners shall inform participants in their own language about the use of data gathering devices - tape, video recordings, photos, physiological measurements, and how this data will be used. They shall also provide information on the anonymity or confidentiality of their participation, and if not possible, to inform the participant that anonymity is not possible. Participants shall be informed of possible consequences of their choice to remain in the research and their right to withdraw consent or participation in the research at any time.

All research partners shall provide each person or partner involved in the research with information regarding the anticipated risks involved in their participation, and any anticipated benefits.

All research partners must be duly informed of each research step along the way and be provided with information about the research process and the distribution of results and information.

All research partners should attempt to impart new skills into the community, e.g. data collection, whenever possible, advisable or desirable by the community.

C 1340-1939

All research scholars shall invite Mi'kmaw participation in the interpretation and/or review of any conclusions drawn from the research to ensure accuracy and sensitivity of interpretation.

All research scholars should consider a variety of research processes, including qualitative and participatory research methods and move beyond the dominant quantitative methods to empower indigenous voices and skills.

Mi'kmawey L'nui Skmaqn (Obligations for Mi'kmaw Ethics Watch)

These principles have been initiated by the Sante' Mawio'mi:

The Mi'kmaw Ethics Watch shall come from local community representatives authorized to review ethic principles, standards, protocols, practices of research conducted, knowledge, and heritage.

Each community shall decide levels of authority locally, and who shall speak for the community.

Members of the Watch shall work collaboratively to avoid misuse of information supplied by individuals without permission of the community.

The Mi'kmaw Ethics Watch shall operate on the basis of self-determination of each community and consider the risks and benefits of research and the rights of individuals and collectives to be recognized and protected.

The Mi'kmaw Ethics Watch shall consider the credentials and intentions of each research project, its sensitivity to Mi'kmaw culture and heritage, and consider how the research can benefit the community.

The Mi'kmaw Ethics Watch shall consider problems surrounding the purchase or publication of private materials and removal of artifacts. Private papers, photographs, or artistic productions are protected under copyright. One cannot legally cite, reproduce, publish, refer to, or distribute, documents without permission, from the authors, heirs, or institutions that hold copyright.

Any research involving the collection of human genes, Mi'kmaw genetic material, or involving the Human Genome Diversity Project shall be rejected or considered only as to its benefits to the Mi'kmaq people.

The Mi'kmaw Ethics Watch shall increase efforts to educate each community and its individuals to the issues, concerns, benefits, and risks of research involving Mi'kmaq people, heritage, environment, and promote ethical conduct and conformity concerning protocols and guidelines for doing research in and about Indigenous peoples with some kind of disciplinary action against those who do not

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comply.

The Mi'kmaw Ethics Watch shall consider the context of the research being requested and the issues of power and control that influence research topics, questions, and results.

The Mi'kmaw Ethics Watch shall encourage researchers to consult with and interpret the research from the tribal perspective and to make research and results available to Mi'kmaq people in their own language(s) and/or orthographies.

Applications to Conduct Research

Shall include:

1. Name of researcher(s) and/or supervisor(s) and related department(s). Name of contact person(s) and contact address (indicate summer addresses if pertinent).

2. Anticipated start date of the research study and expected completion date. Include anticipated field research dates.

3. Title of study.

4. Abstract (100-250 words), giving a brief statement of the hypotheses (or brief statement of research questions and significant proposed research) to be examined.

5. Funding source: indicate the source of research or study funds, and whether grant funds have already been provided.

6. Participants: describe the procedures for recruiting, selecting, and assigning participants.

7. Consent: describe the process by which participants consent to participate in the research project; that is, how will participants be informed of their rights as participants, and by what means they will signify their understanding of those rights and consent to participate. Any research involving children shall require parental informed consent.

8. Language: describe how language and cultural differences of Mi'kmaq people will be accommodated in communicating or deriving consent. Describe process for determining and using appropriate protocols and traditions for entering into Mi'kmaw territories and homes.

9. Methods/Procedures: indicate if any aspects of the study involve risk to the participants or to the Mi'kmaq people collectively. Describe any risk to the person/persons as a result of the findings being

C 1340-1941

reported or published.

10. Risk or deception: indicate if any aspects of the study involve risk to the participants or to the Mi'kmaq people collectively. Describe any risk to the person/persons as a result of the findings being reported or published.

11. Usefulness and Benefits: describe any benefit(s) for the individual Mi'kmaq person or to the Mi'kmaw Nation as a whole as a result of this study or its published report or findings.

12. Interpretation of Results: explain how the data will be analyzed and whether any Mi'kmaq people will be involved in, consulted with, or informed about, the interpretation process of analyzing the data or the presentation of its findings and conclusions.

13. Storage of data: detail how the data will be stored to ensure safety and confidentiality of the participants in the study. How long will the data be kept? Will the data be used again in another aspect of the study? Will the participants have the right to consent to this next phase of the study?

14. Confidentiality: describe what measures will be taken to protect Mi'kmaq participants and third party privacy (confidentiality and anonymity).

15. Publication and royalties: describe anticipated publications or plans for publication from this research and how any royalties from book sales will be shared with the participants of the study.

Send application to:

Associate Dean Lindsay Marshall
Mi'kmaq College Institute
Cape Breton University,
Box 5300
Sydney, Nova Scotia
B1P 6L2
Telephone: (902) 563-1827
Fax: (902) 563 - 1693

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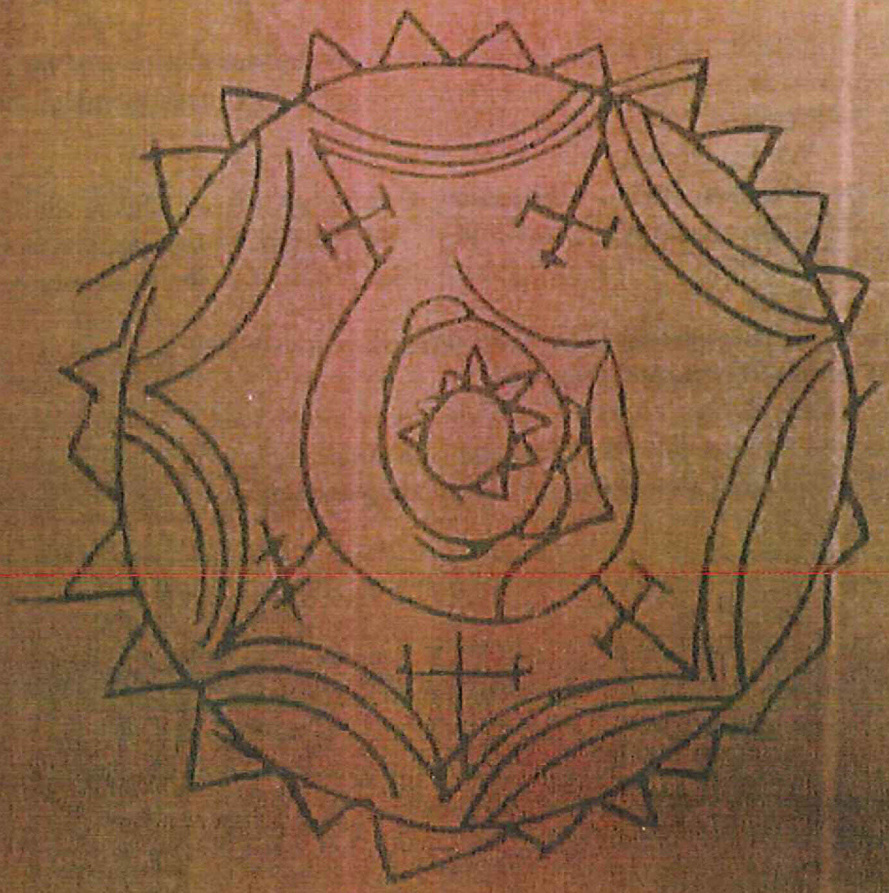
Produced by:

Kwilmu'kw Maw-klusuaqn

Mi'kmaq Rights Initiative



Printed & Designed by:

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Appendix 3

Communication

Application to Mi'kmaw Ethics Watch

Information Letter sent to:

- Assembly of Nova Scotia Chiefs
- Union of Nova Scotia Indians
- Confederacy of Mainland Mi'kmaq
- Kwilmu'kw Maw-klusuaqn
- Chief and Council of 13 Nova Scotia Mi'kmaq Bands
- Native Council of Nova Scotia

Article in Mi'kmaq Maliseet Nations News

Article in Guysborough Journal

Community Meeting Paqtnkek First Nation

Information on MAPS' website (mikmaki.ca)

Appendix 3

Communication

Appendix 4

Cultural Aspects Review

APPENDIX 4

ERDENE RESOURCES DEVELOPMENT CORPORATION
BLACK POINT QUARRRY PROJECT

CULTURAL ASPECTS REVIEW

NOVEMBER 30, 2011

Submitted by:
Roger J. Lewis, M.A. (Archaeologist/Ethnologist)
44-4 Rose Street
Dartmouth, Nova Scotia
B3A 2T6

email: nsarchaeologist@hotmail.com
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1.0 INTRODUCTION

On November 14, 2011, Roger J. Lewis, MA (Consultant) was contracted by Mi'kma'ki All Points Services (MAPS) to prepare a Cultural Aspect Review of known and potential Mi'kmaq Cultural Heritage Resources in Guysborough County, Nova Scotia in response to the development of the proposed Black Point Aggregate Quarry.

This review is to be adjunct to a more comprehensive M'kmaq Ecological Knowledge Study (MEKS) undertaken by MAPS, and highlights existing source materials from which an opinion of the following topics can be formed:

1) Known Mi'kmaq cultural heritage resources in and surrounding the proposed Black Point Quarry development area.
2) It outlines special and/or significant characteristics of those cultural heritage resources.
3) It addresses the relationship between known cultural heritage resources and past Mi'kmaq land and resource use patterns in the area.
4) It considers the limitations of current archaeological research within and surrounding the proposed development area and offers an opinion of the potential existence of unidentified cultural heritage resources.

2.0 PURPOSE OF CULTURAL ASPECTS REVIEWS

Cultural Aspects Reviews set the context for understanding existing and potential cultural heritage resources. They are also utilized to provide information and recommendations which will allow decisions to be made by project proponents and other interested parties to protect cultural heritage resources which may be impacted by accidental disturbance in a development area.

3.0 DEVELOPMENT AREA

The proposed Black Point Aggregate Quarry is situated on a 250 hectare (ha) property located along the southern rim of the Chedabucto Bay approximately 10 kilometres (km) west of the Town of Canso. It falls within a traditional land and resource use area known to Mi'kmaq as *Eskikewas'kik* or 'Skin Drying Area'. Here the cooler waters of the Labrador Current meet the warmer waters of the Gulf Stream and was base of one of the most lucrative fishery initiatives ever undertaken in the New World.

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4.0 MI'KMAQ CULTURAL HERITAGE RESOURCES

Nineteen (19) Mi'kmaq cultural heritage resource sites have been identified in Guysborough County to date, but none in the immediate vicinity of Black Point (see Figure 1.). Thrity-six (36) Mi'kmaq cultural heritage sites have been identified in neighbouring Antigonish County, with 93 Mi'kmaq heritage sites found in Halifax County (NSM 2011 – MARI). The temporal period of sites located in these counties range from Mu Awsami Kejikawe'k L'nuk to Kiskuke'k L'Nuk (Archaic to present) (Lewis 2006).

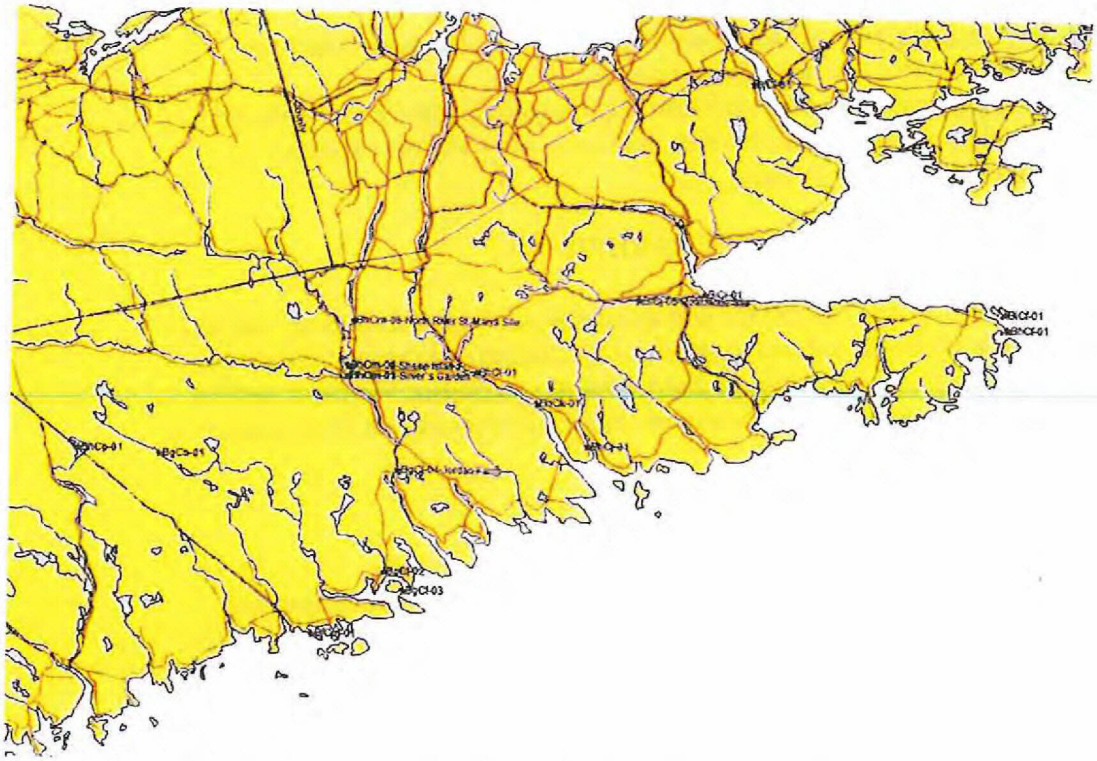

Figure 1: Mi'kmaq Cultural Heritage Resources – Maritime Archaeological Resource Inventory 2011

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Table 1, provides a summary of Mi'kmaq Cultural Heritage Resource in Guysborough County, Nova Scotia

Site	County	Type	Temporal Period	Years
BfCm-1	Guysborough	Resource	Kejikawe'k L'nuk - (Recent People)	2500- 500
BgCo-1	Guysborough	Burial	Kiskukewe'k L'nuk (Todays People)	500 - present
BgCi-2	Guysborough	Resource	Kejikawe'k L'nuk - (Recent People)	2500- 500
BgCi-3	Guysborough	Burial	Kiskukewe'k L'nuk (Todays People)	500 - present
BgCi-4	Guysborough	Resource	Unknown - destroyed	
BhCf-1	Guysborough	Resource	Unknown - but recorded by Harry Piers, NSM (1900's)	
BhCj-1	Guysborough	Resource	Kejikawe'k L'nuk - (Recent People)	2500- 500
BhCk-1	Guysborough	Burial	Unknown - but recorded by Harry Piers (NSM)	
BhCi-1	Guysborough	Burial	Unknown - GSC Maps annotated by Harry Piers, NSM (1900's)	
BhCm-1	Guysborough	Resource	Kejikawe'k L'nuk - (Recent People) - Harry Piers Notes (1900's)	2500- 500
BhCm-2	Guysborough	Burial	Unknown - GSC Maps annotated by Harry Piers Notes (1900's)	
BhCm-3	Guysborough	Resource	Kejikawe'k L'nuk -(Recent People) - Harry Piers Notes, NSM (1900's)	2500- 500
BhCm-4	Guysborough	Unknown	Unknown - Unfinished pipe bowl (Harry Piers Notes 1900's)	
BhCm-6	Guysborough	Resource	Kejikawe'k L'nuk - (Recent People) - Harry Piers Notes (1900's)	2500- 500
BhCp-1	Guysborough	Burial	Kiskukewe'k L'nuk	500 - present

			(Todays People) - Matteo Salome buried wife here.	
BiCf-1	Guysborough	Resource	Unknown – Recorded by Harry Piers	
BiCi -1	Guysborough	Burial	Kiskukewe'k L'nuk (Todays People)	500 - present
BiCi-2	Guysborough	Gathering	Mu Awsami Kejikawe'k L'nuk - Kejikawe'k L'nuk (Not So Recent People - Recent People)	10,000 - 500

Table 2, further explains: Ta'n Telo'ltipni'k L'nuk Mi'kma'kik (How the People Live in Mi'kma'ki).

Temporal Period	Radio Carbon Years	Calendar Years
Sa'qewe'k L'nuk (Ancient People—Palaeo Period)	11,500 – 8,500 BP	13,500 – 10,000
Mu Awsami Kejikawe'k L'nuk (Not so Recent People—Archaic Period)	8,500 – 3,000 BP	10,000 – 2500
Kejikawe'k L'nuk (Recent People—Woodland Period & early European contact era traditions)	3,000 – 300	2500 - 500
Kiskukewe'k L'nuk (Today's People—early European contact and colonial era traditions)	1,000 – present	500 – present

Table 2: Mi'kmaw terms from Roger Lewis (2006).

C 1340-1951

5.0 LIMITATIONS OF ARCHAEOLOGICAL RESEARCH

The archaeological narrative for Guysborough County is incomplete. Scattered surface finds and map annotations provide much of the fragmented archaeological story for the county. Mi'kmaq land and resource patterns in Guysborough County, Nova Scotia would be would be analogous to other areas Nova Scotia, but to date this has never been sufficiently investigated.

Factors influencing Mi'kmaq land and resource in Guysborough County include physiographic features such as climate, physical landscape, and ecological landscape. The primary attraction of the county being its five (5) principal rivers (St. Mary's, Country Harbour River, New Harbour-Salmon, Isaac Harbour River, and Milford Haven River), associated estuaries, a myriad of interior lakes and supporting boundary habitat which constitute critical land and resource use areas (Lewis 2006, 2009).

6.0 CULTURAL HERITAGE VALUE

The overall cultural heritage value of existing and the potential to identify similar sites within Guysborough County would be significant considering the proximity of the development area to principal rivers/estuaries, interior lakes, associated boundary habitats and other known Mi'kmaq cultural heritage sites.

7.0 CONCLUSION

Based upon an archaeological interpretation of the existing record it is reasonable to conclude that there has been a continuous Mi'kmaq presence in the county which spans from *Mu Awsami Kejikawe'k L'nu* (Not so Recent People -Archaic Period -10,000 – 3,000 BP) to *Kiskukewe'k L'nuk* (Today's People - 1,000 – present).

It is also reasonable to conclude that lands set aside for development could be viewed as areas of 'medium - high' potential for past Mi'kmaq land and resource use. The absence

of sites in the development area is not suggestive of a lack of Mi'kmaq presence but more a wanting of archaeological research. The existing archaeological narrative and evidence should not be used in isolation to determine cultural heritage value. It is subsequently recommended that prior any disturbance of the proposed Black Point Aggregate Quarry a pedestrian or surface survey be undertaken.

Appendix 5

Historical Records Review

Historical Records Review

Historic Mi'kmaq Land Use and Occupancy in the Black Point Quarry Study Area

Compiled by

Jennifer Copage, July 2012

Mi'kma'ki All Points Services

Appendix to:

Mi'kmaq Ecological Knowledge Study,
Black Point Quarry, Guysborough County, NS, Proposed by Erdene Resource Development Corp.

Abbreviations

PANS – Previously the Provincial Archives of Nova Scotia changed name in 2012 to Nova Scotia Archives (Halifax, Nova Scotia)
NAC – National Archives of Canada (Ottawa)
TARR – Treaty & Aboriginal Rights Research Centre of Nova Scotia Archives (Indian brook First Nation, Nova Scotia)

Introduction

Historical records were canvassed from National Archives of Canada, Nova Scotia Archives, TARR Centre Archives, The Nova Scotia Museum, internet sources and secondary source print material. It is important to note the limitations of research. Since Mi'kmaq history tends to be an oral history rather than a written history, it is sometimes difficult to put forward a complete history from documented sources as some history may be missing or not available. The following quote by H.C. Hart (1975) makes note of historical events not being recorded:

> *"There are no traces of French occupation here, and no written record of ancient events, but if one could understand the mysterious voices of nature, could know what the winds whisper to the hemlocks, could interpret the wild song Old Boreas sings to Mount Stor through many a long winter's night; if the old legends the waters tell to rock, and beach, and headland could find a hearing in man's dull ears; if the histories of races as well as the convulsions of the earth could be penetrated and made manifest by the geologist, then there would be revealed many a gathering of red braves around the council fire, many a stirring recital of prowess in hunting and skill in fishing; aye, and many a fearful tale of attacks upon the white man in distant settlements, planned here and celebrated here with feasts and rejoicing on their return".*[1]

Mi'kmaw Communities

There are two Mi'kmaq First Nations nearest the project site: Paqtnkek First Nation and Potlotek First Nation. The registered population as of December 2011 for Paqtnkek First Nation is 540 persons. Paqtnkek Reserve lands consist of the Simon Property (24 kilometers East of Antigonish), Pomquet-Afton #23 (24 kilometers East of Antigonish), 48% of Franklin Manor #22 (32 kilometers southwest of Amherst) and Summerside #38 (18 kilometers East of Antigonish).[2] The registered population as of August 2012 for Potlotek First Nation is 691 persons.[3] Potlotek Reserve lands consist of Chapel Island IR #5 (69 kilometers southwest of Sydney) and Malagawatch IR #4 (62 kilometers southwest of Sydney).[4]

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[1] Hart, H.C. History of the County of Guysborough Nova Scotia, 1975, (p. 154)
[2] http://www.aadnc-aandc.gc.ca/eng/1100100017109/1100100017110
[3] http://pse5-esd5.ainc-inac.gc.ca/fnp/Main/Search/FNRegPopulation.aspx?BAND_NUMBER=22&lang=eng
[4] http://pse5-esd5.ainc-inac.gc.ca/fnp/Main/Search/FNReserves.aspx?BAND_NUMBER=22&lang=eng

Chronology of Historical Events

The project area is located within the District Esgigeoagig, the skin dressers' territory.[5] Within this district Hoffman notes that there are seven important sites where settlements were or may have been located. One of these sites is Gamsog - Canso meaning "rock on the other side". A second, Notogetetoalneg, located at the mouth of Salmon River which empties into Setapogtog (Chedabucto Bay), meaning "*running far back*". A third site, Oalamgoaganeg (Port Mulgrave) is at the entrance to the Gut/Strait of Canso.[6] Notogetetoalneg is known to be a summer village from historical sources as Hoffman states:

> *"...Chedabucto Bay was an important fishing station at a very early date, and that a Capuchin mission was already established there by 1634 – from which we may conclude that a relatively permanent Indian village must have been situated in the vicinity. Native tradition places such a village at the mouth of the Salmon River, and gives it the name indicated".*[7] *Oalamgoaganeg is noted as being very important for the Micmac by Deny as Hoffman quotes "...those vessels which are going into the Great Bay of Saint Laurens to make their fishery, and which arrive on the coast at a very early time and are not able to enter into the Grand Bay of Saint Laurens by the Grand Passage [Cabot Strait] because of the ice-fields, come to seek this Little Passage, and place themselves at ancor in this cove to let the ice pass by...I have seen as many as eight or ten vessels, and although the current was extremely strong in this Little Passage, the ice did not inconvience the vessels at this place...".*[8]

Jost writes of the Micmac to be "*A group of people so nomadic in their habits would not be long in establishing for themselves a number of well known travel routes, and one of the best known of these, on the trunk roads, extended almost the entire length of Guysborough County*".[9]

John Reid writes that people had been in the Maritime Provinces "*continuously for more than 10,000 years and the direct ancestors of the Micmac and Maliseet-Passamaquoddy Indian peoples had been established since about 1000 BC. Since then their culture had altered and evolved. Among the periods of most significant change was the century following the first European contacts in or about the year 1500*".[10]

In 1518, Baron le Lery left cattle at Canso before sailing back to France.[11]

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[5] Hoffman, Bernard Gilbert. The Historical Ethnography of the Micmac of the Sixteenth and Seventeenth Centuries, 1955,(p. 536)
[6] Hoffman, Bernard Gilbert. The Historical Ethnography of the Micmac of the Sixteenth and Seventeenth Centuries, 1955,(p. 537)
[7] Hoffman, Bernard Gilbert. The Historical Ethnography of the Micmac of the Sixteenth and Seventeenth Centuries, 1955,(p. 537)
[8] Hoffman, Bernard Gilbert. The Historical Ethnography of the Micmac of the Sixteenth and Seventeenth Centuries, 1955, (p. 538)
[9] Jost. Guysborough Sketches and Essays, Kentville Publishing Company Ltd, Nova Scotia, (p. 8-9)
[10] Reid, John. *Six Crucial Decades: Time of Change in the History of the Maritimes, 1987*, (p 3)
[11] Tremayne, Terry. Faces and Places: Travel and Tales in Nova Scotia's Antigonish and Guysborough Counties. Tremayne Associated Distributors Ltd., Halifax, 1983, (p. 27)

C 1340-1957

In 1607 Marc Lescarbot reports that he met Captain Savalet of Saint-Jean-de-Luz on a voyage from Port Royal to France. Savalet was making his forty-second voyage to Canso, Nova Scotia where he worked in the dry fishery.[12]

A 1607 letter brought to Port Royal from Canso onboard a supply ship informed the French that Indian graves had been opened by the Dutch and beaver skins were taken from the dead. The Indians of Canso had killed the person who shown the location of the graves.[13]

In 1609 Henry Hudson entered Canso to repair his ship and was received kindly by the Indians and an Indian village existed.[14]

In 1650, Nicholas Denys and his brother Simon worked on two forts in Cape Breton (St. Peters and St. Ann's). After a year their forts and ship were seized by the authority of Madame Aulnay and taken to Port Royal. Latour intervened and had their properties returned to them. Nicholas returned to Cape Breton and later again his fort was seized. In exchange for a large sum of money Denys secured a large tract between Canso and Cape Roziers, including Cape Breton and Ile St. Jean. Within six years, two settlements were established with eighty families. At Chedabucto Denys built another fort and trading post.[15]

In the early 1680's Fort Saint Louis was built in Guysborough. It was captured in 1690 by Sir William Phips.

In 1686, France made a large grant of land to the Sedentary Fishery Company of Acadia. This company consisted of La Rochelle merchants and they were to enjoy the fishing monopoly at Chedabucto and Canso. In 1702, New England seized the company's vessels and attached its fishing ports.[16]

New England fishermen were interested in Acadia and since the 1620's they were fishing and drying their catch along the shores. Before the start of the Anglo-French wars in 1689 the Acadians and Mi'kmaq tolerated the fishermen's presence. Fishermen were attacked by French naval forces and by Mi'kmaq warriors in the coastal waters and on land. Fishing activity declined greatly during the wars[17].

In 1621, Sir William Alexander was granted land by King James for "*New Scotland*". In 1629 his colony was captured and Captain Charles Daniel built a trading post at Chedabucto and was later relinquished to Isaac de Razilly. After de Razilly's death it passed to Nicholas Denys. Denys was a French fur-trader, merchant and settler. Denys traded with the Mi'kmaq for furs. He employed up to 120 men and cleared 20 acres for crops. After 1682, Sieur Bergier, a Huguenot merchant from La Rochelle, added a

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[12] Reid, John. Acadia, Maine, and New Scotland: Marginal Colonies in the Seventeenth Century, 1976, (p. 9)
[13] Hart, H.C. History of Canso, Collections of the Nova Scotia Historical Society, Volume XXI, (p. 3)
[14] Haynes, Mark. The Forgotten Battle: A History of the Acadians of Canso/Chedabucto, 2nd Edition, Trafford Publishing, Victoria BC, 2007, (p. 9)
[5] Campbell, G.G. The History of Nova Scotia, They Ryerson Press Halifax, 1948, (p. 46-7)
[16] Reid, John G and Buckner, Phillip A, editors. The Atlantic Region to Confederation: A History, University of Toronto Press, 1994, (p. 74)
[17] Reid, John G et al. The 'Conquest' of Acadia, 1710 Imperial, Colonial, and Aboriginal Constructions, University of Toronto Press, 2004, (p. 69)

C 1340-1958

chapel to honour St. Louis, patron saint of Chedabucto, and increased agriculture development. A sawmill and homes were constructed. In 1688 Chedabucto was captured and looted by English pirates from Boston.[18]

In 1642 Catholic Mission was established at Canso and is known as St. Anne's parish today.[19]

In 1654 Frenchman La Giraudiere had lived what is present day Sherbrooke. He was devoted to the fishery and fur trade. He "*supplied the Indians with nets and spears for the salmon fishery, in the river, and in the Glenelg Lakes*".[20]

In 1654 La Giraudiere, a Frenchman, had a trading post and resided at St. Mary's for many years, devoted to fish and fur trade. The French supplied the Indians with spears and nets for the salmon fishery in St. Mary's river and Glenelg Lakes. In 1669 La Giraudiere's fort was taken by the English.[21] In the Spring of 1856, twenty-two bears were killed in Caledonia (west branch of St. Mary's River) showing this area was a great resort to the Micmac.[22]

In 1657 Father Maitre de Lyonne established mission at Chedabucto and it existed for 30 years.[23]

In 1659 Campseaux (Canso) Harbour has abundances of cod, mackerel and herring.[24] Salmon River has an abundance of large salmon with the smallest being three feet long.[25]

Father Andre Richard, Missionary, returns to France in 1662 and Nicholas Denys write to him requesting the return of missionaries for the Indians. The Mission in Chedabucto became the longest established mission. The Canso tribe of Indians travelled between Chedabucto and Afton. They stayed at Chedabucto during spring, summer and fall and spent winters mostly in Afton. The route between Chedabucto and Afton is known as Roman Valley.[26]

In 1684 La Valliere robbed an Indian Nigascouet while he was on his way to Chedabucto of 70 moose skins, 60 martins, 4 beaver and 2 otter.[27] There was a Micmac village one mile west of Fort St. Louis.[28]

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[18] Jones, Elizabeth. Gentlemen and Jesuits: Quests for Glory and Adventure in the Early Days of New France, University of Toronto Press, 1986, (p. vi)

[19] Haynes, Mark. The Forgotten Battle: A History of the Acadians of Canso/Chedabucto, 2nd Edition, Trafford Publishing, Victoria BC, 2007, (p. 15)

[20] Hart, H.C. History of the County of Guysborough Nova Scotia, 1975, (p. 160)

[21] Hart, H.C. History of the County of Guysborough Nova Scotia, 1975,(p. 160)

[22] Hart, H.C. History of the County of Guysborough Nova Scotia, 1975,(p. 169)

[23] Upton, L.S.F. Micmacs and Colonists: Indian-White Relations in the Maritimes, 1713-1867, University of British Columbia Press, Vancouver, 1979, (p. 21)

[24] [24] Choyce, Leslie; ed. Nova Scotia A Traveller's Companion: Over 300 Years of Travel Writing 2005, (p. 34)

[25] Choyce, Leslie; ed. Nova Scotia A Traveller's Companion: Over 300 Years of Travel Writing 2005, (p. 35)

[26] Haynes, Mark. The Forgotten Battle: A History of the Acadians of Canso/Chedabucto, 2nd Edition, Trafford Publishing, Victoria BC, 2007, (p. 32-3)

[27] Haynes, Mark. The Forgotten Battle: A History of the Acadians of Canso/Chedabucto, 2nd Edition, Trafford Publishing, Victoria BC, 2007, (p. 45)

[28] Haynes, Mark. The Forgotten Battle: A History of the Acadians of Canso/Chedabucto, 2nd Edition, Trafford Publishing, Victoria BC, 2007, (p. 64)

In the year 1687-1688, Chedabucto flourished with 51 inhabitants and 52 Indians. *"Canceau was a small Indian station"*.[29]

On August 9, 1701 Nehemish Jewette, Speaker, writes to his Majesty regarding complaints of spoil of wood by cutting and using trees for private use. Fortification with garrison at Canso Bay *"fifty miles to ye Easter [ards] of any settlement of the English whereby we designed to accomndate the Indians for __ and to supply them at easie rates tho with loss to the Plantation to prevent their going to the French therefore, and to fix them in the English interests, as also to encourage the settlement of [that]/part of the Province, And a Plantation will be speedily set forward there in case a new War does not commence"*.[30]

December 27, 1701 At a council chambers in Boston, a meeting with the Eastern Indians regarding the war between English and French. In order to prevent any wrongdoing it is advised that the Indians bring an English man along to the trading post in Casco so that they are not mistaken by the English for French Indians. Indians state that *"Our lands goes as far as Penicook and St. John's, we want our Lands to hunt on"*.[31]

The Treaty of Utrecht, drafted in 1713, was interpreted differently by the French and English with respect to Canso. French held sovereignty over the islands and Great Britain held the mainland. Canso was an island and it also was close to the shore of the mainland. In 1719, ten British fishing vessels were lost to French privateers and fighting continues for the year making Canso inhospitable.

In 1717 Father Gaulin set up a mission in Afton where the Canso Mi'kmaq had a winter settlement which was just across from the Gut of Canso. In 1718 Father Gaulin went to Paris to lobby for the Acadian-Mi'kmaw claim to the fishery at Canso.[32]

On October 31, 1718 Indians drive English fishermen away from fishing in Cape Canso.[33]

Basques and other Frenchmen have dried fish in Canso since the early seventeenth century. Fishermen and privateers from rival empires had on occasion fought over Canso among themselves but in 1718, Governor of Nova Scotia Richard Philipps notified the British ministry who protested to France and New Englanders took action. In September 1718 frigate *Squirrel* was sent from Massachusetts to Canso. The Commander of the *Squirrel* ordered the French to leave, which they refused. The Commander seized two fishing vessels and escorted them to Boston.[34]

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[29] Morse, William Inglis; ed. Acadiensia Nova (1598-1779) In Two Volumes, Volume I, London, Bernard Quaritch Ltd, 1935, (p. 140)
[30] NAC MG11, C.O. 5, Vol. 862, p. 108, No. 85(ii)
[31] Archives Nationales, Colonies, C II D, Volume IV
[32] Haynes, Mark. The Forgotten Battle: A History of the Acadians of Canso/Chedabucto, 2nd Edition, Trafford Publishing, Victoria BC, 2007, (p. 90)
[33] Haynes, Mark. The Forgotten Battle: A History of the Acadians of Canso/Chedabucto, 2nd Edition, Trafford Publishing, Victoria BC, 2007, (p. 87)
[34] Reid, John G et al. The 'Conquest' of Acadia, 1710 Imperial, Colonial, and Aboriginal Constructions, University of Toronto Press, 2004, (p. 80)

In a letter dated April 29, 1719 John Doucett to Col. Phillips writes that Captain Chadder:

> *"went to Canso to pacify ye savages who threatened the English, but never takes notice to me that he warned the English from Fishing any more there; to which Several in New Englond hove made Oath.....hape you will apply to the Lords of Trade for Presents for the Indians, who are already incensed against Us, by not taking notice of them, and since the beliefs being taken at Canso, the French underhand Exosperate them, to thot I fear our Fishery will suffer this year without a Man of War to protect them, or Forts on the Coast".*[35]

In August of 1720, Governor Philipps responded by erecting a fort at the Canso Islands and for the next twenty years the British enjoyed the fishery at Canso.[36] The fort persuaded the French to stay away but Mi'kmaq warriors continued to resist for the next four years. On one occasion New England fishermen battled with Mi'kmaq warriors in captured ships. Bombs were tossed into the Mi'kmaq's ships and when they swam to shore they were fired upon, killing twenty-two men. The bodies were decapitated and set on spikes near Canso's fort.[37]

In 1720, Gov Phillips stationed troops at Canso as it had become *"by far the most important commercial centre in Nova Scotia"*.[38] Canso was the rendezvous point for the attack on Louisbourg.[39]

In early 1725 the Micmac attacked Canso destroying two houses and killed 6 civilians. In June, Indians were reported to be seizing fishing boats along the Atlantic coast. Governor Lawrence Armstrong proposed a tour of the province the following spring to force the oath of allegiance. Armstrong hired 36 men with 3 whale boats to terrorize the Micmac around the fishing areas. However, on December 15 articles of peace were concluded and the treaty was ratified in June 1726.[40]

Canso was seized by the French in 1744.[41]

The October 1, 1749 council meeting was related to recent hostilities in Canso by Indians. Indians want to declare war as they believe they are free people. Orders were given to all within the province to *"annoy, distress and destroy the Indians every where"* and that 10 Guineas for "every Micmac killed or taken prisoner".[42]

A council meeting on October 8, 1749, was held aboard the *Beaufort* regarding recent hostilities at Canso with the Indians. Edward Cornwallis:

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[35] CO218/1, p. 194-196
[36] Reid, John G et al. The 'Conquest' of Acadia, 1710 Imperial, Colonial, and Aboriginal Constructions, University of Toronto Press, 2004, (p. 81)
[37] Reid, John G et al. The 'Conquest' of Acadia, 1710 Imperial, Colonial, and Aboriginal Constructions, University of Toronto Press, 2004, (p. 82)
[38] Jones, Elizabeth. Gentlemen and Jesuits: Quests for Glory and Adventure in the Early Days of New France, University of Toronto Press, 1986, (p. ix)
[39] Jones, Elizabeth. Gentlemen and Jesuits: Quests for Glory and Adventure in the Early Days of New France, University of Toronto Press, 1986, (p. ix)
[40] Upton, Leslie F.S. Micmac and Colonists: Indian-White Relations in the Maritimes 1713-1867,(p. 43)
[41] Reid, John G et al. The 'Conquest' of Acadia, 1710 Imperial, Colonial, and Aboriginal Constructions, University of Toronto Press, 2004, (p. 151)
[42] PANS RG1, vol. 209, p. 22-23, m/f 15310

"gave orders to the Commanding Officers at Annapolis Royal, Minas & all others within the Province, to annoy, distress & destroy the Indians every where" and that "a Premium be promised of ten guineas for every Indian killed or taken prisoner".[43]

"The crucial period of vigorous Micmac resistance lies between 1749, when Cornwallis placed the bounty of Micmac scalps, and 1763, when a comprehensive treaty was signed between Micmacs and colonists. During this period the Micmac attached the English repeatedly, at Chignecto, Canso, Chebucto, Dartmouth, Lunenburg and Halifax. The British attempt to expand settlement in Nova Scotia was severely impeded by Micmac resistance".[44]

On August 10, 1752 Governor Hopson informs His Excellency that on August 4th two English schooners, the *Friendship* and the *Dolphin*, were fishing near the Isle of Canso and were seized and taken by the Indians. Governor Hopson wishes to use authority to release the twenty men and a canoe that were seized.[45]

August 30, 1752 In response to Governor Hopson, His Excellency is making the return of all prisoners seized and notes that the Indians *"didn't even ask a ransom for their return"*. There is mention of a third schooner that was also taken, the *Halifax*, by the Indians.[46]

June 14, 1754 Sworn before the Governor in Council, Thomas Walker testifies that he was in Louisbourg in September 1753 and met an Indian who told him Father Le Loutre paid the Indians one hundred Livres for every English scalp and one hundred fifty Livres to an English officer's scalp. The Indian told Walker that Canso belonged to them.[47]

Aug 27, 1754 LeLoutre wrote to Governor Lawrence proposing that all territory in the eastern part of Nova Scotia (Cumberland, Colchester, Pictou, Antigonish and Guysborough Counties) should be ceded in perpetuity to the Micmacs.[48]

In 1759 Major Robert Elliot, 43rd Regiment, received special assignment to take men to Restiouche on Chaleur Bay. With his mission complete, Elliot presented Acadians and Micmac Leaders gifts of blankets and provisions. On November 5, Elliot sailed through the Gut of Canso into the Atlantic during storm.[49] By the 15th, they saw land but were not sure of where they were and the schooner ran aground off Sable Island.[50]

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[43] PANS RG1, vol. 186, p. 22-23
[44] Webster, Paul. Pining for the Trees: The History of Dissent Against Forest Destruction in Nova Scotia 1744-1991. M.A. Thesis, Dalhousie University 1991
[45] Letter from His Excellency Governor Hopson to the Governor of Louisbourg, PANS CO. 217, Volume 13.
[46] Letter from Count de Raymond, Governor of Louisbourg to His Excellency Governor Hopson, PANS, CO. 217, Volume 13
[47] Baxter, *History of the State of Maine*, v. 24, p. 15
[48] Don Julien, Mi'kmaq History Presentation, undated
[49] Campbell, Lyall. Sable Island Shipwrecks: Disaster and Survival at the North Atlantic Graveyard 1994, (p. 33)
[50] Campbell, Lyall. Sable Island Shipwrecks: Disaster and Survival at the North Atlantic Graveyard 1994, (p. 34)

Between 1760 and 1764 a vessel belonging to Chedabucto was chased up Chedabucto Bay by a privateer. The first two settlers at Chedabucto bay (Elias and John Cook) made friends with the local Micmac.[51] Messenger Cook came to the aid of the vessel by making a cry of trouble to the Indians. Many Indians came to their aid in canoes and the privateer fled.[52]

On December 9, 1761 King George III gave instructions to the Nova Scotia Governors to maintain treaties and to respect Indian land rights.[53]

On May 4, 1775 Francklin writes to the Earl of Dartmouth about his evidence of the actions of Jonathan Binney, Esquire and member of His Majesty's Council. In 1764 Governor Wilmot sent Binney to regulate the fishery and trade at the new fishing settlement at Canso and to *"watch over the motions of the Indians"*. With the assistance of a navy gentleman who was near Canso Mr. Binney:

> *"Effectually dispersed these Savages, to the very greot Satisfaction of Government, for the Indian Was then ensured, the greatest part of our settlements must have been broken up".*[54]

It was reported on September 18, 1781 that provisions were supplied to the Indians in 1779, 1780 and 1781. *"Delivered Indians from Canso by order of Mr. Buckeley"* November 15th 1781 4 yards cloth, 2 blankets, Pipes of Tobacco for a total cost of £2.15.6.[55]

When Guysboro was a new colony (ca. 1783-179?), many canoes arrived near the harbour entrance and 300 Indians landed at Captain Hadley's home. Messengers Cook and Hadley understood the Micmac language and overheard their plan to attack and were able to plan their defense. Before the attack happened a Cape Breton priest had heard of the plan and influenced the Micmac not to attack the English.[56]

Prior to 1784, the Counties of Antigonish and Guysborough were called Sydney County. Sydney County was created in 1784 and the boundaries were:

> *"Beginning at the Head of Tide at the Head of St. Mary's River thence to run North by the magnet to the Sea Shore to the West of Cape St. Louis, and bounded on every other part by the Sea Coast and to include all Islands in front of these limits deemed to be in Nova Scotia".*[57]

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[51] Hart, H.C. History of the County of Guysborough Nova Scotia, 1975
[52] Hart, H.C. History of the County of Guysborough Nova Scotia, 1975, (p. 54)
[53] Don Julien, Mi'kmaq History Presentation, undated
[54] CO 217 Vol. 51, p.171-174, m/f 13858
[55] TARR Archives File #158
[56] Hart, H.C. History of the County of Guysborough Nova Scotia, 1975
[57] Cooke, Findlay *History and Stories of Issac's Harbour and Goldboro,* Antigonish: Formac, 1976, (p. 6)

A large number of Micmac canoes (around 1786) came into Chedabucto Bay and proceeded to raid Mr. Nixon's store. Before any further outbreak occurred a Cape Breton priest influenced the Indians to abandon further attack to the settlement.[58]

In December 1796 the Indians of Guysborough received necessary articles of potatoes, herring, gunpowder, shot, flint, lead, baize, blankets, shirts, coats, trousers, jackets (under-vests), blue cloth and flour from Government. It was expected that the Indians be faithful to the King and take up arms on the English side in event of invasion.[59]

Mocodome (Country Harbour) was a favorite encampment for the Micmac.[60] Indian Harbour is also a favorite encampment. There were once many villages of wigwams in the area as it was an ideal fishing and hunting area that provided all that the Micmac needed.[61] Beyond the beach at Indian Harbour is Indian Harbour Lake where shelter could be found from storms. At high tide large boats could be taken upstream. There is an extensive Micmac burial ground in this area.[62]

There is record that at Wine Harbour a Portuguese barque loaded with wine wrecked here during a storm. Indians from the adjoining harbour came to seek the spoils of the wreck only to see disaster as several Indians froze to death.[63]

There are two old Micmac burial grounds with the area of St. Mary's. One is on an island in lower Glenelg Lake and the other north of Sherbrook.[64]

In a 1796 Letter of Sir John Wentworth is authoring Major William Nixon, Manchester, for supplies for the Micmac at the area including potatoes, herring, gun powder, shot, lead, flints, baize, blankets, shirts, coats, trousers, jackets or under vests, blue cloth and flour.[65]

In 1801, Joshua Frost writes to His Excellency Sir John Wentworth stating that seven Indians have complained to him and are "*very much Discommoded*" in their fishing and hunting and the Indians are requesting that five acres of land be granted to them at Salmon River with "*a free Priveledge of fish*".[66]

On May 6, 1801 Smith had no luck trout fishing along St. Mary's River probably because

> "*having been so much hunted by Indians formerly, as we saw a multitude of their old winter camps*".[67]

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[58] Hart, H.C. History of the County of Guysborough Nova Scotia, 1975, (p 59-60)
[59] Hart, H.C. History of the County of Guysborough Nova Scotia, 1975, (p. 67-68)
[60] Hart, H.C. History of the County of Guysborough Nova Scotia, 1975, (p. 154)
[61] Hart, H.C. History of the County of Guysborough Nova Scotia, 1975, (p. 157)
[62] Hart, H.C. History of the County of Guysborough Nova Scotia, 1975, (p. 158)
[63] Hart, H.C. History of the County of Guysborough Nova Scotia, 1975,(p. 158-159)
[64] Hart, H.C. History of the County of Guysborough Nova Scotia, 1975,(p. 160)
[65] Hart, H.C. History of the County of Guysborough Nova Scotia, 1975, (p 67-68)
[66] PANS RG1, vol. 430, Doc # 71
[67] PANS RG1 Vol. 380, Pages 1-40, m/f 15,441. Titus Smith's Eastern Tour May 6, 1801, (p. 8)

C 1340-1964

Smith noted that the North Branch of St. Mary's River is ideal for salmon because of the number of summer camps along the lakes.[68] Smith found about twelve broken salmon spears along the bank of St. Mary's River.[69]

In a letter of William Nixon to Sir John Wentworth dated November 20, 1801 Scottish emigrants bringing small pox, measles and whooping cough to the area and the Indians have left for fear of disease and relocated at the head of Guysboro River. He is requesting relief for 40-50 families.[70]

The Great Gale of 1811 destroyed several ships and much of the community of Canso.[71]

In October the great Gale of 1811 took down a white sloop owned by an Indian named Prosper.[72] The sloop left Fox Island with three to four people aboard when all were lost before the sloop left the harbour.[73]

In 1819 Thomas Munroe, his family and others came to Whitehaven and built log cabins up the river. Upon exploring the area they came upon Micmac Indians and together they proceeded to Molasses Harbour.[74]

In 1819 women settlers at Whitehaven encountered Indians while their husbands were out fishing. The women were guided to the Indians wigwams then all went onto Molasses Harbour where they were received by a French family. Relations were quickly established with the Indians and settlers.[75]

Country Harbour, called Mocodome by the Micmac, is a favorite camp area with trout, salmon, herring, mackerel and codfish.[76]

Indian Harbour was a favorite resort of the Micmac with fish and it was close to the forest for fowl. There were large numbers of wigwams there.[77]

On the West Branch St. Mary's River near Caledonia and Trafalgar was a *"great resort for Indians on hunting and trapping expeditions"*.[78]

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[68] PANS RG1 Vol. 380, Pages 1-40, m/f 15,441. Titus Smith's Eastern Tour May 6, 1801, (p. 9)
[69] PANS RG1 Vol. 380, Pages 1-40, m/f 15,441. Titus Smith's Eastern Tour May 6, 1801, (p. 21)
[70] PANS, RG1, v. 430, Doc. No. 88
[71] Tremayne, Terry. Faces and Places: Travel and Tales in Nova Scotia's Antigonish and Guysborough Counties. Tremayne Associated Distributors Ltd., Halifax, 1983, (p. 25-6)
[72] Hart 1975, (p 70)
[73] Hart, H.C. History of the County of Guysborough Nova Scotia, 1975, (p. 70)
[74] Hart, 1975, (p. 144)
[75] Hart, H.C. History of the County of Guysborough Nova Scotia, 1975, (p. 144)
[76] Hart, 1975, (p. 154)
[77] Hart, 1975, (p. 158)
[78] Hart, 1975, (p. 169-170)

C 1340-1965

Wine Harbour was named so because a Portuguese barque with a cargo of wine wrecked there during a storm. Indians from nearby fled with cargo and some froze to death near the wreck.[79]

In 1836, the boundaries of Sydney County were changed when Guysborough County was established out of the former lower part of Sydney County. In 1914 the Lt. Gov and Council authorized a surveyor to run the boundary line for Guysborough County. Indians from Isaac's Harbour encampments

> *"roamed from the Isaac's Harbour interior lakes to the Bay and Country Harbour River as far as the headwater lakes which are: Sinclair, Pringle and Eight Island Lakes near Goshen".*[80]

On February 28, 1838 a Petition was submitted against fishing with large nets in Chedabucto Bay. Fishermen are sewing large nets together and setting them far out in the bay which keeps fish from entering the coves and bay. These nets caused hardship to the inshore commercial fishery and to people who fish for food.[81]

On April 6, 1845 a Petition of John Battis, Joseph Battis, Francis Cope was submitted for land in Guysborough County

> *"in the neighbourhood of which they have many years sojourned. Each year their hunting ground and subsistence there from are more scanty and precarious".*[82]

On February 2, 1848 Abraham Gesner, Indian Commissioner, submitted a petition to the House of Assembly which was signed by eleven chiefs and captains of the Mi'kmaq *"to prevent the Hunting of Moose by Dogs and to Secure to Them Their Fisheries"* and to allow them to spear salmon in any of the rivers within the province. White man's hunting style was threatening the moose population as they only took the skin, leaving the rest behind.[83]

On Feb 19, 1849 Letter seeking relief for Indians. The Committee recommends that £30 be given to the Indian Commissioner at Antigonish for the relief of the Indians in Sydney and Guysborough Counties.[84]

On December 8, 1849 a Petition of Newel Joe, Newel Dennis and others to John Harvey for relief at St. Mary's, Guysborough County. There was crop failure and fish and game are scarce. 200-300 moose were taken by white people last spring in St. Mary's alone. Family names listed are: Joe, Dennis, Grigwell, Lewie, Toney, Cristifer, Glema, Louland, Michal, Potet, Forit, French, Caber, Prosper, and Sabia.[85]

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[79] Hart, 1975, (p. 158-159)
[80] Cooke, Findlay *History and Stories of Issac's Harbour and Goldboro,* Antigonish: Formac, 1976, (p. 7)
[81] PANS RG5 Series P, Vol. 52 #95, m/f 15616
[82] PANS MG15, Vol. 3 # 81 m/f 15106
[83] Haigh, Elizabeth. They Must Cultivate the Land: Abraham Gesner as Indian Commissioner, 1847-1853; Journal of the Royal Nova Scotia Historical Society, Vol. 3, 2000, (p. 63)
[84] PANS, Journal of Legislative Assembly NS, 1894, Appendix No. 49, Page 362 Reel No. 3533
[85] PANS RG1 Vol. 431 # 56 (m/f 15472)

In 1850[?]Chearnley tells a story of a bear given to him by *"an Indians of Great Hunting celebrity who had been dead some yeors Joseph Glode"*. Gloade has shot and killed a female bear and found a cub beside it and presented it to Chearnley.[86]

On October 6, 1851 Denny Michael to Joseph Howe Petitiond for relief for Mi'kmaq in Guysborough County, Country ___ (Harbour? or Clam). The Mackerel fishery has failed and white fisherman have no money to purchase their goods.[87]

On April 28, 1856 Stewart Campbell writes to [? Chearnley] for relief for the Indians at McNairs Cove, in the Straight of Canso.[88]

In the Fall 1857 Harry Piers, Stephen Piers, Charles McDonald and Peter Joe wished to participate in *"the mysteries and glories of Moose Calling"* at Lake Mooin, Guysborough County.[89]

A 1863 Petition from Guysborough County regarding unwanted destruction of the moose population was received. No moose hunting should be allowed for three years to allow stock to recover.[90]

On December 2, 1871 James B. Hadley Sr. writes a letter to an unnamed Sir that there are 8 Indian families staying in the woods for the winter near Port Mulgrave. He writes that they are very poor and cannot sell their items. He left them with forty eight blankets.[91]

On Aug 23, 1872 Angus Cameron writes to the Honourable Joseph Howe of the Indians being deprived of their burial grounds in St. Marys that they claim for 150 years. The burial is at *"Sheep Island at the Forks or Glenelge Lake"*.[92]

A 1872 Letter to the Honourable Joseph Howe, Secretary of State for the Province from John McKinnon, Indian Agent. The letter refers to the conditions of the Indians in the district of Guysborough. It reports that *"considerably large tracts of land"* have been cultivated and abundant crops of hay, potatoes and oats. He reports that in the summer many Indians fish with but this year was not as successful. Last names of Indians listed: Gabril, Prosper, Joe, Sallome, Pictob, Scotchman, Marble, Batist, Fraser, Marshal, Nicholas, Cope, Lafford, Newl, Tony, Brassay, Meuse, Tom, Phillip, Paul, McKeugir, and McMillan.[93]

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[86] PANS MG1 Vol. 1506, no page #, no doc. # (Chearnley Papers 2nd file folder, 1st story)
[87] PANS MG15, Vol. 4a, #101 (m/f 15107)
[88] PANS RG1 Vol. 431 # 92
[89] PANS MG1 Vol. 1464, #45
[90] PANS RG5 Series P Vol. 18, No. 173
[91] NAC RG10 Vol. 459 p. 122-123 (m/f 13329)
[92] NAC RG10, vol. 2134, file 27,046-1
[93] NAC RG10, vol. 2134, file 27,046-1

Letter of John McKinnon Jr., Indian Agent to Joseph Howe, Secterary of State for the Province dated May 22, 1872. Reports that there are two or three Indian families in Guisboro who fish every summer at Cape Canso and camp every winter near the Town of Guisboro. Others make home at the Strait of Canso.[94]

The August Gale of 1873 changed the village of Canso.[95]

John Lewis and Harriet Cremo followed their family traditions by making an annual journey from Chapel Island to Canso where they would fish for swordfish along the areas waters. They would stay for several weeks and return to Chapel Island for the annual St. Anne's Mission.[96]

Harry Piers' hand written notes regarding the moose hunt expedition with Micmac guides, including Peter Joe. Moose, black duck, otter and porcupine were hunted near Lake Mooin, Liscomb River and Hunters Lake, Guysborough.[97]

In 1922 the hunting territories within Guysborough included Frank Cope – Hunting Lake, Governor's Lake and Ten Mile Lake (#35); Peter Joe Cope – Fifteen Mile Lake, Rocky Lake (#36); Michael Tom (Toney) – Moser River (#37); Young Peter Joe Cope – Large District North of Sheet Harbour (#38) (p. 103); Mathew Salome – Big Liscomb Lake (#39); Jim Paul – Hunting Lake and Liscomb River (#40); Abram Paul – Lake Mooin, Back of Liscomb (#41); Newell Denis – Country Harbour, Isaacs Harbour and north (#42); Steve Malone – Loon Lake (#43); Peter Anthony – Mill Village River, near Port Mulgrave (#44).[98]

On February 6, 1965 John S. Erskine writes to Mr. G.G. Campbell, Principal, Sydney Academy. Erskine writes to Campbell that John Prosper, late Chief of Bayfield, was born into the Canso band and spent winters at Framboise Cove spearing eels and would come to Canso to fish in the Spring.[99]

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[94] NAC RG10, vol. 2134, file 27,046-1
[95] Jones, Elizabeth. Gentlemen and Jesuits: Quests for Glory and Adventure in the Early Days of New France, University of Toronto Press, 1986, (p. xv)
[96] Caplin, Ronald; ed. Cape Breton Works: More Lives From Cape Breton's Magazine, Annie and John Battiste: A Mi'kmaq Family History, Breton Books, Wreck Cove, Cape Breton, 1996, (p. 166)
[97] PANS MG1, vol. 1464, No. 43
[98] Beothuk and Micmac, Frank G. Speck, New York, 1922, (p. 104)
[99] Beaton Institute, MG 15.43 A9

Guysborough Mi'kmaq Population Information from Department of Indian Affairs Annual Reports

Year	Guysborough County Population	Antigonish County Population	Department Report Date	Other Notes
1871	88	-	1872[104]	-
1872	48	93	1873[105]	-
1873	48	151	1873[106]	Agent John McKinnon Jr.
1874	-	156	1874[107]	Agent John J. McKinnon
1875	-	-	1875[108]	Agent Rev. W Chisholm – no report submitted for this year
1876	154 (combined)	-	1876[109]	Agent William Chisholm
1877	152 (combined)	-	1877[110]	Agent William Chisholm
1878	152 (combined)	-	1878[111]	-
1879	166 (combined)	-	1879[112]	Agent Rev. William Chisholm reports that the increase in population is due to Indians emigrating from Bras d'Or Lake and other parts of Cape Breton
1880	167 (combined)	-	1880[113]	Agent Rev. William Chisholm notes that houses have been built in this year and are occupied for only part of the year as the Indians go away during the fishing season and in the winter camp in the woods where they can easily gather materials for basket making and coopering
1881	162 (combined)	-	1881[114]	Agent Rev. William Chisholm
1882	169 (combined)	-	1882[115]	Agent Rev. William Chisholm reported that Indians have several small reserves
1883	170 (combined)	-	1883[116]	Agent Rev. William Chisholm
1884	175 (combined)	-	1884[117]	Agent John J. Chisholm
1885	150 (combined)	-	1885[118]	Agent Joseph Chisholm
1886	180 (combined)	-	1886[119]	Agent Joseph Chisholm
1887	177 (combined)	-	1887[120]	Agent William C. Chisholm
1888	175 (combined)	-	1888[121]	Agent Rev. William Chisholm
1889	168 (combined)	-	1889[122]	Agent Rev. William Chisholm
1890	171 (combined)	-	1890[123]	Agent Rev. William Chisholm
1891	169 (combined)	-	1891[124]	Agent Rev. William Chisholm
1892	168 (combined)	-	1892[125]	Agent Rev. William Chisholm
1893	168 (combined)	-	1893[126]	Agent W. C. Chisholm
1894	160 (combined)	-	1894[127]	Agent W. C. Chisholm

[104] Report of the Indian Branch of the Department of the Secretary of States for the Provinces, 1872 Sessional Papers No. 22, Page 35.
[105] Annual Report on Indian Affairs for the Year Ending June 30th 1872, Sessional papers No. 23, Victoria 36, 1873.
[106] Report of the Indian Branch of the Department of the Minister of the Interior 1873, Sessional Papers No. 17, Victoria 37, 1873.
[107] Annual Report of the Department of the Interior for the Year Ended 30th June 1874, Sessional Papers No. 8, Victoria 38, 1875.
[108] Annual Report of the Department of the Interior for the Year Ended 30th June 1875, Sessional Papers No. 9, Victoria 39, 1876.
[109] Annual Report of the Department of the Interior for the Year Ended 30th June 1876, Sessional Papers No. 11, Victoria 40, 1877.
[110] Annual Report of the Department of the Interior for the Year Ended 30th June 1878, Sessional Papers No. 10, Victoria 41, 1878.
[111] Report of the Indian Branch of the Department of the Secretary of States for the Provinces, 1879 Sessional Papers No. 7, Victoria 42.
[112] Report of the Indian Branch of the Department of the Secretary of States for the Provinces, 1880 Sessional Papers No. 4, Page 43.
[113] Report of the Indian Branch of the Department of the Secretary of States for the Provinces, 1881 Sessional Papers No. 14, Page 45.
[114] Report of the Indian Branch of the Department of the Secretary of States for the Provinces, 1882 Sessional Papers No. 6, Page 45.
[115] Report of the Indian Branch of the Department of the Secretary of States for the Provinces, 1883 Sessional Papers No. 5, Page 46.
[116] Annual Report of the Department of Indian Affairs for the Year Ended 31st December 1883, Sessional Papers No. 4, Victoria 47, 1884.
[117] Annual Report of the Department of Indian Affairs for the Year Ended 31st December 1884, Sessional Papers No. 3, Victoria 48, 1885.
[118] Annual Report of the Department of Indian Affairs for the Year Ended 31st December 1885, Sessional Papers No. 4, Victoria 49, 1886.
[119] Annual Report of the Department of Indian Affairs for the Year Ended 31st December 1886, Sessional Papers No. 6, Victoria 50, 1887.
[120] Annual Report of the Department of Indian Affairs for the Year Ended 31st December 1887, Sessional Papers No. 15, Victoria 51, 1888.
[121] Annual Report of the Department of Indian Affairs for the Year Ended 31st December 1888, Sessional Papers No. 16, Victoria 46, 1889
[122] Report of the Indian Branch of the Department of the Secretary of States for the Provinces, 1890 Sessional Papers No. 12, Page 53.
[123] Report of the Indian Branch of the Department of the Secretary of States for the Provinces, 1891 Sessional Papers No. 18, Page 54.
[124] Annual Report of the Department of Indian Affairs for the Year Ended 31st December 1891, Sessional Papers No. 14, Victoria 55, 1892.
[125] Annual Report of the Department of Indian Affairs for the Year Ended 31st December 1892, Sessional Papers No. 14, Victoria 56, 1893.
[126] Annual Report of the Department of Indian Affairs for the Year Ended 30th June 1893, Sessional Papers No. 14, Victoria 57, 1894.

1895	167 (combined)	-	1895[128]	Agent Rev. William Chisholm
1896	158 (combined)	-	1896[129]	Agent William C. Chisholm
1897	130 (combined)	-	1897[130]	Agent John R. McDonald
1898	30	124	1898[131]	Agent J.R. McDonald
1899	32	146	1899[132]	Agent J.R. McDonald
1900	32	146	1900[133]	Agent John R. McDonald
1901	31	155	1901[134]	Agent J.R. McDonald

Mi'kmaq Place Names in Guysborough County

Mi'kmaq words are different from English words. The main difference is the way the words are put together. A lot of information can be packed into a noun or verb and it can take many English words to properly translate them. Mi'kmaq place names name natural features and also describe geological features. Mi'kmaq place names reveal social and political history within a region.[135]

Place -	Mi'kmaq Place Name -	Meaning (if given) [136]
Guysborough County –	Esigeoagig	– skin dressing place
Black Point –	Magteoatgeg	– black head
Chedabucto –	Sedabuktook	– the deep extending (great) harbour
Cooks Cove –	Notogtetoalneg	– small Indian village
Durells Island –	Siplogagneg	
Fox Island –	Sebelogwokun	– where skins are stretched
Half Island Cove –	Aoaganeg	– portage
Halfway Cove –	Oetonitjitjg	
Indian Cove –	Elnoei gomi	
Philips Harbour –	Pilipgomimg	
Fox Island Cove –	Nasonigetjg	– rushy

Specific Land Claims

The Confederacy of Mainland Mi'kmaq was contacted and currently there are no outstanding specific claims identified within the project area. However, there is interest in the Dorts Cove area[137]. This in no way infers that specific land claims may not arise in the future.

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[127] Annual Report of the Department of Indian Affairs for the Year Ended 30th June 1894, Sessional Papers No. 14, Victoria 58, 1895.
[128] Annual Report of the Department of Indian Affairs for the Year Ended 30th June 1895, Sessional Papers No. 14, Victoria 59, 1896.
[129] Annual Report of the Department of Indian Affairs for the Year Ended 30th June 1896, Sessional Papers No. 14, Victoria 60, 1897.
[130] Annual Report of the Department of Indian Affairs for the Year Ended 30th June 1897, Sessional Papers No. 14, Victoria 61, 1898.
[131] Annual Report of the Department of Indian Affairs for the Year Ended 30th June 1898, Sessional Papers No. 14, Victoria 62, 1899.
[132] Annual Report of the Department of Indian Affairs for the Year Ended 30th June 1899, Sessional Papers No. 14, Victoria 63, 1900.
[133] Annual Report of the Department of Indian Affairs for the Year Ended 30th June 1900, Sessional Papers No. 27, Victoria 64, 1901.
[134] Annual Report of the Department of Indian Affairs for the Year Ended 30th June 1901, Sessional Papers No. 27, 1-2 Edward VII, 1902.
[135] Leavitt, Robert M., Maliseet & Micmac First Nations of the Maritimes, New Ireland Press, Fredericton, NB, 1995 (page 40-43)
[136] *Preliminary Historical Research on Mi'kmaq Place-Names in Nova Scotia*, Volume II, Report prepared for the Aboriginal Title Project, 2006
[137] Email communication, Mary Jane Stevens to Jennifer Copage, January 23, 2012.

C 1340-1970

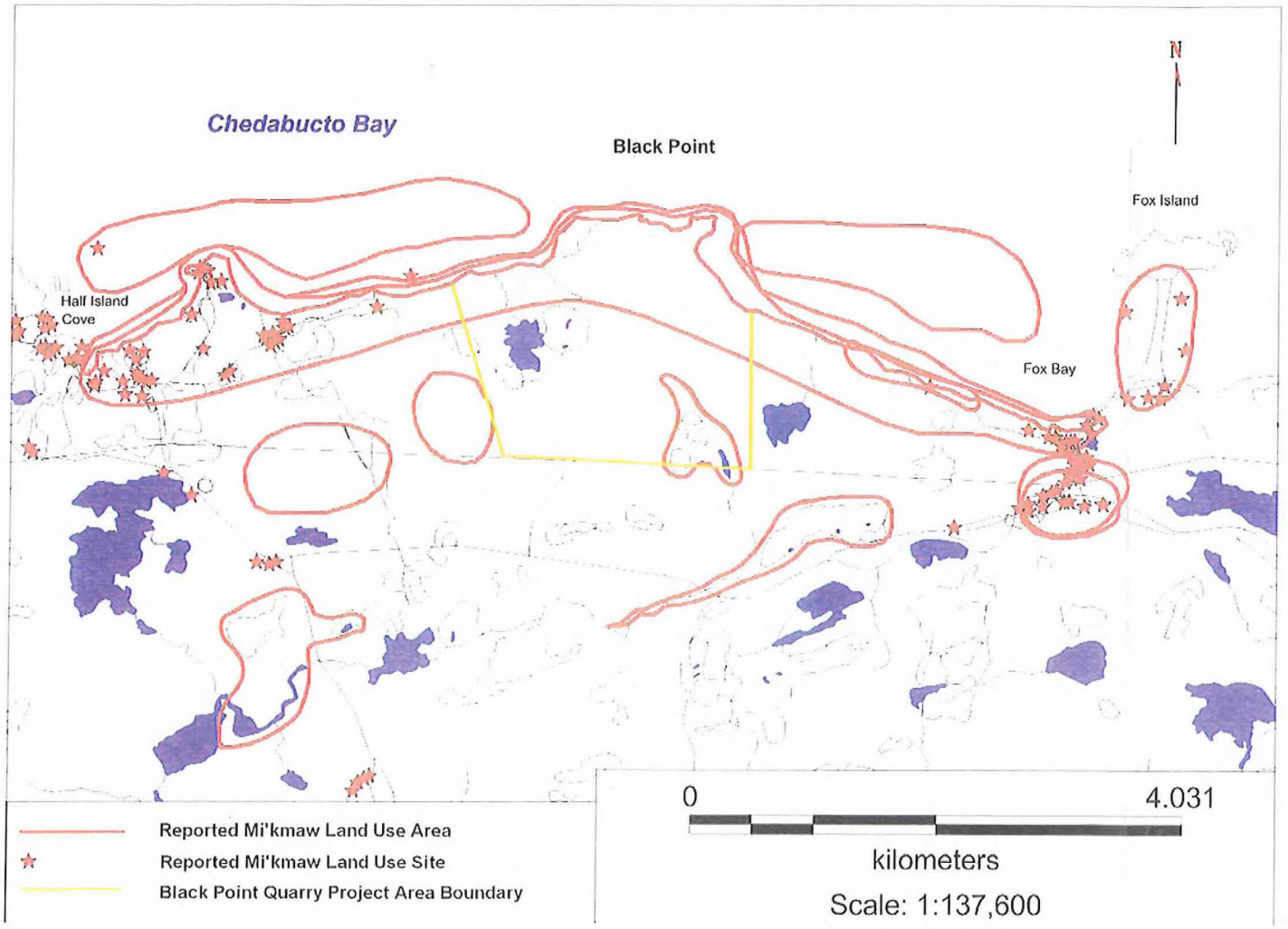
Conclusion

The historical review has found that Mi'kmaq have used sites surrounding the project area. Salmon River/Cooks Cove area was a long established Mi'kmaq community. The Canso Islands National Historic site of Canada recognized that Nicholas Denys first came to the Islands in the 1500's to fish and trade furs and that

> *"Archaeological evidence suggests that their Mi'kmaq trading partners had been coming to the islands for at least 1500 years before that".*[138]

Although no record was discovered, at this time, connecting the Mi'kmaq to the project area one can reasonably assume that it was highly probable due to the fact that the sites surrounding the project site were used by the Mi'kmaq.

[138] http://www.pc.gc.ca/lhn-nhs/ns/canso/natcul.aspx



REPORTED MI'KMAW LAND USE, PROJECT AREA DETAIL

MAPS: Mi'kmaw Ecological Knowledge Study- Black Point Quarry, Guysborough Co., NS. Appendix 6

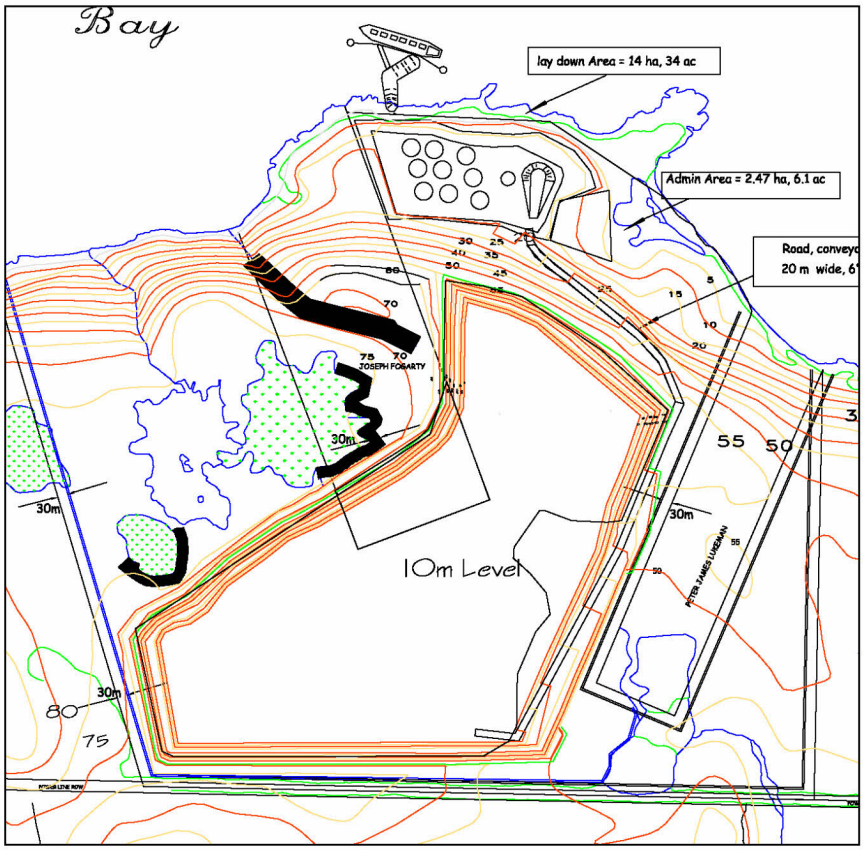
C 1340-1972

APPENDIX L
Archeological Resource Assessment (2011)
And Resource Impact Assessment (2014)

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

BLACK POINT QUARRY PROJECT: ARCHAEOLOGICAL RESOURCE IMPACT ASSESSMENT

HERITAGE RESEARCH PERMIT A2011NS67



JULY 2011

REPORT SUBMITTED TO:
AECOM
1701 Hollis Street
PO Box 567
Halifax, NS B3J 3M8

C 1340-1974

BLACK POINT QUARRY PROJECT:
ARCHAEOLOGICAL RESOURCE IMPACT ASSESSMENT

Heritage Research Permit A2011NS67
Category C

Davis MacIntyre & Associates Limited

Principal Investigator: Stephen A. Davis
Report Compiled by: Laura A. de Boer & Stephen A. Davis

Cover: A preliminary technical drawing showing the projected 25-year quarry layout. Courtesy AECOM.

C 1340-1975

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C 1340-1976

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C 1340-1977

Executive Summary

Davis MacIntyre & Associates Limited conducted an archaeological resource impact assessment of the proposed Black Point Quarry Project in Guysborough County. The assessment included consultation of historic maps, manuscripts, and previous archaeological assessments as well as the Maritime Archaeological Resource Inventory in order to determine the potential for archaeological resources in the study area. An archaeological reconnaissance of the proposed impact area was also conducted.

The assessment indicated that the presence of archaeological resources on the barrens was unlikely, but that the potential for such resources exists in the vicinity of a historic road and two bodies of water within the study area. As a result, it has been recommended that a detailed field reconnaissance be conducted prior to commencement of construction activities on the site.

C 1340-1978

1.0 INTRODUCTION

In July 2011, Davis MacIntyre & Associates Limited was contracted by AECOM on behalf of Erdene Resource Development Corp. to conduct an archaeological resource impact assessment of the proposed Black Point Quarry Project (aggregate quarry) in Guysboro County. The purpose of the assessment was to determine the potential for archaeological resources within the development zone and to provide recommendations for further mitigation if deemed necessary. This assessment included consultation of the Maritime Archaeological Resource Inventory in the Heritage Division of the Nova Scotia Museum as well as historic maps, manuscripts and published resources. A field reconnaissance of the impact area was also conducted in order to more thoroughly evaluate the archaeological potential of the area.

This assessment was conducted under Category C Heritage Research Permit A2011NS67 issued by the Nova Scotia Heritage Division. This report conforms to the standards required by the Heritage Division under the Special Places program.

2.0 STUDY AREA

Erdene Resource Development Corp. proposes to develop an aggregate quarry at Black Point on the Chedabucto Bay shore of Guysborough County. The project will be an open-pit quarry with associated facilities eventually covering approximately 79 hectares, and will include a wharf for loading product aboard bulk carriers for export to the eastern seaboard of the USA. An access road will also be required, to connect with the existing provincial road about 2.5 km distant. There are two possible sources of electric power for the project; it could be generated on-site with a diesel–powered generator, or it may be possible to tap into the closest transmission line, depending on the supply required. On-site equipment and facilities will include: a processing plant area, a ship loader system (conveyors), a marine terminal, and associated infrastructure.

The study area lies within the Canso Barrens natural theme region. In this unit, the upland surface is capped by granite knolls rising up to 200m above the sea along a straight northern coastline controlled by the Chedabucto Fault. The region extends northeast from New Harbour to the point of Cape Canso. Schists have formed from Meguma Group slates and greywacke. Approximately half of the unit's surface is

covered in thin deposits of granite, schist, and slate till, while the rest is exposed bedrock. Only a few drumlins have formed, comprised of red-brown till originating from Tor Bay and Canso Harbour. Coastal sediments are very limited.[1]

Lakes and ponds in this region are found in a variety of sizes and are fed by streams and tributaries of a complex nature. Surface water is slightly acidic. The soil of the region is usually thin and often non-existent, exposing the undulating granite beneath. A form of imperfectly drained sandy loam known as Danesville gleyed podzol is common near the coast, and Gibraltar sandy loam is also present. Black Spruce is the most common tree type, and is found only in areas where the soil is thick enough to sustain larger vegetation, particularly in wetter areas. Balsam Fir is also common, while White Spruce, maple, and birch are also found. Low vegetation on the barrens includes Sheep Laurel, Huckleberry, Labrador Tea, Bracken Fern, alders, and stunted or scrubby Black Spruce. Rockweed and kelp thrive on the rocky shores.[2]

Although the provincial guide to natural theme regions states that "large areas of barren do not provide productive wildlife habitats,"[3] the study area appears to support several established populations. During two days of field reconnaissance (see section 3.3 below), archaeologists observed frequent occurrences of animal tracks, including Black Bear, deer, raccoon, and coyote. Large quantities of coyote scat was also noted. A female partridge and her chicks were startled into open grass when the team passed nearby.

The natural theme region is documented to provide a breeding ground for various birds, including gulls, the Double-crested Cormorant, Great Blue Heron, Arctic Tern, Common Tern, and Common Eider.

[1] Davis and Browne, 1996:213.

[2] Davis and Browne 1996:213.

[3] Davis and Browne, 1996:213.

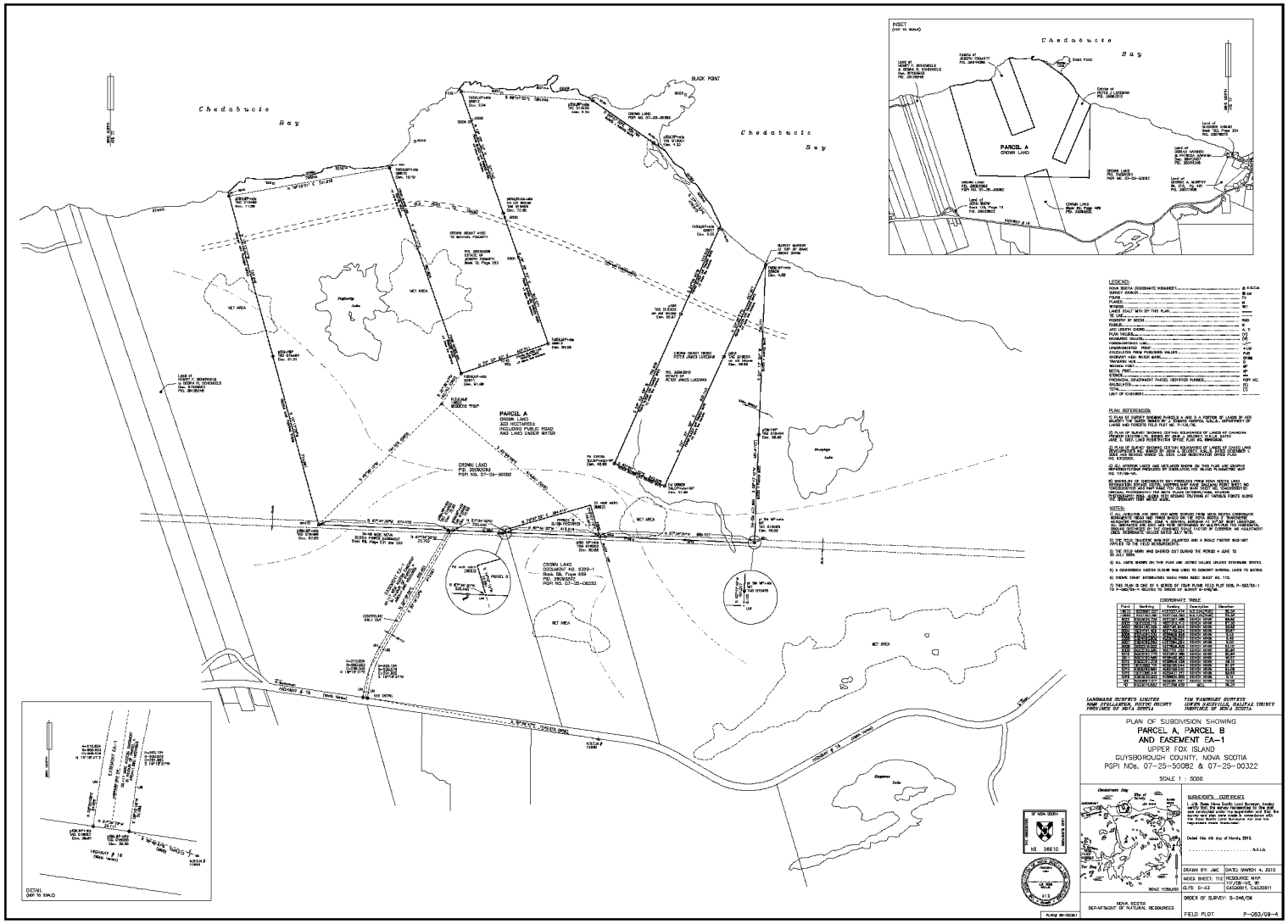

Figure 2.0-1: Map of the Project Study Area at Black Point. Courtesy AECOM.

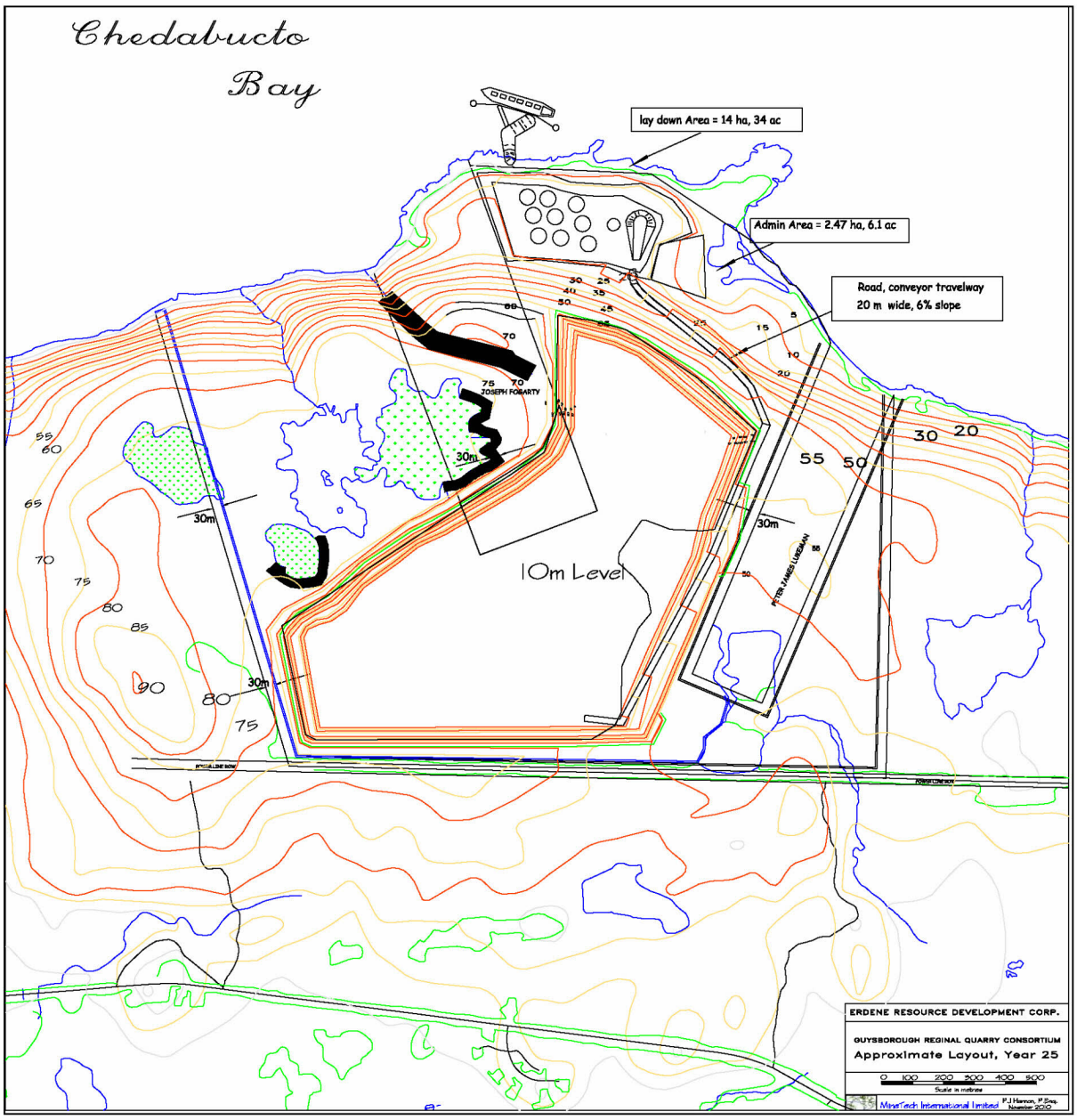

Figure 2.0-2: A 25-year projection of the project study area. Courtesy AECOM.

C 1340-1982

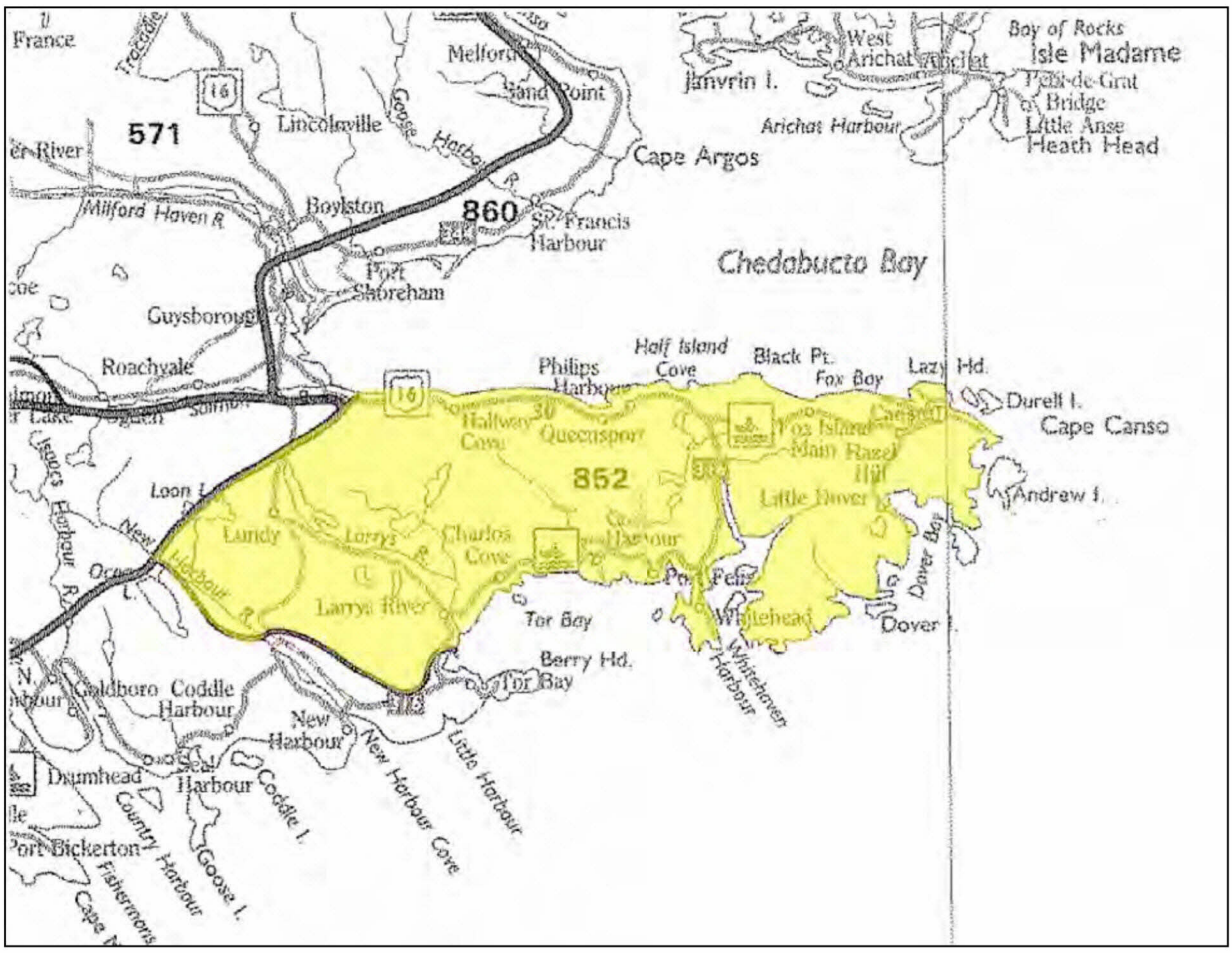

Figure 2.0-3: Natural Theme Regions of Nova Scotia, showing region 852 (highlighted) – Canso Barrens.

3.0 METHODOLOGY

A historic background study was conducted by Davis MacIntyre & Associates Limited in July 2011. Historical maps and manuscripts and published literature were consulted at Nova Scotia Archives and Records Management in Halifax. The Maritime Archaeological Resource Inventory, held at the Nova Scotia Museum's Heritage Division, was searched to understand prior archaeological research and known archaeological resources neighboring the study area. A preliminary archaeological reconnaissance of the impact area was also conducted.

C 1340-1983

3.1 Maritime Archaeological Resource Inventory

The Maritime Archaeological Resource Inventory, a Provincial database of known archaeological sites held at the Nova Scotia Heritage Division, was consulted in July 2011 to understand prior archaeological research and known archaeological resources neighboring the study area. Due to the sensitive nature of archaeological sites, exact locations have not been provided below.

The presence of stone "Indian relics" at the turn of the twentieth century was noted at two sites near Canso (George Island and Glasgow Head) by early historian and curator Harry Piers. A 1973 follow-up survey by Stephen Davis was unable to relocate either site, and so their exact locations remain unknown.

A copper pot burial site was encountered by locals at the mouth of the Salmon River near Guysborough. Copper pot or kettle burials are a particular type of First Nations burials that made use of the copper vessels acquired from early European traders.

Historic fortifications are known at Fort St. Louis in Chedabuctou (modern Guysborough). The remains are well-known through historic sources, and the recovery of an 18th or early 19th century bottle finish has helped to establish the occupation period of the site.

At Birchtown Lake, four sites including historic cellar depressions or house foundations have been reported, two of which contain more than one known depression. These features are all thought to be associated with the Black Loyalist community of Birchtown, inhabited in the mid to late 19th century. A cemetery associated with the community has also been reported.

The absence of recorded archaeological resources within or immediately adjacent the proposed development area is likely an indication that this area was not subjected to previous archaeological assessments.

C 1340-1984

3.2 Historical Background

3.2.1 The Precontact Period

The history of human occupation in Nova Scotia has been traced back approximately 11,000 years ago, to the Palaeo-Indian period or *Sa'qewe'k L'nu'k* (11,000 – 9,000 years BP). The only significant archaeological evidence of Palaeo-Indian settlement in the province exists at Debert/Belmont in Colchester County.

The *Saqiwe'k Lnu'k* period was followed by the *Mu Awsami Kejikawe'k L'nu'k* (Archaic period) (9,000 – 2,500 years BP), which included several traditions of subsistence strategy. The Maritime Archaic people exploited mainly marine resources while the Shield Archaic concentrated on interior resources such as caribou and salmon. The Laurentian Archaic is generally considered to be a more diverse hunting and gathering population.

The Archaic period was succeeded by the Woodland/Ceramic period or *Kejikawek L'nu'k* (2,500 – 500 years BP). Much of the Archaic way of subsistence remained although it was during this period that the first exploitation of marine molluscs is seen in the archaeological record. It was also during this time that ceramic technology was first introduced.

The Woodland period ended with the arrival of Europeans and the beginning of recorded history. The initial phase of contact between First Nations people and Europeans, known as the Protohistoric period, was met with various alliances particularly between the Mi'kmaq and French.

The Mi'kmaq inhabited the territory known as *Mi'kma'ki* or *Megumaage*, which included all of Nova Scotia including Cape Breton, Prince Edward Island, New Brunswick (north of the Saint John River), the Gaspé region of Quebec, part of Maine and southwestern Newfoundland (Figure 3.2-1).

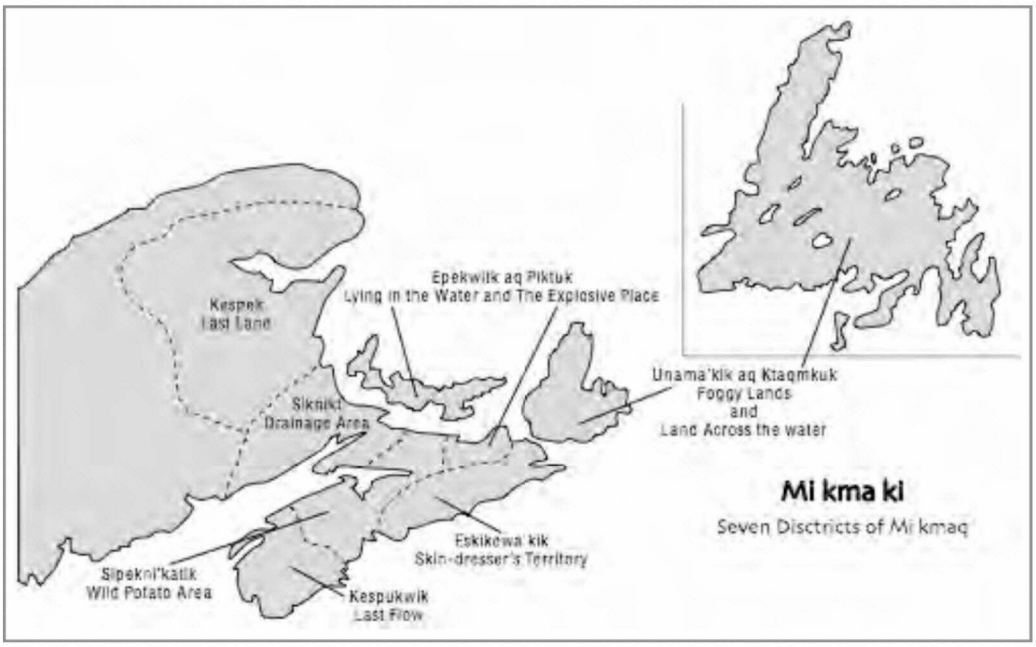

Figure 3.2-1: Map of the Mi'kmaq territories.[4]

A historical Mi'kmaq presence has been well documented in Guysborough County and specifically in the vicinity of Canso, less than 15 kilometres from the study area. In 1607 word reached Port Royal from Campseau (now Canso) that "the Dutch had insinuated themselves into the fur trade on the east shore, having been conducted by a treacherous Frenchman. The avarice of these people was so great, that they had opened the graves and taken the beaver skins in which it was customary for the Indians to wrap the dead. This conduct was so highly resented by the Indians of Canso that they killed the person who had shown the place where the dead were laid."[5]

The place name "Canso" is believed to have originated from the Mi'kmaq term *Kamsok,* meaning "opposite lofty cliffs."[6] Chedabuctou Bay also derives from a Mi'kmaq name, historically also transcribed as *Sedabooktook,* and translated as "running far back."[7]

[4] Confederacy of Mainland Mi'kmaq, 2007:11.
[5] Hart 1877:10-11.
[6] Davis and Browne 1996:214.
[7] Rand 1875:85.

C 1340-1986

3.2.2 European Settlement

It is thought that the French began fishing off the coast of Nova Scotia as early as 1504 and possibly earlier.[8] Activity on land was coastal and seasonal, consisting of trade with the native Mi'kmaq and the use of beaches to dry fish for the long voyage back to France. The fishery continued to be profitable for centuries, supplying variously the French, English, and Basque seamen who sailed along these coasts. The plentiful stocks of fish in the area, particularly the cod, made it necessary for fishermen to establish *dégrats* or temporary processing stations on the shore.[9]

In 1518 Baron de Lery attempted to establish a colony in this new land. Finding himself unprepared for the extreme cold, however, he abandoned herds of cattle at nearby Canso as well as on Sable Island before returning to Europe with his fellow colonists. The cattle did not survive the winter, due either to the harsh conditions or to hunting by native bands.[10]

By the early seventeenth century the Jesuits had begun to establish themselves as missionaries in this area of the New World. In November 1629, a vessel wrecked somewhere in the vicinity of Canso leaving two Jesuit priests, Father Charles Lalemant and Father Alexandre de Vieuxpont, briefly stranded on an island. The victims of the wreck were buried, including Father Philibert Boyrot and his two nephews, presumably on the same island. Given the early date of this occurrence, it is difficult to precisely identify which island was host to the priests and the graves. It has been surmised that the island was Isle Madame, but nothing has yet been confirmed.[11]

It has been suggested that a French settlement also existed at Philip's Harbour, west along the coast from Black Point. This suggestion originated from accounts that early British settlers to the area found the "ruins of several houses and stores" at this location.[12] Whether "the French" refers to early visitors or to a slightly later Acadian presence is unclear.

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[8] Hart 1877:9.

[9] Dawson 1988:40.

[10] Hart 1877:9.

[11] Johnston 1960:10-11, 14.

[12] Hart 1877:120.

C 1340-1987

Although the French had been controlling European settlement and trade in the seventeenth century, in 1713 the Treaty of Utrecht ceded *Acadie,* which included mainland Nova Scotia, to the English. Five years later, HMS *Squirrel* was sent to Canso to "dislodge" the French who were still successfully fishing in the area.[13] The mid-eighteenth century saw a series of deportations of French settlers, including most notably the Acadians beginning in 1755. Canso's French fishermen, however, continued to sail and fish in the vicinity of the Canso Islands, which they did not recognize as part of the mainland included in the 1713 Treaty.[14] Disputes would continue throughout the eighteenth century.

Prior to 1721, a British Government regulation decreed that all tracts of forest land containing trees suitable for ship masts should be set aside as Crown Reserves.[15] It is possible that this regulation was related to the surprising scarcity of land grants within the study area. Indeed, only two grants appear to have been made: the first to Michael Fogerty and the second to Peter James Lukeman (Figure 3.3-1).

Activity continued to increase along the Chedabucto Bay coast during the eighteenth century. By 1731, the fishery had grown so profitable that "there were more fish at Canso than there were vessels to carry to market."[16] In 1767, the population of Canso had grown to 519, of whom 197 were Acadian and 112 were Irish.[17]

Despite the strong Acadian population in the mid-eighteenth century, English dominance continued to assert itself as the years wore on. In 1815, Bishop Plessis noted "Manchester Bay borders the mainland of Nova Scotia, towards the north, and extends from the neighbouring Gut of Canso. The Indians and Acadians try to keep its former name – Chedabouctou Bay – but the English name prevails in spite of them."[18]

[13] Dawson 1988:40.

[14] Dawson 1988:40.

[15] Hart 1877:15.

[16] Hart 1877:20.

[17] Johnston 1960:85.

[18] Plessis 1815, quoted in Johnston 1960:314.

C 1340-1988

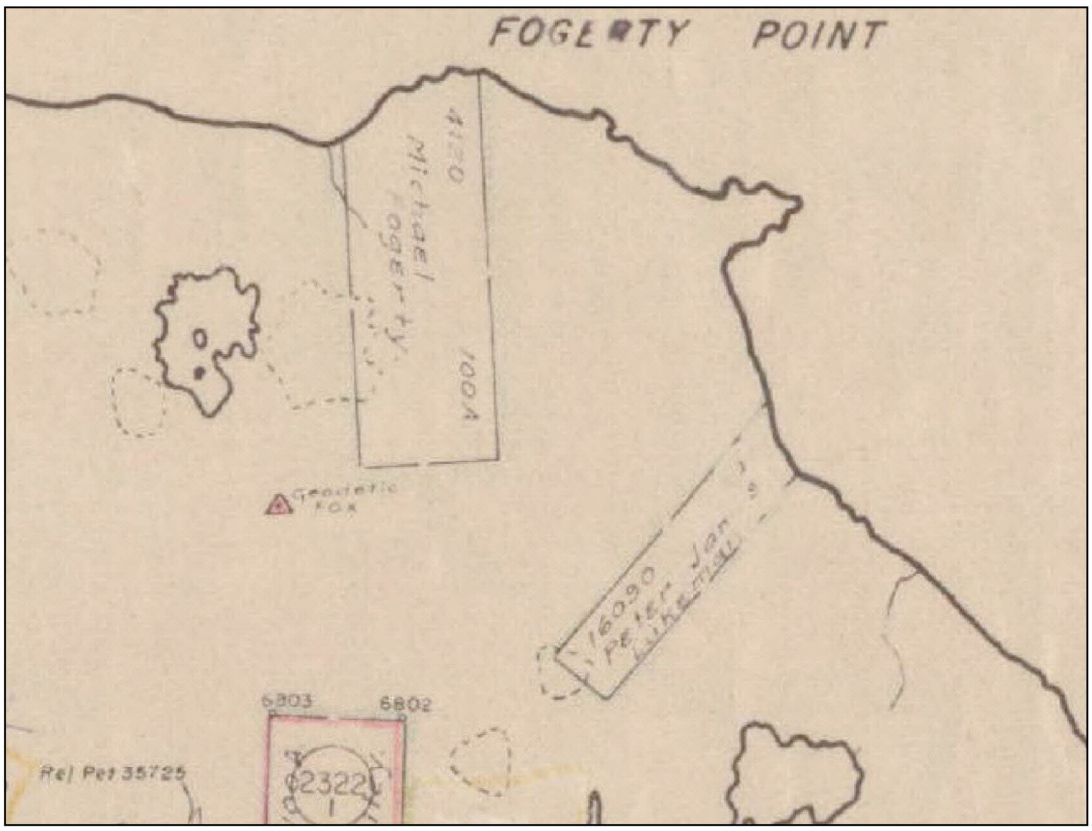

Figure 3.3-1: The original land grants at Fogherty Head or Black Point.[19]

This coast of Chedabucto Bay may also have been the scene of an 1823 quadruple murder. On a calm April evening, four men were returning from Canso to Crow Harbour by boat. George Lamb, John McKenzie, Alexander Smith, and George Smith were never found, though oars from their boat with "ominous marks" were later recovered from the bay.[20]

This was not the only violent incident along this shore. The Canso riots of 1835 are known to have spread to Fox Island, immediately west of the study area, though to what extent is not clear. Additionally, a 1908 account records the events at Fox Island around 1820:

> During Father [James] Grant's incumbency there arose great troubles and quarrels at Fox Island, then a very valuable fishing place on Guysborough Bay, near Canso. It appears the Island had been free to all, so that people

[19] Department of Lands and Forests 1950.

[20] Hart 1877:120.

C 1340-1989

> flocked from all parts for the fall mackerel, which was taken in great abundance. In those days there was no restraint on liquor, and where there was money there was liquor. Things got so bad that a squad of the army was sent for about two months to keep order. The Captain got tired of camp life, and said to his Colonel at Halifax, "There is a priest at Guysborough. If you can obtain his services, he will keep order better with his cane than we can with our guns." After that, Father Grant received £50 a year for keeping order. After some years the Harts secured the Island, and gave no place to fighting characters.[21]

In the 1880s and 1890s, at least sixteen families lived on Fox Island, having built their houses on the mainland side to shelter from the wind (Figure 3.3-2). A chapel was also located on Fox Island Main at Chapel Hill, possibly within the limits of the modern Seabreeze Campground and Cottages. During berry picking expeditions in the 1930s or 1940s, one local resident recalls observing the wooden foundations of the chapel. The resident's grandmother had informed him that a cemetery was associated with the chapel. It contained over 120 graves, marked only by wooden crosses or flat beach stones etched with names or dates. Two relatives of Martin Daley were buried here, after they drowned in a pond nearby. Native burials were also reportedly part of the cemetery.[22]

Until 1857 the "Stagecoach Road" between Crow Harbour and Canso ran along the coast, passing closely to Fogherty Head and Black Point (Figure 3.3-3).[23] The rocky nature of this road meant that passage in the summer by buggy or wagon was nearly impossible. However, it appears that in the 1870s at least two houses were located in or near the eastern end of the study area. When the new road was built farther inland it encouraged settlement along level and fertile ground off the hard coastline.

[21] Father Michael Tompkins, 1908, quoted in Johnston 1960:468-9.

[22] MacDuff, Everett, personal communication 20 July 2011.

[23] MacDuff, Everett, personal communication 20 July 2011.

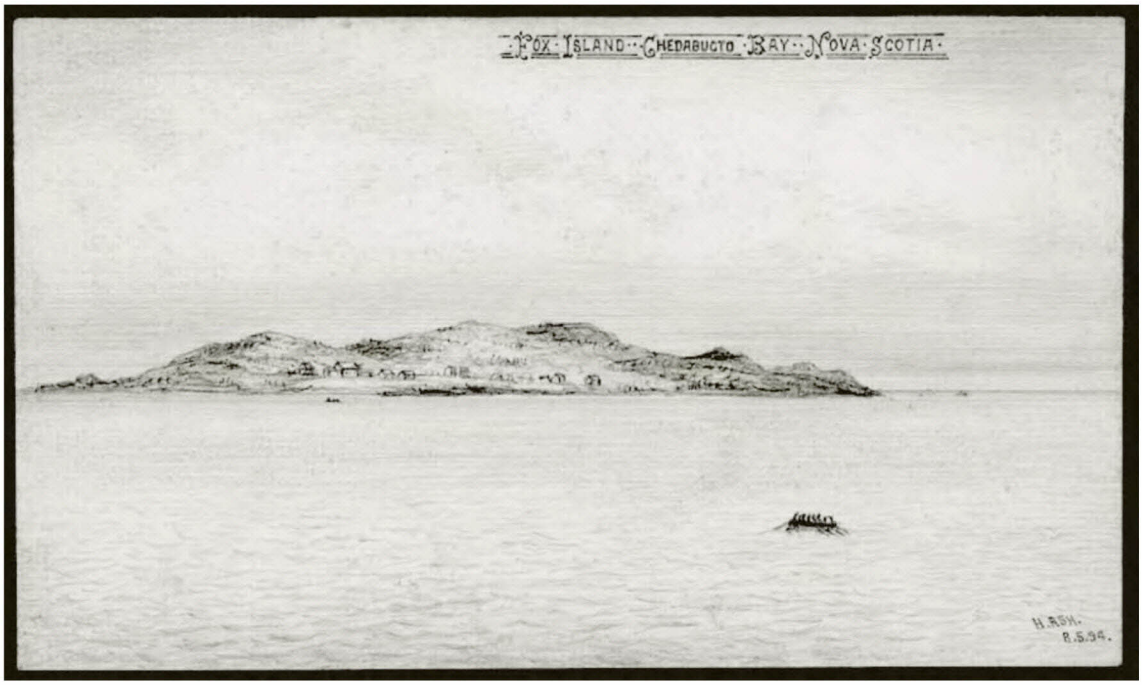

Figure 3.3-2: Fox Island in 1894, from the mainland.[24]

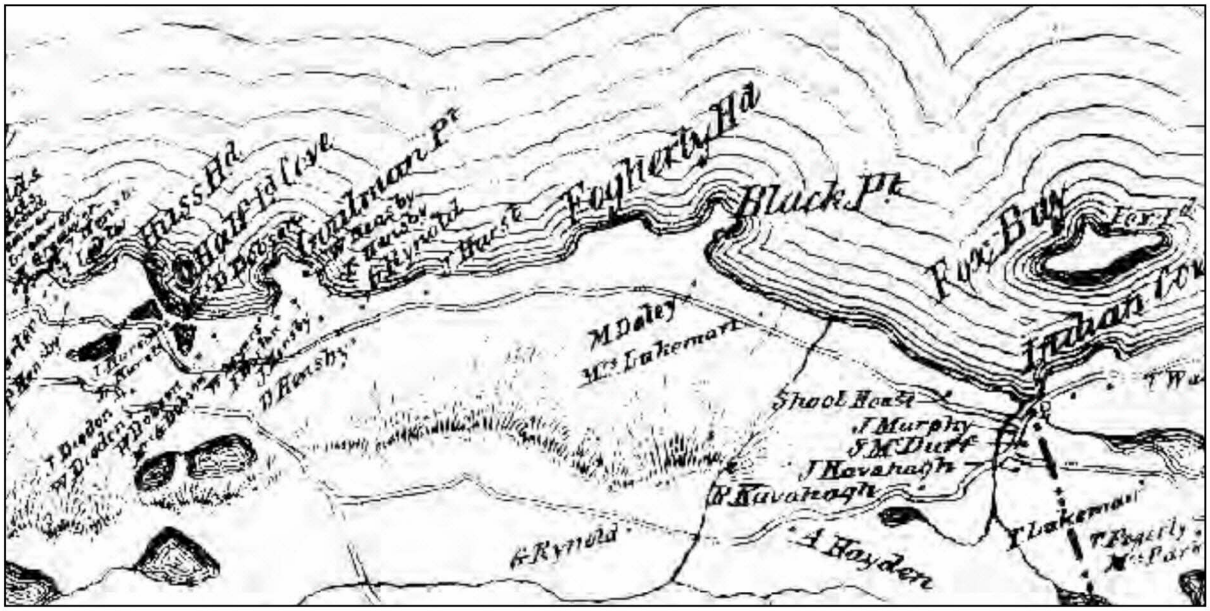

Figure 3.3-3: An 1876 map of Guysborough County shows two houses (M. Daley and Mrs. Lukeman) in or near the study area, bordering the coastal road to Canso.[25]

[24] Library and Archives Canada 1894.

[25] Church 1876.

C 1340-1991

Oral history recounts that Black Point had a strong settlement in the late nineteenth century. The settlement included the Black Point School, and one oral report suggests that a Roman Catholic Church may have been located in the area.[26] Unfortunately, no other sources have directly confirmed the presence of this church. The only clue that may corroborate a church having stood in the vicinity is a vital statistics record showing that Murdock McNeil and Bridget Eaton were married on July 2nd, 1891 at Black Point, Guysborough County under a Roman Catholic licence.[27]

Local residents also report that Martin Daley (likely the "M. Daley" shown on Figure 3.3-3) and his son Vincent were the last residents of Black Point. In his later years, Martin lived at nearby Fox Island or Fox Island Main during the week, working as a fisherman. On weekends, he would return to Black Point to live with his son. The two were both farmers and fishermen, a type of dual employment that was not uncommon on the coast of Nova Scotia during the nineteenth and early twentieth century. Sometime after the 1930s, the Daley house was demolished, as presumably was the associated barn. Both were located in a meadow with a brook running down its centre, where one local resident reported pasturing his family horse in the summers.[28]

Sometime after all of the residents of Black Point had moved to Fox Island Main or further afield, John Rhynold and his son reportedly flew a flag on Black Point in memorial to John's mother, who was born at Black Point.[29] Additionally, a descendent of the Lukeman family kept a cabin on his family property at Fogherty Head, and used to visit the site each year.[30]

[26] MacDuff, Everett, personal communication 20 July 2011, and Grant, James, personal communication 12 July 2011.

[27] Nova Scotia Historical Vital Statistics 1891.

[28] MacDuff, Everett, personal communication 20 July 2011.

[29] MacDuff, Everett, personal communication 20 July 2011.

[30] MacDuff, Everett, personal communication 20 July 2011, and Rhynold, Anne Marie, personal communication 12 July 2011.

3.3 Field Reconnaissance

A partial field reconnaissance of the study area was conducted by Stephen Davis and Laura de Boer on July 12th and 13th, 2011. The goal of the reconnaissance was to establish the layout and conditions of the study area in order to determine whether or not a complete walkover survey would be necessary.

On July 12th, the team accessed the study area via a narrow logging road leading north from Highway 16. This road terminated at a transmission line corridor, which when followed east lead to the southwestern corner of the study area. The southern border of the proposed impact area was found to consist of a moderate south-facing slope, formed of shallow granite bedrock with thin soil. Scrubby brush and sparse black spruce predominate, and as mentioned above evidence for a variety of wildlife was noted, including bear, coyote, partridge, and deer. A crown land marker was observed at the northern termination of the project right-of-way (Plate 1).

When archaeologists reached the marker delineating the western-most corner of the Department of Natural Resources land, they followed a rough trail leading north and created by geotechnical testing equipment. The trail led upwards into a mostly treeless area of granite barrens (Plate 2). The "FOX" geodetic marker was observed on the barrens (Plate 3), though no other evidence of cultural activity was visible outside of the equipment track.

Farther north, the barrens began to slope downwards towards the ocean. When the team reached the southwestern corner of the Fogarty property, inclement weather prompted the decision to continue the survey the following day.

On July 13th, archaeologists returned to the southwestern corner of the Fogarty property using the same access route. The rough equipment trail was found to continue along the southern and then the northeastern edge of the property, and so the team continued to utilize this trail as the path of least resistance through the scrubby vegetation and low, wet areas of the barrens. It was hoped that the old road to Canso would be encountered by following this path, but unfortunately the equipment trail appeared to have gradually been lost before it transected the roadbed. Several hundred metres west of the point marked "5001" on Figure 2.0-1, it was determined that enough data on the barrens

C 1340-1993

portion of the study area had been gathered, and the team exited the site via the logging road in the southwest.

4.0 RESULTS AND DISCUSSION

The high and inhospitable nature of the barrens suggests that little cultural activity, whether Precontact or historic, would have occurred in the central portion of the study area. However, the presence of the old road to Canso suggests that any historic settlement would have closely bordered this thoroughfare, which according to local oral reports is still visible.[31] In addition, predictive modeling suggests that any First Nations activity would have been in proximity to the sparse fresh water resources in the area, including the outlet of Fogherty Lake and the Barachois that appears to have formed on the northeast coast of the study area, immediately south of Black Point. Both of these areas are predicted to be better accessed by water at this point, given the steep slope rising above the shore. It is likely that the historic road is better accessed from above, and will need to be walked in its entirety, if possible, to determine if any archaeological resources can be found on either side of it.

5.0 CONCLUSIONS AND RECOMMENDATIONS

It is recommended that the historic coastal road to Canso be walked to examine either side for archaeological resources. In addition, survey of the two areas of elevated potential for First Nations activity, being the outlet of Fogherty Lake and the Barachois southeast of Black Point, be examined. This portion of the property may be most conveniently accessed by boat rather than on foot. It is unlikely that archaeological resources exist on the granite barrens that make up much of the central study area, and as such, no further mitigation for that area is recommended at this time.

6.0 REFERENCES CITED

Church, Ambrose F. 1876. *Topographical Township Map of Guysborough County*. Halifax: A. F. Church & Co.

[31] Cavanaugh, Tom, personal communication 12 July 2011.

C 1340-1994

Confederacy of Mainland Mi'kmaq. 2007. *Kekina'muek: Learning about the Mi'kmaq of Nova Scotia.* Truro: Eastern Woodland Publishing.

Davis, Derek and Sue Browne. 1996. *Natural History of Nova Scotia, Volume II: Theme Regions*. Halifax: Nimbus Publishing and Nova Scotia Museum.

Dawson, Joan. 1988. *The Mapmaker's Eye: Nova Scotia Through Early Maps*. Halifax: Nimbus Publishing & The Nova Scotia Museum.

Department of Lands and Forests. 1950. Crown Land Index Sheet No. 112: Guysborough and Richmond Counties.

Fergusson, C. Bruce, ed. 1967. *Place Names and Places of Nova Scotia*. Halifax: Public Archives of Nova Scotia.

Hart, H.C. 1877. History of the County of Guysborough. Belleville Ont.: Mika Publishing. Reprinted 1975.

Johnston, A.A. 1960. *A History of the Catholic Church in Eastern Nova Scotia, Vol. I.* Antigonish: St. Francis Xavier University Press.

Library and Archives Canada. 1894. "Fox Island, Chedabucto Bay, Nova Scotia." Henry Ash collection [graphic material, textual record] (R11546-0-3-E). http://collectionscanada.gc.ca.

Nova Scotia Historical Vital Statistics. 1891. Marriage Record: Murdock McNeil to Bridget Eaton, 2nd July. Book 1814, page 162, number 132. https://www.novascotia genealogy.com/

Rand, Silas T. 1875. *First Reading Book in the Micmac Language: Comprising the Micmac Numarals, and the Names of the Different Kinds of Beasts, Birds, Fishes, Trees, &c. of the Maritime Provinces of Canada. Also, Some of the Indian Names of Places, and Many Familiar Words and Phrases, Translated Literally into English.* Halifax: Nova Scotia Printing Company.

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C 1340-1996

Plate 1: A Crown Land marker at the northern extent of the project right-of-way. Looking southeast.

Plate 2: Granite barrens south of the "FOX" geodetic. Looking north.

C 1340-1997

Plate 3: The "FOX" geodetic (red) with concrete blocks and scrap abandoned in the foreground.

C 1340-1998

APPENDIX A: HERITAGE RESEARCH PERMIT

C 1340-1999

NOVA SCOTIA
Tourism, Culture and Heritage
Heritage Division
Special Places Protection Act, R.S.N.S. 1989

Heritage Research Permit (Archaeology)

(Original becomes Permit when approved by the Executive Director of the Heritage Division)

Office Use Only
Permit Number A2011NS67
A2011NS67

Greyed out fields will be made publically available. Please choose your project name accordingly	
Surname Davis	First Name Stephen
Project Name Fogherty Head Project	
Name of Organization Davis MacIntyre & Associates	
Representing (if applicable)	
Permit Start Date 11 July 2011	Permit End Date 31 December 2011
General Location: Guysborough County	
Specific Location: *(cite Borden numbers and UTM designations where appropriate and as described separately in accordance with the attached Project Description. Please refer to the appropriate Archaeological Heritage Research Permit Guidelines for the appropriate Project Description format)* Fogherty Head, north-east of Half Island Cove, immediately east of Fogherty Lake	
Permit Category: Please choose one: ☐ Category A - Archaeological Reconnaissance ☐ Category B - Archaeological Research ☒ Category C - Archaeological Resource Impact Assessment ☒ I certify that I am familiar with the provisions of the *Special Places Protection Act* of Nova Scotia and that I have read, understand and will abide by the terms and conditions listed in the Heritage Research Permit Guidelines for the above noted category. ☐ I currently hold a treasure trove license or pending application for a licence related to this Heritage Research Permit.	
Signature of applicant Stephen Davis	Date 29 June 2011
Approved by Executive Director	Date July 5/11

C 1340-2000

Black Point Quarry 2014

HRP #A2014NS099

October 2014

Davis MacIntyre & Associates Ltd.
109 John Stewart Drive, Dartmouth NS, B2W 4J7

C 1340-2001

BLACK POINT QUARRY 2014:
ARCHAEOLOGICAL RESOURCE IMPACT ASSESSMENT

Heritage Research Permit A2014NS099
Category C

Davis MacIntyre & Associates Limited
Project No.: 14-033.1SLR

Principal Investigator: Laura de Boer
Report Compiled by: Laura de Boer, Courtney Glen, and April MacIntyre

Submitted to:

SLR Consulting (Canada) Ltd.
115 Joseph Zatzman Drive
Dartmouth, NS B3B 1N3

-and-

Coordinator, Special Places
Communities, Culture and Heritage
1741 Brunswick Street P.O. Box 456
Halifax, NS B3H 3A6

Cover: The cove at the western side of Fogherty Head, looking southwest.

C 1340-2002

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C 1340-2005

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C 1340-2006

EXECUTIVE SUMMARY

In October 2014, Davis MacIntyre & Associates Limited was contracted by SLR Consulting to conduct an archaeological resource impact assessment of the proposed site of the Black Point Quarry at Fogherty Head, near Canso in Guysborough County. The purpose of the assessment was to determine the potential for archaeological resources within the development zone and to provide any recommendations for further mitigation, if deemed necessary, and to fulfill the recommendations made in 2011. The assessment consisted of a reconnaissance of the study area and additional documentary research, following a background study and preliminary reconnaissance of the granite barren portion of the study area in 2011 under HRP#A2011NS67.

The reconnaissance has resulted in six probable historic house foundations and five probable outbuilding foundations identified on the lowland of the study area, below the level of the granite barrens. Of these six houses, three are believed to be related to the extended Lukeman family, one to the Fogarty family, and two more to the Daly family. Maritime Archaeological Resource Inventory (MARI) forms for all six have been completed for submission to CCH and the Nova Scotia Museum.

Potential construction impacts arise from removal of large quantities of fill and native soil, potentially unearthing, damaging, or destroying archaeological resources. Of the six identified historic homesteads, two are expected to be impacted by the development. The potential for First Nations archaeological resources has been determined to be low, though contingency measures will be in place to deal with the unlikely discovery of such resources. DM&A has completed an Archaeological and Heritage Resources Management Plan for the proponent, included here as Appendix C.

It is recommended that the three foundations at the east end of the property (the two on the former Lukeman property, and the third just beyond the western boundary on the former Crown parcel referred to as Black Point 1), as well as the foundation and four outbuildings on the former Fogarty property, be avoided by construction activities. It is recommended that these features be well flagged by an archaeologist and a 100 meter buffer be established around the features to ensure that their locations and boundaries are well-known and they are not disturbed during construction. It is also understood and recommended that the headland on the northwest end of the former Fogarty property that may be the location of reported historic burials will be avoided by construction. It is recommended that this area also be flagged and that the buffer zones for these resources be surveyed for future reference. It is recommended that the flagging be removed after construction so as to avoid drawing unwanted attention to these features in order to avoid looting or damage to the sites.

Mitigation of Black Point Homestead 2 and Black Point Homestead 3, which cannot be easily avoided by the development, is recommended prior to commencement of the quarry infrastructure construction. The testing phase should therefore consist of a

formal testing regiment on both of the two sites to be impacted. Prior to excavation, the sites should be cleared of brush, branches, moss and other vegetation, etc. by the archaeological team to allow for detailed surface documentation. Two intersecting lines of formal 0.50 m by 0.50 m excavation units at 1 meter intervals are recommended through the center of both foundations. This is intended to establish a sense of the buildings' interior and exterior remains (both structural and artifactual), layout, stratigraphy and site formation, as well as site integrity. Formal testing is also recommended for the associated outbuilding in order to determine function and site layout. This program of testing will aid in establishing an assessment of site significance which will, in turn, allow the archaeologists to determine the best course for further mitigation, if necessary. At this time it is anticipated that some additional excavation following testing may be necessary at Black Point 3, which is unique in layout at Fogherty Head.

In the event that any archaeological material is encountered during ground disturbance activities and an archaeologist is not already present on the site, all activity should cease and the Coordinator of Special Places, Sean Weseloh-McKeane (902-424-6475) should be contacted immediately to determine a suitable method of mitigation.

C 1340-2008

1.0 INTRODUCTION

In October 2014, Davis MacIntyre & Associates Limited was contracted by SLR Consulting to conduct an archaeological resource impact assessment of the proposed site of the Black Point Quarry at Fogherty Head, near Canso in Guysborough County. The purpose of the assessment was to determine the potential for archaeological resources within the development zone and to provide any recommendations for further mitigation, if deemed necessary, and to fulfill the recommendations made in 2011. The assessment consisted of a reconnaissance of the study area and additional documentary research, following a background study and preliminary reconnaissance of the granite barren portion of the study area in 2011 under HRP#A2011NS67.

This assessment was completed under Category C Heritage Research Permit A2014NS099 issued by the Nova Scotia Culture and Heritage Development Division. This report conforms to the standards required by the Department of Communities, Culture and Heritage as specified under the guidelines of the Special Places Protection Act (*R.S., c. 438, s. 1.)*.

2.0 STUDY AREA

Vulcan Materials Inc. and Morien Resources propose to develop an aggregate quarry at Black Point on the Chedabucto Bay shore of Guysborough County, between Half Island Cove and Fox Island Main near Canso (Figures 2.0-1 and 2.0-2). The project will be an open-pit quarry with associated facilities eventually covering 238 hectares of the 354 hectare property, and will include a wharf for loading product aboard bulk carriers for export to the eastern seaboard of the United States. An access road will also be required, to connect with the existing provincial road about 2.5 km distant. There are two possible sources of electric power for the project; it could be generated on-site with a diesel–powered generator, or it may be possible to tap into the closest transmission line, depending on the supply required. On-site equipment and facilities will include: a processing plant area, a ship loader system (conveyors), a marine terminal, and associated infrastructure.

C 1340-2009

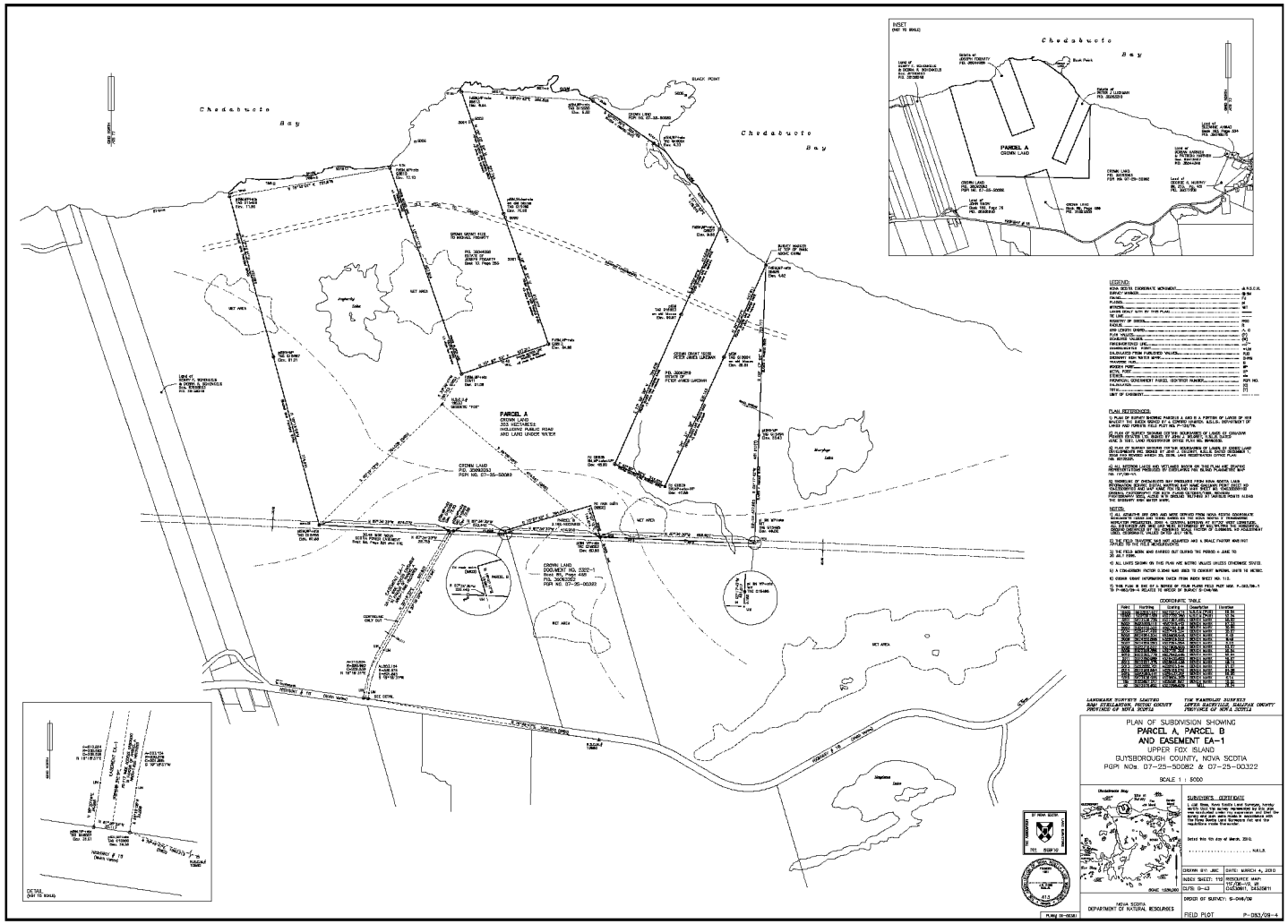


Figure 2.0-1: A survey plan showing the study area, which encompasses former Crown land as well as two historic grants. Courtesy AECOM (2011).

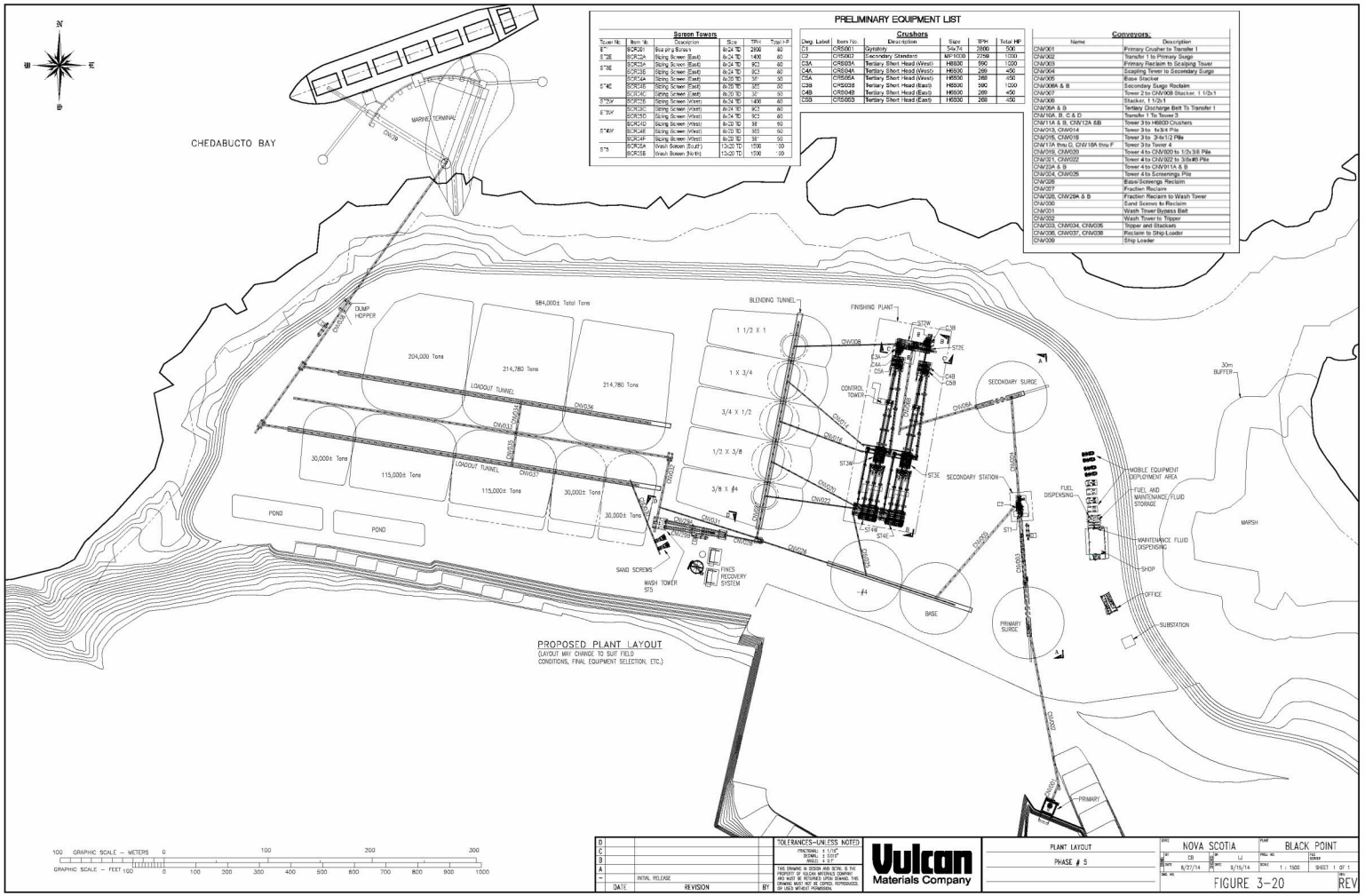


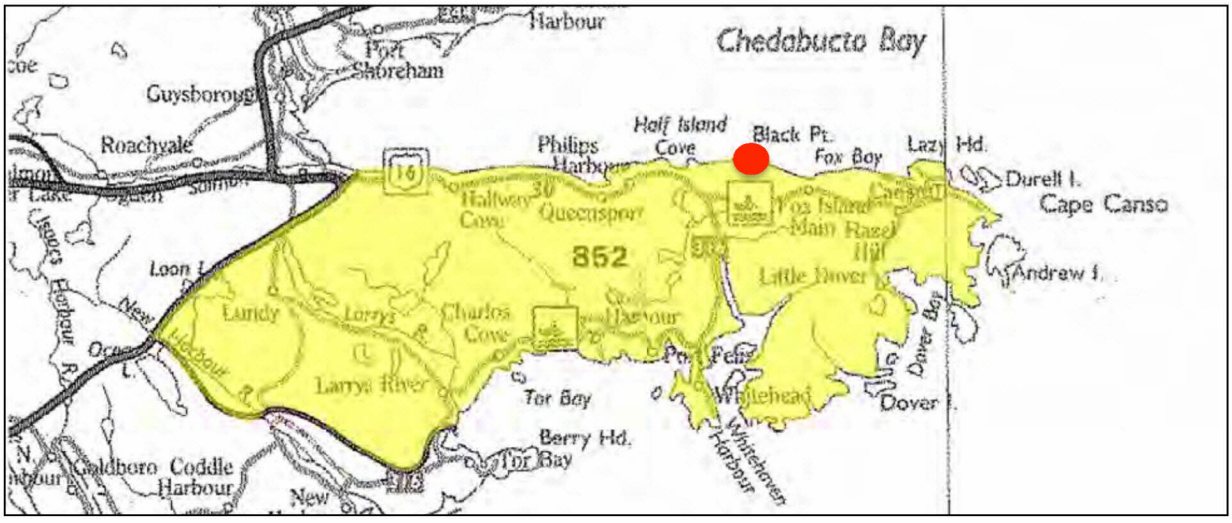
Figure 2.0-2: A plan showing the lowland of Fogherty Head with the proposed infrastructure developments for the quarry. The remainder of the study property consists of granite barrens that will be the source of the aggregate for quarrying. Courtesy SLR Consulting.

C 1340-2011

The study area lies within the Canso Barrens natural theme region (Figure 2.0-3). In this unit, the upland surface is capped by granite knolls rising up to 200m above the sea along a straight northern coastline controlled by the Chedabucto Fault. The region extends northeast from New Harbour to the point of Cape Canso. Schists have formed from Meguma Group slates and greywacke. Approximately half of the unit's surface is covered in thin deposits of granite, schist, and slate till, while the rest is exposed bedrock. Only a few drumlins have formed, comprised of red-brown till originating from Tor Bay and Canso Harbour. Coastal sediments are very limited. [1]

Lakes and ponds in this region are found in a variety of sizes and are fed by streams and tributaries of a complex nature. Surface water is slightly acidic. The soil of the region is usually thin and often non-existent, exposing the undulating granite beneath. A form of imperfectly drained sandy loam known as Danesville gleyed podzol is common near the coast, and Gibraltar sandy loam is also present. Black Spruce is the most common tree type, and is found only in areas where the soil is thick enough to sustain larger vegetation, particularly in wetter areas. Balsam Fir is also common, while White Spruce, maple, and birch are also found. Low vegetation on the barrens includes Sheep Laurel, Huckleberry, Labrador Tea, Bracken Fern, alders, and stunted or scrubby Black Spruce. Rockweed and kelp thrive on the rocky shores.[2]

The natural theme region is documented to provide a breeding ground for various birds, including gulls, the Double-crested Cormorant, Great Blue Heron, Arctic Tern, Common Tern, and Common Eider.



[1] Davis and Browne, 1996:213.

[2] Davis and Browne 1996:213.

Figure 2.0-2-3: Natural Theme Regions of Nova Scotia, showing region 852 (highlighted) – Canso Barrens, with the study area in red. After Davis and Browne 1996.

3.0 METHODOLOGY

A reconnaissance was conducted of key areas of the study area identified in 2011 as meriting a more detailed walkover survey. This included the outflow from Fogarty Lake and the barachois on the lowland of Fogherty Head, along with the coastline of Fogherty Head and several areas of historic occupation identified through oral history and historic mapping.

When a descendant of the Fogarty family, who had previously held a grant of land at Fogherty Head, expressed concerns regarding homesteads and family burials on the property, additional archival research was also conducted in order to determine whether any burials may have occurred on the land and whether a Catholic church ever existed within the study area. Research was also conducted on the Daly and Lukeman families, in order to help identify the original inhabitants of any identified homesteads, and to investigate the possibility of other family burials at Fogherty Head.

3.1 Maritime Archaeological Resource Inventory

The Maritime Archaeological Resource Inventory, a Provincial database of known archaeological sites held at the Nova Scotia Heritage Division, was consulted in July 2011 to understand prior archaeological research and known archaeological resources neighbouring the study area. A review of the database was conducted again in October 2014.

The presence of stone "Indian relics" at the turn of the twentieth century was noted at two sites near Canso (George Island and Glasgow Head) by early historian and curator Harry Piers. A 1973 follow-up survey by Stephen Davis was unable to relocate either site, and so their exact locations remain unknown.

A copper pot burial site was encountered by locals at the mouth of the Salmon River near Guysborough. Copper pot or kettle burials are a particular type of First Nations burials that made use of the copper vessels acquired from early European traders.

Historic fortifications are known at Fort St. Louis in Chedabuctou (modern Guysborough). The remains are well-known through historic sources, and the recovery of an 18th or early 19th century bottle finish has helped to establish the occupation period of the site.

C 1340-2013

An eighteenth to nineteenth century fishing room on Clarke Island off Canso was identified and tested in June of 2014. The room, or fish drying and processing complex, belonged to Andrew Robinson.

The absence of recorded archaeological resources within or immediately adjacent the proposed development area is likely an indication that this area was not subjected to previous archaeological assessments.

3.2 Historical Background

3.2.1 The Precontact Period

The history of human occupation in Nova Scotia has been traced back approximately 11,000 years ago, to the Palaeo-Indian period or *Sa'qewe'k L'nu'k* (11,000 – 9,000 years BP). The only significant archaeological evidence of Palaeo-Indian settlement in the province exists at Debert/Belmont in Colchester County.

The *Saqiwe'k Lnu'k* period was followed by the *Mu Awsami Kejikawe'k L'nu'k* (Archaic period) (9,000 – 2,500 years BP), which included several traditions of subsistence strategy. The Maritime Archaic people exploited mainly marine resources while the Shield Archaic concentrated on interior resources such as caribou and salmon. The Laurentian Archaic is generally considered to be a more diverse hunting and gathering population.

The Archaic period was succeeded by the Woodland/Ceramic period or *Kejikawek L'nu'k* (2,500 – 500 years BP). Much of the Archaic way of subsistence remained although it was during this period that the first exploitation of marine molluscs is seen in the archaeological record. It was also during this time that ceramic technology was first introduced.

The Woodland period ended with the arrival of Europeans and the beginning of recorded history. The initial phase of contact between First Nations people and Europeans, known as the Protohistoric period, was met with various alliances particularly between the Mi'kmaq and French.

The Mi'kmaq inhabited the territory known as *Mi'kma'ki* or *Megumaage*, which included all of Nova Scotia including Cape Breton, Prince Edward Island, New Brunswick (north of the Saint John River), the Gaspé region of Quebec, part of Maine and southwestern Newfoundland (Figure 3.2-1).

A historical Mi'kmaq presence has been well documented in Guysborough County and specifically in the vicinity of Canso, less than 15 kilometres from the study area. In 1607

word reached Port Royal from Campseau (now Canso) that "the Dutch had insinuated themselves into the fur trade on the east shore, having been conducted by a treacherous Frenchman. The avarice of these people was so great, that they had opened the graves and taken the beaver skins in which it was customary for the Indians to wrap the dead. This conduct was so highly resented by the Indians of Canso that they killed the person who had shown the place where the dead were laid."[3]

The place name "Canso" is believed to have originated from the Mi'kmaq term *Kamsok,* meaning "opposite lofty cliffs."[4] Chedabuctou Bay also derives from a Mi'kmaq name, historically also transcribed as *Sedabooktook,* and translated as "running far back."[5]

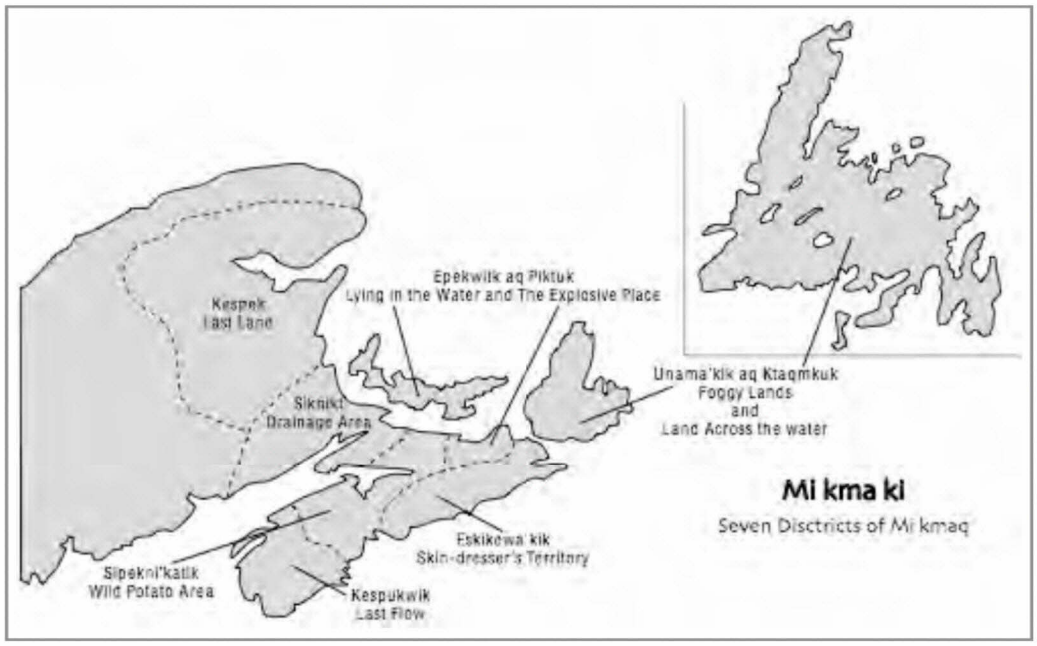


Figure 3.2-1: Map of the Mi'kmaq territories.[6]

3.2.2 European Settlement

It is thought that the French began fishing off the coast of Nova Scotia as early as 1504 or possibly earlier.[7] Activity on land was coastal and seasonal, consisting of trade with the native Mi'kmaq and the use of beaches to dry fish for the long voyage back to

[3] Hart 1877:10-11.

[4] Davis and Browne 1996:214.

[5] Rand 1875:85.

[6] Confederacy of Mainland Mi'kmaq, 2007:11.

[7] Hart 1877:9.

France. The fishery continued to be profitable for centuries, supplying variously the French, English, and Basque seamen who sailed along these coasts. The plentiful stocks of fish in the area, particularly the cod, made it necessary for fishermen to establish *dégrats* or temporary processing stations or "rooms" on the shore.[8]

Although the French had been controlling European settlement and trade in the seventeenth century, in 1713 the Treaty of Utrecht ceded *Acadie,* which included mainland Nova Scotia, to the English. Five years later, HMS *Squirrel* was sent to Canso to "dislodge" the French who were still successfully fishing in the area.[9] The mid-eighteenth century saw a series of deportations of French settlers, including most notably the Acadians beginning in 1755. Canso's French fishermen, however, continued to sail and fish in the vicinity of the Canso Islands, which they did not recognize as part of the mainland included in the 1713 Treaty.[10] Disputes would continue throughout the eighteenth century.

Activity continued to increase along the Chedabucto Bay coast during the eighteenth century. By 1731, the fishery had grown so profitable that "there were more fish at Canso than there were vessels to carry to market."[11] In 1767, the population of Canso had grown to 519, of whom 197 were Acadian and 112 were Irish.[12]

The fishery was not a quiet industry. The Canso riots of 1835 are known to have spread to Fox Island, immediately west of the study area, though to what extent is not clear. Additionally, a 1908 account records the events at Fox Island around 1820:

> During Father [James] Grant's incumbency there arose great troubles and quarrels at Fox Island, then a very valuable fishing place on Guysborough Bay, near Canso. It appears the Island had been free to all, so that people flocked from all parts for the fall mackerel, which was taken in great abundance. In those days there was no restraint on liquor, and where there was money there was liquor. Things got so bad that a squad of the army was sent for about two months to keep order. The Captain got tired of camp life, and said to his Colonel at Halifax, "There is a priest at Guysborough. If you can obtain his services, he will keep order better with his cane than we can with our guns." After that, Father Grant received £50 a year for keeping order. After some years the Harts secured the Island, and gave no place to fighting characters.[13]

[8] Dawson 1988:40.

[9] Dawson 1988:40.

[10] Dawson 1988:40.

[11] Hart 1877:20.

[12] Johnston 1960:85.

[13] Father Michael Tompkins, 1908, quoted in Johnston 1960:468-9.

At Fogherty Head itself, only two formal grants of land appear to have been made: the first to Michael Fogerty and the second to Peter James Lukeman (Figure 3.3-1). Both of these grants existed in their original size and shape, with no subdivisions or additional grants, until the land was acquired or expropriated for development as the Black Point Quarry.

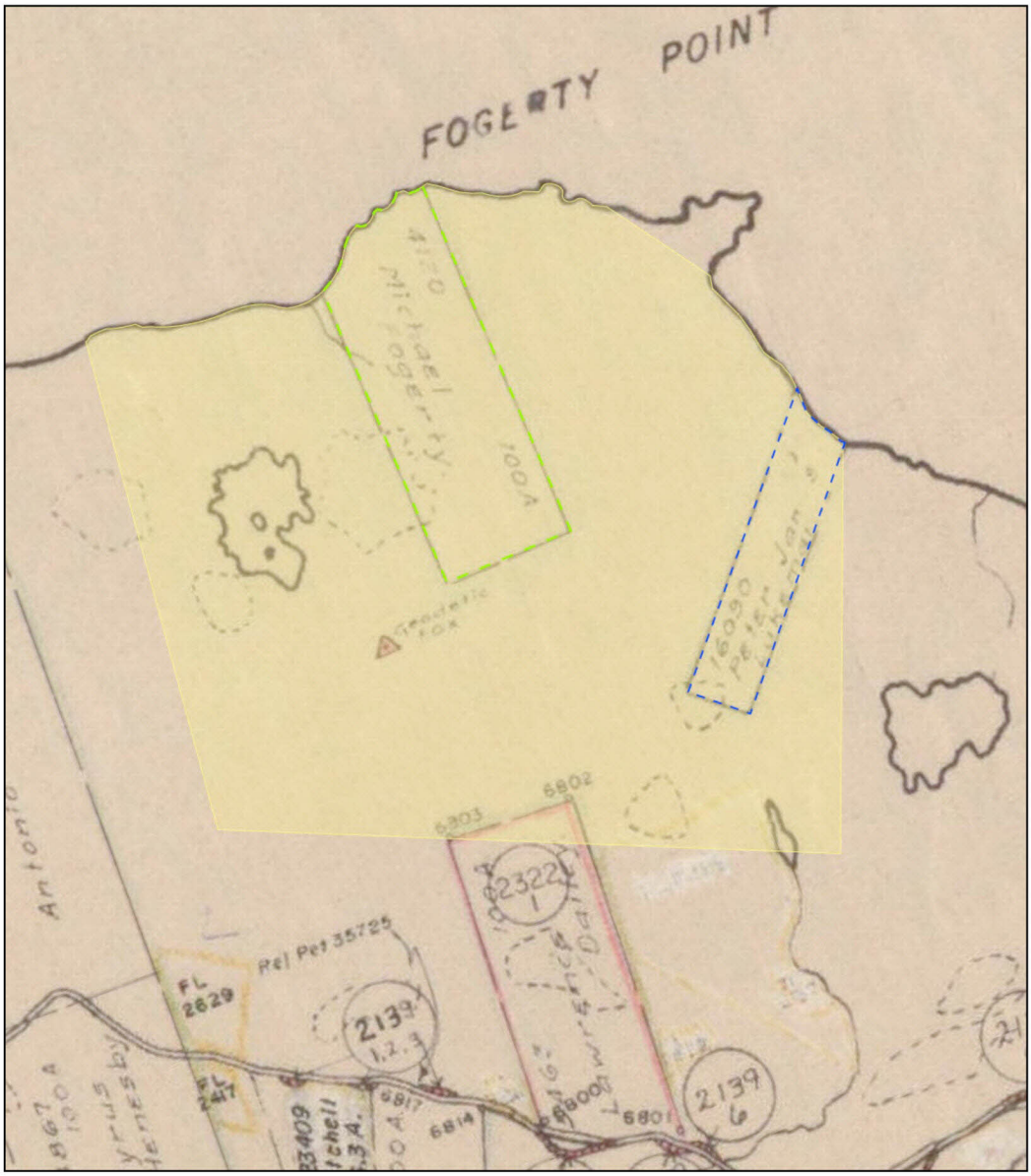


Figure 3.2-2: A plan showing the original land grants at Fogherty Head or Black Point: Michael Fogarty (Green) and Peter James Lukeman (Blue) with the approximate study area (Yellow).[14]

[14] Department of Lands and Forests 1950.

In the 1880s and 1890s, at least sixteen families lived on Fox Island, having built their houses on the mainland side to shelter from the wind. A chapel was also located on Fox Island Main at Chapel Hill, possibly within the limits of the modern Seabreeze Campground and Cottages. During berry picking expeditions in the 1930s or 1940s, one local resident recalls observing the wooden foundations of the chapel. The resident's grandmother had informed him that a cemetery was associated with the chapel. It contained over 120 graves, marked only by wooden crosses or flat beach stones etched with names or dates. Two relatives of Martin Daley were buried here, after they drowned in a pond nearby. Native burials were also reportedly part of the cemetery.[15]

Until 1857 the "Stagecoach Road" between Crow Harbour and Canso ran along the coast, passing closely to Fogherty Head and Black Point (Figure 3.3-3).[16] The rocky nature of this road meant that passage in the summer by buggy or wagon was nearly impossible. However, an 1876 map shows that at least two houses were located on the eastern side of the study area. When the new road was built farther inland it encouraged settlement along level and fertile ground off the hard coastline, without the steep rises and drops on and off the granite barrens.

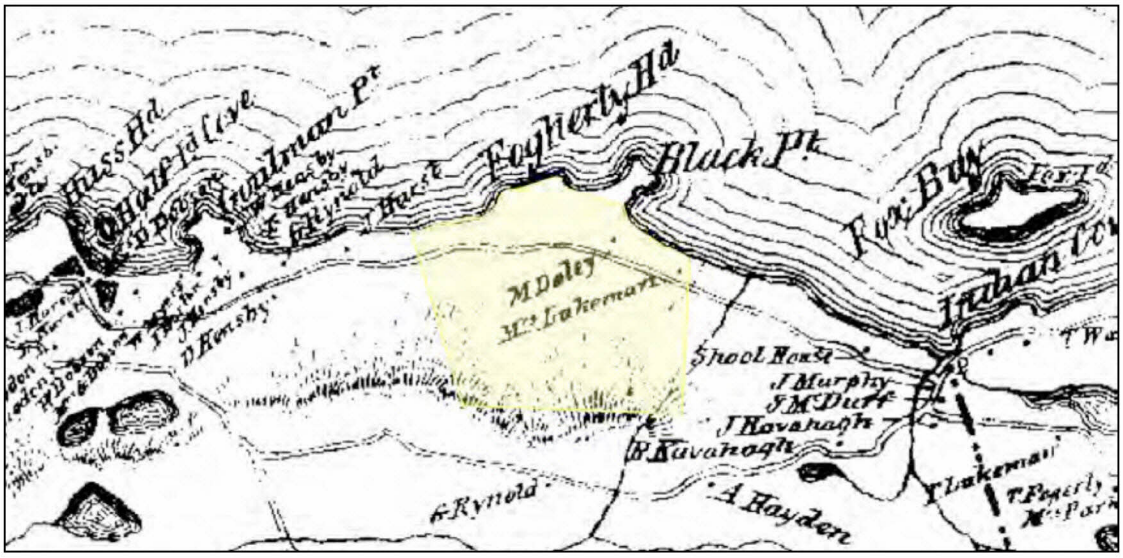


Figure 3.2-3: An 1876 map of Guysborough County shows two houses (M. Daley and Mrs. Lukeman) within the approximate study area (yellow), bordering the coastal road to Canso.[17] Note also the schoolhouse to the east at Fox Island Main, which is here listed as "Indian Cove."

[15] MacDuff, Everett, personal communication 20 July 2011.

[16] MacDuff, Everett, personal communication 20 July 2011.

[17] Church 1876.

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In most instances elsewhere in the province, the Geological Survey of Canada maps completed by Hugh Fletcher and Eugene R. Faribault are considered superior in detail and accuracy to the Ambrose Church map series. However, in this case Faribault appears to have made more errors than usual: his 1893 map completely omits the nearby Murphy's Lake to the southeast of the study area, while showing the Old Canso Road as remaining atop the granite barrens across Fogherty Head (Figure 3.2-4). Based upon field findings and on the relation of the Lukeman and Daly homes to the road shown on the Church map, the Old Canso Road or at least a branch of road running from Fox Island Main may have traversed the lowlands on the eastern side of Fogherty Head. No houses are shown on this map, although all other sources point to at least some occupation at this time.

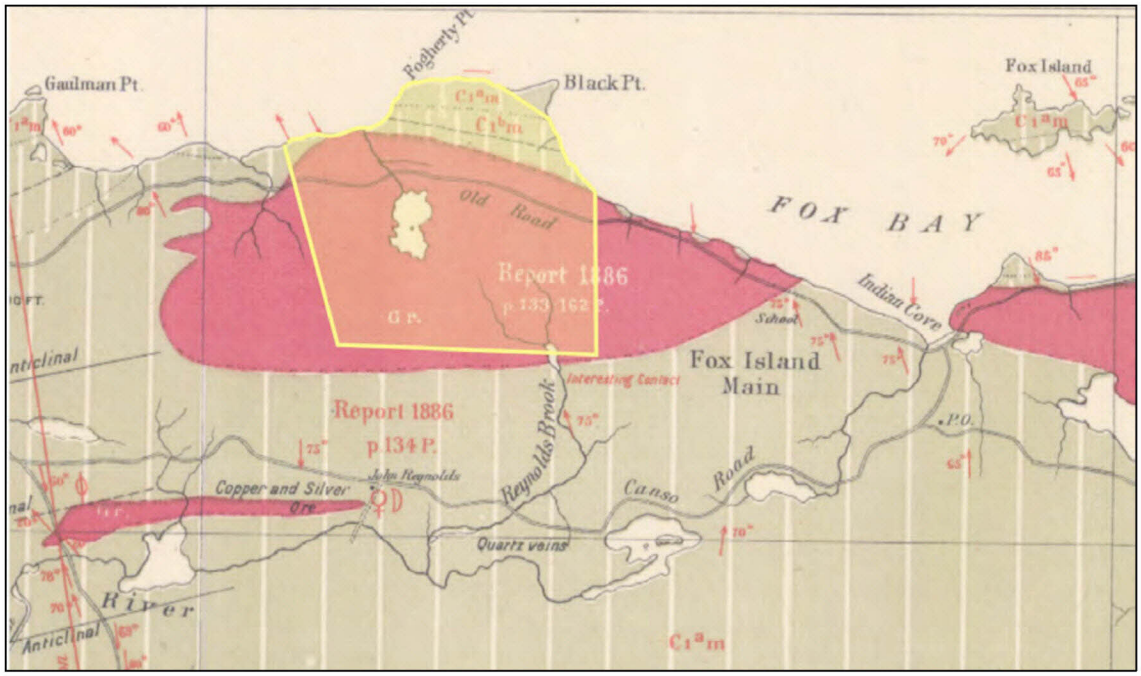

Figure 3.2-4: An 1893 map appears to lack the usual accuracy of the Geological Survey of Canada maps from this period: Murphy's Lake is omitted along with Fogarty Lake being placed eastward of its true location, while the map as a whole was not accurately proportioned enough for modern georeferencing.[18] The approximate study area is shown in yellow.

An 1883 map from the Crown Lands office shows the homes of Edward Daily and Mrs. Lukeman within the study area (Figure 3.2-5), while John Fogarty is shown, surprisingly, immediately east of the Lukeman grant and just outside the study area. Three "fishing huts" are also shown on Black Point itself, outside of the study area.

[18] Faribault 1893.

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Figure 3.2-5: Detail of an 1883 map from the Crown Lands office shows the homes of Mrs. Lukeman and Ed. Daily (Edward Daly) within the study area, and John Fogarty just outside the study area to the east. Note the dotted line most likely indicating an agricultural area around the three houses. Three "fishing huts" are also shown on Black Point outside the study area, while the granite barrens to the south are marked as "High barren land here."[19]

Oral history recounts that Black Point had a strong settlement in the late nineteenth century. The settlement included the Black Point School located east of the study area near Fox Island main (refer back to Figure 3.2-3), and one oral report suggests that a Roman Catholic Church may have been located in the area.[20] No other sources have

[19] Hartshorne 1883.

[20] MacDuff, Everett, personal communication 20 July 2011, and Grant, James, personal communication 12 July 2011.

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confirmed the presence of this church. This includes contact with the Catholic Diocese at Antigonish as well as consultation with a detailed history of the Catholic Church in Eastern Nova Scotia.[21]

Local residents also report that Martin Daly (likely the son of "M. Daley" (Michael) shown on Figure 3.2-3) and his son Vincent were the last residents of Black Point. In his later years, Martin lived at nearby Fox Island or Fox Island Main during the week, working as a fisherman. On weekends, he would return to Black Point to live with his son. The two were both farmers and fishermen, a type of dual employment that was not uncommon on the coast of Nova Scotia during the nineteenth and early twentieth centuries. Sometime after the 1930s, the Daley house was demolished, as presumably was the associated barn. Both were located in a meadow with a brook running down its centre, where one local resident reported pasturing his family horse in the summers.[22]

Sometime after all of the residents of Black Point had moved to Fox Island Main or further afield, John Rhynold and his son reportedly flew a flag on Black Point in memorial to John's mother, who was born at Black Point.[23] Additionally, a descendent of the Lukeman family kept a cabin on his family property at Fogherty Head, and used to visit the site each year.[24]

Review of aerial photographs held at the Nova Scotia Department of Natural Resources show what appears to have been a roadway between the Fogarty side (west) and the Lukeman side (east) of Fogherty Head visible in 1943 (Figure 3.2-6). The road is still visible in 1954, as well as a small shadow that may have represented one of the houses within the study area (Figure 3.2-7).

[21] Johnston 1960.

[22] MacDuff, Everett, personal communication 20 July 2011.

[23] MacDuff, Everett, personal communication 20 July 2011.

[24] MacDuff, Everett, personal communication 20 July 2011, and Rhynold, Anne Marie, personal communication 12 July 2011.

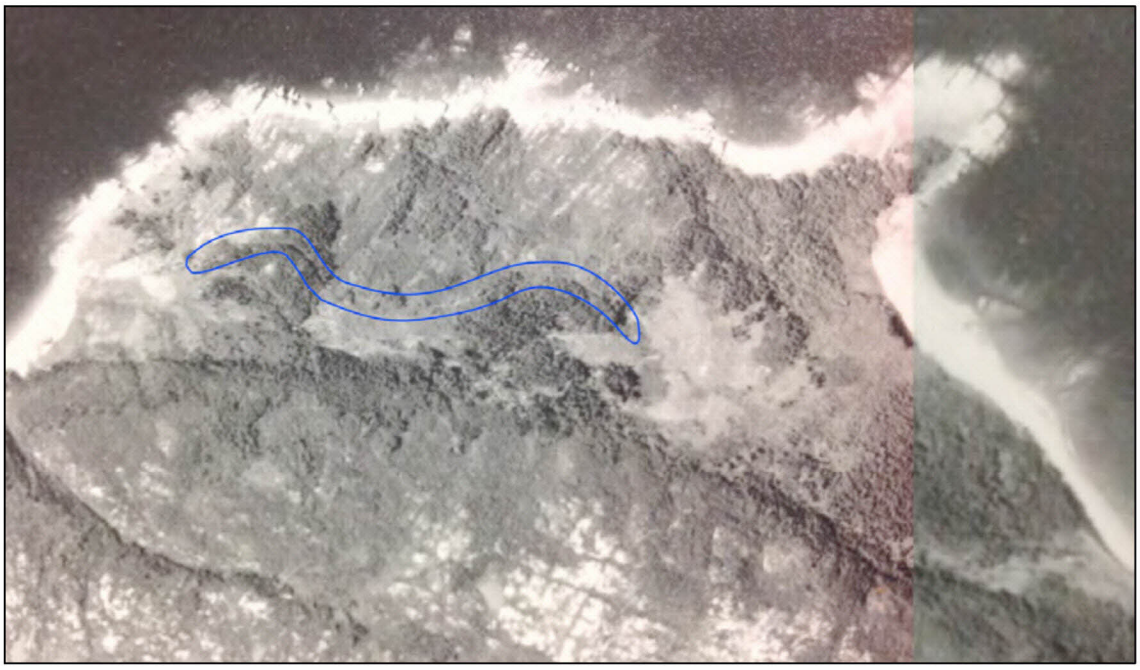

Figure 3.2-6: A 1943 aerial photo shows what appears to be a road on Fogherty Head (blue). [25]

Figure 3.2-7: A 1954 aerial photo shows what appears to be a road on Fogherty Head as well as a possible house (blue). [26]

[25] National Air Photo Library A14198, #157.

[26] National Air Photo Library A6981, #62.

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3.2.3 Fogarty Family History (Spellings FOGARTY, FOGERTY, FOGHERTY, FOGATI)

In 2014, a descendant of Michael Fogarty came forward with additional oral history regarding Fogherty Head, as well as photographs of one of three house foundations known to the family at this location (Figure 3.2-8). Mr. Fogarty indicated that from 1820 to 1928, the Fogarty grant was home to four generations of the family, while he and his living relations comprise the seventh and eighth generations. The Fogarty family indicates that approximately 120 births occurred on the granted lands. [27] However, a review of available vital statistics records online indicates less than a dozen Fogarty births at Black Point, and no deaths or burials, most of these incidents seeming to have occurred nearby at Fox Island Main, Half Island Cove, Hazel Hill, or Canso.

The available vital statistics records should by no means be considered a complete index of all births, marriages, and deaths, but it does provide a sizeable sample from which to estimate the level of activity in the area. Based upon this information, it appears likely that the Fogarty family had a small but historically very notable presence on their granted lands at Fogherty Head.

Mr. Fogarty also provided the following family history regarding the grant:

> On, or around 1890, Joseph Fogarty, 9th child of Mickal (2nd generation inhabitant), began a fishing operation at Fogarty's cove. He was joined in this pursuit by his sons and, after death; it was continued by his son Vincent and Vincent's sons. This operation continued long after the Fogarty's [*sic*] moved their home to Hazel Hill (1928). The land however was never abandoned. Vincent and his sons would commute to the site. Some extended periods of time would be spent living in Fogarty's Cove while fishing.
> By the late 1800's, the area had a school and a church. The church burnt down c. 1930's, resulting in the loss of all records. [28]

This pattern of habitation and gradual withdrawal appears to have been echoed by the Daly and Lukeman families on the other side of Fogherty Head, as indicated by other oral history accounts presented above. It appears most likely, as noted above, that both the school and the church were located outside the study area, at or near Fox Island Main to the east.

[27] Fogarty 2014:6.

[28] Fogarty 2014:6.

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Figure 3.2-8: A photograph supplied by Frank Fogarty of one of the foundations at Fogherty Head. Note the distinct metal fragment inside the cellar (blue), which allowed the archaeological team to confirm that this cellar is one of those identified during the reconnaissance as belonging to the Daly family.

Finally, Mr. Fogarty indicated that the family was aware of three foundations of "original dwellings," and he also reports that the family believes it likely that burials occurred on the property, "given the poverty and distance to Canso."[29] While this information as presented appears speculative rather than concrete, the family was also able to provide specific locational information on both the foundations and the probable burial site (Figure 3.2-9). Both of these locations were investigated during the field reconnaissance, with the results presented in section 3.3 below. Additionally, Brian Fogarty indicated that there is an oral account of wooden crosses observed in the mid-twentieth century, and additionally a beach rocky east of the study area is the reported source of stones used as rough headstone markers. Neither crosses nor stone markers were observed during the reconnaissance.[30]

[29] Fogarty 2014:7.

[30] Fogarty, Brian, personal communication 21 October 2014.

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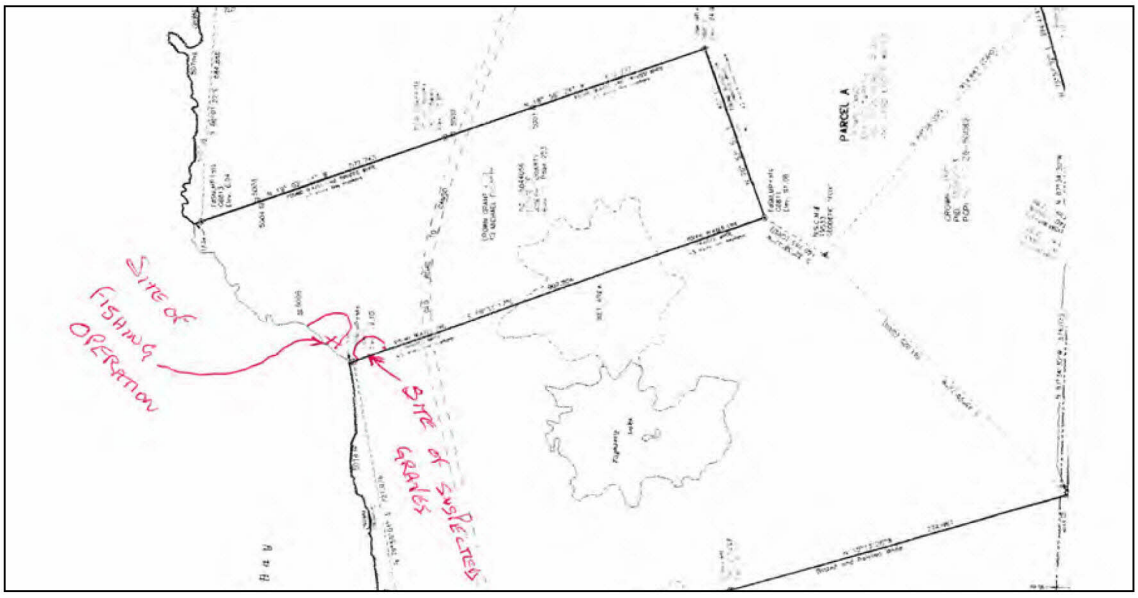

Figure 3.2-9: Detail of a scanned map with a hand-written annotation by the Fogarty family, showing the site of the Fogarty fishing operation as well as the site where the family suspects burials have occurred. Note that the map has been turned sideways; north is to the left. Courtesy Frank Fogarty.

3.2.4 Daly Family History (Spellings DAILY/DALY/DALLY/DALEY)

The Nova Scotia Historical Vital Statistics, an online database of birth, marriage and death registration, as well as census records and the online parish records of St. Ann Church, Guysborough, were searched in an effort to construct a detailed genealogy of the Daly family. Additionally, these records can provide information about residence of family members at the time of events such as births, deaths and marriages. Unfortunately, the census data for the area can be scarce on details and the only census with a specific address listed for each entry is the 1911 census. Multiple spelling variations are found throughout the consulted archival material. For ease of reporting, one spelling will be used consistently throughout, which may not reflect the spelling within specific documents.

Lawrence Daly first appears in archival documents in 1829, when he is listed as a sponsor for the baptism of Elizabeth Dobbins. This baptism took place at Black Point.[31] Historically it was not uncommon for baptisms to occur at home rather than in a church or chapel.

[31] St. Ann Parish Records Book 1 Baptisms 1829-1831 page 41 no 580.

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Just a few years later, he appears again in the baptismal records. This time, he is the parent of Mary Daly, 12 months old, who is baptised at Black Point in 1833.[32] Lawrence and his wife, Elizabeth, appear three more times in the baptismal records for the baptisms of their children Michael in 1834, John in 1836, and Edward in 1839. The records of these baptisms do not explicitly state Black Point; in fact no location is given.[33]

Based on marriage and census records, Lawrence and Elizabeth had at least six children: Mary born 1832, Michael born 1834, John born 1836, Edward born 1839, Johanna born around 1841, and Ann born around 1843. When Lawrence's employment is described, it is listed as fisherman. His place of birth is listed as Ireland.[34]

Lawrence also appears in the 1861 census, the earliest census surviving for the area, in a household with four males and three females.[35] In 1865, Lawrence's death records indicate that he died at the age of 72 of consumption at Black Rock. He is described as a fisherman and a widower. His son Michael was the informant.[36]

In the 1871 census, the single Daly household of 1861 has been split into two households occupying separate dwelling houses. Michael, now 43, is living with his wife Mary and one year old daughter Catherine. Michael is described as Catholic, Irish and a fisherman. His remaining unmarried siblings are listed in the next census entry, in a separate dwelling house. John, now 40, is listed as the head of the household, which contains Edward, age 38, Mary, age 45 and Johanna, age 30. Edward and John are both listed as fisherman.[37]

Ann Daly, the youngest sibling, married James Eaton in 1868 at Black Point. Both Ann and James were living at Black Rock at the time of their marriage and James is working as a fisherman.[38] Ann and James appear in the 1871 census living in James' parent's household.[39] Several records of their children's births survive, including Bridget Ann Haden (*sic*, Eaton), born 1870 at Black Point,[40] James Edgar Eaton, born 1875 at Black

[32] St. Ann Parish Records Book 1 Baptisms 1832-1833 page 190 no 69.

[33] St. Ann Parish Records Book 1 Baptisms 1834-1835 page 196 no 20; 1836-37 page 222 no 27; 1838-1839 page 267 no 38).

[34] 1871 Census Nova Scotia Guysborough, Crow Harbour page 36 no 107-108; 1881 Census Nova Scotia Guysborough Crow Harbour page 18 no 81-82; 1891 Census Nova Scotia Guysborough Crow Harbour page 9 no 39-40; 1901 Census Nova Scotia Guysborough Crow Harbour page 17 no 161-164.

[35] 1861 Census Nova Scotia Guysborough no 14.

[36] Nova Scotia Historical Vital Statistics 1865 book 1807 page 4 no 11.

[37] 1871 Census Nova Scotia Guysborough, Crow Harbour page 36 no 107-108.

[38] Nova Scotia Historical Vital Statistics 1868 book 1814 page 26 no 19.

[39] 1871 Census Nova Scotia Guysborough, Crow Harbour page 36 no 112.

[40] Nova Scotia Historical Vital Statistics 1870 book 1808 page 108 no 35.

Point,[41] and Lawrence Eaton, born 1875 at Black Point.[42] Interestingly, in James' and Bridget's registrations, their father is listed as a fisherman but in Lawrence's registration, as a farmer. Ann and James appear in the 1881, 1891 and the 1901 census, living in the Crow Harbour polling district. By 1911, they have moved to Fox Island and are living near two of James Lukeman's children (Peter and Patrick) and close to Martin Daly, Ann's nephew.[43]

James Edgar Eaton and Lawrence Eaton, both born in 1875, appear to have died young, as they are not found in the 1881 census or any later census. However, death registration records could not be located for either one, suggesting they may have moved out of the district and even out of the province.

Bridget married Murdock McNeil in 1891 at Black Point. At the time of their marriage, Bridget was living at Black Point, where she had also been born. Her parents are described as fishermen. [44] Lucy married Edmund Hurst in 1903 at Canso. Her place of residence and place of birth are both listed as Fox Island Main and her parents are described as farmers.[45] This may indicate that the family moved from Black Point sometime between Bridget's birth in 1871 and Lucy's birth in 1881. However, given that Bridget's marriage took place at Black Point, it seems more likely that the family moved to Fox Island between Bridget's marriage in 1891 and Lucy's in 1903.

Much of Ann (nee Daly) Eaton's family died of tuberculosis (TB). Ann and her son Alexander died of the disease the same year in 1911. Both were listed as living at Fox Island Main at the time. Alexander was single and working as a fisherman. He is listed as being born at Fox Island Main.[46] John died a few years later in 1917, also of TB. He was single, living at Hazel Hill and working as a labourer. His birthplace is listed as Hazel Hill.[47] Both Alexander and John's death registrations appear to have the incorrect birthplace. Bridget died of TB in 1912, while living at Canso.[48] Lucy also died of TB in Canso, in 1916. Her death registration lists her birthplace as Fox Island.[49] No death registration could be found for their father and Ann's husband, James Eaton.

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[41] Nova Scotia Historical Vital Statistics 1875 book 1808 page 177 no 39.

[42] Nova Scotia Historical Vital Statistics 1875 book 1808 page 190 no 304.

[43] 1871 Census Nova Scotia Guysborough, Crow Harbour page 36 no 112; 1881 Census Nova Scotia Guysborough Crow Harbour page 18 no 85; 1891 Census Nova Scotia Guysborough Crow Harbour page 9-10 no 42; 1901 Census Nova Scotia Guysborough Crow Harbour page 17 no 161. 1911 Census Nova Scotia Guysborough Hazel Hill page 11-12 no 116.

[44] Nova Scotia Historical Vital Statistics 1891 book 1814 page 162 no 32.

[45] Nova Scotia Historical Vital Statistics 1903 book 1814 page 241 no 18.

[46] Nova Scotia Historical Vital Statistics 1911 book 7 page 128 no 777-778.

[47] Nova Scotia Historical Vital Statistics 1917 book 38 page 445 no 841.

[48] Nova Scotia Historical Vital Statistics 1912 book 7 page 158 no 961.

[49] Nova Scotia Historical Vital Statistics 1916 book 38 page 492 no 915.

Michael's wife Mary was also an Eaton and was the sister of James. They were married one year after Ann and James in 1869.[50] Archival documentation indicates that Michael and Mary had three children: Catherine born 1869, Martin born 1871 and Stephen born 1873.[51] Catherine and Martin's birth registrations list their place of birth as Black Point.[52] No birth registration could be located for Stephen.

Catherine appears to have left the household by 1891, when she disappears from the census. No marriage or death records could be located for her. Martin was married twice. His first marriage was to Annie Walsh in 1903 and Martin is listed as a fisherman living at Fox Island Main but born at Black Point.[53] Three years later, Martin married Julia Haines in 1906. Their marriage registration lists Martin as living at Fox Island and also states he was born at Fox Island.[54] This contradicts his first marriage registration and his birth registration, which also lists his birthplace as Black Point. Martin and Julia appear in the 1911 census with four children, living at Fox Island.[55] Martin died in 1956 at Fox Island Main at the age of 85.[56]

Stephen remained single and never married. He appears to have remained living in the family homestead with his parents and all three of them appear in the 1911 census as the only household in Black Point. At the time of the census, a young woman named Minnie Fogetary is also living with the Dalys. Stephen is listed as the head of household and works as a fisherman.[57]

Michael died in 1916 at the age of 61. He is listed as living at Black Point at the time of his death.[58] His wife Mary died in 1929 at the age of 95. She is listed as living at Fox Island Main at the time of her death. Interestingly, she is described as living at the place of her death for 50 years.[59] Clearly there is some error or misunderstanding as this conflicts with the 1911 census and her husband's death registration in 1916. Stephen died in 1935 at the age of 61. He was living at Fox Island Main at the time of his death.[60]

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[50] Nova Scotia Historical Vital Statistics 1869 book 1814 page 27 no 26.

[51] 1871 Census Nova Scotia Guysborough, Crow Harbour page 36 no 107-108; 1881 Census Nova Scotia Guysborough Crow Harbour page 18 no 81-82; 1891 Census Nova Scotia Guysborough Crow Harbour page 9 no 39-40; 1901 Census Nova Scotia Guysborough Crow Harbour page 17 no 161-164

[52] Nova Scotia Historical Vital Statistics 1869 book 1808 page 85 no 457; Nova Scotia Historical Vital Statistics 1871 book 1808 page 121 no 302.

[53] Nova Scotia Historical Vital Statistics 1903 book 1814 page 241 no 16

[54] Nova Scotia Historical Vital Statistics 1906 book 1814 page 264 no 39.

[55] 1911 Census Nova Scotia Guysborough Hazel Hill page 11 no 112.

[56] Nova Scotia Historical Vital Statistics 1956 page 4007.

[57] 1911 Census Nova Scotia Guysborough Hazel Hill page 11-12 no 116.

[58] Nova Scotia Historical Vital Statistics 1916 book 38 page 517 no 958.

[59] Nova Scotia Historical Vital Statistics 1929 book 122 page 590.

[60] Nova Scotia Historical Vital Statistics 1935 book 145 page 282.

Again, his death registration lists him as living his whole life at Fox Island Main, something clearly contradicted by other archival documentation.

No grant or land papers were located for the Dalys at Black Point and it is possible that the lack of a Crown grant to land is behind the discrepancies in the 20th century documents. It is possible that the Daly grant, which is shown on Crown land maps as along the new Canso Road, is shown in error or perhaps more likely, the Dalys may have opted to settle near the shore rather than farther inland.

Lawrence's unmarried children continue to live together in the same dwelling until 1896, when Mary Daly marries George Rhynold. At the time of her marriage, Mary was 57 years old and a spinster. Both are listed as living in Black Point at the time and Mary is listed as born at Black Point.[61] The A.F. Church map (Figure 3.2-3) depicts a home belonging to G. Rhynold inland from the study area, along the new Canso Road.[62] It is possible that this is the same G. Rhynold whom Mary Daly married.

By 1901, Mary is widowed and living with her brother, John, a fisherman. However, she is listed as the head of the household. Johanna, their sister, appears to be living with Ann Daly and James Eaton. Edward, the remaining Daly sibling, does not appear in the census for this area.[63] His death registration indicates that he was living in Canso from the 1890s until his death in 1921 and working as a labourer.[64] The 1891 census shows Edward living with his wife, Mary and children Lawrence and Mary near his siblings, in the Crow Harbour polling district. He also appears in the 1901 census, this time living in the Cape Canso polling district.[65] Further examination of the archival record identified the marriage registration of his daughter, Margaret C. Daly who married John Patrick Kennedy (descended from Thomas Kennedy and Mary Lukeman) in Canso in 1912. Their marriage registration indicates that she was born in Canso around 1895.[66]

The household of unmarried and widowed siblings does not appear in the 1921 census. John Daly died in 1915, single and living at Half Island Cove at the time of his death.[67] Mary died in 1924, also living at Half Island Cove at the time.[68] While John's death registration lists his place of birth as Black Point, Mary's list her birthplace as Fox Island. There are several other errors in Mary's registration, however, including being listed as

[61] Nova Scotia Historical Vital Statistics 1896 book 1814 page 192 no 26.

[62] A.F. Church 1876.

[63] 1901 Census Nova Scotia Guysborough Crow Harbour page 17 no 161-164.

[64] Nova Scotia Historical Vital Statistics 1921 book 69 page 314.

[65] 1891 Census Nova Scotia Guysborough Crow Harbour page 10 no 43; 1901 Census Nova Scotia Guysborough Canso page 6 no 54.

[66] Nova Scotia Historical Vital Statistics 1912 book 30 page 9.

[67] Nova Scotia Historical Vital Statistics 1915 book 38 page 223 no 465.

[68] Nova Scotia Historical Vital Statistics 1924 book 69 page 473.

English and married, instead of Irish and widowed. No death registration could be located for Johanna.

See Appendix B for a family tree compiled during this research.

3.2.5 Lukeman Family History (Spellings LUKEMAN/LOOKMAN/LUFEMAN/LUIKMAN/ LOUGHLIN)

The Nova Scotia Historical Vital Statistics, an online database of birth, marriage and death registration, as well as census records and the online parish records of St. Ann Church, Guysborough, were searched in an effort to construct a detailed genealogy of the Lukeman family. Additionally, these records can provide information about residence of family members at the time of events such as births, deaths and marriages. Unfortunately, the census data for the area can be scarce on details and the only census with a specific address listed for each entry is the 1911 census. Multiple spelling variations are found throughout the consulted archival material. For ease of reporting, one spelling will be used consistently throughout, which may not reflect the original spelling within specific documents.

James Lukeman Senior and his wife Sara first appear in archival documentation in 1830-1831, when they are listed as the witness to the marriage of John Downey and Margaret Lukeman.[69] Margaret is probably their daughter, although this is not explicitly stated in the record. Several other Lukeman marriages occurred in the 1830s. Thomas Kennedy married Mary Lukeman in 1832,[70] James Murphy married Margaret Lukeman in 1835[71] and James Lukeman married Mary Eaton in 1836.[72]

These Lukemans are probably all children of James and Sara. This is speculation and could not be confirmed due to scarcity of records, particularly of death records. However, the relationships between these four families (Downey, Kennedy, Murphy and Lukeman) can be seen in the witnesses to their marriages and sponsors for the baptisms of their children, in which they figure prominently. For example, James Lukeman and Thomas and Mary Kennedy were the witness to James and Mary Murphy's marriage in 1835. Additionally, both Margaret Murphy (nee Lukeman) and Mary Kennedy (nee Lukeman) are listed in the censuses as being born in Newfoundland, as is James Lukeman in some of his children's death registrations.[73]

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[69] St. Ann Parish Records Book 1 Marriages 1826-1831 page 298 no 13.

[70] St. Ann Parish Records Book 1 Marriages 1826-1831 page 297 no 6.

[71] St. Ann Parish Records Book 1 Marriages 1826-1831 page 288 no 15.

[72] St. Ann Parish Records Book 1 Marriages 1826-1831 page 285 no 1.

[73] 1871 Census Nova Scotia Guysborough, Crow Harbour page 37 no 110; 1881 Census Nova Scotia Guysborough, Cape Canso page 32 no 130; Nova Scotia Historical Vital Statistics 1922 book 68 page 522.

James Lukeman Senior and his wife do not appear in any censuses. Unfortunately, the death records among the St. Ann Parish records are quite sparse and death records could not be located for James or Sara. It is likely that they died prior to the census of 1861.

The Downy family also disappears relatively quickly from records of the area. A baptism record in 1832 indicates they had at least one child, a daughter named Catherine.[74] No other records of births, marriages or deaths could be found for the Downeys or their daughter.

Thomas Kennedy and wife Mary Lukeman appear more often in the records and the baptisms and births of five of their children were located. Mary Ann was baptised in 1833,[75] followed by James in 1837,[76] Catherine in 1839,[77] Patrick in 1844,[78] and finally Thomas in 1848.[79] Thomas' baptism record contains Canso Harbour written above the entry. This may be an error since the family does appear in the 1861 census in the Black Point area. Thomas Kennedy is listed as the head of the household with five males and two females.[80]

By 1871, Thomas appears to have died and Mary is listed as the head of the household and a widow at 59 years of age. She is living with her daughter Mary, age 37, and two sons Thomas and John, ages 23 and 21.[81] By 1881, the family disappears from the Black Point area. Mary Kennedy can be found in the household of her son, John with his wife Margaret and their five children. They are living in the Cape Canso polling district where John is working as a fisherman.[82] Mary does not appear in the 1891 census.

John Kennedy married Margaret Ryan in 1873. Both John and Margaret were living in Canso at the time of their marriage but the registration notes that John was born at Black Point. John was working as a fisherman.[83] John and Margaret had a large family, reflected in the censuses from 1881 to 1911, which all place the family in Canso.[84] One

[74] St. Ann Parish Records Book 1 Baptisms 1832-1833 page 178 no 142.

[75] St. Ann Parish Records Book 1 Baptisms 1832-1833 page 183 no 10.

[76] St. Ann Parish Records Book 1 Baptisms 1836-1837 page 228 no 17.

[77] St. Ann Parish Records Book 1 Baptisms 1838-1839 page 275 no 76.

[78] St. Ann Parish Records Book 1 Baptisms 1843-1845 page 37.

[79] St. Ann Parish Records Book 2 Baptisms 1846-1848 page 69.

[80] 1861 Census Nova Scotia Guysborough no 32.

[81] 1871 Census Nova Scotia Guysborough, Crow Harbour page 37 no 110.

[82] 1881 Census Nova Scotia Guysborough, Cape Canso page 32 no 130.

[83] Nova Scotia Historical Vital Statistics 1973 book 1814 page 82.

[84] 1881 Census Nova Scotia Guysborough, Cape Canso page 32 no 130; 1891 Census Nova Scotia Guysborough Cape Canso page 27 no 121; 1901 Census Nova Scotia Guysborough Canso West page 1 no 1; 1911 Census Nova Scotia Guysborough Canso Town (North) page 13-14 no 134.

of John's children, John Patrick Kennedy, married Margaret Daly in 1912 in Canso.[85] Margaret's father, Edward Daly, was also from Black Point and moved to Canso in the 1890s. John Kennedy died in 1932 in Canso.[86]

A death registration was also located for Mary Ann, the eldest Kennedy daughter. She died in Canso in 1875, possibly suggesting the family had moved from Black Point to Canso by this date. Her place of birth is listed as Canso, which may be an error.[87] Thomas and Mary Kennedy's remaining children (James, Catherine, Patrick and Thomas) disappear from the archival records. Catherine does not seem to have been counted in the 1861 census, although all of her brothers were. Ten years later, only John and Thomas are listed in census.[88] No marriage registrations or death registrations could be located for any of the siblings, aside from John and Mary Ann.

James Murphy and his wife Margaret Lukeman also have a presence in the archival record that suggests they lived at Black Point during at least part of the 19th century. They had at least five children including John, baptised in 1839[89] and James baptised in 1846.[90] They appear in the 1861 census as James Murphy, with a household of two males and one female. In the 1871 census, however, James Murphy appears to have died and his son John is the head of the household. Margaret appears, age 57, as do three daughters: Mary (age 30), Alice (age 27) and Bridget (age 22).[91]

In the 1881 census, most of the Murphy family has disappeared. Daughters are often difficult to trace due to their changing name if they married and the three Murphy daughters could not be identified in any further censuses, nor could a marriage or death registration be located for any of them. A Mary Murphy of the right age was located in the 1881 census in Canso working as a servant. Although she is Catholic and Irish, there is not enough identifying information to conclusively identify her as the daughter of James and Margaret Murphy.[92] Margaret Murphy (nee Lukeman) has also disappeared by 1881 and a death registration could not be located for her either. Her son James Murphy was not listed in any census and the only archival record that could be located for him was his baptism in 1846.

[85] Nova Scotia Historical Vital Statistics 1912 book 30 page 9.

[86] Nova Scotia Historical Vital Statistics 1932 book 122 page 1102.

[87] Nova Scotia Historical Vital Statistics 1875 book 1807 page 83 no 93

[88] 1861 Census Nova Scotia Guysborough no 32; 1871 Census Nova Scotia Guysborough, Crow Harbour page 37 no 110

[89] St. Ann Parish Records Book 1 Baptisms 1838-1839 page 267 no 76.

[90] St. Ann Parish Records Book 1 Baptisms 1846-1848 page 53.

[91] 1871 Census Nova Scotia Guysborough Crow Harbour page 37 no 110.

[92] 1881 Census Nova Scotia Guysborough Cape Canso page 30 no 120.

John Murphy was found living in the Cape Canso polling district in 1881, along with his wife Jane and son George, age 7. Jane is noted as French in the census. Their neighbour is Patrick Lukeman, John's cousin.[93] John and Jane had two children, George (born ~ 1873) and Katherine (born ~1885). Katherine appears only in the 1891 and 1901 censuses and no marriage or death registration could be located for her.

George Murphy married Julia Boudreau sometime prior to the 1901 census, where he appears to be living with Julia next door to his parents and sister, in the Cape Canso polling district.[94] In 1911, George Murphy's household had dramatically expanded. In addition to five children, his widowed mother Jane and her adopted son Charles are also living with George. This large family is living at Fox Island. [95] His father, John, had died in 1908 at Fox Island Main. John's death registration lists Black Point as his birthplace.[96]

George and Julia had a large family and between the census data and birth registrations, ten children were identified. George's place of birth is given in some of his children's birth registrations. However, it is often contradictory. Laurier Murphy's birth registration states George was born at Harbour a Bouche, Antigonish County.[97] Robert Murphy's birth registration states Fox Island Main[98] and Anna Murphy's lists Black Point at George's place of birth.[99]

In 1921, George is widowed and living with his seven surviving children. His wife died in 1917, while living at Fox Island Main.[100] His mother, Jane, is now living alone next door.[101] George remarried in 1923 to a widow, Elizabeth Ryan, and in marriage registration lists Fox Island as both his place of birth and the birthplace of his father, John.[102] This is probably an error since John seems to have lived at Black Point until the mid 1870s. George died in 1958 at the age of 85. He was living at Fox Island at the time of his death.[103]

James Lukeman married Mary Eaton in 1836. They had eight children: Bridget born 1838, John born 1841, Thomas born 1844, Patrick born 1846, Margaret born 1848, James or Joseph born 1850, Mary born 1854 and Peter born 1856. Baptisms and marriage records

[93] 1881 Census Nova Scotia Guysborough Cape Canso page 38 no 158.

[94] 1901 Census Nova Scotia Guysborough Cape Canso page 19 no 171-172.

[95] 1911 Census Nova Scotia Guysborough Hazel Hill page 11 no 108-109.

[96] Nova Scotia Historical Vital Statistics 1908 book 7 page 2 no 24.

[97] Nova Scotia Historical Vital Statistics 1912 no 56800700.

[98] Nova Scotia Historical Vital Statistics 1911 no 56800241.

[99] Nova Scotia Historical Vital Statistics 1909 no 56700480.

[100] Nova Scotia Historical Vital Statistics 1917 book 38 page 337 no 658.

[101] 1921 Census Nova Scotia Guysborough Hazel Hill page 8 no 74-75.

[102] Nova Scotia Historical Vital Statistics 1923 book 30 page 927.

[103] Nova Scotia Historical Vital Statistics 1958 page 2791.

for John, Thomas, Margaret and James indicate that they were born at Black Point.[104] James Lukeman appears to have died prior to the 1861 census, where Mary Lukeman is listed as a widow and the head of a household with four males and two females.[105]

By 1871, most of the Lukeman's children have left their household. Mary is still shown as the head of the household and is living with Patrick, Peter and Mary. Thomas and his wife Elizabeth are also living at home, with their two young children, James and Mary.[106]

Of James and Mary's other children, there was little archival material available, particularly birth, marriage and death registrations. Therefore, this research was heavily reliant on census information. Overall, no trace could be found of their three daughters. No marriage or death registration could be located for Bridget, Margaret or Mary and they could not be located in any censuses. Their son James or Joseph, whose baptism records place his birth at Black Point, could also not be located further in the archival material.

By 1881, Peter Lukeman is listed as the head of the household at Black Point, with his mother Mary and a servant, Mary Eaton. He is working as a fisherman.[107] Peter married Johanna Cavanagh in 1883. Their marriage registration states that both Peter and Johanna were born at Black Point and that they are currently living there.[108] By 1891, the family has disappeared from Black Point completely, suggesting that they left between 1883 and 1891.

Mary Lukeman appears to have died before the 1891 census, although no death registration could be located for her. Peter can be found in the Cape Canso polling district living next door to his brother Patrick.[109] Patrick has been living in this polling district since the 1881 census, where he appears with his wife, Bridget and two sons. He is living next door to his cousin, John Murphy.[110] Bridget is Johanna Cavanagh's sister and she married Patrick in 1876. Their marriage registration states that both Bridget and Patrick were born at Black Point and are currently living there.[111] This suggests that

[104] St. Ann Parish Records Book 1 Baptisms 1838-1839 page 281 no 17; Nova Scotia Historical Vital Statistics 1871 book 1814 page 37 no 16; St. Ann Parish Records Book 1 Baptisms 1843-1845 page 33; Nova Scotia Historical Vital Statistics 1868 book 1814 page 23 no 75; St. Ann Parish Records Book 2 Baptisms 1846-1848 page 51; St. Ann Parish Records Book 2 Baptisms 1846-1848 page 69; St. Ann Parish Records Book 2 Baptisms 1849-1851 page 88; 1871 Census Nova Scotia Guysborough Crow Harbour page 36-37 no 109.

[105] 1861 Census Nova Scotia Guysborough no 30.

[106] 1871 Census Nova Scotia Guysborough Crown Harbour page 36-37 no 109.

[107] 1881 Census Nova Scotia Guysborough Crow Harbour page 18 no 83.

[108] Nova Scotia Historical Vital Statistics 1883 book 1814 page 116 no 67.

[109] 1891 Census Nova Scotia Guysborough Cape Canso page 35 no 153-154

[110] 1881 Census Nova Scotia Guysborough Cape Canso page 38 no 157.

[111] Nova Scotia Historical Vital Statistics 1876 book 1814 page 71 no 35.

Patrick left Black Point between 1876 and 1881, when he appears in the Cape Canso polling district.

Peter and Patrick also appear in the 1901 and 1911 censuses as neighbours. According to the 1911 census, Peter and his family are living in Fox Island, next door to Patrick's son William. William is living with his wife, three children and his elderly father Patrick.[112] Peter died in 1922 at Fox Island. His registration lists that he had lived at Fox Island his entire life, which is contradicted by census information and his marriage registration.[113] No death registration could be located for Patrick.

James and Mary's oldest son John was married in 1871 to Elizabeth Kennedy. At the time of their marriage, John is listed as living at Black Point, where he was born.[114] By 1881, however, he has moved to Guysborough and appears with his wife in the 1881, 1891, 1901 and 1911 census.[115] John did not appear to have children. His death registration indicates that he died at the age of 76 in Guysborough.[116]

Their second oldest son, Thomas, was living at Black Point 1871 in his mother's household with his wife, Elizabeth Self and two children. Thomas and Elizabeth married in 1868 and their marriage registration lists them both as born and currently living at Black Point.[117] By the time of the 1881 census, however, Thomas and his family appear to have moved. They are counted in the Cape Canso polling district in both 1881 and 1891.[118] By 1901, Thomas' eldest son, James, is living next door to his parents with his wife and young family in the Canso West district.[119] In 1911, Thomas and Elizabeth are living with James and his family at Hazel Hill.[120] Thomas Lukeman's 1930 death registration lists Hazel Hill as his residence and notes he has been living there for 30 years.[121]

The Lukeman family, as well as the Kennedy and Murphy families, appear to have lived at Black Point during the 19th century. It difficult to tell when these families first arrived

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[112] 1911 Census Nova Scotia Guysborough Hazel Hill page 11 no 114-115.

[113] Nova Scotia Historical Vital Statistics 1922 book 63 page 522.

[114] Nova Scotia Historical Vital Statistics 1871 book 1814 page 37 no 16.

[115] 1881 Census Nova Scotia Guysborough Guysborough page 19 no 84; 1891 Census Nova Scotia Guysborough Guysborough page 37 no 171; 1901 Census Nova Scotia Guysborough Guysborough page 9 no 98; 1911 Census Nova Scotia Guysborough Guysborough page 11 no 133.

[116] Nova Scotia Historical Vital Statistics 1916 book 38 page 296 no 581.

[117] Nova Scotia Historical Vital Statistics 1868 book 1814 page 23 no 75.

[118] 1881 Census Nova Scotia Guysborough Cape Canso page 39 no 162; 1891 Census Nova Scotia Guysborough Cape Canso page 36 no 160.

[119] 1901 Census Nova Scotia Guysborough Canso West page 10 no 88-89.

[120] 1911 Census Nova Scotia Guysborough Hazel Hill page 6 no 59-60.

[121] Nova Scotia Vital Statistics 1930 book 122 page 764.

at Black Point as early archival material, such as baptism records, often do not include a location. It is easier to pin point when the families left Black Point. The Kennedys seem to have moved to Canso in the 1870s. The Murphys also seem to have left in the 1870s, although went only as far as Fox Island Main. The Lukemans had several sons who left for places like Guysborough, Hazel Hill and Fox Island during the 1870s and 1880s. The last Lukemans probably left Black Point between 1883 and 1891.

Although they might have left Black Point, many of these families settled in communities with other Black Point descendants close by. For example, in the 1911 census, George Murphy (James Murphy and Margaret Lukeman), Martin Daly (Michael Daly and Mary Eaton), Peter and Patrick Lukeman (James Lukeman and Mary Eaton) and James and Ann Eaton (nee Daly) are all close neighbours at Fox Island.[122]

See Appendix B for a family tree compiled during this research.

3.3 Field Reconnaissance

A field reconnaissance was conducted by Laura de Boer and Courtney Glen in early October 2014. Unlike the 2011 reconnaissance which accessed the barrens from the south, access to the outflow from Fogarty Lake as well as to the Fogherty Head lowland was achieved by following a very rough and overgrown ATV trail east from the end of Half Island Cove Road across the granite barrens. The team then used the eastern cutline of the former Fogarty grant to climb down the steep escarpment between the granite barrens and the coastal lowlands that were of prime interest during this reconnaissance. The reconnaissance was aided by a hand-held GPS unit as well as LiDAR data provided by SLR Consulting. Results are indicated on Figure 3.3-1 as well as detailed maps throughout this section.

The eastern extent of Half Island Cove Road, though no longer driveable by car, was clearly a substantial roadway at one time and most likely represents a portion of the Old Canso Road shown on historic mapping. The presence of a corrugated steel culvert (20 T 642948 5023626, NAD83) on the road towards the study property indicates that road improvements have been made in the later half of the twentieth century. However, upon crossing a small brook (20 T 643109 5023566) (Plate 1) the road abruptly and dramatically changes into a rough and undulating ATV trail unsuitable for car or even cart travel. Rhodora and moss overgrowth punctuated with sections of spruce-dominated forest has obscured any sure sign of the Old Canso Road beyond this point, although it seems likely that the ATV trail that extends towards Canso from this point may at some locations intersect or travel along the historic roadway. In some areas where mud was exposed in low areas of the trail, animal tracks were observed,

[122] 1911 Census Nova Scotia Gusyborough Hazel Hill page 11 no 108-116.

dominated by deer but also including a small bear track. Coyote scat was observed throughout the study area.

In multiple locations a low, wet area or a steep rock escarpment had been made more traversable by the addition of fallen logs to create a short corduroy road (20 T 644336 5023751, 20 T 644402 5023791, among others) (Plate 2). While this technique is historical in nature it is unlikely that these short sections represent the original corduroys that would most likely have been found along the Old Canso Road. Similarly, in some locations loose stone has been used to build rough causeways over wet ground (20 T 643182 5023575) (Plate 3), but it is unclear whether this is historic or modern activity. A rough ATV bridge of spruce rails was observed spanning part of the outlet from Fogarty Lake (20 T 643982 5023670) (Plate 4), which was found to be little more than a trickle of water with a surrounding wet corridor some 5m wide.

Although on the way to the lowland the team examined the few instances of exposed granite for signs of petroglyphs, none were observed (Plate 5). In fact, the only exposures of granite on the barrens appear to be caused by ATV activity in the past several decades scraping the vegetation from the stone, where it is slow to regenerate. It appears likely, therefore, that any petroglyph creation in this area would have necessitated not only a steep and dangerous climb from the water or the lowlands, but also the activity of scraping away 10 to 30cm of moss, rhodora, and other vegetation to create petroglyphs, which within a few decades would likely have been re-covered without continued maintenance.

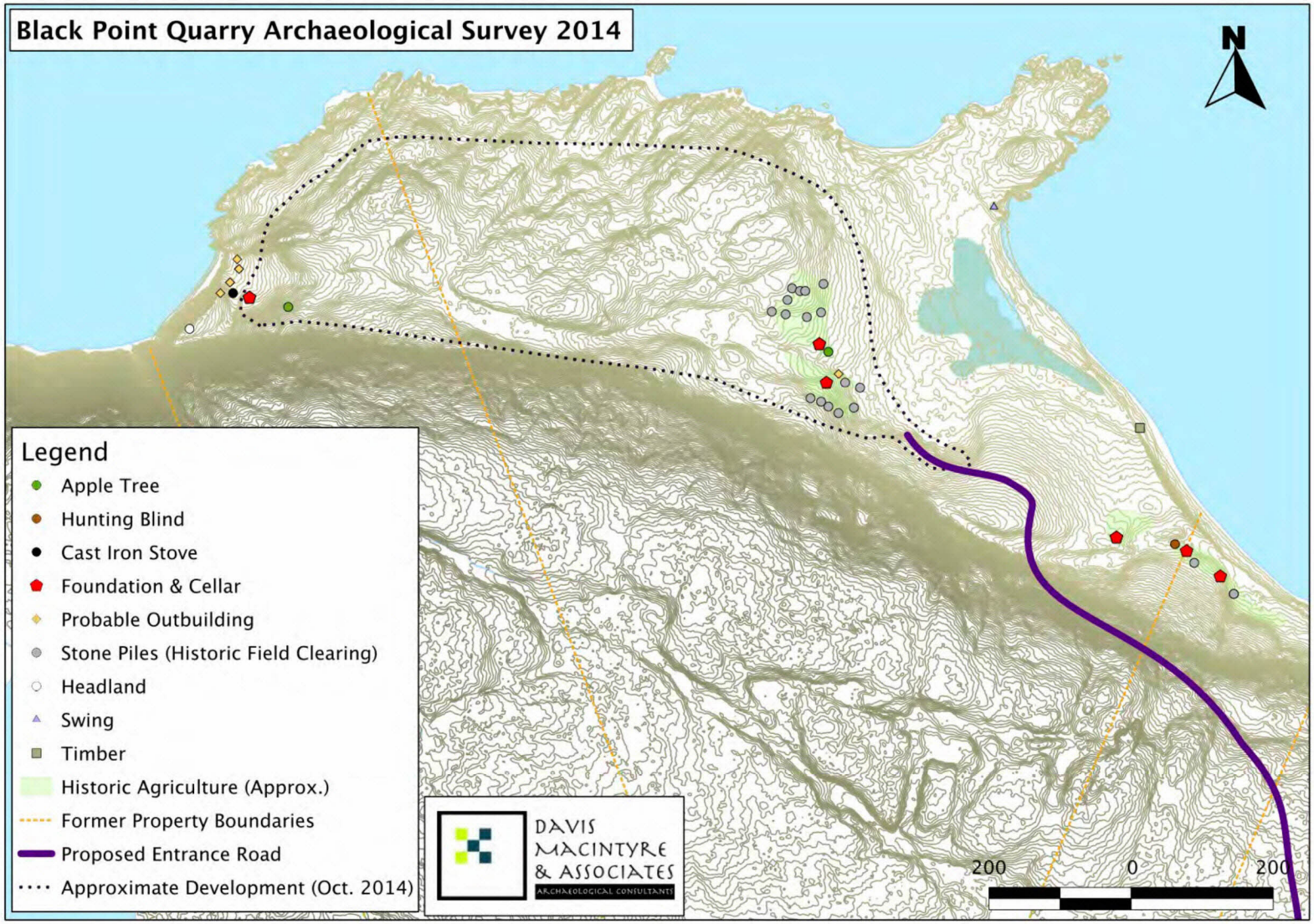


Figure 3.3-1: A map showing 2014 reconnaissance findings at Fogherty Head. Please note that the elevation lines shown are drawn from LiDAR survey data, courtesy SLR Consulting.

With the exception of the corduroy road elements and the trail itself, the granite barrens in this area appear to have been even more untouched by cultural activity than the areas examined during the 2011 survey. Upon reaching the cut line that would lead down to the lowland, the team found that the signs of heavy equipment observed in 2011 were still present along the cutline and extending to the northeast towards the edge of the barrens. Following the cutline, the team made the steep climb down to the lowlands and continued to follow the line to the rocky coast.

With an awareness of the early European fishing history of the Canso area along with the possibility of First Nations encampment and resource use along this shore, the team walked the full extent of the lowland shoreline, watching for any signs of fishing rooms or other historic activity as well as any areas suitable for First Nations encampment. It was found that the shoreline is dominated by sharp bedrock outcroppings of Lower Cambrian Metamorphic Slate and Quartzite, which fractures in blocky patterns that do not provide an appealing surface for petroglyphs nor a surface upon which cut or drilled post-holes for fishing stages can be easily seen (Plate 6). Most of the rocky outcroppings rise at least two to three meters above the high tide mark along the northern face of Fogherty Head. While aesthetically very beautiful, this shoreline is very treacherous both for habitation and for bringing small boats ashore where they could easily be smashed against the rocks (Plate 7).

Tucked against the steep bedrock outcroppings are small areas of high-energy cobble beaches sloping steeply into the water, indicating a possible rip tide (Plate 8). The bedrock framing these beaches has been beaten smoother by waves and cobbles in the intertidal zone. Although careful examination was made of these beaches, almost all cultural material was modern plastic, with the exception of an iron object that may have functioned as a net weight or some kind of cast iron base, observed near the cut line that was used to access the shore (Plate 9).

Against the cobble beaches in at least two notable locations, the bedrock exhibited natural faults extending inland, providing what seemed to be a more inviting path to access the land from the water (Plate 10). However, these sheltered lower areas were found to be soggy and wet, while the higher ground to either side is extremely rough and densely covered in vegetation and storm deadfall, making what may initially have appeared an inviting camp location into an inhospitable cove.

Black Point itself, protruding northeast from Fogherty Head, incorporates on its northwestern side a broad cove with a cobble beach backed by level ground that is more suitable for encampment, particularly by First Nations groups (Plate 11). However, the point is beyond the proposed impact area and in fact has remained reserved as Crown land. This location was encountered while the team was seeking a suitable crossing to the eastern shore of Fogherty Head to return to the study area. Its suitability for short-term encampment even in modern times was visible by a scattering of modern beer bottles visible just above the beach (20 T 645373 5024284) (Plate 12). The beach

itself was carefully examined for signs of archaeological material, but none was encountered (Plate 13). It should be noted that quartz cobbles suitable for use in lithic tool manufacture were present all the way around the study area's shoreline, originating from quartz veins in the local bedrock. No signs of worked quartz could be found.

Along the eastern shore, other signs of modern recreation were present, including a wood and rope swing hung from a tree (20 T 645465 5024223) (Plate 14) as well as an overgrown ATV trail most likely leading from Fox Island Main just above the shoreline. A very broad cove with a cobble beach takes up the entire eastern shoreline of the study area (Plate 15), fronting against a barachois along its northern half and a tall erosional face to the south. The Crown marker post marked on survey plans as positioned 63 feet (19m) inland was found loose on the beach, indicating either extreme storm activity or vandalism in its removal (Plate 16).

The beach itself is, like the smaller beaches to the north, very steep and shows signs of high-energy wave action. The small open barachois is fresh water, sloping gently up into a very large area of rough wetland (Plate 17). Coyote and deer tracks were observed in the mud exposed as the barachois dried out, while the beach-facing side of the barachois has been completely edged in cobbles from the storm beach as well as wild cranberry plants (Plate 18). The team swept the beach for signs of archaeological material, but none was present. It appears likely that the beach experiences regular overturning of its stones during every storm surge.

Beyond the barachois as the team continued south along the shore, the land above the beach rises dramatically to produce a sloped erosional face of soil rather than bedrock (Plate 19). All exposed soils were examined, but beyond modern beach debris the only cultural material observed against or in the erosional face was a square-cut timber approximately 4"x4" protruding from the bank (20 T 645671 5023912) (Plate 20). The timber may represent the remnants of a small wharf, but in the absence of any other timber nearby or any signs of cultural activity on the shore above the timber, it appears more likely that it is an isolated fragment, perhaps related to signage or a hunting blind.

Upon reaching the southern edge of the study area's shoreline, the team proceeded inland onto what had previously been the historic Lukeman family grant. It was found that a thin strip of high ground lay between the shore and a low, wet area running parallel to the beach. Just inland from this, the team began to observe signs of historic agricultural activity in the form of smoother topography, with forest dominated by mature spruce rather than scrub hardwood, and several piles of stones most likely resulting from historic field clearing (20 T 645803 5023678). Within this agricultural area, the team identified two stone-lined cellars with the stone outline of a foundation around each (20 T 645784 5023703, Lukeman Homestead 1, and 20 T 645736 5023739, Lukeman Homestead 2) (Plates 21 and 22 and Figure 3.3-2), and a third cellar and foundation of the same type just beyond the former Lukeman boundary (20 T 645638

5023758, Black Point Homestead 1) (Plate 23). All of the foundations are positioned on small rises or headlands on the suitable ground between the ocean shore and the steeper rise to the granite barrens behind them. The rotten remains of a modern hunting blind are also visible near the second of these foundations (20 T 645720 5023748) (Plate 24).

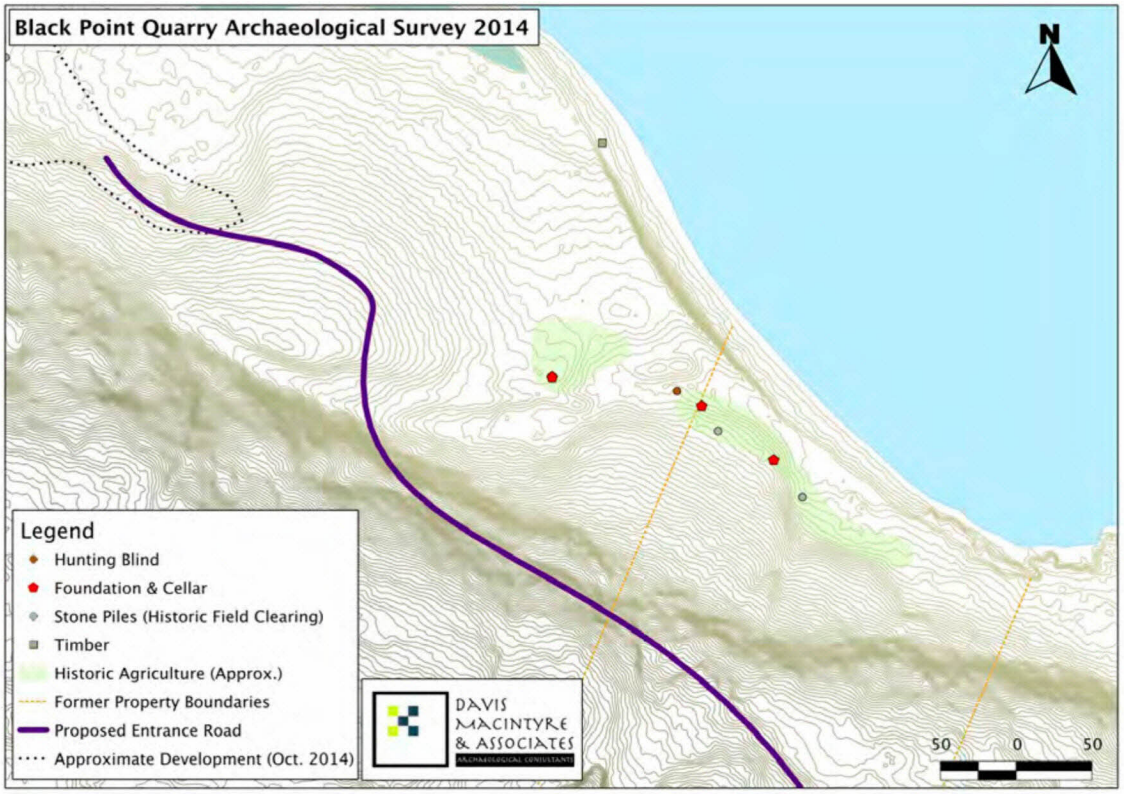


Figure 3.3-2: Detail of a map showing 2014 reconnaissance findings near the former Lukeman grant.

From here, the team proceeded northwest along an ATV trail, observing that the agricultural landscape quickly gave way to a rougher topography covered in dense undergrowth and deadfall. Nearly 400m from the previous agricultural area, stone piles and smooth topography were again noted. A fourth foundation (20 T 645230 5023976, Black Point Homestead 2) (Plate 25 and Figure 3.3-3), along with an earthen depression suggesting an outbuilding (20 T 645247 5023988) (Plate 26), were noted in the approximate center of this agricultural area, along with at least seven stone piles around the outer edges.

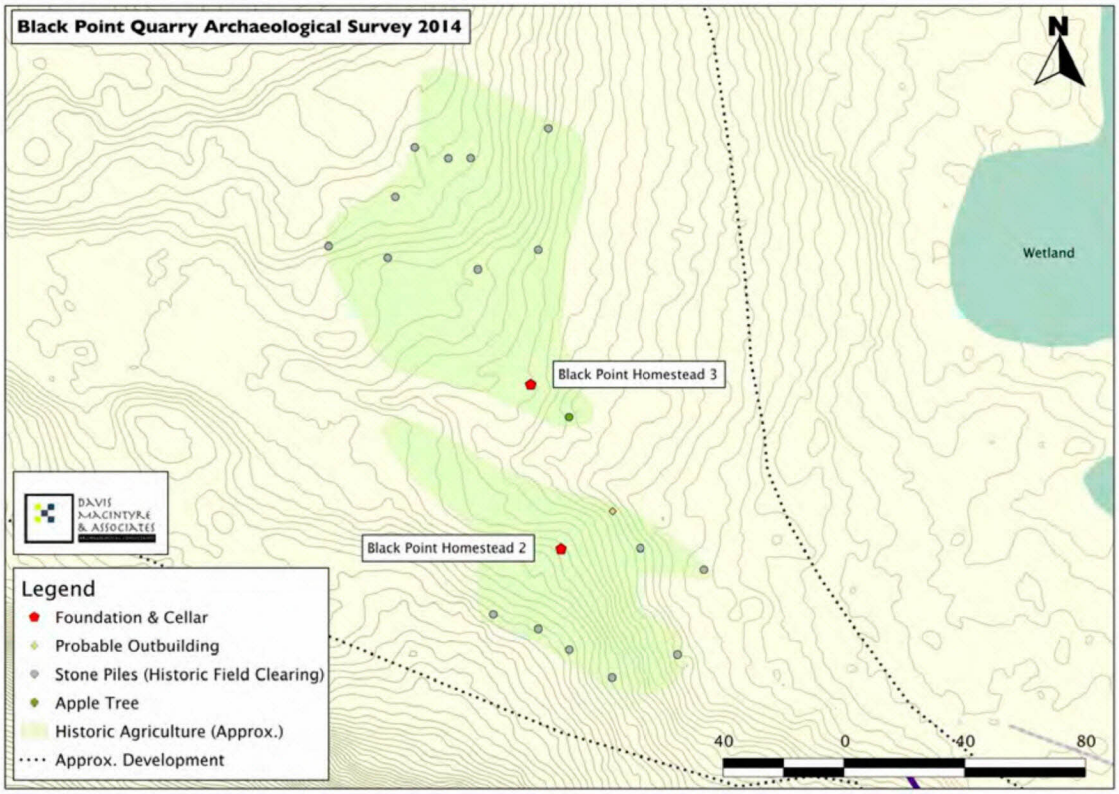


Figure 3.3-3: Detail of a map showing 2014 reconnaissance findings inland from the former Lukeman grant.

Crossing a very small stream, the team immediately encountered a mature apple tree and, proceeding onto the rising ground behind it, a fifth cellar and foundation (20 T 645219 5024030, Black Point Homestead 3) (Plate 27). Unlike the previous four foundations, which included a stone-lined cellar in the southern halves of each, this feature consists of a large rectangular foundation outlined in stone with a small cellar extending south from the middle of the southern wall. Further exploration of the surrounding area revealed that most of the agricultural landscape associated with this feature is found to the north, dotted with at least nine more stone piles.

Despite further examination of the surrounding landscape, the team was unable to locate any further signs of agriculture or any other archaeological features on this side of the headland. Proceeding north to the shoreline again, the team followed the open and rocky shore to the western side of the property, where the land had been previously granted to the Fogarty family.

Like the shore on the eastern side, again the rocky outcroppings and small cobble beaches gave way to a broader cove pressed against the higher cliffs of the granite barrens beyond (Plate 28). Above the cove, an open meadow slopes from higher, rougher ground down to the shore (Plate 29). Upon entering the meadow the team

found that much of the landscape is very wet, representing a broad, slow drainage from a low and wet area farther inland. Two large stone mounds were observed in the meadow (20 T 644400 5024150, 20 T 644403 5024136) (Plates 30 and 31 and Figures 3.3-4 and 3.3-5), one of which also included a historic brick and a fragment from a cast iron cook stove (Plate 32). Both mounds are broad and flat enough that they may represent footings for outbuildings or alternately small drying pads for processed fish. Neither was formally measured, but both are at least 3m x 3m in size and rise nearly 1m above the surrounding wet soil.

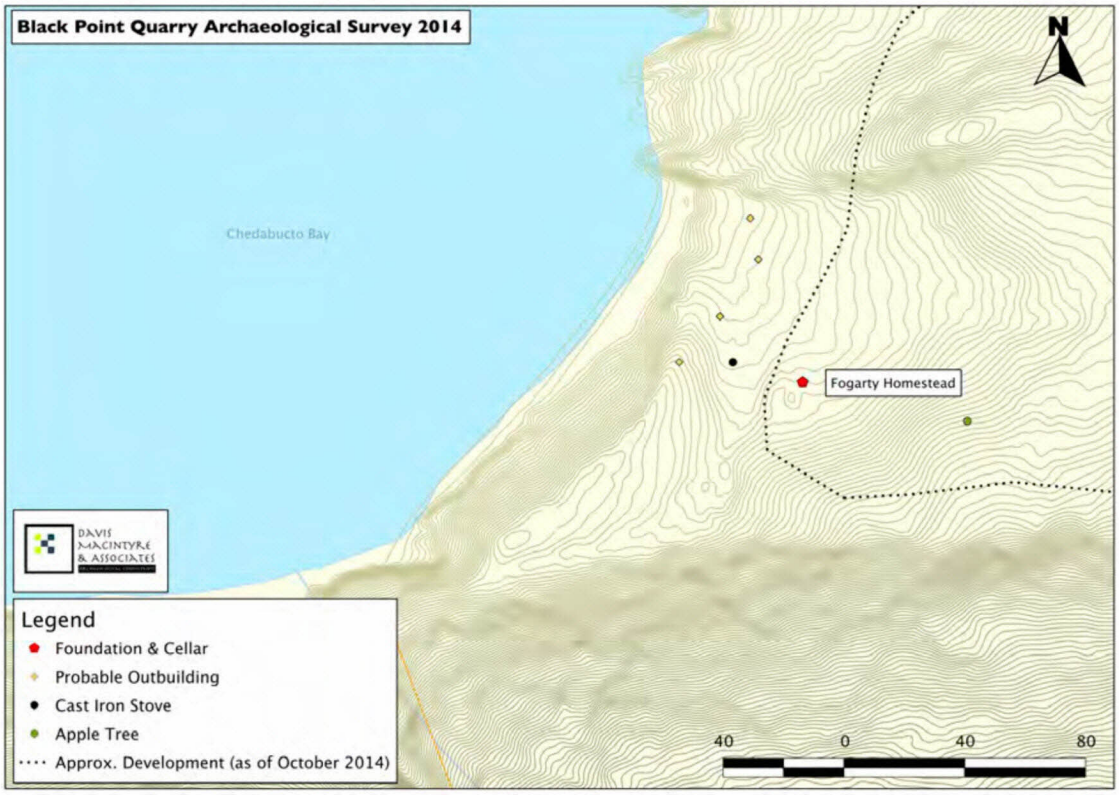


Figure 3.3-4: Detail of a map showing 2014 reconnaissance findings at the former Fogarty grant. Note that the Fogarty cellar is visible in the LiDAR data (shown here as elevation lines) as a small anomaly just below the red pin on this map. The slight discrepancy in location is due to hand-held GPS error, which can range up to 6m.

Examination of the edges of the meadow revealed few signs of cultural activity beyond the presence of some rose bushes, which had also been spotted along the rougher portions of the coast. The southern edge of the meadow, in contrast, included three historic features, along with an apple tree on higher ground overlooking the meadow (20 T 644472 5024082). Fortunately the team was able to reach the extent of the higher ground suitable for habitation before catching the heavy scent of a bear and moving on from the area.

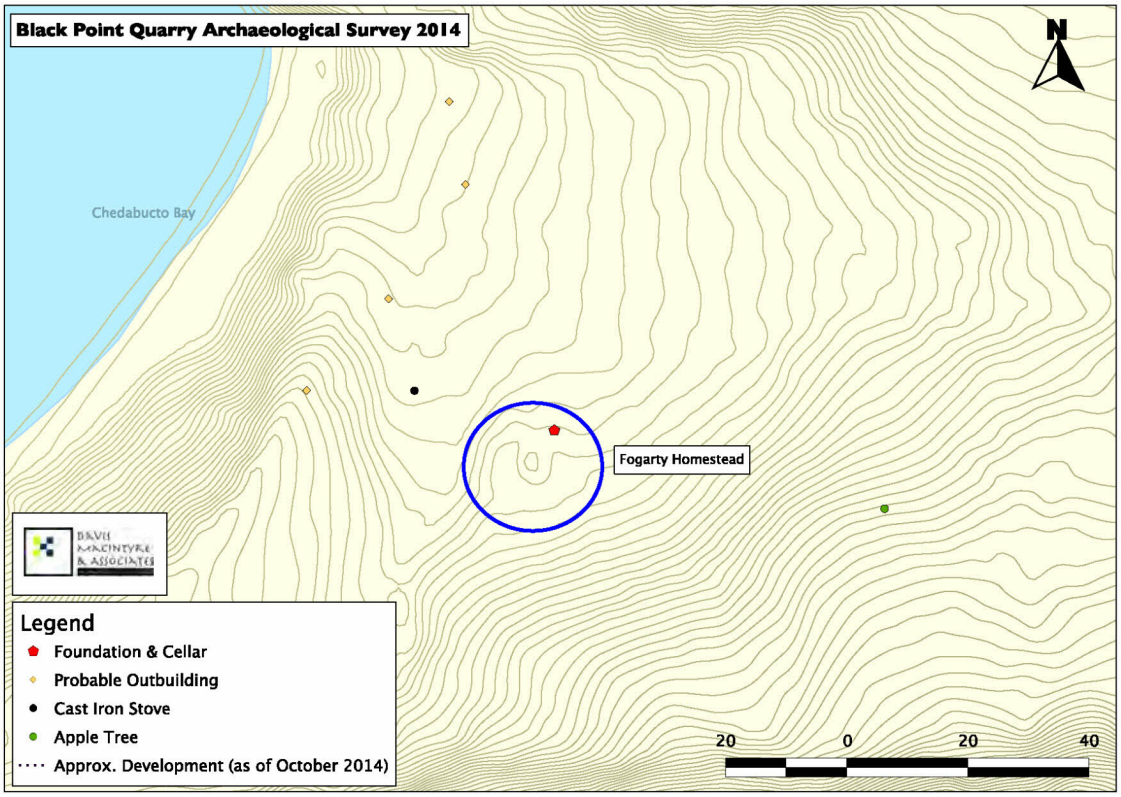


Figure 3.3-5: Closer detail of a map showing 2014 reconnaissance findings at the former Fogarty grant. Note that the Fogarty cellar is visible (blue) in the LiDAR data, shown here as elevation lines.

The largest of the historic features is a very deep stone-lined cellar (20 T 644417 5024095) (Plate 33), positioned within the meadow but near its edge and on higher, drier ground. The outline of this cellar is the only one of the six identified foundations that is visible on the available LiDAR data (refer back to Figure 3.3-4), most likely due to its depth and its position on more open and level ground than the other five. The surrounding soil is heavily overgrown, obscuring any foundation outline if there is one present. A rough open drain or entryway also appears to extend at least ten metres westward from the cellar. The feature is sheltered from the shoreline by a ridge of higher ground covered in spruce trees. Within the treed area, two more probable outbuildings were identified, the first a stone-lined depression (20 T 644390 5024117) (Plate 34) and the second an earthen depression built against the side of the hill (20 T 644377 5024102) (Plate 35).

A cast iron cook stove in pieces is visible on the surface between the cellar and one of the outbuildings. For the most part the stove is undecorated, but it does include the foundry marks “Record F & [Co.]” (20 T 644394 5024102) (Plate 36).

Proceeding uphill along the treed divide between the meadow and the shore, the team observed that the land eventually flattens into what would have been a scenic headland before the regrowth of spruce trees covered what appears to have been smooth agricultural lands (20 T 644333 5024052) (Plate 37). While the presence of burials cannot be confirmed or refuted at this stage, it is worth noting that this location is the most suitable for historic burial of all areas observed within the study boundaries, providing a scenic view of the sea and in proximity to historic settlement by the Fogarty family. It also corresponds to the area indicated by the surviving Fogarty family's oral history as the area where burials may have occurred (refer back to Figure 3.2-6).

4.0 RESOURCE INVENTORY AND EVALUATION

Six probable historic house foundations and five probable outbuilding foundations have been identified on the lowland of the study area, below the level of the granite barrens. Of these six houses, three are believed to be related to the extended Lukeman family, one to the Fogarty family, and two more to the Daly family. Maritime Archaeological Resource Inventory (MARI) forms for all six have been completed for submission to CCH and the Nova Scotia Museum.

The 1871 census lists the following six families: Michael Fogarty, Michael Daly, John Daly, Mary Lukeman, Mary Kennedy and James and Margaret Murphy. Based on the Church map (Figure 3.2-3) and the crown land grants (Figure 3.2-2), the census enumerator may have visited families along the old Canso road from the west to the east. This would place Michael Fogarty's house at the Fogarty end of the study area, with the two Daly households in the middle, which would match with the cellar features found and referred to as Black Point 2 and Black Point 3 (See sections 3.3 and 3.4 below).

Two more cellar features were found on land granted to the Lukeman family, with a third cellar located just west of the Lukeman grant (see sections 3.3 and 3.4 below). Since both Mary Kennedy and Margaret Murphy were originally Lukemans (probably sisters to James), it is possible that the cellar features on the Lukeman grant belonged to Kennedy and Murphy families. If the census enumerator did in fact travel west to east, the cellar at Black Point 1 may belong to James and Mary Lukeman, with Lukeman Homestead 2 belonging to Thomas and Mary Kennedy (nee Lukeman) and Lukeman Homestead 1 belonging to James and Margaret Murphy (nee Lukeman).

Lukeman Homestead 1 and Lukeman Homestead 2 are both positioned along the coastal portion of what was originally the land granted to Peter James Lukeman. Black Point Homestead 1, Black Point Homestead 2, and Black Point Homestead 3 are all located on ungranted land that was held by the Crown prior to plans to develop the Black Point Quarry. Black Point Homestead 1 is located in close proximity to the

C 1340-2045

Lukeman homes and may have been built by a member of the Lukeman family expanding the family holdings.

The Lukeman Homestead 1 site includes a long narrow strip of agricultural landscape set against a sharper slope angled towards the barrens, along with at least one stone pile, and a house foundation of stone approximately 9m x 7m in size with a stone-lined cellar approximately 2m deep in its southern half. Based on documentary records, it appears likely that this house belonged to James and Margaret Murphy, nee Lukeman.

The Lukeman Homestead 2 site includes a house foundation of stone approximately 10m x 7m in size with a stone-lined cellar approximately 1.5m deep in its southern half, and a possible collapsed drain extending eastward from the cellar. Twenty metres southeast, a pile of stones indicates some limited field clearing or possibly the footing of an outbuilding. The smoothness of the topography immediately surrounding the foundation also suggests limited field clearing and agriculture or animal husbandry. Based on documentary records, it appears likely that this house belonged to Thomas and Mary Kennedy, nee Lukeman.

The Black Point Homestead 1 site is a house foundation of stone approximately 10mx7m in size with a stone-lined cellar approximately 1m deep in its southern half. The smoothness of the topography immediately surrounding the foundation also suggests limited field clearing and agriculture or animal husbandry. The feature was very heavily covered with deadfall and organic debris, and so size estimates are very rough. Based on documentary records, it appears likely that this house belonged to James and Mary Lukeman.

Black Point Homestead 2 consists of a house foundation of stone approximately 8.5m x 6m in size with a stone-lined cellar approximately 1.5m deep in its southern half. The smoothness of the topography immediately surrounding the foundation also suggests limited field clearing and agriculture or animal husbandry. An earthen depression suggestive of an outbuilding and at least seven stone piles have also been recorded. Based on documentary records and oral history, it appears likely that this house belonged to Michael Daly.

Black Point Homestead 3 is a house foundation of stone approximately 8.5m x 9m in size with a stone-lined cellar approximately 1.5m deep, 3m wide and 3.5m long extending off the middle of the foundation's southern edge. The smoothness of the topography immediately surrounding the foundation also suggests limited field clearing and agriculture or animal husbandry. An apple tree and at least 9 stone piles have also been recorded. Based on documentary records and oral history, it appears likely that this house belonged to John Daly.

The Fogarty Homestead consists of a stone-lined cellar approximately 6m x 3.5m in size and 2m deep. The site is heavily overgrown, and so it is unclear if additional foundation

stones are located beyond the cellar's exterior stones. As many as four associated outbuildings have also been identified, one an earthen depression, the second a stone-outlined earthen depression, and two more near the shore of the cove are stone mounds that appear structural, one of which included a cook stove plate fragment and a historic brick. Fragments of a "Record F. & Co." cast iron cook stove are found on the surface less than 20m from the cellar, which dates approximately to a range of 1882 and 1947 (see below).

One member of the Fogarty family has indicated that he has spoken with a local resident who used the Lukeman property area and possibly the house remains as a hunting blind for many years.[123] The team intends to follow up with this oral history source prior to or during future archaeological mitigation at Black Point.

Table 1: Reconnaissance findings, coordinates, and estimated significance.

Site or Feature Name	Location (UTM NAD83)	Probable Significance
Lukeman Homestead 1		
Cellar and Foundation	20 T 645784 5023703	High
Stone Pile	20 T 645803 5023678	Low
Lukeman Homestead 2		
Cellar and Foundation	20 T 645736 5023739	High
Stone Pile, could be structural	20 T 645747 5023722	Unknown
Black Point Homestead 1		
Cellar and Foundation	20 T 645638 5023758	High
Black Point Homestead 2		
Cellar and Foundation	20 T 645230 5023976	High
Earthen Depression (Outbuilding)	20 T 645247 5023988	Moderate to High
Stone Piles	20 T 645268 5023941 20 T 645246 5023933 20 T 645232 5023942 20 T 645222 5023949 20 T 645207 5023954 20 T 645277 5023969 20 T 645256 5023976	Low
Black Point Homestead 3		
Cellar and Foundation	20 T 645219 5024030	High
Stone Piles	20 T 645202 5024068 20 T 645222 5024075 20 T 645172 5024072 20 T 645153 5024076 20 T 645175 5024092 20 T 645200 5024105	Low

[123] Fogarty, Brian, personal communication 21 October 2014.

	20 T 645192 5024105 20 T 645181 5024109 20 T 645225 5024115	
Apple Tree	20 T 645232 5024019	Low
Fogarty Homestead		
Cellar	20 T 644417 5024095	High
Probable Outbuilding 1 (Stone)	20 T 644400 5024150	Unknown
Probable Outbuilding 2 (Stone)	20 T 644403 5024136	Unknown
Probable Outbuilding 3 (Earth and Stone)	20 T 644390 5024117	Unknown
Probable Outbuilding 4 (Earthen)	20 T 644377 5024102	Unknown
Cast Iron Stove	20 T 644394 5024102	Moderate to High
Apple Tree	20 T 644472 5024082	Low
Other Features (Modern)		
Collapsed Hunting Blind	20 T 645720 5023748	Low
Corduroy Road Locations	20 T 644336 5023751 20 T 644402 5023791	Low
Stone Infilling for Trail	20 T 643182 5023575	Low
Swing	20 T 645465 5024223	Low
Timber at Shoreline	20 T 645671 5023912	Low

5.0 RESULTS AND DISCUSSION

The current development plan allows for an approximate 100m buffer between the recorded sites of Lukeman 1 and Lukeman 2 as well as Black Point 1. In addition, the proponent has indicated that avoidance of the Fogarty Homestead site will be possible with modifications to the proposed facility, although the changes have not yet been made.

Therefore, of the six archaeological sites recorded during this impact assessment, only two are expected to be impacted and most likely destroyed by the proposed development: Black Point 2 and Black Point 3. The Black Point Homestead 2 is of a similar style to Lukeman 1, Lukeman 2, and Black Point 1. Therefore, in the event of its destruction, in is believed that multiple examples of comparable sites will remain intact. The same is not true of Black Point 3, which is unique in layout compared to the other 5 foundations and indeed is not a layout that the team has encountered elsewhere in the past. The cellar of this foundation is positioned outside the southern wall of the main foundation, as if added after initial construction. While both Black Point 2 and Black Point 3 should be considered valuable archaeological sites, it is argued that Black Point 3 is of particular note and merits particular attention during the mitigation phase of this project.

In response to the discovery of a cast iron stove near the Fogarty cellar bearing foundry marks “Record F. & …”, the team briefly researched the stove company in an effort to date the artifact. It was found that the mark refers to the Record Foundry & Machine Company. Charles B. Record started a foundry business in Moncton in 1857 with George Scales as his partner. This company was known as the Moncton Iron Foundry. Upon Scales’ death in 1858, Record took over the business.

Record's business was successful for a number of years until he turned the company over to the management of his son Edwin Albert Record and Robert F. Boyer in 1879. Boyer and Record made unwise contracts and ruined the company within two years. The business was sold to pay off creditors at auction in 1882 and Charles Record, who formed a joint-stock company in order to make the purchase, bought the physical foundry. This foundry was re-established as Record Foundry & Machine Company. Under Charles' direction, the company was successful and grew throughout the late nineteenth century.[124]

A newspaper add from the 1947 indicates that the Record Foundry was still in existence at that time, operating under the name "Record Stove & Furnance [*sic*] Co."[125] It is unclear when the business named changed from Record Foundry & Machine Company. Therefore the date range for the cast iron stove fragment found at Black Point with "Record F. &..." inscribed is 1882 to 1947.

It is important to emphasize that although a Mi’kmaq presence along the Chedabucto Bay coast is well-known, there were no areas of elevated potential for First Nations archaeological resources identified within the study area. An area of moderate archaeological potential was identified outside of the study area on Black Point, but it is likely that the most suitable locations for encampment or other activities can be found to the east and west of the study area, at Half Island Cove and particularly at Fox Island Main where historic maps make note of “Indian Cove” at the outlet of a sizeable freshwater stream (refer back to Figures 3.2-3 and 3.2-4).

In contrast to these locations, very little of the study area is remotely suitable for the type of First Nations activity that would result in the creation of archaeological deposits. While the cobble beaches on the east and west sides of Fogherty Head would allow access by canoe to the land and resources, the extremely high-energy nature of the beaches and lack of suitable higher, drier ground adjacent mean that even if activity resulting in archaeological site formation had taken place on the beaches, they would quickly have been destroyed by the natural environment. At the cove on the western side, there are instances of somewhat level ground elevated from the cobble beach by

[124] Pincombe 1982.

[125] Cormier 2007.

only about 2.5 metres, making them perhaps the closest to suitable encampment areas within the study area, though still less suitable than the moderate potential area identified on Black Point itself. These areas included an extensive erosional face that upon careful examination yielded no sign of archaeological materials or soils. In addition, current development plans to not encroach upon these areas, and therefore despite being within the study area these sections are beyond the impact zone.

The remainder of the study area is notably inhospitable to encampment or even to general access without roadways: the granite barrens are extremely high and rough, while the northern shore of the low-lying Fogherty Head is dominated by sharp bedrock outcroppings that would be treacherous for canoe or boat access even on a calm day. It is possible that limited resource exploitation may have taken place, such as hunting or berry-picking at the barachois where cranberries were noted. None of these activities, however, would result in archaeological deposits of any note.

Addressing previous recommendations made in 2011, it has been determined that the historic Canso Road cannot be traced across the barrens due to their rough nature and extensive overgrowth, and it is unfortunately unclear at what point the road sloped off the barrens and down to the Daly and Lukeman Homesteads below. It is also unclear if anything more than a rough trail ever connected the Fogarty Homestead to this road, which was most likely efficiently accessed from the water rather than overland. The Ambrose Church map does seem to indicate that the Canso Road did somehow reach the lowland, however, in order to pass in proximity to M. Daly and Mrs. Lukeman's homes (refer back to Figure 3.2-3). In these areas, small sections of what appeared to be historic road were noted, but given that modern ATV trails appear to obscure and criss-cross these areas, they have not been formally marked due to doubtful identification.

Despite not being able to confirm a single continuous Old Canso Road, the team believes that they have identified all visible historic resources in proximity to the road, given that no signs of habitation can be found on the barrens and that the distinction between cultural and non-cultural topography on the lowland was found to be astonishingly distinct. While it is arguably possible that heavy deadfall and vegetation growth could have obscured additional features, a contingency plan has been put in place in the unlikely event that additional heritage resources are encountered during project construction (see section 6.0 below).

The 2011 impact assessment also recommended exploration of the Fogarty Lake outlet as well as the barachois on the eastern side of Fogherty Head. It has been found that the Fogarty Lake outlet is not only extremely small, but also that it appears to empty into the ocean from the top of a steep and inaccessible bedrock escarpment, visible on the right-hand side of Plate 28. The barachois, although of fresh water and perhaps inviting for visitation from the high-energy beach, grades upwards into marshy and very densely vegetated wetland, difficult to travel through for any reason. The problems of

archaeological deposits on the high-energy beach adjacent to the barachois have also been enumerated above.

6.0 RECOMMENDATIONS AND CONCLUSIONS

Potential construction impacts arise from removal of large quantities of fill and native soil, potentially unearthing, damaging, or destroying archaeological resources. In this case, six historic period archaeological sites related to early settlement have been identified, of which two are expected to be impacted by the development. The potential for First Nations archaeological resources has been determined to be low, though contingency measures will be in place to deal with the unlikely discovery of such resources. DM&A has completed an Archaeological and Heritage Resources Management Plan for the proponent, included here as Appendix C.

It is recommended that the three foundations at the east end of the property (the two on the former Lukeman property, and the third just beyond the western boundary on the former Crown parcel referred to as Black Point 1), as well as the foundation and four outbuildings on the former Fogarty property, be avoided by construction activities. It is recommended that these features be well flagged by an archaeologist and a 100 meter buffer be established around the features to ensure that their locations and boundaries are well-known and they are not disturbed during construction. It is also understood and recommended that the headland on the northwest end of the former Fogarty property that may be the location of reported historic burials will be avoided by construction. It is recommended that this area also be flagged and that the buffer zones for these resources be surveyed for future reference. The headland is approximately ten by 25 metres, though a more firm outline can be established on the ground during flagging based upon topography. It is recommended that the flagging be removed after construction so as to avoid drawing unwanted attention to these features in order to avoid looting or damage to the sites.

Mitigation of Black Point Homestead 2 and Black Point Homestead 3, which cannot be easily avoided by the development, is recommended prior to commencement of the quarry infrastructure construction. The testing phase should therefore consist of a formal testing regiment on both of the two sites to be impacted. Prior to excavation, the sites should be cleared of brush, branches, moss and other vegetation, etc. by the archaeological team to allow for detailed surface documentation. Two intersecting lines of formal 0.50 m by 0.50 m excavation units at 1 meter intervals are recommended through the center of both foundations. This is intended to establish a sense of the buildings' interior and exterior remains (both structural and artifactual), layout, stratigraphy and site formation, as well as site integrity. Formal testing is also recommended for the associated outbuilding in order to determine function and site layout. This program of testing will aid in establishing an assessment of site significance which will, in turn, allow the archaeologist to determine the best course for further

mitigation, if necessary. At this time it is anticipated that some additional excavation following testing may be necessary at Black Point 3, which is unique in layout at Fogherty Head.

In the event that any archaeological material is encountered during ground disturbance activities and an archaeologist is not already present on the site, all activity should cease and the Coordinator of Special Places, Sean Weseloh-McKeane (902-424-6475) should be contacted immediately to determine a suitable method of mitigation.

7.0 REFERENCES CITED

Church, Ambrose F. 1876. *Topographical Township Map of Guysborough County*. Halifax: A. F. Church & Co.

Confederacy of Mainland Mi'kmaq. 2007. *Kekina'muek: Learning about the Mi'kmaq of Nova Scotia*. Truro: Eastern Woodland Publishing.

Cormier, Aline. 2007. "Moncton Business Around 1947." *Acadian Roots.* Accessed October 17 2014. Available online <http://www.acadian-roots.com/moncton.html>

Davis, Derek and Sue Browne. 1996. *Natural History of Nova Scotia, Volume II: Theme Regions*. Halifax: Nimbus Publishing and Nova Scotia Museum.

Dawson, Joan. 1988. *The Mapmaker's Eye: Nova Scotia Through Early Maps.* Halifax: Nimbus Publishing & The Nova Scotia Museum.

Department of Lands and Forests. 1950. Crown Land Index Sheet No. 112: Guysborough and Richmond Counties.

Faribault, Eugene R. 1893. Province of Nova Scotia (Guysborough County," Whitehaven Sheet No. 26. Geological Survey of Canada, No. 380.

Fergusson, C. Bruce, ed. 1967. *Place Names and Places of Nova Scotia*. Halifax: Public Archives of Nova Scotia.

Fogarty, Frank. 2014. "Fogarty Family Environmental Impact Statement Response, Proposed Black Point Quarry Project, CEAA File # 80064." Manuscript on file with and supplied by Frank Fogarty.

Hart, H.C. 1877. History of the County of Guysborough. Belleville Ont.: Mika Publishing. Reprinted 1975.

C 1340-2052

Hartshorne, William. 1883. “Plan of lands on the south side of Chedabucto Bay shewing the Connections between the different granted lots and also the Connections between the Lots granted on the New Road to Cape Canso and Connections with White Head land, made in Nov. 1883.” Crown Land Information Management Centre, Guysborough Portfolio #37.

Johnston, A.A. 1960. *A History of the Catholic Church in Eastern Nova Scotia, Vols. I & 2.* Antigonish: St. Francis Xavier University Press.

National Air Photo Library. 1943. Flight path A6981, #62.

National Air Photo Library. 1954. Flight path NS A14198, #157.

Pincombe, C. Alexander. 1982. "Record, Charles B." in *Dictionary of Canadian Biography,* Volume 11. University of Toronto/Universite Laval. Accessed October 17, 2014. Available online <http://www.biographi.ca/en/bio/record_charles_b_11E.html>

Rand, Silas T. 1875. *First Reading Book in the Micmac Language: Comprising the Micmac Numerals, and the Names of the Different Kinds of Beasts, Birds, Fishes, Trees, &c. of the Maritime Provinces of Canada. Also, Some of the Indian Names of Places, and Many Familiar Words and Phrases, Translated Literally into English.* Halifax: Nova Scotia Printing Company.

PLATES

C 1340-2054

Plate 1: A small stream crossing marks an abrupt change from the traceable Old Canso Road to a rougher ATV trail. Looking west.

C 1340-2055

Plate 2: A short section of corduroy road along a rough and overgrown ATV trail within the study area. Looking east.

C 1340-2056

Plate 3: Loose stone piled across a small gap in the bedrock where a tiny stream flows down from the barrens. Looking east.

C 1340-2057

Plate 4: A rough spruce rail ATV bridge survives under a partially fallen spruce tree. Looking east.

Plate 5: Bedrock exposed by ATV action on the barrens, looking south.

C 1340-2058

Plate 6: The rocky shore of Fogherty Head, looking west toward Half Island Cove.

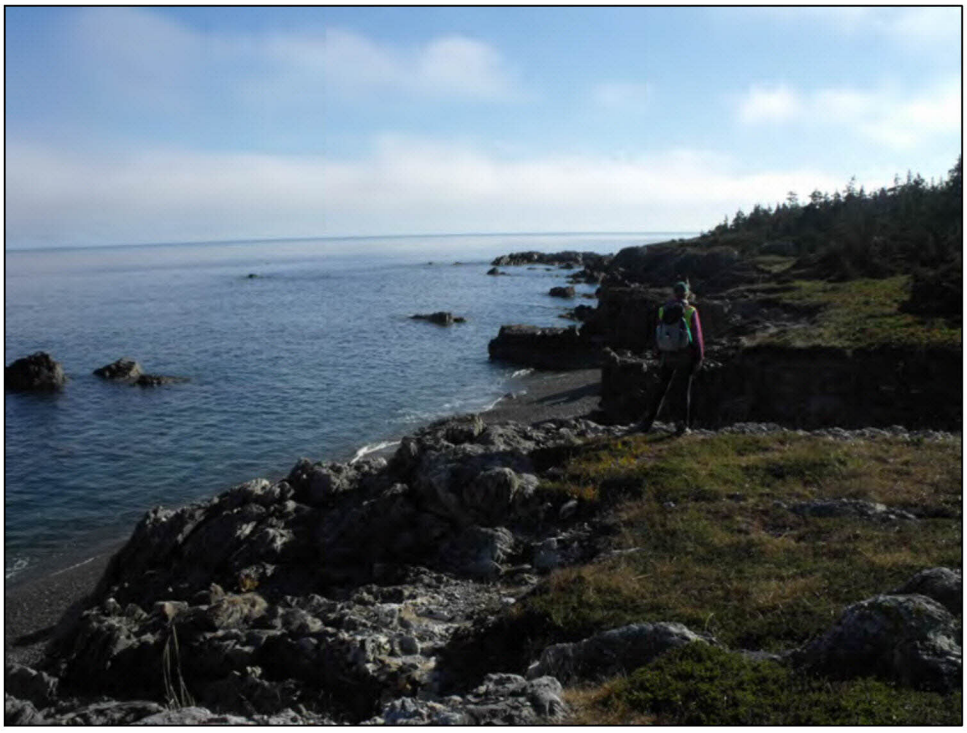


Plate 7: Courtney Glen stands on a rocky precipice overlooking a 2m drop to the cobble beach below, visible in the distance. Looking east.

C 1340-2059

Plate 8: A steep cobble beach tucked against bedrock outcroppings, looking east.

Plate 9: A metal artifact noted on the cobble beach at Fogherty Head. The object was not collected.

C 1340-2060

Plate 10: A small cobbled cove appears to offer an inviting access point from the water. However, wet soil and heavy deadfall inside the treeline belies this impression.

Plate 11: A broad cove on the northwest side of Black Point, looking southwest towards the study area.

C 1340-2061

Plate 12: Modern beer cans show that this cove, located just outside the study area, is attractive to modern visitors.

Plate 13: Courtney Glen examines the upper edge of the beach adjacent to a level area of ground. On Crown land at Black Point, looking south.

C 1340-2062

Plate 14: A swing near a disused ATV trail on the southeast side of Black Point, looking north.

Plate 15: The broad eastern cove on the historic Lukeman side of the study area, looking north to Black Point.

C 1340-2063

Plate 16: A displaced Crown land marker on the cobble beach, looking east.

Plate 17: The barachois and wetland behind it, looking southwest towards the higher granite barrens.

C 1340-2064

Plate 18: The barachois, showing the intrusion of the cobble beach on the left or east side. Looking south.

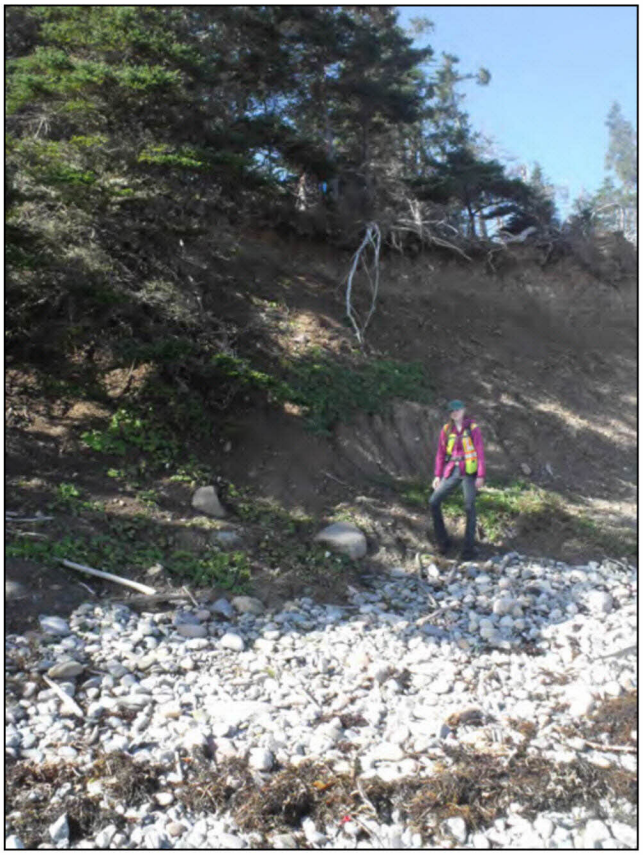


Plate 19: A tall erosional face in proximity to the historic Lukeman property, looking west.

C 1340-2065

Plate 20: A weathered square timber protrudes from the erosional face along the eastern cove, looking south.

Plate 21: The Lukeman Homestead 1 foundation, looking southwest.

C 1340-2066

Plate 22: The Lukeman Homestead 2 foundation, looking northwest.

Plate 23: The third foundation to be identified, Black Point Homestead 1, looking southeast.

C 1340-2067

Plate 24: A fallen hunting blind near the second foundation, looking southwest.

C 1340-2068

Plate 25: Intact stone within the fourth foundation, Black Point Homestead 2, looking southeast.

Plate 26: An earthen depression indicates a probable outbuilding near the fourth foundation, looking west.

Plate 27: The fifth foundation (Black Point 3), looking south into the cellar. Note the distinct metal fragment that was also visible in Frank Fogarty's photograph (Blue) (refer back to Figure 3.2-5).

Plate 28: The cobble beach on the western side of Fogherty Head, looking southwest.

C 1340-2070

Plate 29: The open meadow on the historic Fogarty side of the property, looking south.

Plate 30: The first of two stone pads located in the meadow, looking west.

Plate 31: Looking west down the meadow towards the two stone features (blue).

Plate 32: A cast iron stove fragment and a historic brick fragment on the first of the two stone features.

Plate 33: Courtney Glen stands inside the heavily overgrown stone cellar, looking east.

Plate 34: The stone outline of a probable outbuilding, looking west.

C 1340-2073

Plate 35: An earthen depression in the side of a slope suggests another outbuilding, looking northeast.

Plate 36: Fragments of a cast iron stove near the Fogarty foundation, looking west.

C 1340-2074

Plate 37: The smooth topography of this headland suggests it may have been an appropriate location for family burials; digging graves would have been easier than the rocky land all around, while the scenic look off towards Half Island Cove is the type of view that is found at many historic cemeteries.

APPENDIX A: HERITAGE RESEARCH PERMIT

C 1340-2076

NOVA SCOTIA

Heritage Research Permit (Archaeology)

Special Places Protection Act 1989

(Original becomes Permit when approved by Communities, Culture and Heritage)

Office Use Only
Permit Number:
A2014NS099

Greyed out fields will be made publically available. Please choose your project name accordingly

Surname de Boer	First Name Laura

Project Name Black Point Quarry

Name of Organization Davis MacIntyre & Associates Limited

Representing (if applicable)

Permit Start Date 1 October 2014	Permit End Date 31 December 2014

General Location: Fogerty Head, Guysborough County

Specific Location: *(cite Borden numbers and UTM designations where appropriate and as described separately in accordance with the attached Project Description. Please refer to the appropriate Archaeological Heritage Research Permit Guidelines for the appropriate Project Description format)*

20 T 644005.711 m E 5022431.120 m N (southwest corner)

Permit Category:
Please choose one

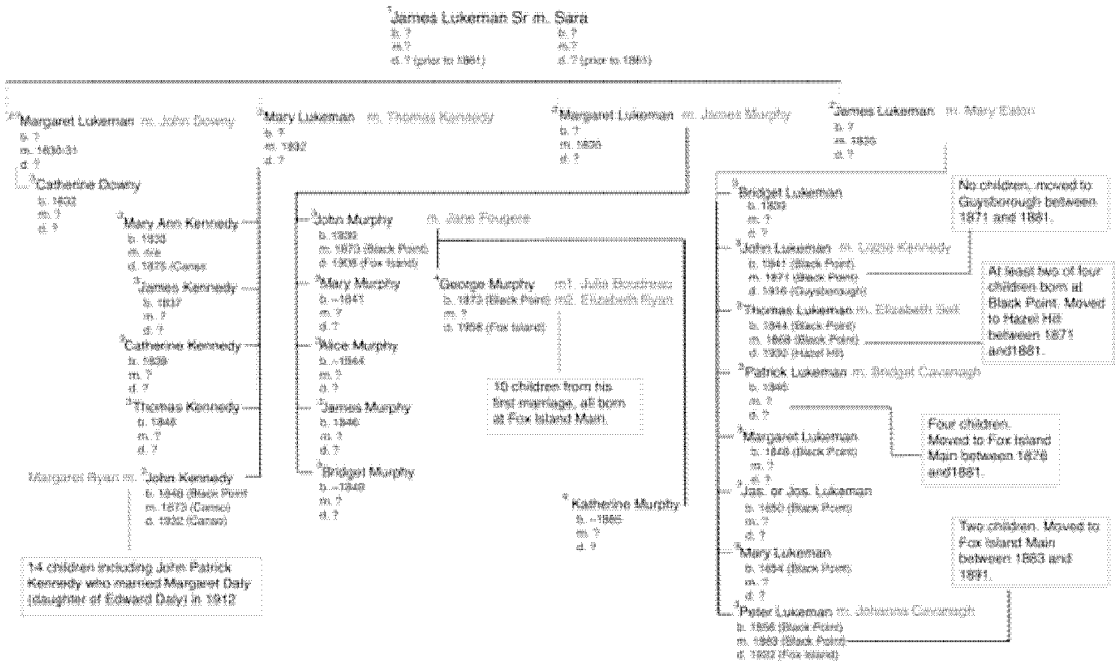
- ☐ Category A – Archaeological Reconnaissance
- ☐ Category B – Archaeological Research
- ☑ Category C – Archaeological Resource Impact Assessment
- ☑ I certify that I am familiar with the provisions of the *Special Places Protection Act* of Nova Scotia and that I have read, understand and will abide by the terms and conditions listed in the Heritage Research Permit Guidelines for the above noted category.

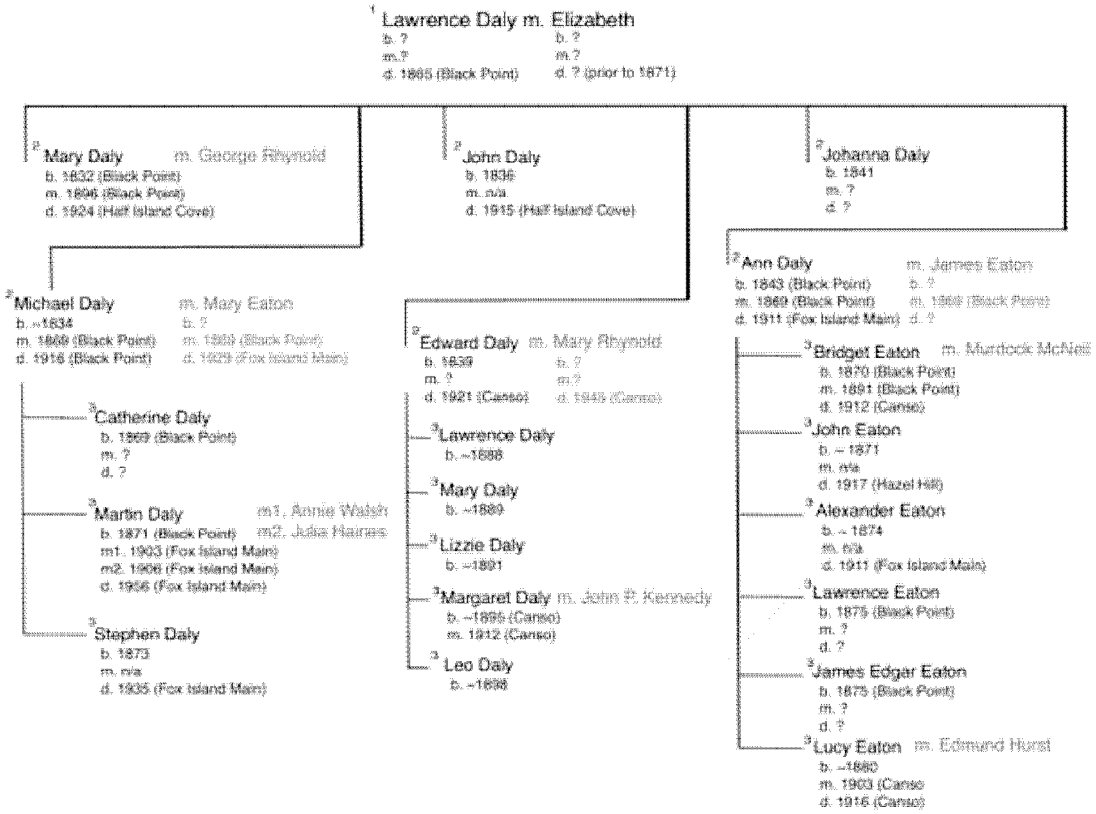
Signature of applicant Anla MacIntyre for Laura de Boer	Date 23 September 2014
Approved by Executive Director	Date Sept 29-14

C 1340-2077

APPENDIX B: LUKEMAN AND DALY FAMILY TREES

C 1340-2078


1James Lukeman Sr m. Sara
b. ?
m.?
d. ? (prior to 1861)
b. ?
m.?
d. ? (prior to 1861)
2Margaret Lukeman m. John Dowey
b. ?
m. 1830-31
d. ?
2Mary Lukeman m. Thomas Kennedy
b. ?
m. 1832
d. ?
2Margaret Lukeman m. James Murphy
b. ?
m. 1835
d. ?
2James Lukeman m. Mary Eaton
b. ?
m. 1835
d. ?
3Catherine Dowey
b. 1832
m. ?
d. ?
3Mary Ann Kennedy
b. 1833
m. n/a
d. 1875 (Canso)
3James Kennedy
b. 1837
m. ?
d. ?
3Catherine Kennedy
b. 1839
m. ?
d. ?
3Thomas Kennedy
b. 1846
m. ?
d. ?
Margaret Ryan m. 3John Kennedy
b. 1848 (Black Point)
m. 1873 (Canso)
d. 1932 (Canso)
14 children including John Patrick Kennedy who married Margaret Daly (daughter of Edward Daly) in 1912
3John Murphy m. Jane Foulgare
b. 1832
m. 1870 (Black Point)
d. 1908 (Fox Island)
3Mary Murphy
b. ~1841
m. ?
d. ?
3Alice Murphy
b. ~1844
m. ?
d. ?
3James Murphy
b. 1846
m. ?
d. ?
3Bridget Murphy
b. ~1848
m. ?
d. ?
4George Murphy m1. Julia Boudreau m2. Elizabeth Ryan
b. 1873 (Black Point)
m. ?
d. 1958 (Fox Island)
10 children from his first marriage, all born at Fox Island Main.
4Katherine Murphy
b. ~1866
m. ?
d. ?
3Bridget Lukeman
b. 1839
m. ?
d. ?
No children, moved to Guysborough between 1871 and 1881.
3John Lukeman m. Lizzie Kennedy
b. 1841 (Black Point)
m. 1871 (Black Point)
d. 1916 (Guysborough)
At least two of four children born at Black Point. Moved to Hazel Hill between 1871 and1881.
3Thomas Lukeman m. Elizabeth Bell
b. 1844 (Black Point)
m. 1868 (Black Point)
d. 1930 (Hazel Hill)
3Patrick Lukeman m. Bridget Cavanagh
b. 1846
m. ?
d. ?
Four children. Moved to Fox Island Main between 1878 and1881.
3Margaret Lukeman
b. 1848 (Black Point)
m. ?
d. ?
3Jas. or Jos. Lukeman
b. 1850 (Black Point)
m. ?
d. ?
Two children. Moved to Fox Island Main between 1883 and 1891.
3Mary Lukeman
b. 1854 (Black Point)
m. ?
d. ?
3Peter Lukeman m. Johanna Cavanagh
b. 1856 (Black Point)
m. 1883 (Black Point)
d. 1932 (Fox Island)


1Lawrence Daly m. Elizabeth
b. ?
m.?
d. 1865 (Black Point)
b. ?
m.?
d. ? (prior to 1871)
2Mary Daly m. George Rhynold
b. 1832 (Black Point)
m. 1856 (Black Point)
d. 1924 (Half Island Cove)
2John Daly
b. 1836
m. n/a
d. 1915 (Half Island Cove)
2Johanna Daly
b. 1841
m. ?
d. ?
2Michael Daly m. Mary Eaton
b. ~1834
m. 1869 (Black Point)
d. 1916 (Black Point)
b. ?
m. 1869 (Black Point)
d. 1929 (Fox Island Main)
3Catherine Daly
b. 1869 (Black Point)
m. ?
d. ?
3Martin Daly m1. Annie Walsh m2. Julia Haines
b. 1871 (Black Point)
m1. 1903 (Fox Island Main)
m2. 1906 (Fox Island Main)
d. 1956 (Fox Island Main)
3Stephen Daly
b. 1873
m. n/a
d. 1935 (Fox Island Main)
2Edward Daly m. Mary Rhynold
b. 1839
m. ?
d. 1921 (Canso)
b. ?
m.?
d. 1949 (Canso)
3Lawrence Daly
b. ~1888
3Mary Daly
b. ~1889
3Lizzie Daly
b. ~1891
3Margaret Daly m. John P. Kennedy
b. ~1895 (Canso)
m. 1912 (Canso)
3Leo Daly
b. ~1898
2Ann Daly m. James Eaton
b. 1843 (Black Point)
m. 1869 (Black Point)
d. 1911 (Fox Island Main)
b. ?
m. 1869 (Black Point)
d. ?
3Bridget Eaton m. Murdock McNeil
b. 1870 (Black Point)
m. 1891 (Black Point)
d. 1912 (Canso)
3John Eaton
b. ~ 1871
m. n/a
d. 1917 (Hazel Hill)
3Alexander Eaton
b. ~ 1874
m. n/a
d. 1911 (Fox Island Main)
3Lawrence Eaton
b. 1875 (Black Point)
m. ?
d. ?
3James Edgar Eaton
b. 1875 (Black Point)
m. ?
d. ?
3Lucy Eaton m. Edmund Hurst
b. ~1880
m. 1903 (Canso
d. 1916 (Canso)

C 1340-2079

APPENDIX C:

ARCHAEOLOGICAL & HERITAGE RESOURCES MANAGEMENT PLAN

Black Point Quarry

C 1340-2080

ARCHAEOLOGICAL & HERITAGE RESOURCES MANAGEMENT PLAN

Black Point Quarry

Prepared by

DAVIS MACINTYRE & ASSOCIATES
ARCHAEOLOGICAL CONSULTANTS

15 October 2014

Submitted to:
SLR Consulting (Canada) Ltd.

C 1340-2081

ARCHAEOLOGICAL & HERITAGE RESOURCES MANAGEMENT PLAN

Black Point Quarry

INTRODUCTION

This component plan is designed to identify, manage, mitigate and protect historic and First Nations archaeological resources potentially encountered in advance of and during construction of the Black Point Quarry in Guysborough County, Nova Scotia. This plan focuses on the requirements for construction monitoring and procedures to protect archaeological sites in construction areas.

In 2014, Davis MacIntyre & Associates Limited, under contract to SLR Consulting (Canada) Ltd., completed an archaeological assessment under Heritage Research Permit A2014NS099. This study concluded that there were a number of historic period archaeological resources including six house foundations and related outbuildings and stone field clearings, and four possible buildings related to the local fishery in the study area. Oral history also indicates that previous generations of the Fogarty family may have buried their deceased on a wooded headland above the water, though no physical evidence of this activity could be discerned during the field reconnaissance. The following plan includes general recommendations for the management and protection of archaeological resources, as per the standards of the Special Places Protection Act (*R.S., c.438, s.1*), as well as site-specific recommendations for known and suspected archaeological resources within the study area.

POTENTIAL CONSTRUCTION IMPACTS

Potential construction impacts arise from removal of large quantities of fill and native soil, potentially unearthing, damaging, or destroying archaeological resources. In this case, a number of historic period archaeological resources related to early settlement may be impacted by construction. The potential for First Nations archaeological resources has been determined to be low, though contingency measures should be in place to deal with the unlikely discovery of such resources.

Contingency measures will be in place to deal with any unexpected impacts to heritage resources which may be encountered during construction activities and which currently cannot be anticipated. Specific management initiatives are also recommended to deal with those known archaeological and heritage resources encountered during the 2014 reconnaissance.

C 1340-2082

REGULATORY REQUIREMENTS

The Special Places Protection Act provides the Nova Scotia Department of Communities, Culture and Heritage (CCH) with a mandate to protect important archaeological, historical and palaeontological sites and remains, both on land and underwater. The CCH administers and enforces the Act by overseeing the protection of all sites and remains in the Province, managing the Heritage Research Permit system, and designating outstanding heritage sites as "Protected Sites."

The *Archaeological & Heritage Resources Management Plan* includes details of site-specific management procedures for known archaeological resources as well as monitoring procedures and locations, mitigation measures, and protocols to be implemented in the event of the discovery of an archaeological site or artifact. The Plan should be implemented with input from the appropriate development personnel and regulatory bodies and the Culture and Heritage Development Division of the Nova Scotia Department of Communities, Culture and Heritage.

ENVIRONMENTAL MANAGEMENT

Pre-Construction Education and Awareness Training

Prior to construction, contractors should receive training from the Project Archaeologist in how to identify and protect archaeological resources that may be discovered. The pre-construction training will include some limited site recognition training for the types of archaeological sites that may occur in the construction areas. In general, indicators of a pre-contact archaeological site that may be encountered in construction areas include:

- Artifacts, such as flaked stone knives and projectiles, ground stone woodworking tools, hammer stones, and loose pieces of flaked stone, along with a variety of bone and antler tools and earthenware ceramics;

- Middens, which are the remains of ancient living areas identified by:
    - Shells and shell fragments;
    - Fish, bird and mammal bones;
    - Fire-altered rock;
    - Ash and charcoal; and,
    - Artifacts and cultural features (hearths or pits);

- Burial places, which are indicated by the presence of light brown to dark brown bones either whole or in fragments and may include certain types of artifacts or soil indicators and red ochre, calcined bone/cremains, *et cetera.*

However, it is unlikely that First Nations archaeological artifacts or features will be encountered in this context. It is more likely that historic period resources will be encountered which may include:

- Artifacts, tools, bottles
- Historical refuse such as:
    - Bottle and windowpane glass;
    - Tin cans;
    - Broken ceramics and crockery;
    - Broken toys;
    - Farming and fishing implements:
    - Electrical, plumbing, and heating fixtures;
    - Ash, charcoal;
    - Broken bricks and mortar; and
    - Wood

Dark soil that appears to be greasy in texture or contains ash, bone, charcoal, coal, shell fragments, and cultural materials like those listed above may indicate the potential of an archaeological site. Other visible signs can include linear or circular stone structures which may be indicative of foundations, wells, privies (outhouses), or outbuildings.

Archaeological Monitoring

The Project Archaeologist, or qualified representative, should monitor excavation works to ensure the protection of potential buried archaeological resources during construction. Monitoring should be conducted in those areas where intact archaeological resources are known or suspected to exist. This includes, but is not limited to, grading, tree removal (grubbing), and excavation.

Managing Archaeological Discoveries

During construction, archaeological sites may be managed in a variety of ways, including avoidance, salvage or emergency excavation and the use of temporary or long-term site protection measures.

If contractors make an archaeological discovery at a construction site they must stop work and contact the Project Archaeologist. The Project Archaeologist will determine an appropriate exclusion zone which will be no less than 30 m in diameter around the find and:

- Mark the 30 m exclusion zone around the discovery with snow fence or flagging, and install a sturdy barrier fence;
- Implement necessary slope stabilization, drainage, erosion and sediment control measures to protect the discovery.

The preferred long-term approach to managing archaeological discoveries in the construction area is avoidance. If avoidance is not feasible, then salvage or emergency excavations may be necessary. These operations will require a Heritage Research Permit (HRP), which are issued by CCH under the *Special Places Protection Act*. It is the

C 1340-2084

responsibility of the Project Archaeologist to ensure that suitable methodologies to cover the full range of circumstances in the case of emergency measures is in place and covered by the permit. These methodologies will be established in consultation with CCH. In the case of unexpected discoveries and emergency work, CCH and the client will be notified as to the location and scope of emergency measures. Any salvage or emergency excavations will be conducted by the Project Archaeologist. All onsite archaeological management strategies will be designed and supervised by the Project Archaeologist. Contractors must ensure that construction personnel and sub-contractors do not collect archaeological remains. However, if an isolated artifact is found and may be destroyed by not immediately removing it from the working area, then personnel should follow these steps:

- Collect the artifact and mark its location with flagging, a wooden stake or some other visible marker or, where possible, notify the Project Archaeologist immediately;
- Inform the Site Supervisor that an artifact was found; and,
- Establish a 30 m exclusion zone around the find.

The Project Archaeologist must then conduct a site inspection and develop the necessary mitigation plan. In the unlikely event that the finds are determined to, or may be, of First Nation origin, this plan must be coordinated with CCH and will be developed in consultation with the Archaeology Research Division (ARD) of the KMKNO. Again, avoidance is the recommended method of mitigation for any archaeological resources. If avoidance is not possible, it is recommended that the feature be recorded in detail by a qualified archaeologist prior to any disturbance. It is also recommended that any materials which assist in assigning a date, and further determining the significance of the resource, be collected for curation. In the case of small midden deposits a sampling strategy for collection of artifacts will be adopted with the purpose of determining a mean date for the deposit. If a significant intact archaeological feature is encountered (i.e. a foundation, well, privy, or other outbuilding), a strategy of mitigation will be adopted. Mitigation will focus on detailed recording and excavation and all cultural material will be collected with the aim of providing an intact record of the archaeological feature/site, recognizing that the feature/site is a non-renewable resource. Depending on the nature of the material that is brought up, archaeological conservation by a certified conservator may be required. In the interim, the material is to be stabilized and secured by the Project Archaeologist in consultation with certified conservators.

Site-Specific Measures for the Management of Known Archaeological Resources

Former Lukeman and Fogarty properties:

It is recommended that the three foundations at the east end of the property (the two on the former Lukeman property, and the third just beyond the western boundary on the former Crown parcel), as well as the foundation and four outbuildings on the former Fogarty property are currently expected to be avoided by construction activities. It is recommended that these features be well flagged by the Project Archaeologist and a 100 meter buffer be established around the features to ensure that their locations and

boundaries are well-known and they are not disturbed during construction. It is also believed that the headland on the northwest end of the former Fogarty property which may be the location of reported historic burials will be avoided by construction. It is recommended that this area also be flagged and that the buffer zones for these resources be surveyed for future reference. It is recommended that the flagging be removed after construction so as to avoid drawing unwanted attention to these features in order to avoid looting or damage to the sites.

Former Daly Homesteads:
The two foundations believed to be related to occupation by the Daly family are expected to be impacted by construction and, therefore, further assessment of these features is recommended. The southern of the two foundations is similar in character to the foundations on the former Lukeman and Fogarty properties which are expected to be avoided. Therefore, it is expected that other representative archaeological features will remain. The northern foundation, however, is unique. It is recommended that both sites be subjected to formal testing which will require clearing the sites of brush, branches, moss and other vegetation in order to complete a detailed survey and documentation of the features. Two intersecting lines of formal 0.50 m by 0.50 m excavation units at 1 meter intervals are recommended through the center of both foundations. This is intended to establish a sense of the buildings interior and exterior remains (both structural and artifactual), layout, stratigraphy and site formation, as well as site integrity. Formal testing is also recommended for the associated outbuilding in order to determine function and site layout. This program of testing will aid in establishing an assessment of site significance which will, in turn, allow the archaeologist to determine the best course for further mitigation, if necessary.

It is necessary that a more convenient and expedient access route to these sites be established before further mitigation can be conducted. This may require that, preferably, the access road at the east end of the property be built or that transportation be supplied via boat and ATV before archaeologists can transport excavation equipment to the sites on the former Daly property. The latter option will require a substantial amount of travel time in and out of the sites each day.

Discovery of Human Remains

In the unlikely event that human remains or suspected human remains are discovered in working areas the contractor must:

- Immediately stop construction and notify the Project Archaeologist and Site Supervisor;
- Cover exposed bone with plastic sheeting, blanket or some other clean cover;
- Do not cover any finds with fill;
- Ensure that site security is immediately established to carry through until the nature of remains and/or location are determined.

The Project Archaeologist will then notify the appropriate people (these may include the local detachment of RCMP and the Office of the Medical Examiner, CCH, and representatives of KMKNO). If the remains are confirmed to be of an archaeological nature then negotiations will follow to determine how the remains will be handled.

Note that if remains are discovered during construction excavations, in the box of a truck or in an excavation bucket for example, then the excavated material must be carefully placed on the ground, in a secure area for inspection by the Project Archaeologist. If the detected material is determined or suspected to be human remains, the entire contents of the bucket must be sifted through 1/4 inch mesh, as per standard archaeological practice. Further excavation at the site of discovery must cease immediately until the Project Archaeologist can determine if additional remains exist at the site.

Discovery of Human Remains that are of Modern Origin

If the remains are human, and are determined to be of recent origin, the RCMP and Office of the Medical Examiner will assume responsibility for the remains.

Guidelines for the Archaeological Handling and Treatment of Human Remains

Onsite management strategies for the discovery of human remains will require consultation with CCH and other representatives (Mi'kmaq, Afro-Canadian community, etc), as appropriate. One of the following two strategies may be followed:

- The remains are to be left undisturbed in their original location where possible. If additional remains are suspected to be present, a program of delineation is required through archaeological techniques if the project is expected to further impact on the area. Once delineated, an impact-exclusion zone can be established and partial project redesign may be necessary.
- If the remains must be removed or have been disturbed, salvage or emergency excavation to remove the remains for reburial by the local community or First Nations (depending upon the origin of the remains) may be required.

The following is a list of guidelines that must be adhered to by all archaeologists responsible for the management, handling, and treatment of human remains, whether they are of Euro-Canadian or First Nations origin:

- Any natural elements of the human body including bones (whether partial or complete), teeth (partial or complete), hair, and nails are to be treated as human remains;
- Rubber, latex, or cotton gloves must be worn when handling human remains, including at initial discovery in the soil or screen;
- Remains or suspected remains must be packaged in acid-free paper and placed in a secure container with full provenience noted.
- Once the remains or suspected remains have been removed from the site (if

necessary) they are to be carefully stored in a locked laboratory or office until plans for reburial or storage can be made.

It is important to note that human remains are not accepted for curation by the Nova Scotia Museum as they do not constitute archaeological or artifactual remains.

Human Remains Discovered that are not of Modern Origin and First Nation

In the case of First Nations human remains, bodies may have been cremated and consequently, skeletal material is typically more fragmented and modified by the burning process. These *cremains* may be more difficult to identify by the untrained eye. First Nations burials may also be identifiable by the presence of red ochre, a naturally-occurring mineral pigment that was often used in First Nations ritual burial practices. The following are a list of guidelines that must be adhered to by all archaeologists responsible for the management, handling, and treatment of human remains if they are suspected to be of First Nations origin:

- Representatives of KMKNO are to be contacted to arrange for a culturally-appropriate container as well as traditional medicines and herbs to be supplied for the storage of the remains. In the interim, the remains must be stored in the same manner as those not suspected to be of First Nations origin.
- Representatives of KMKNO are to be contacted immediately to perform the necessary ceremonial rites (i.e. smudging of the site, the remains, the container for the remains and the person responsible for care of the remains, and ensure a culturally appropriate delegate to care for the remains; as well as any other ceremonial rites First Nations representatives may deem appropriate).
- Immediate and continual consultation with KMKNO will be established regarding their treatment, handling, storage, and ultimate destination which may differ from the measures applied to non-First Nations individuals' remains.
- Any testing of the material, where the remains are determined or suspected to be of First Nations' individuals' origin must be planned with the support and approval of the appropriate First Nation representative, such as KMKNO on behalf of the Mi'kmaq of Nova Scotia.

APPENDIX M
Consultation and Engagement References

Attachment 1- Summer 2014 / Winter 2015 Newsletters

Attachment 2 – CLC Terms of Reference

Attachment 3 – Vulcan Company Presentation

Attachment 4 – Participants in Proponent Outreach Events.

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

Attachment 1- Summer 2014/Winter 2015 Newsletters

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

BLACK POINT AGGREGATE QUARRY PROJECT
SUMMER 2014 NEWSLETTER

Welcome

We are pleased to share the first edition of the Black Point Aggregate Quarry Project newsletter. The newsletter will provide you with accurate and timely information about the project and key milestones. We plan to publish newsletters on a semi-annual basis, or when specific project developments warrant additional communications.

Have a great summer,
The Black Point Project Team

PROJECT OVERVIEW

The proposed Black Point Aggregate Quarry Project consists of the development and operation of a construction aggregate quarry and marine terminal in Guysborough, Nova Scotia. The project is being developed by Morien Resources Corp., a Nova Scotia-based mineral exploration and development company, and Vulcan Materials Company, a leading producer of construction aggregates in the United States.

Project lifespan:	50+ years
Quarry size:	180 hectares of a 354 hectare property
Estimated volume:	400+ million tonnes of high quality aggregate
Employment:	120-150 direct and indirect jobs during peak production and 50-60 full time employees at operation
Capital expenditure:	$80-$110 million

ENVIRONMENTAL ASSESSMENT BEGINS

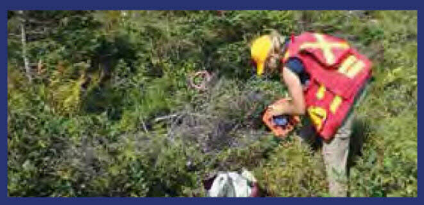
The environmental assessment process for the Black Point Aggregate Quarry Project is underway. On February 28, 2014, the Project Description was formally submitted to the Canadian Environmental Assessment Agency (CEAA). Following this submission, a 30 day public comment period commenced, and on April 28, CEAA provided the Draft Guidelines for preparation of an Environment Impact Statement (EIS) report.

On June 9, CEAA and Nova Scotia Environment (NSE) issued the final EIS Guidelines, which are available for review on the CEAA website (https://www.ceaa-acee.gc.ca search: Black Point 80064). The guidelines describe the information and studies that will be needed to support the environmental assessment report.

In support of the EIS preparation, the project team has met with a number of specialists at NSE and the Department of Fisheries and Oceans (DFO) to understand their expectations with respect to wetlands, groundwater and the marine environment. Similar meetings are planned with fishermen, tourism operators and members of the Community Liaison Committee to gain further understanding of the public's expectations.

The project team has also been meeting with First Nation communities and organizations to learn more about First Nation interests in the project, as well as how First Nation engagement will take place during the environmental assessment process. This includes meeting with CEAA, NSE, and the Mi'kmaq Rights Initiative (KMK) on May 27, and with the Shubenacadie Band and CEAA on June 17.

ON-SITE ACTIVITY



Representatives of Morien and Vulcan expect to be on the site more frequently throughout the summer to continue baseline environmental studies. There has been no clearing or construction activity on the site.

On June 18, we toured the site with representatives from the CEAA, NSE, DFO, KMK, and the Confederacy of Mainland Mi'kmaq (CMM). The visitors viewed the site from the coast to the east and west of the property, and then walked to the highest elevation on the site, which provides views of Chedabucto Bay, Fogherty Lake and Lookout Hill.

We are currently advancing some of the baseline studies that will support the environmental assessment. At this early stage in the project, we're focused on collecting data and information about the site (both terrestrial and marine components), while at the same time we're identifying issues of community concern and responding to questions raised about the project.

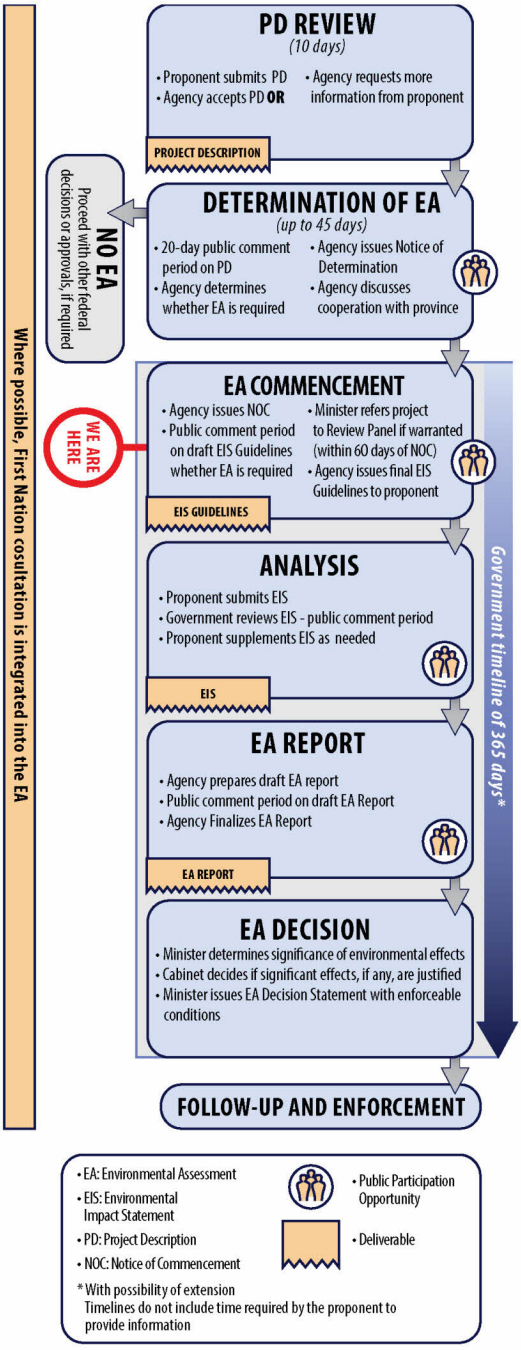
For more information on the Black Point Aggregate Quarry and Marine Terminal and the environmental assessment please visit www.MorienRes.com/Black-Point.

Morien Resources Corp.

Vulcan Materials Company

BLACK POINT AGGREGATE QUARRY PROJECT
SUMMER 2014 NEWSLETTER

ENVIRONMENTAL ASSESSMENT PROCESS



www.ceaa-acee.gc.ca

OPEN HOUSE

On April 22, Morien and Vulcan hosted the first of several open house meetings at the Queensport Fire Hall. Approximately 200 people attended the open house to learn more about the project proponents, Morien Resources Corp. and Vulcan Materials Company, the environmental assessment, and future opportunities for engagement. We are very appreciative of the strong support and interest in the project.

The display boards from the Open House can be viewed at www.MorienRes.com/Black-Point.

SUPERPORT DAYS

On July 10, Frank Lieth, Director of Geological Services with Vulcan, presented an overview of the Black Point Aggregate Quarry Project at the annual Strait of Canso Superport Days. The event attracted over 120 delegates with a focus on doing business along the Strait of Canso and prospering into the future.

COMMUNITY LIAISON COMMITTEE

A Community Liaison Committee (CLC) is being established for the project. The CLC will encourage two-way communication with the community, and facilitate input and engagement on project activities. The project team solicited potential candidates at the open house and also ran a series of advertisements in the Guysborough Journal, ending on May 15th. We have received great interest from community members and are currently contacting people who have expressed interest in participating. The list of CLC members will be made public following the first meeting in August.

CONTACT US

For more information on the proposed Black Point Aggregate Quarry Project visit www.MorienRes.com/Black-Point or contact Morien Resources Corp at 902-466-7255 or info@MorienRes.com.

Morien Resources Corp.

Vulcan Materials Company

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BLACK POINT QUARRY PROJECT
WINTER 2014 - 2015 NEWSLETTER

Hello

We are excited to update you on the progress of the Black Point Quarry Project.

The Team is committed to transparent communication and providing all stakeholders with accurate information as the project progresses.

In this newsletter, you will read about the Environmental Impact Statement (EIS) submission to Canadian Environmental Assessment Agency (CEAA) and the next steps in the Environmental Assessment process. We also introduce you to the Community Liaison Committee (CLC), a diverse group of volunteers who have committed to meeting regularly, providing input and facilitating open communication between the local community and the Project Team. We continue to stay busy and active in the province and municipality. For a list of recent community outreach events, see page 3.

In October, you may have been one of the 350 residents polled about your awareness of the Black Point Quarry Project. According to the poll, commissioned by the MODG, residents overwhelmingly support the Black Point Quarry Project, citing job creation and economic growth as major benefits. The poll also indicated that more information about the project is desired by the public. In response, we have mailed a four page "Frequently Asked Questions" document to each home in the Municipality of the District of Guysborough (MoDG). We trust that the additional information will be helpful, but as always, please check out our website at www.blackpointquarry.ca.

And lastly, we ask you to join us this Winter as we host our second open house meeting on March 11, 2015 at the Queensport Fire Hall. We will have visual boards on display, along with subject matter experts to answer your questions.

We look forward to seeing you soon,

The Black Point Project Team

BLACK POINT QUARRY PROJECT RECEIVES MAJOR ENDORSEMENT FROM FISHERMEN

The Black Point Quarry Project started the New Year with a major endorsement from the Guysborough County Inshore Fishermen's Association of the Black Point Quarry Project.

"We are grateful to receive the support from the members of the Guysborough County Inshore Fishermen's Association," said Frank Lieth, Director of Geological Services, Vulcan Materials Company. "We believe this endorsement by the Association for the Black Point Quarry Project reflects the overall desire of the community and validates the ongoing dialogue we have had and continue to have with the fishing industry here in Guysborough County."

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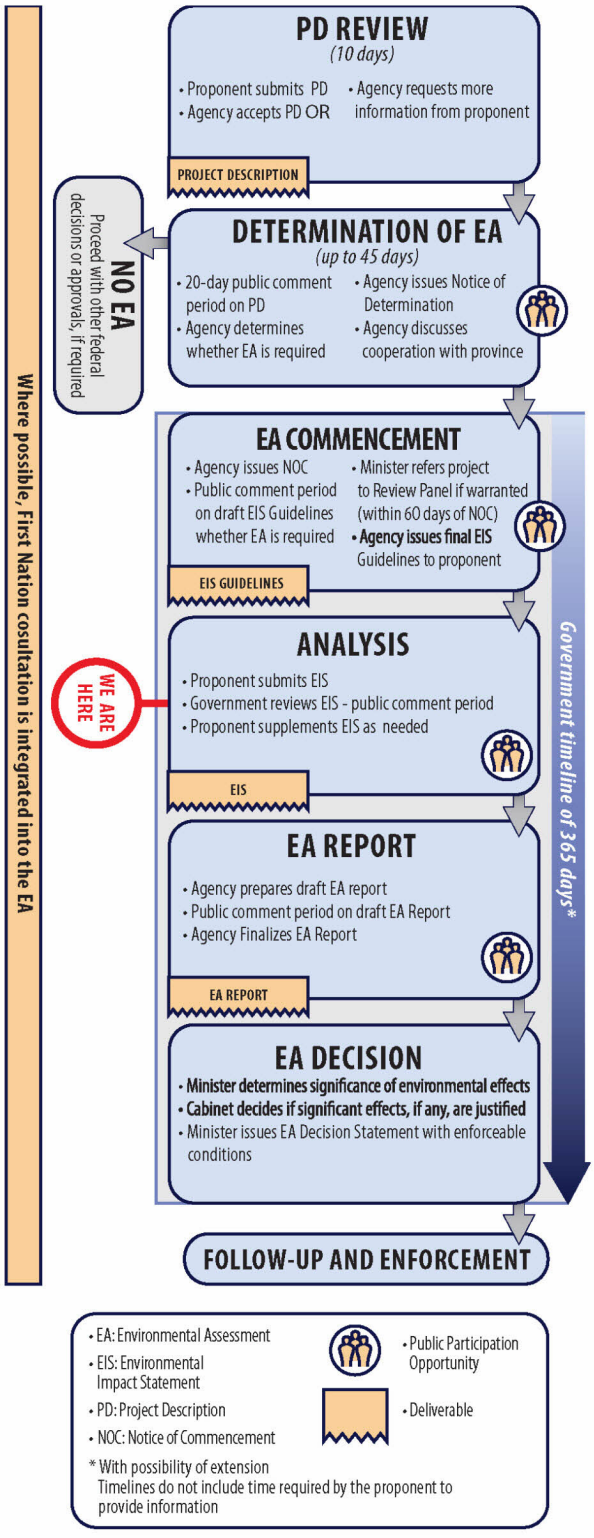

www.ceaa-acee.gc.ca

Morien Resources Corp.

Vulcan Materials Company

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BLACK POINT QUARRY PROJECT
WINTER 2014 - 2015 NEWSLETTER

"We are very appreciative of the support we have been receiving from all parts of the community," added Lieth. "We intend to keep working hard to ensure that we earn the trust of residents in Guysborough by delivering on our commitments and continuing our open and transparent relationship with people throughout the community."

ENVIRONMENTAL ASSESSMENT

On October 31, 2014 we successfully submitted a draft of the Project Environmental Impact Statement (EIS) to the Canadian Environmental Assessment Agency (CEAA, http://www.ceaa-acee.gc.ca/). The 2,100 page document provides a detailed project description of the Black Point Quarry and addresses any environmental effects of the proposed project, as well as actions to mitigate any adverse impacts. Analysis in the EIS include air and noise studies, surface water and groundwater quality, mainland moose and other threatened or endangered species, archeological studies, in addition to social and economic assessments. We have received the first comments back from CEAA and are in the process of preparing the final version. Despite its length, there will be a summary document once the final version of the EIS is submitted in the next two months. This will be available online and at select public viewing locations in MoDG.

COMMUNITY LIASON COMMITTEE

The Black Point Quarry Project Community Liaison Committee (CLC) was established in August 2014. Meetings have taken place on August 12, 2014 and October 15, 2014. The next CLC meeting has been tentatively scheduled for February 2015.

CLC Members continue to be available to take suggestions, answer questions or convey concerns about the Project to the Project Team.

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gmacdonald@modg.ca
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(902) 466-7255

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*Atisthan Roach (Secretary) **
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roacha@vmcmail.com
(205) 298-3189

* Black Point Quarry Project Team Members
Dawson Brisco is the alternate for Mike MacDonald

Morien Resources Corp.

Vulcan Materials Company

C 1340-2095

BLACK POINT QUARRY PROJECT

WINTER 2014 - 2015 NEWSLETTER

MODG POLLS THE COMMUNITY

During October 24-31, 2014, the Municipality of the District of Guysborough commissioned a study to poll the community's awareness of the Black Point Quarry. 350 residents were randomly selected and asked about their awareness and knowledge levels, and their support or opposition of the Project.

The results? Participants overwhelmingly support the Project. Seventy six percent of the respondents registered their support of the Project, with half of those declaring that they "strongly support" the Project. Eighteen percent stated that they neither support nor oppose it, while only 6% of interviewees said they "oppose" the Project. It is noteworthy that of those neutral respondents, over half lean in support of the Project.

While awareness of the Project is high at 84%, our work continues. Poll respondents, although favorable to the Project, consider themselves to have low levels of knowledge about the Project. The Black Point Quarry Project Team is committed to transparency and information sharing. We will continue to update and engage with all stakeholders. Whether it is through periodic newsletters, website updates, open houses and other community outreach, we are committed to enhancing the community's awareness and knowledge of the Black Point Quarry Project. We encourage you visit our Black Point Quarry project webpage at www.blackpointquarry.ca for updates and additional information.

COMMUNITY OUTREACH

- October 15, 2014: Community Liaison Committee Meeting at the Queensport Fire Hall
- October 16, 2014: Visited the 4th grade class at Fanning Academy, teaching a session on rocks and minerals
- October 16, 2014: Presented an overview of the Black Point Quarry Project to the high students at Fanning Academy, and discussed future job opportunities
- October 27, 2014: the Black Point Quarry Project Team provided a tour of the proposed quarry site to Chief Wilbert Marshall (Potlotek First Nation) and Kerry Prosper (Paq'tnkek First Nation)
- October 28, 2014: Presented an overview of the Black Point Quarry Project to the high school students at Guysborough Academy, and discussed future job opportunities
- October 28, 2014: Visited middle school students at Guysborough Academy, teaching a session on rocks and minerals
- November 13, 2014: Team member Chris Ridgway (Vulcan) was a featured speaker at the Department of Natural Resources' annual Geology Matters conference in Halifax, providing an introduction to Vulcan Materials Company and the Company's social responsibility programs, as well as an update on the Project
- December 2, 2014: Project Manager, Frank Lieth (Vulcan), provided an overview and update on the Project to the Strait Area Chamber of Commerce

Morien Resources Corp.

Vulcan Materials Company

C 1340-2096

BLACK POINT QUARRY PROJECT

WINTER 2014 - 2015 NEWSLETTER

OPEN HOUSE

Black Point Quarry Project Open House

DATE	March 11, 2015
TIME	3:00 – 7:00 pm
	A brief presentation will be given at 3:30 pm
	and 6:00pm
LOCATION	Queensport Fire Hall
	5615 HWY 16 Queensport, NS

The Black Point Project Team invites you to attend an open house meeting on March 11, 2015 at the Queensport Fire Hall.

As a follow up to our April 2014 Open House, we will be providing visitors with an update on the Project. Subject matter experts will also be on hand to answer your questions.

For more information about the meeting, visit: www.blackpointquarry.ca, or call (205) 298-3189.

CONTACT US

For more information on the proposed Black Point Quarry Project
visit www.blackpointquarry.ca

Morien Resources Corp.

Vulcan Materials Company

C 1340-2097

Attachment 2 – CLC Terms of Reference

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

Black Point Quarry

Community Liaison Committee (CLC)

TERMS OF REFERENCE

PURPOSE

To bring together community members of the Municipality of the District of Guysborough to provide input and facilitate open communication between the local community and the Black Point Quarry Project Team; to protect and enhance the quality of life for all residents, and to promote a vibrant and sustainable economic climate in the Municipality of the District of Guysborough.

OBJECTIVES

- To serve as an advisory body providing the Black Point Quarry Project Team (Project Team) input on existing or potential community concerns as it relates to the Black Point Quarry Project (the Project);
- To represent community interest;
- To communicate information and updates to the community as it relates to the Project in a timely manner thereby reflecting a true transparency as the project proceeds from permitting to construction to operations;

MEMBERS

Participation in the Community Liaison Committee (CLC) is open to individuals interested in providing guidance and input on the Project. The CLC will be made up of at least 6 and no more than 12 individuals who collectively provide a balanced and broad representation of members in terms of interest in the Project, location relative to the Project and insight on the Project. The CLC will include Project Team members and the Warden will serve ex-officio.

C 1340-2099

Individuals in attendance at the April 22, 2014 Black Point Quarry Project Open House were invited to sign-up to participate in the CLC. Members of the CLC were also solicited in local advertisement in the *Guysborough Journal* and via the Project website www.morienres.com/black-point.

The recruitment of members may also be sought from the First Nations community, African Nova Scotian community, local fisheries representative, local Municipality of the District of Guysborough Councillor, staff member of the Municipality of the District of Guysborough, and local economic development organizations.

If numerous nominations are received for representation from the same geographic area or interest, the Project Team may elect to randomly draw potential members for each area or interest.

All members of the CLC will be selected by the Project Team, with guidance from Municipality of the District of Guysborough staff.

CLC participation is on a voluntary basis.

Participation in the CLC does not constitute support or endorsement of the Black Point Quarry Project, but rather CLC members share a desire to provide community input and guidance to the Project Team and represent the community interests.

All appropriate and reasonable expenses to conduct meetings are reimbursed through an account managed by the Project Team.

OVERVIEW: MEMBER ROLES AND RESPONSIBILITIES

Positions to be held:

CO-CHAIRS	A representative of the Project Team will act as Chair during the first meeting, at which time the committee will select a Co-Chair from among the members present. The Co-Chairs are responsible for: Managing CLC meetings, including setting meeting agendas, timing of agenda items and adherence to purpose and objectives of the committee, ensuring focused discussions;
Secretary	A member of the Project Team will serve as Secretary, providing support in drafting and distribution of minutes, notices of meetings, agenda preparation, meeting coordination, and logistics and support to the committee and the Co-Chairs.
CLC Members	CLC members are representatives of their community, group or organization. As such, each member is responsible for the sharing of perspectives and information from their community, group or organization with other members of the CLC and the Project Team. Members are also responsible for sharing factual information obtained from the CLC with their community, group or organization.

PRINCIPLES OF PARTICIPATION

Each member of the CLC will abide by the following principles of participation:

- the CLC is not a decision-making body. There will be no voting. The CLC is in place to provide input, knowledge and advice to the Protect Team;
- open dialogue in an atmosphere of mutual respect and professional conduct;
- supportive role to seek solutions to misunderstandings with or within the community, if they arise;
- respect the consensus approach of the panel and reflect this in dialogue with other parties;
- represent as broad a base of the community as possible;
- respect the confidentiality of key business information that may, from time-to-time, be shared with the committee.

ROLE AND RESPONSIBILITIES OF MEMBERS

- work collaboratively with the Project Team by providing practical advice and feedback to help avoid or minimize impacts from the Project on the community and environment;
- be prepared to consider a range of views, and work in a respectful way while positively addressing issues and concerns;
- provide input and guidance on community opinions, issues and concerns with respect to the Project;
- provide suggestions on communications efforts necessary to enhance community participation and inform the community and other organizations;
- allow name, email and telephone number to be published as a CLC member;
- be prepared to attend CLC meetings, including review of appropriate documents and information.

June 2014

Location

CLC meetings will be held at a suitable location in the Municipality of the District of Guysborough as determined by the Project Team.

QUORUM

The CLC is considered to have a quorum when at least 50% of all members are present, and at least one representative from the Project Team.

AGENDA

The agenda for each meeting will be set by the CLC. Any CLC member can request that a matter be placed on the agenda for the next meeting by communicating information to the Secretary no later than five business days prior to the meeting at which the matter is to be discussed.

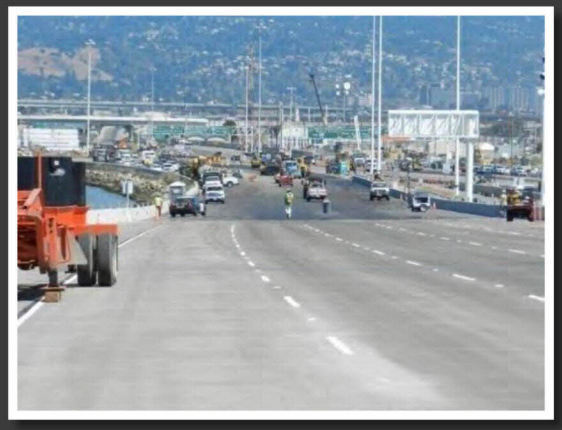
MINUTES

The minutes of each meeting of the CLC will be prepared by the Secretary or designee and will be distributed to CLC members within 15 days of that meeting.

Attachment 3 – Vulcan Company Presentation

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

Vulcan Materials Company

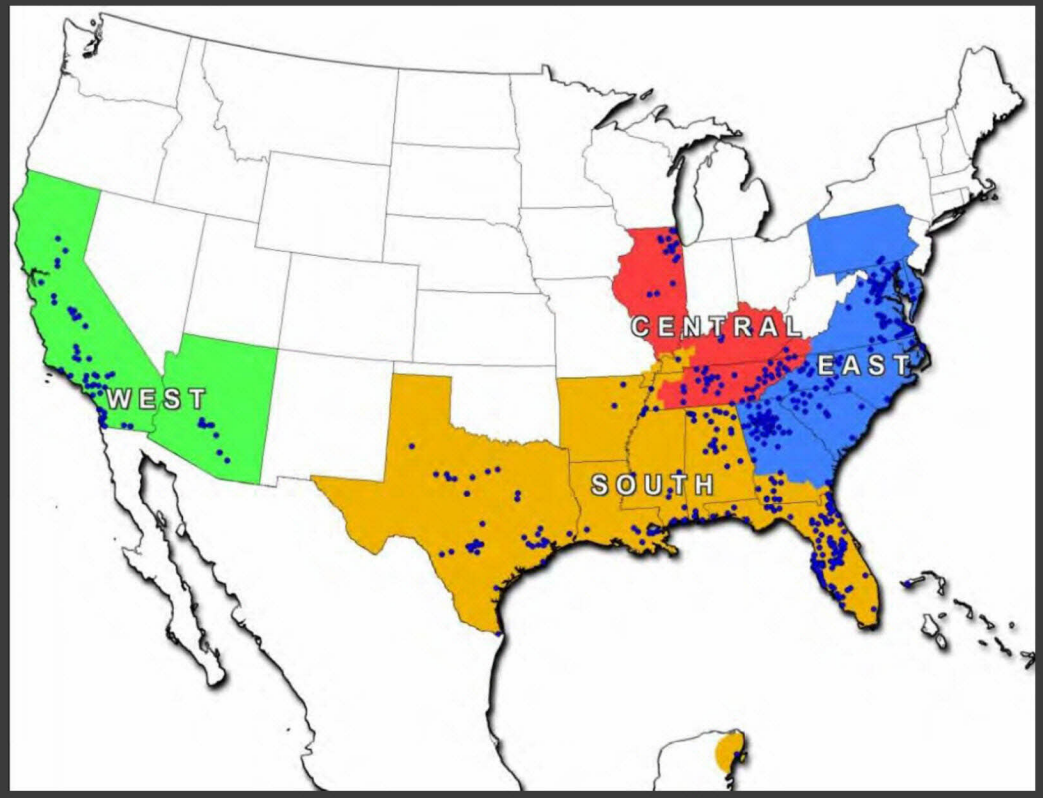


BUILDING STRONGER COMMUNITIES

We have built a successful company over many decades because we believe that doing the right thing – socially, environmentally and financially – is the right way to do business.

Vulcan Materials Company — The Leading Aggregates Producer in the U.S.

VULCAN'S REGIONS
Regional Headquarters and States Served



- The nation's largest producer of construction aggregates, primarily crushed stone, sand and gravel
- Public company with shares traded on the NYSE
- Market Cap: $7.7 billion Revenues: $2.8 billion

**December 31, 2013*

CAPITAL EXPENDITURES		
	2013	2012
Plant property & equipment expense	$275 M	$95 M
Business Acquisitions	$90 M	$0

- Operating 342 aggregates facilities, serving markets in 18 states, the District of Columbia, Mexico and the Bahamas with a full line of aggregates and employing 6,902 people
- A major producer of asphalt and concrete
- Headquartered in Birmingham, Alabama

END USES

- Highways, roads, streets and other public works projects

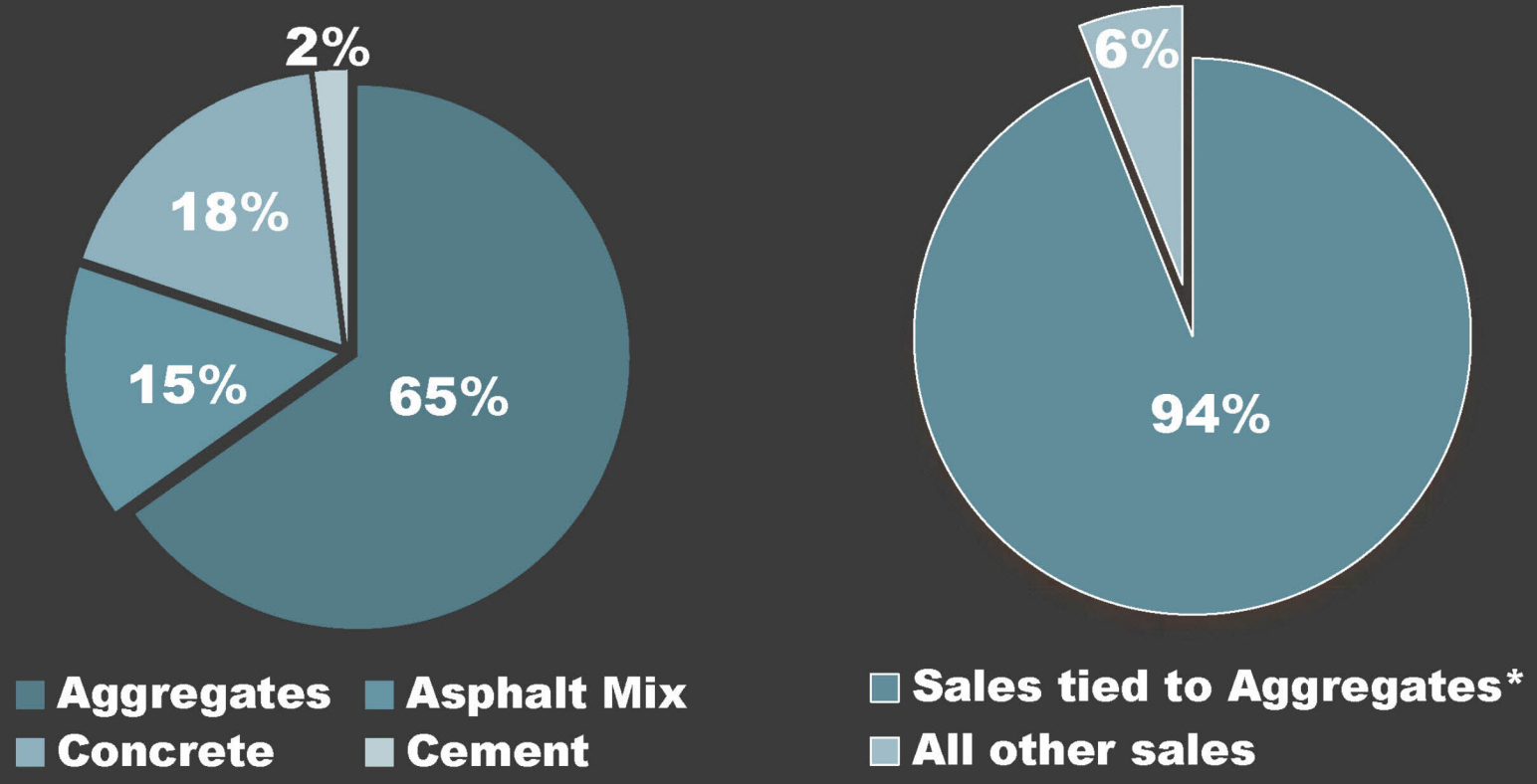
- Housing, non-commercial buildings, commercial and industrial buildings, railroad ballast and in non-construction uses such as agriculture

CALICA OPERATION

Vulcan's largest quarry operation is an international venture that produces a full line of crushed limestone products on Mexico's Yucatan Peninsula.

Vulcan owns three Panamax-class, self-unloading ships that transport products to sales and distribution yards along the U.S. Gulf Coasts and Atlantic.

AGGREGATES-LED VALUE CREATION – 2013 NET SALES



**Represents sales to external customers of our aggregates and our downstream products that use our aggregates.*

LEADING POSITION

STRATEGICALLY POSITIONED

75%
Share of US population growth

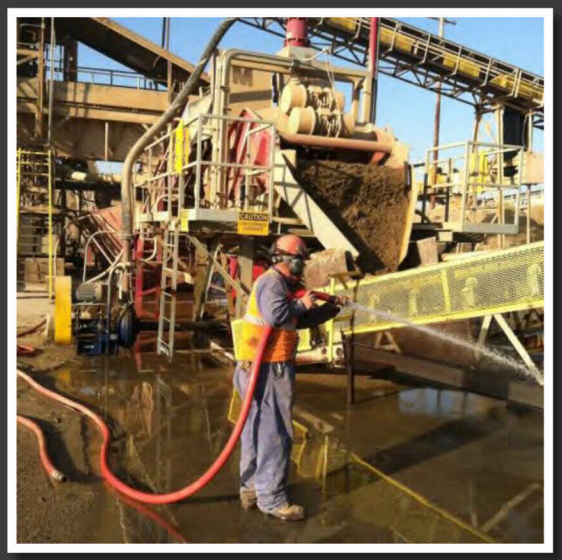
LEADING RESERVE POSITION

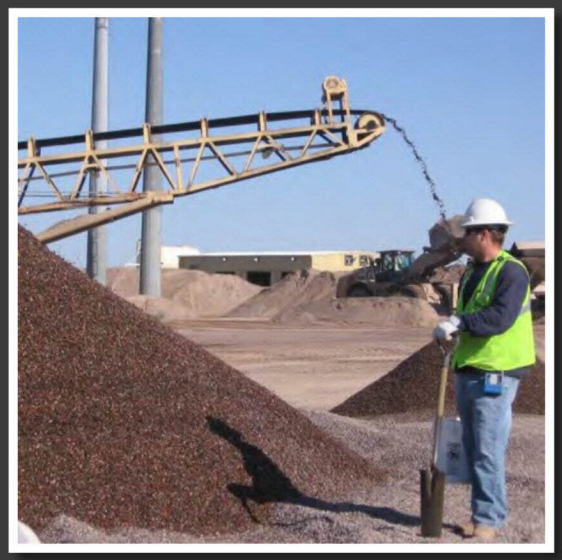
15.0
Billion tons of proven and probable aggregates reserves

UNIT PROFITABILITY CONTINUES TO GROW

32%
Cash gross profit per ton of aggregate higher than peak year volumes

SAFETY IS OUR #1 PRIORITY





PROTECTING THE HEALTH, SAFETY AND WELL-BEING OF OUR WORKFORCE IS PARAMOUNT.

SAFETY & HEALTH AWARDS & RECOGNITIONS

Protecting the safety and health of our employees are essential priorities for Vulcan. We are proud to have our employees and facilities recognized for their operational excellence, exemplary efforts in safety and health.

- 2013 Excellence in Hearing Loss Prevention Award (Manufacturing Sector) National Institute of Occupational Safety and Health (NIOSH) in partnership with National Hearing Conservation Association (NHCA)
- 2013 National Ready Mixed Concrete Association Excellence in Safety – Gold, Silver and Bronze Levels
- 2012 Eagle Award of Excellence – Safety Award Georgia Construction Aggregates Association
- 2012 National Ready Mixed Concrete Association Excellence in Safety – Gold, Silver and Bronze Levels
- 2012 Safety Awards, Virginia Transportation Construction Alliance (VTCA) and Virginia Department of Mines, Minerals and Energy-Division of Mineral Mining (DMM)
- 2012 California Construction and Industrial Materials Association – Safety Award
- 2011 Sentinels of Safety – Mine Safety and Health Administration (MSHA)
- 2011 NSSGA Sterling Safety Award – Bronze
- 2011 NSSGA Safety Excellence – Gold, Silver and Bronze Levels
- 2011 Safety Awards, Virginia Transportation Construction Alliance (VTCA) and Virginia Department of Mines, Minerals and Energy-Division of Mineral Mining (DMM)
- 2010 NSSGA Safety Excellence – Gold, Silver and Bronze Levels
- 2010 NSSGA James M. Christie Safety & Health Professional Award
- 2010 NSSGA Berry Wendt Award (Safety & Health)
- 2010 Outstanding Contribution to Mine Safety and Health, International Society of Mine Safety Professionals
- 2010 Sentinels of Safety – Mine Safety and Health Administration (MSHA)
- 2010 National Ready Mixed Concrete Association Excellence in Safety Award – Gold, Silver and Bronze Levels
- 2009 NSSGA Safety Excellence – First, Second and Third Place Awards

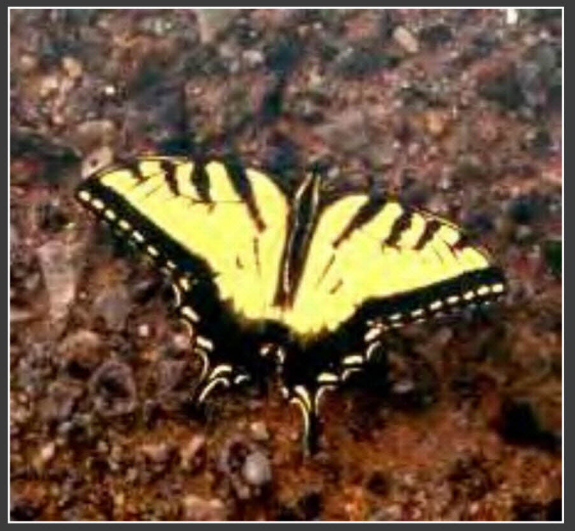
LAND RECLAMATION

WE ARE COMMITTED TO RESPONSIBLE STEWARDSHIP OF THE LAND.

•A former quarry operation, the Rank Island project preserved ponds, wetlands and riparian along the San Joaquin River in Fresno County, California

•2011 Award for Excellence in Reclamation from State of California's Department of Conservation, Office of Mine Reclamation

•300-acre project site attracts and provides food, water, habitat and open space for over 175 species of wildlife including over 136 species of birds



WILDLIFE HABITAT ENHANCEMENT

Developing wildlife habitat buffer lands around our facilities has been an important environmental program for Vulcan. We now have 43 certified wildlife habitats at sites across North America, making us the second largest company in the United States with certified habitats and third globally.

ENVIRONMENTAL STEWARDSHIP AWARDS & RECOGNITIONS

We are proud of our awards for environmental programs.

- 2013 Energy Showcase Award San Diego Gas & Electric (California)
- 2012 NSSGA Environmental Excellence Award - Gold, Silver and Bronze Levels
- 2012 NSSGA Gold Environmental Excellence Award
- 2012 NSSGA Silver Environmental Excellence Award
- 2012 NSSGA Bronze Environmental Excellence Award
- 2012 VTCA-DMM Reclamation Award – Virginia Transportation Construction Alliance
- 2011 NSSGA Environmental Excellence Award - Gold, Silver and Bronze Levels
- 2011 Award for Excellence in Reclamation – California Department of Conservation, Office of Mine Reclamation (OMR)
- 2010 NSSGA Environmental Excellence Award - Gold, Silver and Bronze Levels
- 2010 Corporate Sustainability Award – Industrial Environmental Association
- 2010 Solid Waste Reduction Award, Irwindale, CA Chamber of Commerce
- 2010 National Ready-Mixed Concrete Association Green-Star Certification
- 2009 NSSGA Gold Environmental Excellence Award

SOCIAL RESPONSIBILITY

We take pride in being a trusted corporate neighbor by engaging in open dialogue about our operations and by being responsible partners in the growing communities we serve.

COMMUNITY OUTREACH

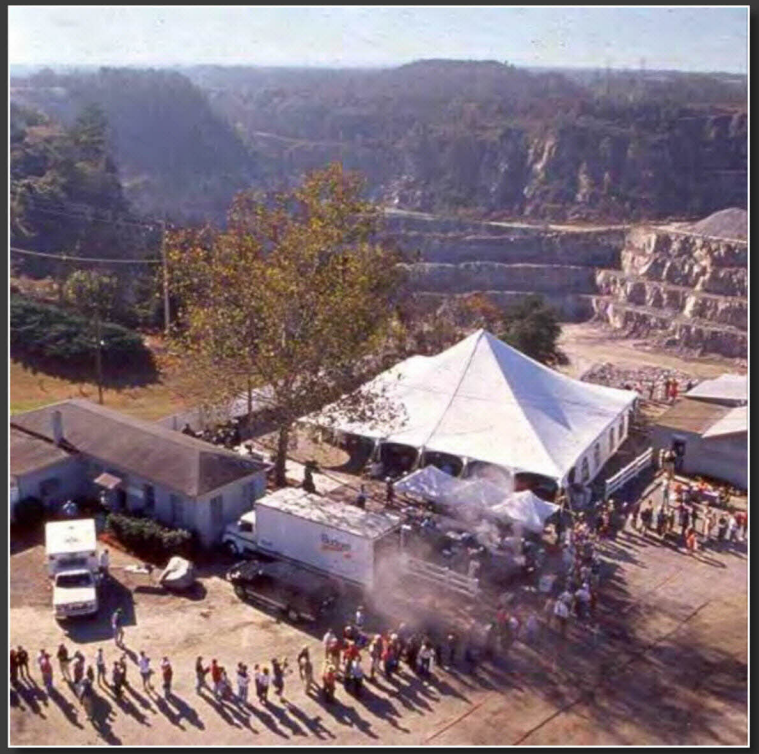
- Our community involvement includes support for community and civic organizations.
- We provide financial support and take an active part in many public and charitable projects.
- We encourage and provide support to our employees who participate in local public service activities.

COMMUNITY RELATIONS PROGRAMS

In collaboration with the Mexican National Institute of Archaeology and History, we preserved Mayan ruins discovered on our Calica (Mexico) property when we began operations in the 1980s.

Vulcan employees and their families participated in the annual California Coastal Clean-Up Day volunteering to collect trash along San Diego area beaches.

OPEN HOUSES



Fostering long-term relationships with our neighbors requires us to be active participants in the community. One way is through open houses at our facilities to welcome our neighbors in and let them learn more about us.

EDUCATION

- 286 adopt-a-school partnerships
- Excellence-based college scholarships nationwide
- Internships and mentoring programs
- Job Shadow
- Matching gifts program
- Vulcan's Foundation support
- School Tours

These partnerships provide schools with much-needed resources. They provide us with an opportunity to teach young people about the free enterprise system, the benefits our industry provides to society and to enhance our image in the community.

COMMUNITY RELATIONS AWARDS & RECOGNITIONS

We are proud of our awards for community relations programs and activities.

2013 NSSGA Grassroots Coordinator of the Year

2012 NSSGA Excellence in Community Relations Award – Silver and Bronze Levels

2012 VTCA Community Excellence – Virginia Transportation Construction Alliance

2011 NSSGA Excellence in Community Relations Award – Gold, Silver and Bronze Levels

2011 VTCA Community Excellence – Virginia Transportation Construction Alliance (VTCA)

2011 Community Involvement Finalist – National Asphalt Pavement Association

2011 Fairfax County, VA Business Partnership Award

2010 NSSGA Excellence in Community Relations Award – Gold, Silver and Bronze Levels

2010 National Stars of Excellence – 2 Stars Award

2010 Business of the Year Award – City of Irwindale, CA and Irwindale Chambers of Commerce

2010 Excellence in Manufacturing – Corona, CA Chamber of Commerce

AWARDS & RECOGNITIONS

Fortune's World's Most Admired Companies

*Top 10 in Social Responsibility *twice* in last decade

*Top 10 for Use of Corporate Assets and Long-Term Investment

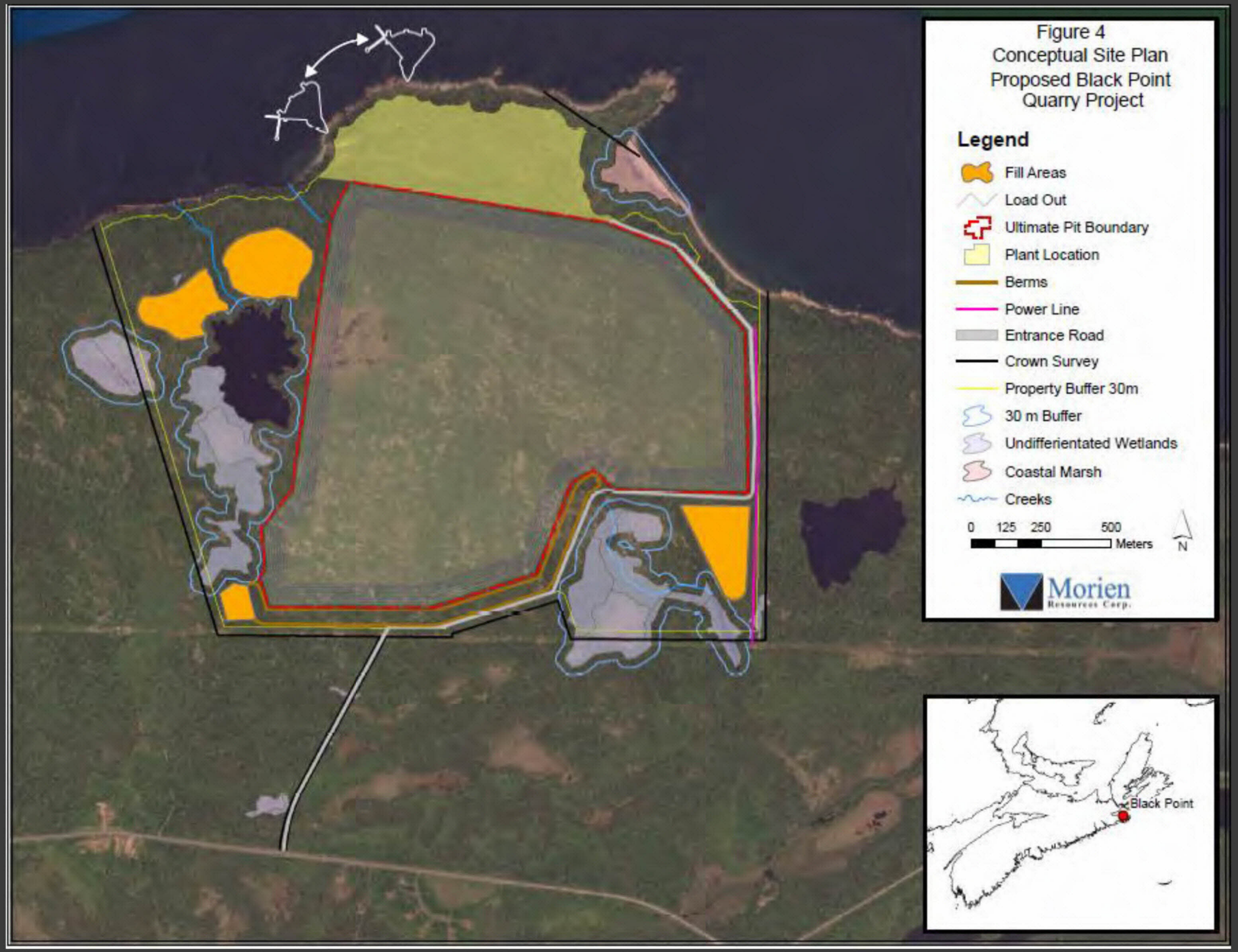
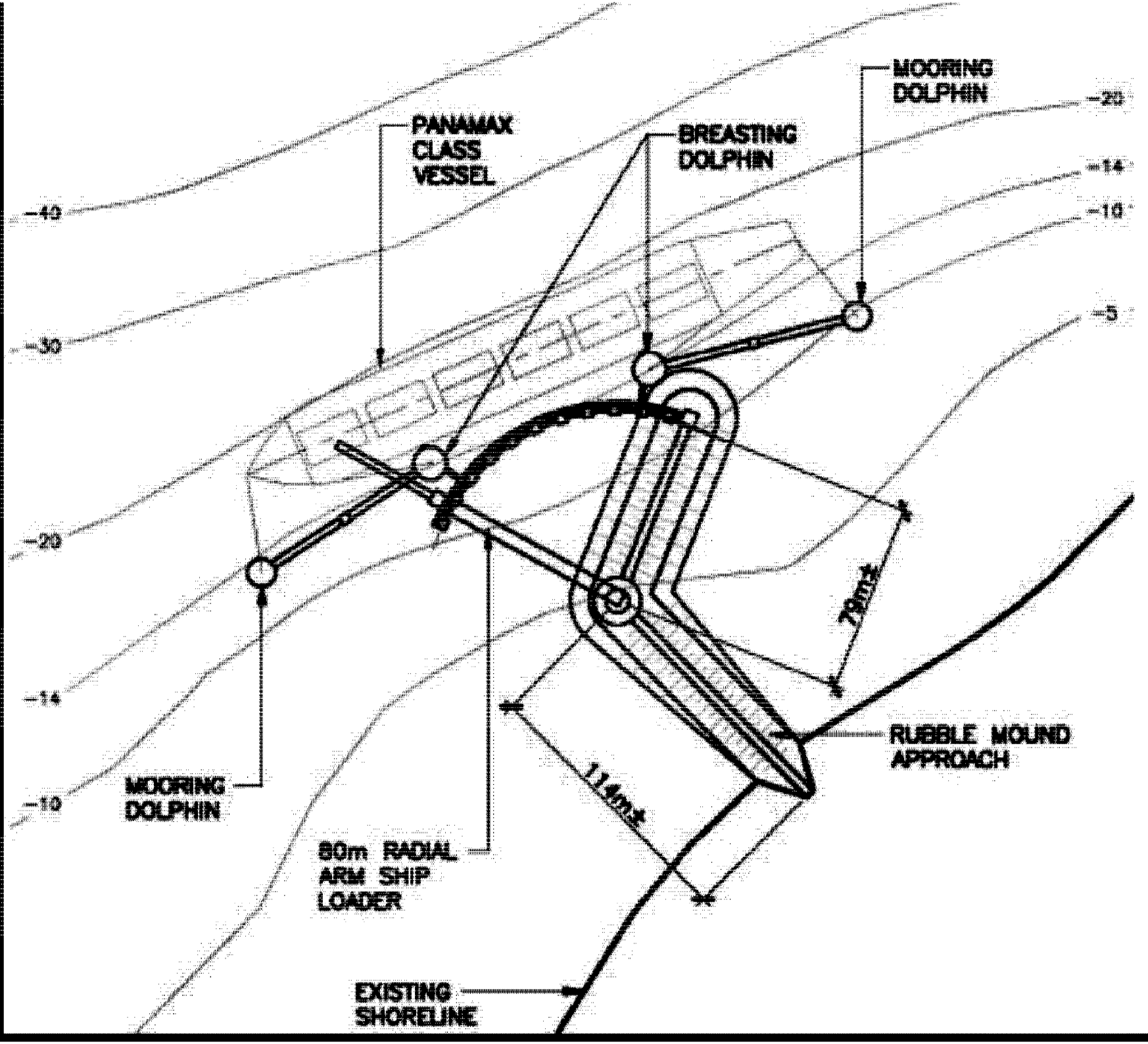
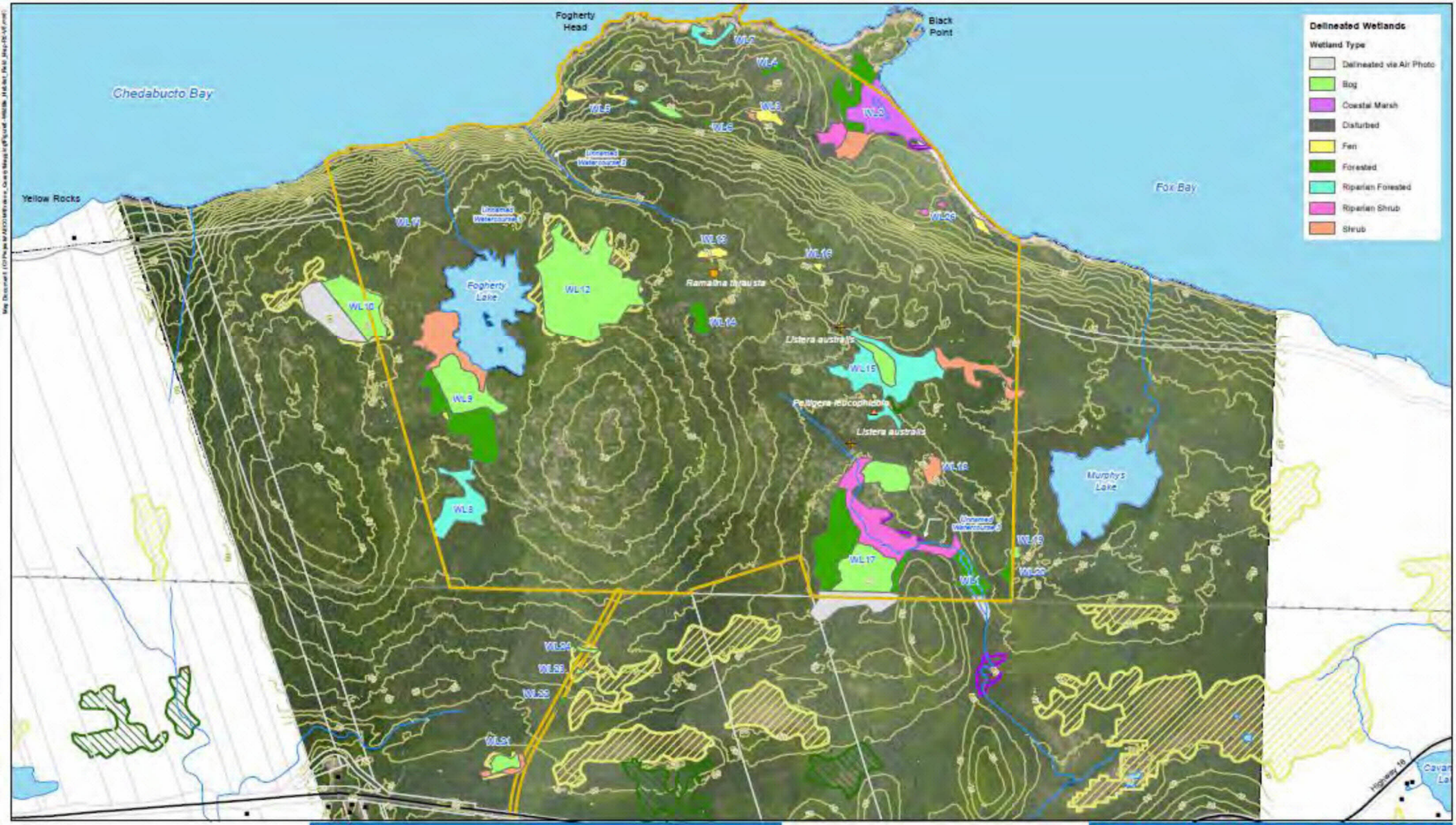


Figure 4
Conceptual Site Plan
Proposed Black Point
Quarry Project
Legend
Fill Areas
Load Out
Ultimate Pit Boundary
Plant Location
Berms
Power Line
Entrance Road
Crown Survey
Property Buffer 30m
30 m Buffer
Undifferientated Wetlands
Coastal Marsh
Creeks
0 125 250 500
Meters
N
Morien
Resources Corp.
Black Point

C 1340-2124


MOORING DOLPHIN
PANAMAX CLASS VESSEL
BREASTING DOLPHIN
-20
-14
-10
-40
-30
-5
-20
-14
-10
79m±
114m±
MOORING DOLPHIN
RUBBLE MOUND APPROACH
80m RADIAL ARM SHIP LOADER
EXISTING SHORELINE

C 1340-2125



REFERENCES:
Base data is from NSDNR (2010), GeoNova (2009), GeoBase (2007). Wetland data from NSDNR (2007). Property Boundary from SNS (2011). Access Road location provided by AECOM (2011). Rare plant and Lichen locations from AMEC report (2011). Imagery and LiDAR derived contours from Leading Edge Geomatics (2011). Delineated Wetlands from AECOM (2011).

Map Features

- Building
- Approximate Lichen Location
  - Ramalina thrausta
  - Peltigera leucophlebia
- Approximate Rare Plant Location
  - Listera australis
- Cut Line (> 100m long & < 20m wide)
- Major Road
- Secondary Road
- Tertiary Road
- Transmission Line
- Property Boundary
- Study Area Boundary
- Contour Line
- Watercourse
- Waterbody
- NSDNR Wetland
  - Bog or Fen
  - Marsh
  - Swamp

DATE: February 17, 2014
SCALE: 1:12,000
ADB NO:
REVISION: 0
DRAWN: CA-SES

0 200 400 600
Meters

Morien Resources Corp.

Figure 6 - Wildlife Habitat and Known Locations of Species of Concern

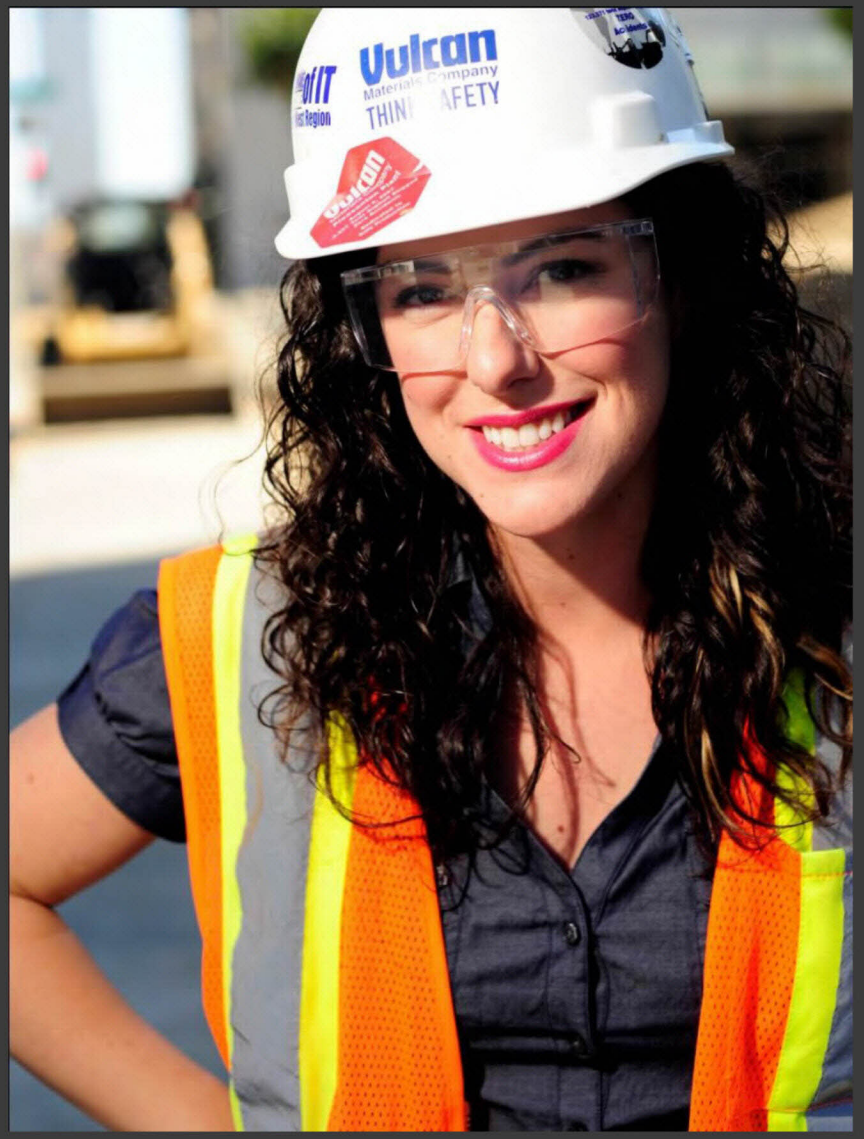
Proposed Black Point Quarry Project
Morien Resources Corp.

C 1340-2126

TIMELINE (PRELIMINARY)

February 28, 2014	File Project Description
May 1, 2014	Posting of the Notice of Commencement
September 1, 2014	Environmental Baseline Studies (completion)
November 1, 2014	File Environmental Impact Statement (EIS)
September 1, 2015	Environmental Assessment Approval
2016-2017	Permitting, Market Evaluation and Equipment Acquisition
April 2018 - April 2021	Site Preparation and Construction
May 2021	Commence Operations
2070 +	Decommissioning and Reclamation

At Vulcan Materials Company, our employees are committed to conducting our business in an environmentally, socially and economically responsible manner.



Vulcan
Materials Company

Attachment 4 – Proponent Outreach Events

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

Appendix M Black Point Quarry Outreach Events

This list does not include most meetings with regulatory agencies, except when they related to citizen outreach

Outreach Event	Date	Location	External Particpants	Proponent Participants	Subject
Meetings	2008-2011	Guysborough	Municipal Representatives	M. Davies	Land Transfer
Meeting	21-Jul-11	Store near site	Four fishermen w/ licences in the Project area	M. Davies	Project Initiation
Presentations	12-Oct-11	Canso and Guysborough High Schools	50-75 students and teachers	M. Davies	Project Initiation
Meeting	21-Nov-11	Membertou	KMK	M. Davies	Project Initiation
Telephone Call	4-Jan-12	NA	Corey Leblanc, Reporter w/ Antigonish Casket	M. Davies	Project Initiation
Telephone Call	4-Jan-12	NA	Brent Lombardi (area resident)	M. Davies	Project Initiation
Meetings	Feb 2012-Oct 2013	Guysborough	Municipal Representatives	M. MacDonald	Land Transfer
Meetings	Jan 2013-Aug 2013	Guysborough	Municipal Representatives	M. MacDonald	Land Lease for Quarry
Presentation	13-Mar-13	Guysborough	Municipal Representatives	M. MacDonald	Project Update
Meeting	9-Oct-13	Guysborough	Municipal Representatives	M. MacDonald	Land Expropriation
Site Visits	15, 16-Apr-2013	Guysborough	Municipal Representatives	M. MacDonald	Project Overview
Site Visits	23, 24-Sept-2013	Guysborough	Municipal Representatives + Fisherman B. Hensbee	M. MacDonald	Project Overview
Meeting	18-Feb-14	Halifax	Premier S. MacNeil; MLA Lloyd Hines	M. MacDonald/F. Lieth	Project Introduction
Meeting	25-Feb-14	Halifax	L. Jonart, NS Off. of Aboriginal Affairs	M. MacDonald/F. Lieth	Project Introduction
Telephone Calls	11-Feb-14; 24-Feb-14; 26-Feb-14;27-Feb-14	NA	Twila Gaudet, KMK	M. MacDonald	To fix meeting date
Telephone Calls	28-Feb-14	NA	Ginny Boudreau, Guys. Co. Inshore Fish. Assoc.	M. MacDonald	Project Status Update
Email	4-Mar-14	NA	Beata Dera, OAA	M. MacDonald	Information Exchange
Meeting	11-Mar-14	Halifax	Jennifer MacGillivary, Impacts and Benefits Officer, KMKNO	M. MacDonald/F. Lieth	Information Exchange
Email and Letter	11-Mar-14	NA	Barry Carroll, CAO for MODG	M. MacDonald	Project Update
Email and Telephone Calls	00-April-14	NA	Chief Bob Gloade KMK Benefits Committee Chair	M. MacDonald/C. Milley	Project Presentation
Email	2 and 3-April 2014	NA	M. Savard (CEAA)	Russell Dmytriw	Public and Agency Comments to Project Description
Meeting	8-Apr-14	Guys. Co. Inshore Fish. Assoc. Office, Canso	Ginny Boudreau, Manager, Guys. Co. Inshore Fish. Assoc.	M. MacDonald	Introductions
Meetings	9-Apr-14	Various locations	Local business owners/operators; Dave Hanham, Gabi Krause, Last Port Motel	M. MacDonald	Introductions
Meeting	9-Apr-14	Peas Brook, Guysborough Co	Principal of Canso P-12 School	M. MacDonald	Interactions with students
Emails and Telephone Calls	March-April	NA	D. Jamieson, B. George, G. MacDonald, B. Carroll	M. MacDonald	Open House Planning
Open House	22-Apr-14	Chedabucto Fire Hall	126 people attended, based on sign in sheet	Vulcan and Morien Project Teams, R. Dmytriw, S. Lewis	Project Introduction and Q&A
Meeting	23-Apr-14	NSE Office Port Hawkesbury	Lorne MacNeil, Dave Fougere, Dave Shea, Sean Gillis (all NSE)	F. Lieth, R. Hall, CJ Spainhour, C. Ridgway, J. DeCinque, R. Dmytriw, M. MacDonald	Provincial Permits and Discharges
Meeting	23-Apr-14	DFO Office, BIO, Dartmouth	E. Parker G. Herbert, Tanya Koropatnick (all DFO)	F. Lieth, R. Hall, CJ Spainhour, C. Ridgway, J. DeCinque, R. Dmytriw, M. MacDonald	Fisheries Act Permits, work completed to date, information sources and consultation with fishers
Meeting	7-May-14	Truro	Chief Bob Gloade (Millbrook FN), Terry French (Dir. Commercial Operations)	F. Leith, C. Ridgway, D. Brisco, C. Milley	Introduction to the project; introduced to Paq'tnkek Band Councillor Kerry Prosper
Telephone Call	2-May-14	NA	Donald Dixon, International Union of Operating Engineers	F. Lieth	Project Introduction & timing; Use of Union Workers
Email	5-May-14	NA	Michael Hendsbee	D. Brisco	Project update
Email	21-May-14	NA	Jacob Cook, With a Little Help Society (WALHS)	C. Ridgway	Sponsorship Request
Meeting	27-May-14	Halifax	T. Gaudet, M. Nevin – KMKNO (KMK Negotiation Office, Mi'kmaq Rights Initiative); M. Savard (CEAA); B. Cougle (CEAA, Sr. Advisor Aboriginal Affairs); H. MacPhail (NSE, EA Branch); B. Dera (NS Office of Aboriginal Affairs)	R. Hall, F. Lieth, C. Ridgeway, CJ Spainhour, R. Dmytriw, M. MacDonald, C. Milley	• Roles of the Proponent and government • Proponent's engagement with KMK moving forward • Draft EIS guidelines
Meeting	28-May-14	Guysborough	G. MacDonald, Dir. Economic Development, MODG	F. Lieth, M. MacDonald, CJ Spainhour, R. Dmytriw (A. Roach, C. Ridgway by phone)	Project Status Update

Meeting	29-May-14	Guys. Co. Inshore Fish. Assoc. Office, Canso	Ginny Boudreau, Guys. Co. Inshore Fish. Assoc.	F. Lieth, M. MacDonald, CJ Spainhour, R. Dmytriw	Fishing Activity and Potential Project Effects on Fisheries
Website Post	6-Jun-14	MODG Website	Various	D. Brisco	Project Status
Telephone Call	12-Jun-14	NA	M. Nevin, KMK	R. Dmytriw	Invitation to Site Visit
Email	12-Jun-14	NA	J. Walsh, CMM	R. Dmytriw	Site Visit / Project Info
Email	16-Jun-14	NA	Ginny Boudreau, Guys. Co. Inshore Fish. Assoc.	R. Dmytriw	Request to meet with Fishermen
Meeting	17-Jun-14	Shubenacadie	Jennifer Copage, Consultation Coordinator, James Michael, Barrister and Solicitor, Nathan Sack, Dir Operations, Shubenacadie Band	C. Ridgway, CJ Spainhour, C. Milley	Expectations with respect to consultation & engagement
Radio Interview	18-Jun-14	NA	NA	J. Budreski with V. Pitts from MODG	Informed listeners the expropriation has been ongoing for a number of years with many opportunities for comment; explained the EA is just beginning, explained construction has not begun
Email	19-Jun-14	NA	Jennifer Copage, Consultation Coordinator, Shubenacadie Band	C. Ridway	Additonal company information
Meeting (on Site)	18-Jun-14	Black Point Quarry	H. MacPhail, E. Parker, B. Cougle, J. Walsh, M. Nevin, S. Gillis	C. Ridgway, CJ Spainhour, R. Dmytriw, C. Milley, J. Budreski	Site Visit
Emails	20-Jun-14	NA	J. Walsh, CMM; M. Nevin, KMK	R. Dmytriw	Follow up to Site Visit
Emails	1-Jul-14	NA	Local residents C. Cosgrove, MJ Taylor, D. Harnish, D. Hochman	A. Roach	CLC
Fact Sheet (mail out)	7-Jul-14	NA	Guysborough Co. residents	S. Lewis	Project Introduction
Presentation	10-Jul-14	Strait of Canso Superport Days, Dundee	120 participants	F. Lieth, M. MacDonald	Project Status Update
Meeting	16-Jul-14	Half Island Cove	David Murphy	M. MacDonald; R. Dmytriw	Project Status Update
Meeting	16-Jul-14	Half Island Cove	Jean Greencorn	M. MacDonald; R. Dmytriw	Project Status Update
Meeting	16-Jul-14	Half Island Cove	Errol and Donna Grigor	M. MacDonald; R. Dmytriw / R. Dmytriw July18	Project Status Update
Meeting	16-Jul-14	Half Island Cove	Gloria and Darrel David	M. MacDonald; R. Dmytriw	Project Status Update
Meeting	16-Jul-14	Half Island Cove	Eldon O'Leary	M. MacDonald; R. Dmytriw	Project Status Update
Meeting	16-Jul-14	Phillips Harbour	Jerry Creamer	M. MacDonald; R. Dmytriw	Project Status Update
Meeting	16-Jul-14	Fox Island Main	Pat Murphy	M. MacDonald; R. Dmytriw	Project Status Update
Meeting	16-Jul-14	Fox Island Main	Paula Richard	M. MacDonald; R. Dmytriw	Project Status Update
Meeting	16-Jul-14	Fox Island Main	Wes and Jeanesta Moser	M. MacDonald; R. Dmytriw	Project Status Update
Meeting	16-Jul-14	Upper Fox Island	Gabi and Holger Krause	M. MacDonald; R. Dmytriw	Project Status Update
Meeting	16-Jul-14	Upper Fox Island	Gerhard Vorauer and Barbara Brauneis	M. MacDonald; R. Dmytriw	Project Status Update
Meeting	16-Jul-14	Upper Fox Island	Odessa Snow	M. MacDonald; R. Dmytriw	Project Status Update
Meeting	17-Jul-14	Fox Island Main	Dorian Harnish	M. MacDonald; R. Dmytriw	Project Status Update
Meeting	17-Jul-14	Fox Island Main	Trudi Loomis	M. MacDonald; R. Dmytriw	Project Status Update
Meeting	17-Jul-14	Canso	Fishermen: Kenny Snow, Alan Newel, Bob Anderson, Tom Anderson, Steve Mead, Billy Bond, Basil Dobson,	M. MacDonald; R. Dmytriw	Project Status Update
Meeting	18-Jul-14	Queensport	Ben Hensbee, Dave Murphy, R.D, MM, Allan Hensbee, Thane Jameson	M. MacDonald; R. Dmytriw	Project Status Update
Meeting	17-Jull-14	Fox Island Main	Ann Marie Rhynold, Seabreeze Campground	R. Dmytriw, T. Bachiu	Project Status Update
Email	18-Jul-14	NA	Trudi Loomis	M. MacDonald	Vulcan Community Relations

Email	18-Jul-14	NA	Trudi Loomis	M. MacDonald	Vulcan Community Relations
Newsletter	30-Jul-14	NA	Project mailing list / Insert to Guysborough Journal	S. Lewis	Summer Newsletter
FAQ Document	30-Jul-14	NA	Posted to Morien website	S. Lewis	Frequently Asked Questions
Email	5-Aug-14	NA	Trudi Loomis	R. Dmytriw	Site Workers
Meeting	11-Aug-14	Halifax	I. Thompson, B. Howse, C. McIlveen (Chronicle Herald Editorial Board)	D. Donaldson, J. Budreski, M. MacDonald, A. Roach	Project Introduction
Meeting	11-Aug-14	Indian Brook	J. Copage, Chief R. Copage, I. Knockwood, J. MacDonald, J. Martin, O. Marr (Shubenacadie Band)	D. Donaldson, F. Lieth, M. MacDonald, A. Roach, C. Ridgway, C. Milley	Project Introduction / Q&A
Meeting (on Site)	12-Aug-14	Black Point Quarry	Jennifer Copage, Ian Knockwood, Jason MacDonald, Shubenacadie Band	F. Lieth, D. Brisco, Chris Milley, Chris Ridgway	Site location, layout and environment
Meeting	12-Aug-14	Port Hawkesbury	John Pettipas, Pettispas Market, Aulds Cove	D. Donaldson, J. Budreski, M. MacDonald, A. Roach	Project Progress
CLC Meeting	12-Aug-14	Queensport Fire Hall	C. Cosgrove, MJ Taylor, Ben Hendsbee, Dorian Harnish, Donna Hochman, G. MacDonald, B. George + Ed Parker (DFO) + Ian Knockwood, Jason MacDonald (Shubenacadie Band)	F. Lieth, A. Roach, D. Donaldson, J. Budreski, D. Brisco, M. MacDonald	Subjects of interest to the CLC members
Telephone Call / Email	12-Aug-14	NA	Grail Sangster, Executive Director Guysborough County Adult Learning Centre	D. Brisco	Response to request for information re: CLC
Meeting	13-Aug-14	GCIFA Offices, Canso, NS	Garth Meade, Jim Meade, Fishermen	M. MacDonald, A. Roach, D. Donaldson	Project Effects to Fishing
Meeting	13-Aug-14	Millbrook	J. MacGillivary, Impacts and Benefits Officer, KMKNO	F. Lieth, D. Brisco, Chris Milley, Chris Ridgway	KMK Benefits/Update/Q&A
Telephone Call	14-Aug-14	NA	M. Nevin, KMK	R. Dmytriw	Various
Email	14-Aug-14	NA	Chief Copage, J. Copage. R. Copgage	A. Roach	Project Status
Meeting	13-Aug-14	Guysborough	Mary Jurcina Taylor	A. Roach, D. Donaldson	CLC Meeting Effectiveness
Email	29-Aug-14	NA	All CLC members	A. Roach	CLC Meeting Minutes
Meeting	10-Sep-14	Guysborough	G. MacDonald, Dir. Economic Development, MODG; Barry Carroll, Councillor	C. Ridgway, R. Hall	Project Status
Invitations	July to Sept 2014	NA	KMK	C. Milley	Project Status, Benefits
Meeting	10-Sep-14	Truro	KMK	M. MacDonald, D. Brisco, C. Milley, F. Leith	Benefits Committee
Meeting	10-Sep-14	Upper Fox Island	Gabi and Holger Krause	C. Ridgway	Project Status
Meeting	10-Sep-14	Half Island Cove	Dave Hanhan	C. Ridway	Project Status
Meeting	11-Sep-14	Guysborough	Dean Jamieson, Bruce, Peter	C. Ridway	Project Status
Meeting	11-Sep-14	Guysborough	Staff, Guysborough Pharmacy	C. Ridway	Project Status
Meeting	11-Sep-14	Guysborough	Gary Cleary, Director, Guysborough Waste Management Factility	C. Ridway	Project Status
Telephone Call	16-Sep-14	NA	Ed MacDonald, Edmar Engineering Inc, P.Eng	D. Brisco	Wastewater Treatment Methods
Telephone Call	22-Sep-14	NA	Valerie Bowers, Executive Director, Mi'kmaq Employment/Training Secretariat	C. Ridgway	Training requirements for work at Black Point
CLC Meeting	15-Oct-14	Queensport	CLC Members	F. Lieth, M. MacDonald, R.Dmytriw	Various, Presentation re: Ground and Surface Water
Presentation	16-Oct-14	Fanning Acadamy	4th Graders and Teachers	F. Lieth, C. Ridgeway	Presentation re: rocks and minerals
Presentation	16-Oct-14	Fanning Acadamy	High School Students	F. Lieth, C. Ridgeway	Future Job Opportunities
Presentation	16-Oct-14	Gusborough Academy	Middle School Students	F. Lieth, C. Ridgeway	Presentation re: rocks and minerals
Presentation	16-Oct-14	Gusborough Academy	Middle School Students	F. Lieth, C. Ridgeway	Future Job Opportunities
Site Visit	29-Oct-14	Project Site	W. Marshall (Potlotek); K. Prosper (Paqtnkek)	F. Lieth, C. Ridgeway, M. MacDonald, C. Milley	Project Status, Traditonal Use of Site
Presentation	13-Nov-14	Halifax	NSDNR Geology Conference	C. Ridgeway	Project Status, Sustainability
Presentation	2-Dec-14	Guysborough Co	Strait Area Chamber of Commerce	F. Lieth	Project Status.
Mail Out	19-Dec-14	Guysborough Co	County Residents	Project Team	FAQ sent to 3,000 Households
Newsletter	1-Jan-15	Gusborough Co.	County Residents	Project Team	2015 Winter Newsletter
Presentation	13-Jan-15	Canso	Canso Lions Club	F. Lieth	Donation for Seaman's Memorial

Appendix N – Species at Risk Supporting Documentation

ATTACHMENT A – Species at Risk and Species of Conversation Concern Status

ATTACHMENT B – 2010 ACCDC Report

ATTACHMENT C – 2014 ACCDC Report

ATTACHMENT D – NSMNH Report (2014)

ATTACHMENT E – Short List of Priority Species

ATTACHMENT F – Moose Survey Results

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

ATTACHMENT A
SAR and SOCConcern Status Definitions

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

SPECIES AT RISK AND SPECIES OF CONSERVATION CONCERN STATUS DEFINITIONS

1. *Species at Risk Act* (SARA)

A "species at risk" is an extirpated, endangered or threatened species or a species of special concern (Section 2.(1) Species at Risk Act. 2002, c. 29).

- Extirpated – a wildlife species that no longer exists in the wild in Canada, but exists elsewhere in the wild.
- Endangered – a wildlife species that is facing imminent extirpation or extinction.
- Threatened – a wildlife species that is likely to become an endangered species if nothing is done to reverse the factors leading to its extirpation or extinction.
- Special Concern - a wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.

2. *Nova Scotia Endangered Species Act* (*NSESA*)

A "species at risk" means a species that is determined to be extinct, extirpated, vulnerable, threatened or endangered and is listed pursuant to Section 12 (Endangered Species Act. 1998, c. 11, s. 1).

- Extinct – a species that no longer exists and is listed as an extinct species pursuant to Section 12.
- Extirpated – a species that no longer exists in the wild in the Province but exists in the wild outside the Province and is listed as an extirpated species pursuant to Section 12.
- Endangered – species that faces imminent extinction or extirpation and is listed as an endangered species pursuant to Section 12.
- Threatened – means a species that is likely to become endangered if the factors affecting its vulnerability are not reversed and is listed as a threatened species pursuant to Section 12.
- Vulnerable – a species of special concern due to characteristics that make it particularly sensitive to human activities or natural events and that is listed as a vulnerable species.

3. Committee on the Status of Endangered Wildlife in Canada (COSEWIC)

COSEWIC determines the national status of wild Canadian species, subspecies and separate populations suspected of being at risk. COSEWIC bases its decisions on the best up-to-date scientific information and Aboriginal Traditional Knowledge available. All native mammals, birds,

reptiles, amphibians, fish, molluscs, lepidopterans (butterflies and moths), vascular plants, mosses and lichens are included in its current mandate. COSEWIC categorizes listed species based on a qualitative classification system as follows:

- Extinct – Species that no longer exists.
- Endangered – Species is facing imminent extirpation or extinction.
- Extirpated – Species that no longer exists in the wild in Canada, but occurs elsewhere.
- Threatened – Species is likely to become endangered if limiting factors are not reversed.
- Special concern – Species has characteristics that make it particularly sensitive to human activities or natural events.
- Not at Risk – Species that has been evaluated and found to be not a risk.
- Data Deficient – Species for which there is insufficient information to designate a status.

Although there are seven categories of classifications, review of the COSEWIC database is limited to those species listed as endangered, extirpated, threatened, and of special concern.

5. Atlantic Canada Conservation Data Centre (ACCDC)

Conservation Data Centres (CDCs), as part of The NatureServe (formally The Nature Conservancy) international network, track biodiversity at two levels: species and ecological communities. Species and ecological communities are referred to as elements of biodiversity. Elements are ranked in each jurisdiction (province or state) and at global and national levels in order to help prioritize conservation efforts. NatureServe and all CDCs (called Heritage Programs in the US) use a standardized element ranking system that has evolved over 30 years with input from hundreds of scientists, managers and conservationists. The ranking system is very elaborate and comprehensive, thus, the following material describes the National rarity of taxon in Canada as well as the Subnational, (i.e. provincial-level) ranking used in this investigation.

The National ('N', for Canada-wide status) and Subnational ('S', for Provincial status) rarity of taxon uses the following:

- N1/S1 – Critically Imperiled: Critically imperiled in the nation or province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the province.
- N2/S2 – Imperiled: Imperiled in the nation or province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or province.
- N3/S3 – Vulnerable: Vulnerable in the nation or province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.
- N4/S4 – Apparently Secure: Uncommon but not rare; some cause for long-term concern due to declines or other factors.

- N5/S5 – Secure: Common, widespread, and abundant in the nation or province.
- N#N#/S#S# – Numeric range rank: A range between two consecutive ranks for a species/community. Denotes uncertainty about the exact rarity (e.g., S1S2).
- NNR/SNR – Unranked: Nation or province conservation status not yet assessed.
- NNA/SNA – Not Applicable: A conservation status rank is not applicable because the species is not a suitable target for conservation activities.
- NH/SH – Historical: Previously occurred but may have been overlooked during the past 20-70 years. Presence is suspected and will likely be rediscovered; depending on species/community.
- NU/SU – Unrankable: Possibly in peril, but status is uncertain - need more information.
- NX/SX – Extinct/Extirpated: believed to be extirpated from its former range.
- N?/S? – Unranked: not yet ranked.
- NA/SA – Accidental: Accidental or casual, infrequent and far outside usual range. Includes species (usually birds or butterflies) recorded once or twice or only at very great intervals, hundreds or even thousands of miles outside their usual range.
- NE/SE – Exotic: An exotic established in the province (e.g., Purple Loosestrife or Coltsfoot); may be native in nearby regions.
-

The above rankings may be combined with one or more of the following qualifiers:

- B Breeding (Migratory species)
- N Non-breeding (Migratory species)
- ? Inexact of uncertain (the "?" qualifies the character immediately preceding it in the S-rank)
- C Captive or cultivated

5. Wild Species - The General Status of Species in Canada (GSWSC)

Reports from the Wild Species series represent the most comprehensive look at the state of Canada's species and contain the general status assessments for a broad cross-section of species, from all provinces, territories and ocean regions. Originating from the collaboration of all provincial and territorial governments in Canada, and of the federal government, reports from the Wild Species series represent a huge accomplishment that summarizes the monitoring efforts of species in the country.

The Wild Species reports are released every five years. The most recent report, Wild Species 2010, represents the third report of the series, after the 2000 and 2005 versions. Each species assessed in the Wild Species reports received a general status rank in each province, territory, or ocean region in which they are known to be present, as well as an overall Canada General Status Rank (Canada rank).

- 0.2: Extinct – Species that are extirpated worldwide (i.e., they no longer exist anywhere).
- 0.1: Extirpated – Species that are no longer present in a given geographic area, but occur in other areas.
- 1: At Risk – Species for which a formal, detailed risk assessment (COSEWIC status assessment or provincial or territorial equivalent) has been completed and that have been determined to be at risk of extirpation or extinction (i.e. Endangered or Threatened). A COSEWIC designation of Endangered or Threatened automatically results in a Canada General Status Rank (Canada rank) of At Risk. Where a provincial or territorial formal risk assessment finds a species to be Endangered or Threatened in that particular region, then, under the general status program, the species automatically receives a provincial or territorial general status rank of At Risk.
- 2: May Be At Risk – Species that may be at risk of extirpation or extinction and are therefore candidates for a detailed risk assessment by COSEWIC, or provincial or territorial equivalents.
- 3: Sensitive – Species that are not believed to be at risk of immediate extirpation or extinction but may require special attention or protection to prevent them from becoming at risk.
- 4: Secure – Species that are not believed to belong in the categories Extinct, Extirpated, At Risk, May Be At Risk, Sensitive, Accidental or Exotic. This category includes some species that show a trend of decline in numbers in Canada but remain relatively widespread or abundant.
- 5: Undetermined – Species for which insufficient data, information, or knowledge is available with which to reliably evaluate their general status.
- 6: Not Assessed – Species that are known or believed to be present regularly in the geographic area in Canada to which the rank applies, but have not yet been assessed by the general status program.
- 7: Exotic – Species that have been moved beyond their natural range as a result of human activity. In this report, Exotic species have been purposefully excluded from all other categories.
- 8: Accidental – Species occurring infrequently and unpredictably, outside their usual range.

6. Nova Scotia Museum of Natural History (NSMNH)

The Nova Scotia Museum of Natural History is an active partner with the provincial government in evaluating, protecting, and aiding in recovery efforts of habitats and species at risk. The Museum relies heavily on the COSEWIC and General Status Ranks to identify species at risk but compile records of confirmed sightings or collections of such species.

The Museum has developed a resource book titled Natural History of Nova Scotia that is intended to provide a framework in which the significant natural resources of the province of Nova Scotia can be understood, managed and interpreted. The information is useful for parks and natural areas planning, management and interpretation; land use planning for municipalities; development project planning, assessment and evaluation; eco-tourism and recreational planning. Accordingly, the Museum has generated a broad base of knowledge pertaining to Nova Scotia environment, and therefore, is an exceptional source for information related to species at risk and potential for species to be present at any particular site.

ATTACHMENT B
2010 ACCDC Report

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

Atlantic Canada Conservation Data Centre
Centre de données sur la conservation du Canada Atlantique

DATA REPORT 3928: Black Point, NS

Prepared 30 April, 2010
by S.H. Gerriets

CONTENTS OF REPORT

1.0 Preface
- 1.1 Caveats
- 1.2 Additional Information

2.0 Study Area Results
- 2.1 Flora
- 2.2 Fauna
- Map 1: Flora and Fauna

3.0 Special Areas
- 3.1 Managed Areas
- 3.2 Significant Areas
- Map 2: Special Areas

4.0 Taxa List

5.0 Source Bibliography

1.0 PREFACE

The Atlantic Canada Conservation Data Centre (ACCDC) is part of a network of circa 85 NatureServe data centres & heritage programs in 10 provinces, 1 territory, 50 states, plus several Central and South American countries. The NatureServe network is more than 30 years old and shares a common conservation data methodology. The ACCDC was founded in 1997, and maintains data for the jurisdictions of New Brunswick, Nova Scotia, Prince Edward Island, Newfoundland and Labrador. Although a non-governmental agency, the ACCDC is supported by 6 federal agencies, plus 4 provincial governments, outside grants and data processing fees. URL: www.ACCDC.com.

Upon request, the ACCDC provides known occurrence data for rare and endangered flora and fauna, in and near a specifiied study area. As a standard supplement to that data, the ACCDC includes locations of managed areas with some level of protection for flora and fauna, and also known sites of ecological interest, e.g. NB DOE Environmentally Significant Areas. Floral, faunal and Special Areas data are attached to our e-mail response as *.dbf files which may be opened from within data software (e.g. Excel, Access) or mapped in GIS (e.g. ArcView, MapInfo, AutoCAD).

1.1 CAVEATS

While the ACCDC makes a strong effort to verify the accuracy of all the data it obtains, generates and manages, it shall not be held responsible for any inaccuracies in any data that it provides. The following CAVEATS apply:

a.) Data is restricted to use by the specified Data User; any third party requiring data must make its own data request.
b.) To ensure the currency of data, the ACCDC requires Data Users to cease using data 12 months after receipt; if data is still needed after that term, the ACCDC will supply current data as a replacement.
c.) ACCDC data responses are restricted to that data in our Data System at the time of the data request.
d.) Data is qualified as to location (Precision) and time (SurveyDate); cf Data Dictionary for details.
e.) ACCDC data reports are not to be construed as exhaustive inventories of taxa in an area.
f.) The non-occurrence of a taxon cannot be inferred by its absence in an ACCDC data report.

1.2 ADDITIONAL INFORMATION

Please direct biological questions about ACCDC data to: Sean Blaney, ACCDC: (506) 364-2658, and technical data queries to: Stefen Gerriets, ACCDC: (506) 364-2657.
For provincial information on rare taxa and protected areas, or information on game animals, deer yards, old growth forest, archeological sites, fish habitat etc, please contact Sherman Boates, NSDNR: (902) 679-6146.
For more specific information about Peregrine Falcon locations, please contact: Diane Amirault, CWS: (506) 364-5060.

2.0 RARE AND ENDANGERED TAXA

A 100km buffer around the study area contains a relatively large (quintile 5) density of taxa records: 1528 records of 301 taxa from 55 sources. (Data Density: 19.46 rec/km2).

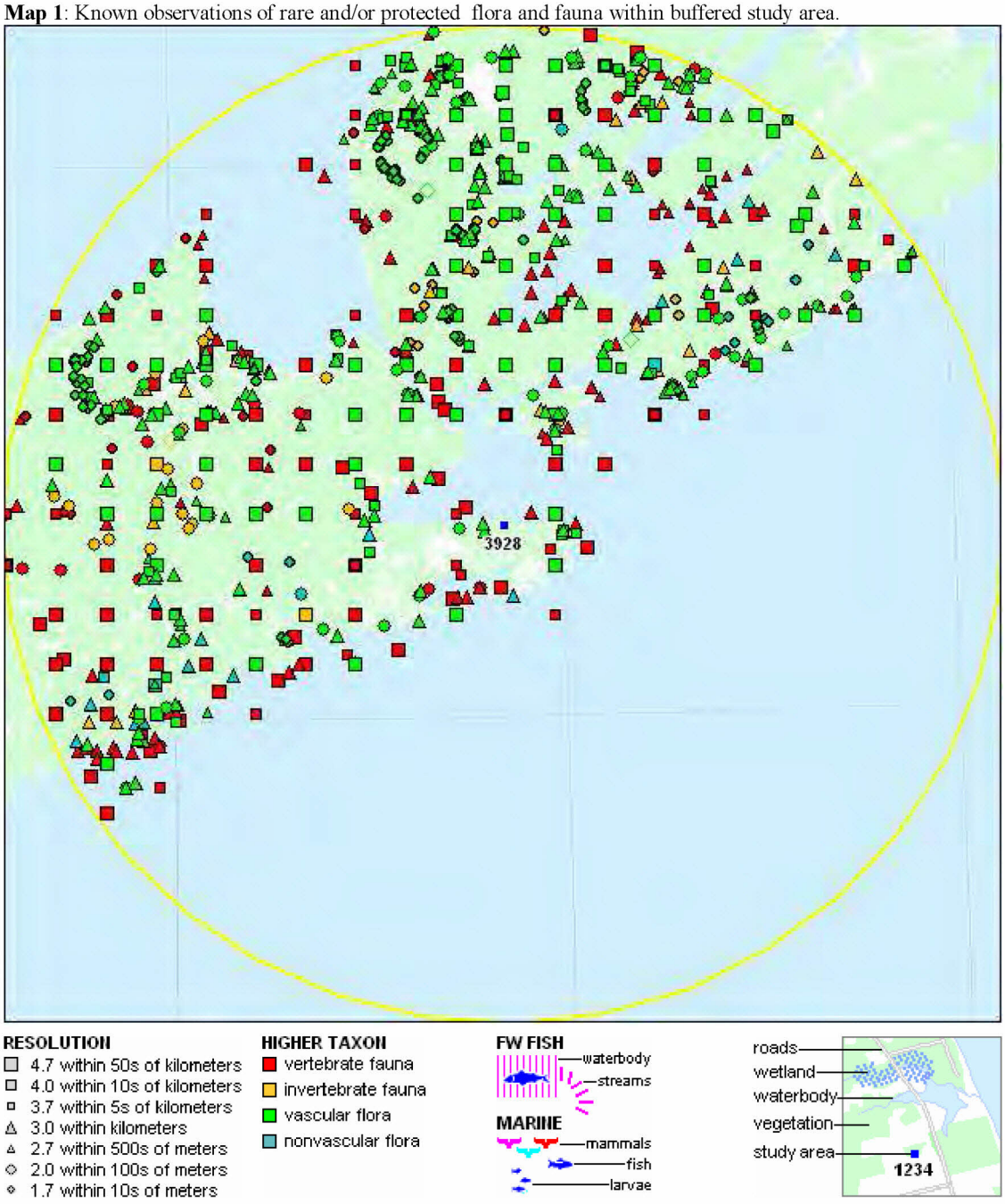
2.1 FLORA

A 100km buffer around the study area contains 715 records of 205 vascular, 38 records of 7 nonvascular flora (see attached *ob.dbf).

2.2 FAUNA

A 100km buffer around the study area contains 660 records of 56 vertebrate, 115 records of 33 invertebrate fauna (cf attached *ob.dbf). No data-sensitive taxa were identified.

Map 1: Known observations of rare and/or protected flora and fauna within buffered study area.



3.0 SPECIAL AREAS

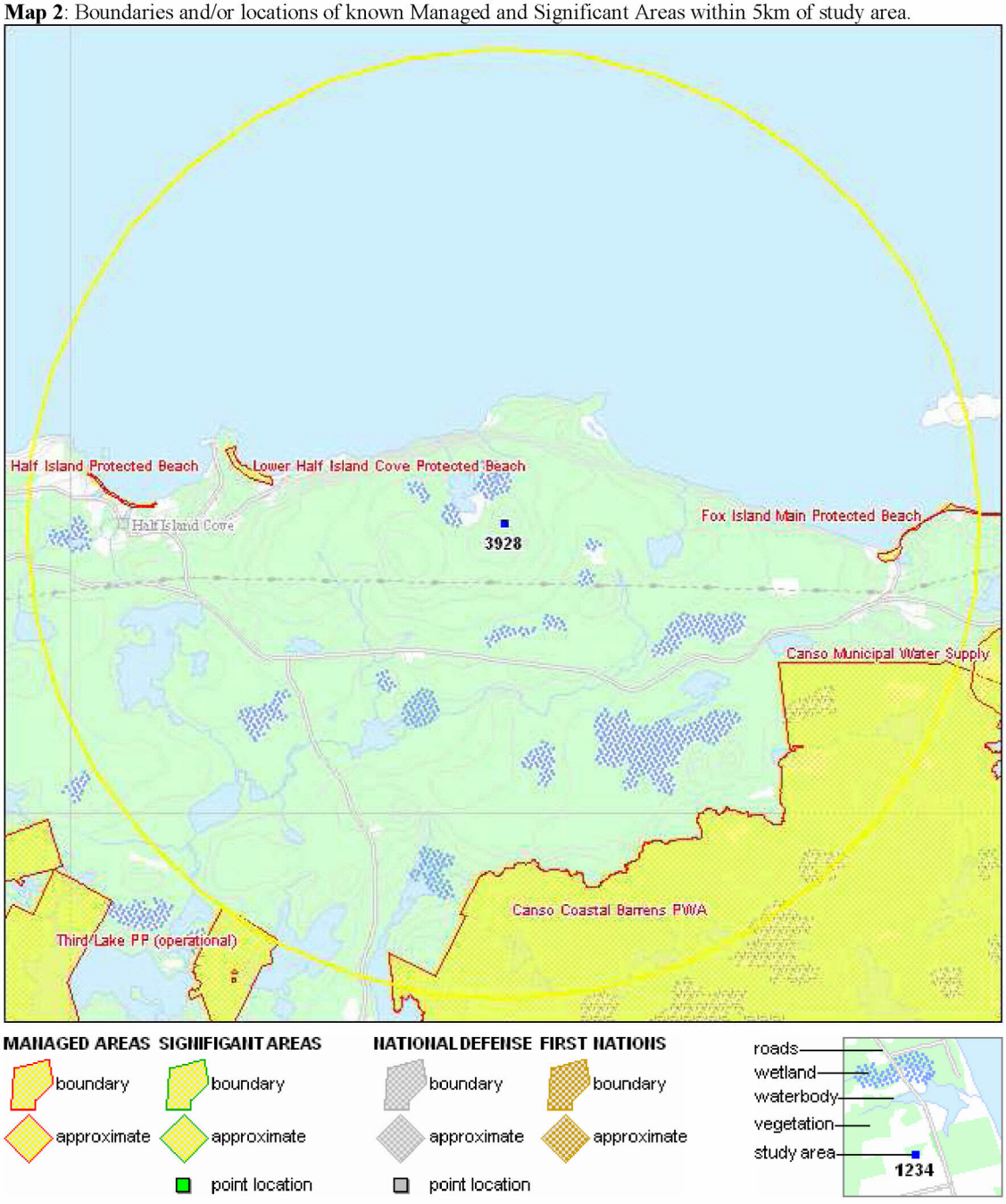
3.1 MANAGED AREAS

The GIS scan identified 5 Managed Areas with some degree of protected status, in the vicinity of the study area (see attached *ma.dbf).

3.2 SIGNIFICANT AREAS

No biologically significant areas identified.

Map 2: Boundaries and/or locations of known Managed and Significant Areas within 5km of study area.



4.0 TAXON LIST

Flora and fauna within the buffered area listed in order of concern, beginning with any legally listed taxa, including the number of observations per taxon and the distance in kilometers from study area centroid to the closest observation.

Scientific name	Common name	COSEWIC	Provincial	Srank	obs	dist.km
Sterna dougallii	Roseate Tern	E	Endangered	S1B	14	12 ±5
Erioderma pedicellatum (Atlantic pop.)	Boreal Felt Lichen (Atlantic pop.)	E	Endangered	S1S2	31	14 ±1
Calidris canutus rufa	Red Knot rufa ssp	E	Endangered	S3M	3	56 ±0.5
Lynx canadensis	Canada Lynx	NAR	Endangered	S1	14	41 ±1
Aegolius funereus	Boreal Owl	NAR		S1B	1	49 ±0.1
Floerkea proserpinacoides	False Mermaidweed	NAR		S2S3	10	32 ±10
Sialia sialis	Eastern Bluebird	NAR		S2S3B	5	37 ±5
Hemidactylium scutatum	Four-toed Salamander	NAR		S3	13	29 ±10
Ammodramus nelsoni	Nelson's Sharp-tailed Sparrow	NAR		S3B	22	20 ±5
Sterna hirundo	Common Tern	NAR		S3B	100	10 ±5
Accipiter gentilis	Northern Goshawk	NAR		S3B	20	10 ±5
Buteo lagopus	Rough-legged Hawk	NAR		S3N	2	27 ±10
Juncus caesariensis	New Jersey Rush	SC	Vulnerable	S2	18	44 ±0.1
Passerculus sandwichensis princeps	Savannah Sparrow princeps ssp	SC		S1B	1	57 ±5
Alasmidonta varicosa	Brook Floater	SC		S1S2	6	31 ±0.1
Danaus plexippus	Monarch	SC		S2B	1	48 ±1
Euphagus carolinus	Rusty Blackbird	SC		S3B	44	23 ±5
Catharus bicknelli	Bicknell's Thrush	T	Vulnerable	S1S2B	4	38 ±5
Glyptemys insculpta	Wood Turtle	T	Vulnerable	S3	33	26 ±10
Morone saxatilis	Striped Bass	T		S1	3	68 ±10
Caprimulgus vociferus	Whip-Poor-Will	T		S1?B	2	73 ±5
Alces americanus	Moose		Endangered	S1	11	79 ±10
Martes americana	American Marten		Endangered	S1	3	82 ±10
Thuja occidentalis	Eastern White Cedar		Vulnerable	S1S2	1	41 ±10
Equisetum palustre	Marsh Horsetail			S1	1	81 ±0
Cryptogramma stelleri	Steller's Rockbrake			S1	5	69 ±5
Stuckenia vaginata	Sheathed Pondweed			S1	2	91 ±5
Potamogeton nodosus	Long-leaved Pondweed			S1	1	77 ±5
Torreyochloa pallida var. pallida	Pale False Manna Grass			S1	1	82 ±10
Elymus wiegandii	Wiegand's Wild Rye			S1	2	43 ±0
Cinna arundinacea	Sweet Wood Reed Grass			S1	2	39 ±0
Bromus latiglumis	Broad-Glumed Brome			S1	2	39 ±0
Malaxis brachypoda	White Adder's-Mouth			S1	1	37 ±10
Listera australis	Southern Twayblade			S1	4	24 ±10
Triantha glutinosa	Sticky False Asphodel			S1	2	91 ±0
Juncus stygius ssp. americanus	Moor Rush			S1	5	42 ±1
Iris prismatica	Slender Blue Flag			S1	4	70 ±10
Scirpus pedicellatus	Stalked Bulrush			S1	2	39 ±0
Rhynchospora capillacea	Slender Beakrush			S1	5	78 ±10
Carex viridula var. elatior	Greenish Sedge			S1	1	91 ±0
Carex tincta	Tinged Sedge			S1	2	56 ±1
Carex tenuiflora	Sparse-Flowered Sedge			S1	2	26 ±1
Carex livida var. radicaulis	Livid Sedge			S1	4	39 ±5
Carex haydenii	Hayden's Sedge			S1	1	87 ±5
Carex gynocrates	Northern Bog Sedge			S1	1	91 ±0.1
Carex alopecoidea	Foxtail Sedge			S1	1	59 ±0.5
Viola canadensis	Canada Violet			S1	1	82 ±1
Scrophularia lanceolata	Lance-leaved Figwort			S1	2	32 ±10
Salix candida	Sage Willow			S1	2	91 ±0
Montia fontana	Water Blinks			S1	1	34 ±1
Polygonum viviparum	Alpine Bistort			S1	1	40 ±1
Utricularia resupinata	Inverted Bladderwort			S1	1	60 ±0.1
Vaccinium ovalifolium	Oval-leaved Bilberry			S1	3	11 ±10
Cuscuta cephalanthi	Buttonbush Dodder			S1	3	59 ±10
Hypericum majus	Large St. John's-wort			S1	2	75 ±1
Suaeda maritima ssp. richii	White Sea-blite			S1	4	13 ±10
Cochlearia tridactylites	Limestone Scurvy-grass			S1	5	20 ±10
Cardamine pratensis var. angustifolia	Cuckoo Flower			S1	2	52 ±10
Ageratina altissima	White Snakeroot			S1	2	68 ±10
Bidens hyperborea	Estuary Beggarticks			S1	1	68 ±1
Arnica lonchophylla	Northern Arnica			S1	1	34 ±10
Sanicula odorata	Clustered Sanicle			S1	2	84 ±10
Somatochlora williamsoni	Williamson's Emerald			S1	1	97 ±0.1
Ophiogomphus mainensis	Maine Snaketail			S1	1	81 ±0.1
Ophiogomphus aspersus	Brook Snaketail			S1	3	50 ±0.1
Polygonia gracilis	Hoary Comma			S1	1	90 ±1
Sorex dispar	Long-tailed Shrew			S1	1	73 ±10
Cystopteris laurentiana	Laurentian Bladder Fern			S1?	2	73 ±0
Triglochin gaspensis	Gaspé Arrowgrass			S1?	2	42 ±1
Schoenoplectus robustus	Sturdy Bulrush			S1?	2	89 ±5
Rubus flagellaris	Northern Dewberry			S1?	1	12 ±5
Crataegus submollis	Quebec Hawthorn			S1?	2	86 ±10
Chenopodium rubrum	Red Pigweed			S1?	1	73 ±10
Acipenser oxyrinchus	Atlantic Sturgeon			S1?	1	87 ±10
Vireo philadelphicus	Philadelphia Vireo			S1?B	2	77 ±5
Vireo gilvus	Warbling Vireo			S1?B	4	38 ±5
Progne subis	Purple Martin			S1B	1	75 ±0.5
Empidonax traillii	Willow Flycatcher			S1B	1	79 ±5

Tringa solitaria	Solitary Sandpiper	S1B	2	48 ±0.1
Nycticorax nycticorax	Black-crowned Night-heron	S1B	1	73 ±5
Sparganium hyperboreum	Northern Burreed	S1S2	3	32 ±0.1
Calamagrostis stricta ssp. stricta	Slim-stemmed Reed Grass	S1S2	1	93 ±1
Juncus alpinoarticulatus ssp. nodulosus	Alpine Rush	S1S2	4	12 ±5
Juncus greenei	Greene's Rush	S1S2	2	61 ±1
Carex tenera	Tender Sedge	S1S2	2	12 ±1
Carex pensylvanica	Pennsylvania Sedge	S1S2	1	91 ±0
Carex hystericina	Porcupine Sedge	S1S2	6	59 ±0
Carex bebbii	Bebb's Sedge	S1S2	2	63 ±10
Anemone virginiana var. alba	Virginia Anemone	S1S2	4	68 ±1
Anemone virginiana	Virginia Anemone	S1S2	3	73 ±0
Cornus suecica	Swedish Bunchberry	S1S2	2	15 ±5
Lobelia kalmii	Brook Lobelia	S1S2	8	62 ±0.1
Zizia aurea	Golden Alexanders	S1S2	4	58 ±1
Nymphalis vaualbum j-album	Compton Tortoiseshell	S1S2	1	48 ±1
Papilio brevicauda	Short-tailed Swallowtail	S1S2	2	87 ±10
Asio otus	Long-eared Owl	S1S2	5	38 ±5
Carex vacillans	Estuarine Sedge	S1S3	1	59 ±0.5
Selaginella selaginoides	Low Spikemoss	S2	2	42 ±1
Botrychium lanceolatum var. angustisegmentum	Triangle Moonwort	S2	3	63 ±10
Equisetum pratense	Meadow Horsetail	S2	2	85 ±0
Woodsia glabella	Smooth Cliff Fern	S2	3	72 ±10
Polystichum lonchitis	Northern Holly Fern	S2	5	54 ±5
Dryopteris fragrans var. remotiuscula	Fragrant Wood Fern	S2	1	29 ±10
Asplenium trichomanes-ramosum	Green Spleenwort	S2	4	65 ±10
Asplenium trichomanes	Maidenhair Spleenwort	S2	1	32 ±0.1
Potamogeton obtusifolius	Blunt-leaved Pondweed	S2	10	44 ±0
Potamogeton friesii	Fries' Pondweed	S2	3	44 ±0
Spiranthes lucida	Shining Ladies'-Tresses	S2	6	66 ±1
Cypripedium reginae	Showy Lady's-Slipper	S2	10	44 ±10
Cypripedium parviflorum var. makasin	Yellow Lady's-slipper	S2	1	82 ±0.1
Cypripedium parviflorum var. pubescens	Yellow Lady's-slipper	S2	3	37 ±10
Allium schoenoprasum var. sibiricum	Wild Chives	S2	1	24 ±10
Juncus trifidus	Highland Rush	S2	1	74 ±5
Eriophorum gracile	Slender Cottongrass	S2	1	40 ±1
Eleocharis quinqueflora	Few-flowered Spikerush	S2	10	74 ±0
Eleocharis olivacea	Yellow Spikerush	S2	2	68 ±0.1
Carex atratiformis	Scabrous Black Sedge	S2	2	72 ±10
Carex atlantica ssp. capillacea	Atlantic Sedge	S2	2	50 ±10
Viola nephrophylla	Northern Bog Violet	S2	2	59 ±1
Saxifraga paniculata ssp. neogaea	White Mountain Saxifrage	S2	1	73 ±10
Parnassia palustris var. parviflora	Marsh Grass-of-Parnassus	S2	3	86 ±0.5
Comandra umbellata	Bastard's Toadflax	S2	1	59 ±10
Salix pedicellaris	Bog Willow	S2	2	59 ±0
Galium labradoricum	Labrador Bedstraw	S2	2	91 ±0
Ranunculus flammula var. flammula	Lesser Spearwort	S2	1	70 ±10
Caltha palustris	Yellow Marsh Marigold	S2	4	84 ±10
Anemone quinquefolia	Wood Anemone	S2	4	68 ±0.5
Anemone canadensis	Canada Anemone	S2	2	49 ±0.1
Pyrola minor	Lesser Pyrola	S2	2	66 ±10
Samolus valerandi ssp. parviflorus	Seaside Brookweed	S2	1	71 ±1
Rumex salicifolius var. mexicanus	Triangular-valve Dock	S2	3	36 ±5
Polygonum scandens	Climbing False Buckwheat	S2	3	38 ±0
Utricularia gibba	Humped Bladderwort	S2	1	61 ±10
Myriophyllum farwellii	Farwell's Water Milfoil	S2	3	44 ±10
Vaccinium uliginosum	Alpine Bilberry	S2	2	74 ±10
Vaccinium caespitosum	Dwarf Bilberry	S2	1	74 ±10
Vaccinium boreale	Northern Blueberry	S2	9	21 ±1
Shepherdia canadensis	Soapberry	S2	7	80 ±0
Crassula aquatica	Water Pygmyweed	S2	3	38 ±10
Triosteum aurantiacum	Orange-fruited Tinker's Weed	S2	15	58 ±1
Stellaria humifusa	Saltmarsh Starwort	S2	3	77 ±0.1
Draba arabisans	Rock Whitlow-Grass	S2	1	76 ±1
Betula michauxii	Newfoundland Dwarf Birch	S2	5	49 ±0
Betula borealis	Northern Birch	S2	1	83 ±10
Caulophyllum thalictroides	Blue Cohosh	S2	4	43 ±0
Impatiens pallida	Pale Jewelweed	S2	7	44 ±1
Senecio pseudoarnica	Seabeach Ragwort	S2	6	22 ±0.1
Erigeron philadelphicus	Philadelphia Fleabane	S2	4	63 ±10
Osmorhiza longistylis	Smooth Sweet Cicely	S2	4	59 ±1
Lampsilis radiata	Eastern Lampmussel	S2	15	46 ±0.1
Somatochlora septentrionalis	Muskeg Emerald	S2	1	99 ±0.1
Somatochlora forcipata	Forcipate Emerald	S2	3	84 ±1
Gomphus descriptus	Harpoon Clubtail	S2	7	50 ±0.1
Nymphalis milberti	Milbert's Tortoiseshell	S2	1	90 ±1
Boloria chariclea	Arctic Fritillary	S2	1	68 ±1
Pieris oleracea	Mustard White	S2	3	48 ±1
Microtus chrotorrhinus	Rock Vole	S2	1	73 ±10
Salmo salar	Atlantic Salmon	S2	60	23 ±10
Picoides dorsalis	American Three-toed Woodpecker	S2	1	83 ±5
Rissa tridactyla	Black-legged Kittiwake	S2	4	83 ±0.5
Lycopodium hickeyi	Hickey's Tree-clubmoss	S2?	1	91 ±0
Juncus dudleyi	Dudley's Rush	S2?	6	76 ±0
Amelanchier fernaldii	Fernald's Serviceberry	S2?	2	21 ±1
Epilobium coloratum	Purple-veined Willowherb	S2?	1	69 ±0.5

Symphyotrichum boreale	Boreal Aster	S2?	2	87 ±10
Scorpidium scorpioides	a Moss	S2?	1	44 ±10
Platydictya jungermannioides	a Moss	S2?	1	73 ±0
Paludella squarrosa	a Moss	S2?	1	93 ±5
Cardinalis cardinalis	Northern Cardinal	S2B	2	44 ±5
Piranga olivacea	Scarlet Tanager	S2B	2	63 ±5
Hylocichla mustelina	Wood Thrush	S2B	3	31 ±5
Rallus limicola	Virginia Rail	S2B	2	45 ±5
Anas acuta	Northern Pintail	S2B	2	63 ±10
Bucephala clangula	Common Goldeneye	S2B,S4N	31	8 ±10
Tringa melanoleuca	Greater Yellowlegs	S2B,S5M	13	24 ±5
Calidris bairdii	Baird's Sandpiper	S2M	1	44 ±0.5
Branta bernicla	Atlantic Brant	S2M	1	8 ±10
Calidris maritima	Purple Sandpiper	S2N	11	8 ±10
Botrychium simplex	Least Moonwort	S2S3	1	86 ±1
Potamogeton zosteriformis	Flat-stemmed Pondweed	S2S3	4	82 ±10
Stuckenia filiformis ssp. alpina	Thread-leaved Pondweed	S2S3	9	59 ±1
Stuckenia filiformis	Thread-leaved Pondweed	S2S3	1	84 ±10
Poa glauca	Glaucous Blue Grass	S2S3	2	73 ±0
Alopecurus aequalis	Short-awned Foxtail	S2S3	4	44 ±0
Goodyera repens	Lesser Rattlesnake-plantain	S2S3	5	42 ±1
Cypripedium parviflorum	Yellow Lady's-slipper	S2S3	4	65 ±10
Lilium canadense	Canada Lily	S2S3	12	52 ±10
Carex hirtifolia	Pubescent Sedge	S2S3	3	43 ±0
Carex adusta	Lesser Brown Sedge	S2S3	1	83 ±5
Limosella australis	Southern Mudwort	S2S3	2	42 ±5
Geocaulon lividum	Northern Comandra	S2S3	1	24 ±10
Decodon verticillatus	Swamp Loosestrife	S2S3	1	54 ±5
Teucrium canadense	Canada Germander	S2S3	2	27 ±0.1
Hedeoma pulegioides	American False Pennyroyal	S2S3	1	87 ±5
Halenia deflexa	Spurred Gentian	S2S3	4	18 ±5
Hypericum dissimulatum	Disguised St John's-wort	S2S3	1	28 ±1
Betula pumila	Bog Birch	S2S3	1	91 ±0.5
Symphyotrichum ciliolatum	Fringed Blue Aster	S2S3	1	70 ±10
Rudbeckia laciniata var. gaspereauensis	Cut-Leaved Coneflower	S2S3	1	68 ±10
Erigeron hyssopifolius	Hyssop-leaved Fleabane	S2S3	6	75 ±10
Asclepias incarnata ssp. pulchra	Swamp Milkweed	S2S3	5	65 ±1
Alasmidonta undulata	Triangle Floater	S2S3	4	23 ±0.1
Erynnis juvenalis	Juvenal's Duskywing	S2S3	1	69 ±1
Pooecetes gramineus	Vesper Sparrow	S2S3B	3	43 ±5
Passerina cyanea	Indigo Bunting	S2S3B	1	54 ±5
Sayornis phoebe	Eastern Phoebe	S2S3B	9	37 ±5
Limosa haemastica	Hudsonian Godwit	S2S3M	4	44 ±0.5
Polygonum raii	Sharp-fruited Knotweed	S2S3SE	5	26 ±1
Schizaea pusilla	Little Curlygrass Fern	S3	3	4 ±1
Botrychium dissectum	Cut-leaved Moonwort	S3	1	80 ±1
Lycopodiella appressa	Southern Bog Clubmoss	S3	1	54 ±1
Isoetes acadiensis	Acadian Quillwort	S3	1	4 ±1
Equisetum variegatum	Variegated Horsetail	S3	5	75 ±0
Dryopteris filix-mas	Male Fern	S3	8	44 ±1
Sparganium natans	Small Burreed	S3	4	56 ±0.5
Milium effusum var. cisatlanticum	Tall Millet Grass	S3	10	83 ±0
Dichanthelium clandestinum	Deer-tongue Panic Grass	S3	1	68 ±5
Platanthera orbiculata	Small Round-leaved Orchid	S3	2	54 ±5
Platanthera hookeri	Hooker's Orchid	S3	1	32 ±0.1
Platanthera grandiflora	Large Purple Fringed Orchid	S3	9	40 ±10
Listera convallarioides	Broad-Leaved Twayblade	S3	4	70 ±5
Goodyera tesselata	Checkered Rattlesnake-Plantain	S3	2	91 ±1
Corallorhiza trifida	Early Coralroot	S3	2	64 ±5
Trillium erectum	Red Trillium	S3	1	88 ±5
Luzula parviflora	Small-flowered Woodrush	S3	1	94 ±5
Carex eburnea	Bristle-leaved Sedge	S3	3	68 ±5
Carex bromoides	Bromelike Sedge	S3	8	39 ±0
Verbena hastata	Blue Vervain	S3	1	69 ±0.1
Laportea canadensis	Canada Wood Nettle	S3	2	39 ±0
Salix petiolaris	Meadow Willow	S3	1	59 ±0
Galium kamtschaticum	Northern Wild Licorice	S3	5	77 ±1
Rhamnus alnifolia	Alder-leaved Buckthorn	S3	10	39 ±0
Polygonum pensylvanicum	Pennsylvania Smartweed	S3	4	36 ±1
Epilobium strictum	Downy Willowherb	S3	3	45 ±0.5
Fraxinus nigra	Black Ash	S3	14	11 ±10
Bartonia virginica	Yellow Bartonia	S3	1	41 ±0.1
Stellaria longifolia	Long-leaved Starwort	S3	1	44 ±0
Packera paupercula	Balsam Groundsel	S3	3	73 ±0
Megalodonta beckii	Water Beggarticks	S3	5	67 ±0.5
Asclepias incarnata	Swamp Milkweed	S3	9	52 ±10
Panax trifolius	Dwarf Ginseng	S3	6	83 ±0
Amphiagrion saucium	Eastern Red Damsel	S3	3	61 ±0.1
Sympetrum danae	Black Meadowhawk	S3	8	43 ±10
Nannothemis bella	Elfin Skimmer	S3	2	40 ±0.1
Gomphaeschna furcillata	Harlequin Darner	S3	2	40 ±0.1
Boyeria grafiana	Ocellated Darner	S3	2	87 ±1
Aeshna clepsydra	Mottled Darner	S3	2	41 ±0.1
Ophiogomphus carolus	Riffle Snaketail	S3	20	45 ±0.1
Lanthus parvulus	Northern Pygmy Clubtail	S3	5	63 ±1
Polygonia faunus	Green Comma	S3	1	48 ±1

Euphydryas phaeton	Baltimore Checkerspot	S3	5	24 ±1
Hesperia comma laurentina	Laurentian Skipper	S3	2	77 ±1
Hesperia comma	Common Branded Skipper	S3	2	77 ±1
Cepphus grylle	Black Guillemot	S3	12	41 ±5
Lycopodium sitchense	Sitka Clubmoss	S3?	3	73 ±1
Lycopodium sabinifolium	Ground-Fir	S3?	4	76 ±1
Lycopodium complanatum	Northern Clubmoss	S3?	1	54 ±5
Isoetes lacustris	Lake Quillwort	S3?	12	4 ±1
Cystopteris tenuis	Mackay's Brittle Fern	S3?	5	46 ±5
Sparganium fluctuans	Floating Burreed	S3?	2	17 ±1
Potamogeton richardsonii	Richardson's Pondweed	S3?	4	48 ±5
Potamogeton praelongus	White-stemmed Pondweed	S3?	7	25 ±0.1
Carex foenea	Hay Sedge	S3?	1	92 ±0
Salix pellita	Satiny Willow	S3?	1	31 ±1
Agrimonia gryposepala	Hooked Agrimony	S3?	7	43 ±0
Campanula aparinoides	Marsh Bellflower	S3?	4	70 ±5
Bidens connata	Purple-stemmed Beggarticks	S3?	3	70 ±0.5
Polygonia interrogationis	Question Mark	S3B	2	48 ±1
Icterus galbula	Baltimore Oriole	S3B	5	37 ±5
Dolichonyx oryzivorus	Bobolink	S3B	62	13 ±5
Mimus polyglottos	Northern Mockingbird	S3B	9	11 ±5
Coccyzus erythropthalmus	Black-billed Cuckoo	S3B	15	41 ±5
Sterna paradisaea	Arctic Tern	S3B	33	6 ±1
Mergus serrator	Red-breasted Merganser	S3B	39	8 ±10
Numenius phaeopus	Whimbrel	S3M	8	16 ±10
Equisetum scirpoides	Dwarf Scouring-Rush	S3S4	3	67 ±1
Polystichum braunii	Braun's Holly Fern	S3S4	12	47 ±1
Cystopteris bulbifera	Bulblet Bladder Fern	S3S4	10	32 ±1
Sphenopholis intermedia	Slender Wedge Grass	S3S4	12	57 ±0
Spiranthes romanzoffiana	Hooded Ladies'-Tresses	S3S4	14	12 ±1
Liparis loeselii	Loesel's Twayblade	S3S4	7	21 ±1
Juncus nodosus	Knotted Rush	S3S4	10	59 ±0
Sisyrinchium angustifolium	Narrow-leaved Blue-eyed-grass	S3S4	1	58 ±0
Carex albicans var. emmonsii	White-tinged Sedge	S3S4	2	9 ±0.1
Lindernia dubia	Yellow-seeded False Pimperel	S3S4	1	43 ±0
Lysimachia thyrsiflora	Tufted Yellow Loosestrife	S3S4	1	38 ±0
Polygonum robustius	Stout Smartweed	S3S4	1	43 ±0
Sanguinaria canadensis	Bloodroot	S3S4	10	43 ±0
Proserpinaca palustris var. crebra	Marsh Mermaidweed	S3S4	4	38 ±0
Myriophyllum sibiricum	Siberian Water Milfoil	S3S4	1	91 ±0.1
Polygonia progne	Gray Comma	S3S4	3	48 ±1
Speyeria aphrodite	Aphrodite Fritillary	S3S4	2	69 ±100
Callophrys polios	Hoary Elfin	S3S4	2	61 ±1
Synaptomys cooperi	Southern Bog Lemming	S3S4	1	73 ±10
Loxia curvirostra	Red Crossbill	S3S4	9	38 ±5
Pluvialis dominica	American Golden-Plover	S3S4M	3	44 ±0.5
Didymodon fallax	Fallacious Screw Moss	S4?	1	73 ±0
Rhodobryum ontariense	a Moss	S4S5	2	73 ±0
Cratoneuron filicinum	a Moss	S4S5	1	73 ±0
Cyperus lupulinus ssp. macilentus	Hop Flatsedge	SH	3	61 ±1
Solidago simplex var. randii	Sticky Goldenrod	SH	2	26 ±5

5.0 SOURCE BIBLIOGRAPHY

The recipient of this data shall acknowledge the ACCDC and the data sources of the dataset in any documents, reports, publications or presentations, in which this dataset makes a major contribution. The sources listed below contributed data contained in this report:

recs	source
231	Lepage, D. 2009. Maritime Breeding Bird Atlas Database. Bird Studies Canada, Sackville NB, 143,498 recs.
191	Newell, R.E. 2000. E.C. Smith Herbarium Database. Acadia University, Wolfville NS, 7139 recs.
183	Benjamin, L.K. (compiler). 2007. Significant Habitat & Species Database. Nova Scotia Dept Natural Resources, 8439 recs.
144	Blaney, C.S.; Mazerolle, D.M. 2009. Fieldwork 2009. Atlantic Canada Conservation Data Centre. Sackville NB, 13343 recs.
138	Erskine, A.J. 1992. Maritime Breeding Bird Atlas Database. NS Museum & Nimbus Publ., Halifax, 82,125 recs.
100	Pronych, G. & Wilson, A. 1993. Atlas of Rare Vascular Plants in Nova Scotia. Nova Scotia Museum, Halifax NS, I:1-168, II:169-331. 1446 recs.
55	Newell, R.E. 2005. E.C. Smith Digital Herbarium. E.C. Smith Herbarium, Irving Biodiversity Collection, Acadia University, Web site: http://luxor.acadiau.ca/library/Herbarium/project/. 582 recs.
49	Chardine, J.W. & et al. 2008. Colonial Waterbird Database. Canadian Wildlife Service, Sackville NB, 2699 sites, 9623 recs (7882 obs).
36	Hicks, A. 2009. Coastal Waterfowl Surveys Database, 2000-08. Canadian Wildlife Service, Sackville NB, 46491 recs (11153 non-zero).
33	Zinck, M. & Roland, A.E. 1998. Roland's Flora of Nova Scotia. Nova Scotia Museum, 3rd ed., rev. M. Zinck; 2 Vol., 1297 pp.
32	Benjamin, L.K. 2009. D. Anderson Odonata Records for Cape Breton, 1997-2004. Nova Scotia Dept Natural Resources, 1316 recs.
29	Layberry, R.A. & Hall, P.W., LaFontaine, J.D. 1998. The Butterflies of Canada. University of Toronto Press. 280 pp+plates.
28	Roland, A.E. & Smith, E.C. 1969. The Flora of Nova Scotia, 1st Ed. Nova Scotia Museum, Halifax, 743pp.
26	Brunelle, P.-M. (compiler). 2009. ADIP/MDDS Odonata Database: data to 2006 inclusive. Atlantic Dragonfly Inventory Program (ADIP), 24200 recs.
24	Blaney, C.S.; Mazerolle, D.M.; Oberndorfer, E. 2007. Fieldwork 2007. Atlantic Canada Conservation Data Centre. Sackville NB, 13770 recs.
23	Benjamin, L.K. (compiler). 2001. Significant Habitat & Species Database. Nova Scotia Dept of Natural Resources, 15 spp, 224 recs.
19	Pulsifer, M.D. 2002. NS Freshwater Mussel Fieldwork. Nova Scotia Dept Natural Resources, 369 recs.
19	Cameron, R.P. 2009. Erioderma pedicellatum database, 1979-2008. Dept Environment & Labour, 103 recs.
17	Morrison, Guy. 2006. Maritime Shorebird Survey (MSS) database. Canadian Wildlife Service, Environment Canada, 52 taxa, 570 sites, 11496 surveys. 59704 recs.
14	Scott, F.W. 2002. Nova Scotia Herpetofauna Atlas Database. Acadia University, Wolfville NS, 8856 recs.
12	Blaney, C.S. 2000. Fieldwork 2000. Atlantic Canada Conservation Data Centre. Sackville NB, 1265 recs.
11	Blaney, C.S.; Spicer, C.D. 2001. Fieldwork 2001. Atlantic Canada Conservation Data Centre. Sackville NB, 717 recs.
11	Adams, J. & Herman, T.B. 1998. Thesis, Unpublished map of C. insculpta sightings. Acadia University, Wolfville NS, 88 recs.
10	"Newell, R.E. 2004. Assessment and update status report on the New Jersey Rush (Juncus caesariensis) in Canada. Committee on the Status of Endangered Wildlife in Canada, 15 recs."
9	Neily, T.H. 2010. Erioderma Pedicellatum records 2005-09. Mersey Tobiatic Research Institute, 67 recs.
8	Benjamin, L.K. & Boreal Felt Lichen, Mountain Avens, Orchid and other recent records. 2009. Nova Scotia Dept Natural Resources, 105 recs.
7	Oldham, M.J. 2000. Oldham database records from Maritime provinces. Oldham, M.J; ONHIC, 487 recs.
7	"Knapton, R. & Power, T.; Williams, M. 2001. SAR Inventory: Fortress Louisbourg NP. Parks Canada, Atlantic, SARINV01-13. 157 recs ."
7	Chaput, G. 2002. Atlantic Salmon: Maritime Provinces Overview for 2001. Dept of Fisheries & Oceans, Atlantic Region, Science Stock Status Report D3-14. 39 recs.
6	Blaney, C.S.; Spicer, C.D.; Mazerolle, D.M. 2005. Fieldwork 2005. Atlantic Canada Conservation Data Centre. Sackville NB, 2333 recs.
4	Rousseau, J. 1938. Notes Floristiques sur l'est de la Nouvelle-Ecosse in Contributions de l'Institut Botanique de l'Universite de Montreal. Universite de Montreal, 32, 13-62. 11 recs.
4	Goltz, J.P. & Bishop, G. 2005. Confidential supplement to Status Report on Prototype Quillwort (Isoetes prototypus). Committee on the Status of Endangered Wildlife in Canada, 111 recs.
4	Downes, C. 1998-2000. Breeding Bird Survey Data. Canadian Wildlife Service, Ottawa, 111 recs.
4	Benjamin, L.K. (compiler). 2002. Significant Habitat & Species Database. Nova Scotia Dept of Natural Resources, 32 spp, 683 recs.
3	Whittam, R.M. 1999. Status Report on the Roseate Tern (update) in Canada. Committee on the Status of Endangered Wildlife in Canada, 36 recs.
3	Parker, G.R., Maxwell, J.W., Morton, L.D. & Smith,G.E.J. 1983. The ecology of Lynx , Lynx canadensis, on Cape Breton Island. Canadian Journal of Zoology, 61:770-786. 51 recs.
3	Gilhen, J. 1984. Amphibians & Reptiles of Nova Scotia, 1st Ed. Nova Scotia Museum, 164pp.
2	Sollows, M.C,. 2008. NBM Science Collections databases: mammals. New Brunswick Museum, Saint John NB, download Jan. 2008, 4983 recs.
2	Quigley, E.J. 2006. Plant records, Mabou & Port Hood. Pers. comm. to S.P. Basquill, Jun. 12. 4 recs, 4 recs.
2	Olsen, R. Herbarium Specimens. Nova Scotia Agricultural College, Truro. 2003.
2	Newell, R.E. 2001. Fortress Louisbourg Species at Risk Survey 2001. Parks Canada, 4 recs.
2	Hill, N. 2003. Floerkea proserpinacoides at Heatherdale, Antigonish Co. 2002. , Pers. comm. to C.S. Blaney. 2 recs.
2	Cameron, R.P. 2009. Nova Scotia nonvascular plant observations, 1995-2007. Nova Scotia Dept Natural Resources, 27 recs.
1	Whittam, R.M. 2000. Senecio pseudoarnica on Country Island. , Pers. comm. to S. Gerriets. 1 rec.
1	Standley, L.A. 2002. Carex haydenii in Nova Scotia. , Pers. comm. to C.S. Blaney. 4 recs.
1	Powell, B.C. 1967. Female sexual cycles of Chrysemy spicta & Clemmys insculpta in Nova Scotia. Can. Field-Nat., 81:134-139. 26 recs.
1	Murphy, S. 2006. Juncus caesariensis data from Yava Technologies In Situ Leach Mining Environmental Assessment. Jacques Whitford Inc., 10 recs.
1	Gillis, J. 2007. Botanical observations from bog on Skye Mountain, NS. Pers. comm., 8 recs.
1	Doucet, D.A. 2009. Census of Globally Rare, Endemic Butterflies of Nova Scotia Gulf of St Lawrence Salt Marshes. Nova Scotia Dept of Natural Resources, Species at Risk, 155 recs.
1	Clayden, S.R. 1998. NBM Science Collections databases: vascular plants. New Brunswick Museum, Saint John NB, 19759 recs.
1	Christie, D.S. 2000. Christmas Bird Count Data, 1997-2000. Nature NB, 54 recs.
1	Bridgland, J. 2006. Cape Breton Highlands National Park Digital Database. Parks Canada, 190 recs.
1	Benjamin, L.K., NSDNR Fieldwork & Consultants Reports. 2009. Nova Scotia Dept Natural Resources, 143 recs.
1	Bagnell, B.A. 2001. New Brunswick Bryophyte Occurrences. B&B Botanical, Sussex, 478 recs.
1	anon. 2001. S.. H.. NS Freshwater Mussel Fieldwork. Nova Scotia Dept Natural Resources, 76 recs.

ATTACHMENT C
2014 ACCDC Report

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

Atlantic Canada Conservation Data Centre
Centre de données sur la conservation du Canada Atlantique

DATA REPORT 5173: Black Point, NS

Prepared 24 January, 2014
by J. Churchill, Data Manager

CONTENTS OF REPORT

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3.0 Special Areas
- 3.1 Managed Areas
- 3.2 Significant Areas
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4.0 Rare Species Lists
- 4.1 Fauna
- 4.2 Flora

5.0 Source Bibliography

1.0 PREFACE

The Atlantic Canada Conservation Data Centre (ACCDC) is part of a network of NatureServe data centres and heritage programs serving 50 states in the U.S.A, 10 provinces and 1 territory in Canada, plus several Central and South American countries. The NatureServe network is more than 30 years old and shares a common conservation data methodology. The ACCDC was founded in 1997, and maintains data for the jurisdictions of New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland and Labrador. Although a non-governmental agency, the ACCDC is supported by 6 federal agencies and 4 provincial governments, as well as through outside grants and data processing fees. URL: www.ACCDC.com.

Upon request and for a fee, the ACCDC queries its database and produces customized reports of the rare and endangered flora and fauna known to occur in or near a specified study area. As a supplement to that data, the ACCDC includes locations of managed areas with some level of protection, and known sites of ecological interest or sensitivity.

1.1 DATA LIST

Included datasets:

Filename	Contents
BlackPtNS_5173ob.xls	Rare and legally protected *Flora and Fauna* in your study area
BlackPtNS_5173bp.xls	Rare and common *Pelagic Birds* in your study area (CWS database)
BlackPtNS_5173sa.xls	All *Significant Natural Areas* in your study area
BlackPtNS_5173ma.xls	All *Managed Areas* in your study area

1.2 RESTRICTIONS

The ACCDC makes a strong effort to verify the accuracy of all the data that it manages, but it shall not be held responsible for any inaccuracies in data that it provides. By accepting ACCDC data, recipients assent to the following limits of use:

a) Data is restricted to use by trained personnel who are sensitive to landowner interests and to potential threats to rare and/or endangered flora and fauna posed by the information provided.
b) Data is restricted to use by the specified Data User; any third party requiring data must make its own data request.
c) The ACCDC requires Data Users to cease using and delete data 12 months after receipt, and to make a new request for updated data if necessary at that time.
d) ACCDC data responses are restricted to the data in our Data System at the time of the data request.
e) Locations given for rare species records may be deliberately imprecise. Each record has an estimate of locational uncertainty, which must be referenced in order to understand the record's relevance to a particular location. Please see attached Data Dictionary for details.
f) ACCDC data responses are not to be construed as exhaustive inventories of taxa in an area.
g) The absence of a taxon cannot be inferred by its absence in an ACCDC data response.

1.3 ADDITIONAL INFORMATION

The attached file DataDictionary 2.1.pdf provides metadata for the data provided.

Please direct any additional questions about ACCDC data to the following individuals:

Plants, Lichens, Ranking Methods
Sean Blaney, Botanist
Tel: (506) 364-2658
sblaney@mta.ca

Animals (Fauna)
John Klymko, Zoologist
Tel: (506) 364-2660
jklymko@mta.ca

Plant Communities
Sarah Robinson , Community Ecologist
Tel: (506) 364-2664
srobinson@mta.ca

Data Management, GIS
James Churchill, Data Manager
Tel: (902) 679-6146
jlchurchill@mta.ca

Billing
Cindy Spicer
Tel: (506) 364-2665
cspicer@mta.ca

All other Inquiries
R.A. Lautenschlager
Tel: (506) 364-2661
rlautenschlager@mta.ca

Questions on the biology of Federal Species at Risk can be directed to ACCDC: (506) 364-2657, with questions on Species at Risk regulations to: Samara Eaton, Canadian Wildlife Service (NB and PE): (506) 364-5060 or Julie McKnight, Canadian Wildlife Service (NS): (902) 426-4196.

For provincial information about rare taxa and protected areas, or information about game animals, deer yards, old growth forests, archeological sites, fish habitat etc., in New Brunswick, please contact Stewart Lusk, Natural Resources: (506) 453-7110.

For provincial information about rare taxa and protected areas, or information about game animals, deer yards, old growth forests, archeological sites, fish habitat etc., in Nova Scotia, please contact Sherman Boates, NSDNR: (902) 679-6146.

For provincial information about rare taxa and protected areas, or information about game animals, fish habitat etc., in Prince Edward Island, please contact Rosemary Curley, PEI Dept. of Agriculture and Forestry: (902) 368-4807.

2.0 RARE AND ENDANGERED SPECIES

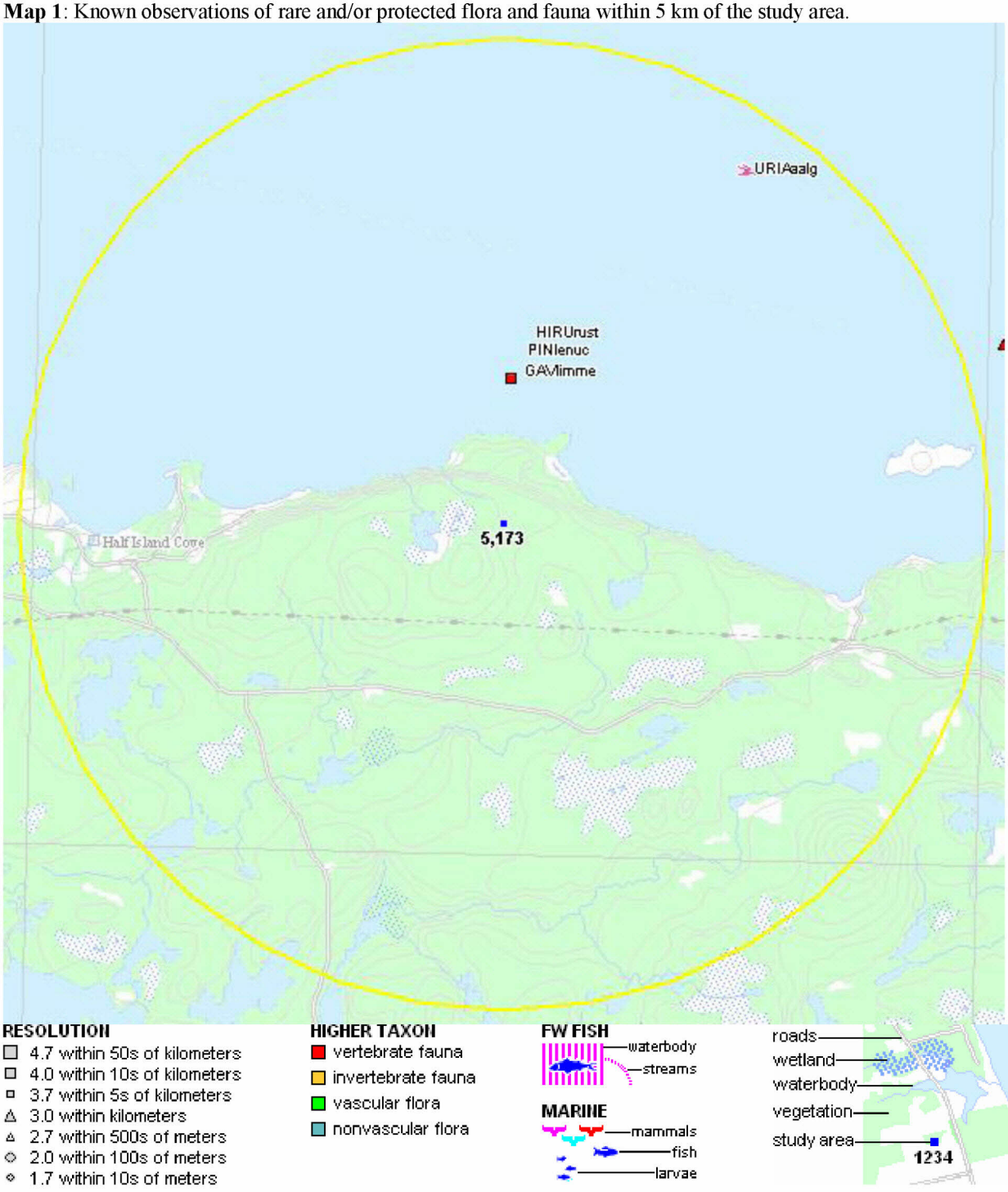
2.1 FLORA

A 5 km buffer around the study area contains no records of vascular, no records of nonvascular flora (Map 1 and attached: *ob.xls).

2.2 FAUNA

A 5 km buffer around the study area contains 4 records of 4 vertebrate, no records of invertebrate fauna (Map 1 and attached data files - see 1.1 Data List).

Map 1: Known observations of rare and/or protected flora and fauna within 5 km of the study area.

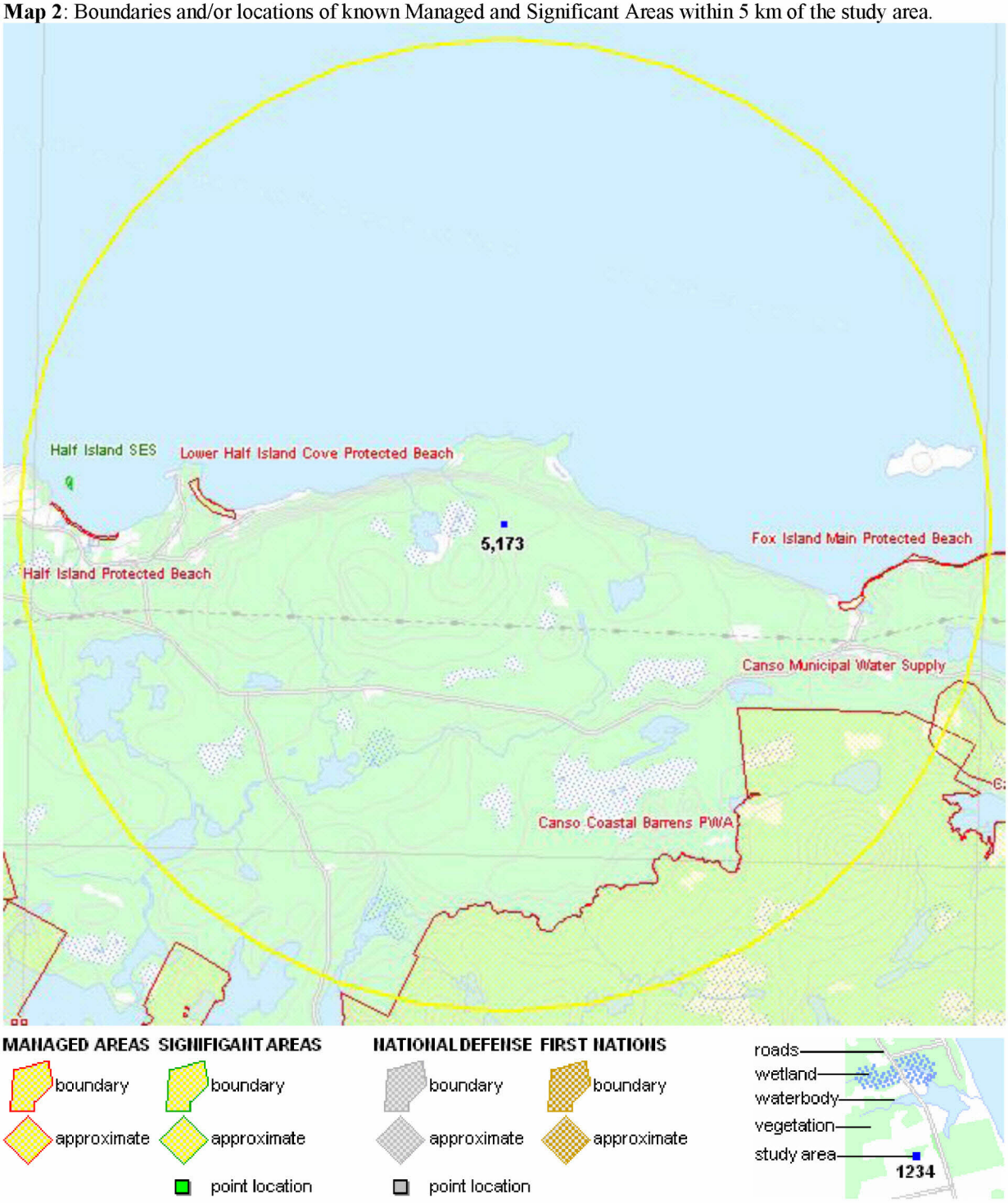


3.0 SPECIAL AREAS

3.1 MANAGED AREAS
The GIS scan identified 5 managed areas in the vicinity of the study area (Map 2 and attached file: *ma*.xls)

3.2 SIGNIFICANT AREAS
The GIS scan identified 1 biologically significant site in the vicinity of the study area (Map 2 and attached file: *sa*.xls)

Map 2: Boundaries and/or locations of known Managed and Significant Areas within 5 km of the study area.



4.0 RARE SPECIES LISTS

Rare and/or endangered taxa within the buffered area listed in order of concern, beginning with legally listed taxa, with the number of observations per taxon and the distance in kilometers from study area centroid to the closest observation. [P] = vascular plant, [N] = nonvascular plant, [A] = vertebrate animal, [I] = invertebrate animal, [C] = community.

4.1 FLORA

Scientific Name	Common Name	COSEWIC	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)

4.2 FAUNA

	Scientific Name	Common Name	COSEWIC	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
A	*Hirundo rustica*	Barn Swallow	Threatened	Endangered	S3B	At Risk	1	1.5 ± 5.0
A	*Gavia immer*	Common Loon	Not At Risk		S3B,S4N	May Be At Risk	1	1.5 ± 5.0
A	*Pinicola enucleator*	Pine Grosbeak			S3?B,S5N	May Be At Risk	1	1.5 ± 5.0
A	*Uria aalge*	Common Murre			S1B,S3N	Secure	1	4.5 ± 0.1

5.0 SOURCE BIBLIOGRAPHY

The recipient of this data shall acknowledge the ACCDC and the data sources listed below in any documents, reports, publications or presentations, in which this dataset makes a significant contribution.

# recs	CITATION
3	Erskine, A.J. 1992. Maritime Breeding Bird Atlas Database. NS Museum & Nimbus Publ., Halifax, 82,125 recs.
1	Canadian Wildlife Service. 2011. Eastern Canada Seabirds at Sea (ECSAS), 3.27 Ed. Environment Canada, 305,783 recs.

ATTACHMENT D
NSMNH Report (2014)

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

NOVA SCOTIA

Communities, Culture & Heritage

1741 Brunswick Street
3rd Floor
P.O. Box 456
Halifax, NS
B3J 2R5

Tel: (902) 424-6475
Fax: (902) 424-0560

October 8, 2014

Beth Cameron
AMEC
Environmental and Infrastructure
50 Troop Ave, Unit 300
Dartmouth, NS B3B 1Z1

Dear Ms. Cameron:

RE: Environmental Screening 14-09-22
Black Point Quarry

Further to your request of September 22, 2014 staff at Communities, Culture and Heritage has reviewed their files for reference to the presence of heritage resources in the study area. Please be aware that our information is not comprehensive, and may include varying degrees of accuracy with respect to the precise location and condition of heritage resources.

It should be noted that the amount and degree of disturbance from previous developments could have a significant role in establishing the presence, absence or condition of heritage resources in this area.

Archaeological, Historical Sites and Remains

There are no recorded archaeological sites on file for the proposed study area. There are recorded archaeological sites, pre-contact and historic, to the west and east of the study area. The study area contains watercourses/waterbodies and has a large section along the coast. Historic maps indicate settlement.

It is recommended that an assessment for archaeological resources take place.

Botany

Staff has reviewed the records for plant species-at-risk in the Black Point area. The following species are ones of potential concern within the project area. The following plants are known from the vicinity of Black Point and should be considered prior to any development of the quarry or access roads.

Isoetes acadiensis (provincially yellow-listed)
Vaccinium ovalifolium (provincially orange-listed)

The presence/absence of the above species should be determined when identification is certain and the results should be stated in the final report. Please note that the Nova Scotia Museum

holds few records from this coast and it would be advisable to include a plant species inventory list as part of the field assessment.

Zoology

There are no records of zoological species with conservation implications in the foot-printed site.

There are, however, reports of nesting or potential nesting records of several bird species of concern within the immediate area.

Blue-winged Teal
Common Tern
Arctic Tern
Spotted Sandpiper
Willet
Common Loon
Gray Jay
Barn Swallow
Bank Swallow
Tree Swallow
Gray Catbird
Boreal Chickadee
Bay-breasted Warbler
Blackpoll Warbler
Tennessee Warbler
Wilson's Warbler
Ruby-crowned Kinglet
Golden-crowned Kinglet
Olive-sided Flycatcher
Yellow-bellied Flycatcher
Black-backed Woodpecker

Presence or absence of hibernating bats within the province is a potential concern due to the decimation of these populations due to White-Nose- Syndrome. There is little information on potential hibernacula in the outlined area, so if the geological features would support such sites, these should be investigated. Such structures could include caves (solution or fissure), abandoned mines, as well as abandoned fortifications with tunneling

It is recommended that the proponent also consult NSDNR with respect to wildlife species with special conservation concern such as Mainland Moose and Canada Lynx, as they would have more-specific data concerning possible presence within the area of the proposed development.

The adjacent marine waters may (seasonally) support resident or migratory species of Cetaceans as well as Marine Turtles. The majority of these do have some conservation concerns, but we note that these fall within the jurisdiction of the Federal Crown

C 1340-2158

NOVA SCOTIA

Communities, Culture & Heritage

1741 Brunswick Street
3rd Floor
P.O. Box 456
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Tel: (902) 424-6475
Fax: (902) 424-0560

Palaeontology

This project will disrupt rocks of the Meguma Supergroup (both the Goldenville Group and the Halifax Group) as well as a muscovite biotite monzogranite. No fossils are expected.

I have attached an invoice for the staff time spent reviewing our records and compiling this response. If you have any questions, please contact me at 424-6475.

Sincerely,

Sean Weseloh-McKeane
Coordinator, Special Places

Enclosure

ATTACHMENT E
Short List of Priority Species

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

SCIENTIFIC NAME	COMMON NAME *	*SPECIES AT RISK ACT* Status & Schedule	NOVA SCOTIA ENDANGERED SPECIES ACT	COMMITTEE ON THE STATUS OF WILD SPECIES IN CANADA	GENERAL STATUS OF WILD SPECIES IN CANADA- NS /Atlantic	REGION	HABITAT	Step 2 - Possible Occurrence in Region?	Step 3- Possible Occurrence on Site based on habitats present
VASCULAR PLANTS									
Adiantum pedatum	Northern Maidenhair-Fern				2- May Be At Risk	Yarmouth to north Cape Breton Island. Along Meander River.	In fertile or alkaline soils. Under oak-birch-sugar maple trees.	YES	NO
Agalinis maritima	Saltmarsh Agalinis/Salt-Marsh False-Foxglove				2- May Be At Risk	Salt marsh along the Argyle River at Argyle Head, Yarmouth County.	Salt marshes along the coast.	NO	NO
Ageratina altissima	White Snakeroot				2- May Be At Risk	A recording west of Advocate (North East NS), and unconfirmed near Antigonish.	Clearings, thickets, and moist woods.	Possibly	YES
Allium schoenoprasum	Wild Chives				2- May Be At Risk	Scattered in NS	Wet lowlands near the coast	Unlikely	YES
Allium tricoccum	Small White Leek				2- May Be At Risk	Cape Blomidon and Cambridge in Kings County. Kemptown in Colchester County. Beaman's Mountain in Digby County; and Inverness County.	Rich, deciduous forests and Intervales. (Hinds 2000: rich hardwoods and alluvial bottomlands.)	NO	NO
Alnus serrulata	Smooth Alder				3- Sensitive	Southwestern Nova Scotia.	Lakeshores	NO	NO
Alopecurus aequalis	Short-awned Foxtail				3- Sensitive	Top of Cape Blomidon, and from Cumberland County to Strathlorne and Margaree in Cape Breton.	The muddy edges of rivers and shallow ponds, and gravel margins.	YES	NO
Amelanchier nantucketensis	Nantucket Shadbush/Serviceberry				2- May Be At Risk	Southern coastal plains.	Cliff dweller, pine barrens, pond margins, fields, edges and thickets. Also in non-tidal river shore (non-forested and seasonally wet), roadside (non-forested wetland or upland). (www.dnr.state.md.us) (www.mainenaturalareas.org)	NO	NO
Anagallis minima	Chaffweed				2- May Be At Risk	Sable Island- only location in Eastern Canada; cosmopolitan.	Muddy shores, with Sagina procumbens.	NO	NO
Anemone americana	Round-lobed Hepatica				2- May Be At Risk	Scattered throughout NS: from Bridgewater to Antiogonish	Dry, usually mixed deciduous forests	YES	NO
Anemone canadensis	Canada Anemone				2- May Be At Risk	Near the sea at Cape Jack and Havre Boucher, Antigonish County. North of Cheticamp, at Presquille, Cape North, and Bay St. Lawrence, Cape Breton. Meander River area, Hants County, and Queens County.	Damp thickets, meadows, and gravelly shores, on calcareous or alluvial soils.	NO	NO
Anemone multifida	Cut-leaved Anemone				2- May Be At Risk	One colony found on north face of limestone cliff below waterfall at Corney Brook gorge in Inverness (var. *hudsonia*)	Shores and rocky banks on calcareous soil.	NO	NO
Anemone parviflora	Small-flowered Anemone				2- May Be At Risk	Cape Breton Highlands National Park, in Inverness County.	Wet limestone cliffs bordering waterfalls, gravelly bluffs.	NO	NO
Anemone quinquefolia	Wood Anemone				3- Sensitive	North of Bridgetown, Annapolis County. Newport, Hants County; and Middle Stewiacke, Colchester County. Two miles north of Sherbrooke, Guysborough County. Cape Breton.	Wooded riverbanks and shaded intervales.	YES	NO
Anemone virginiana	Virginia Anemone				3- Sensitive	Meander River in Hants County; Colchester and Pictou counties; Northern Cape Breton; Truro area.	Streamsides. Calcareous and slaty ledges, shores, and thickets.	YES	NO
Antennaria parlinii	Parlin's Pussytoes				2- May Be At Risk	Abundant along the LeHave River, Bridgewater. Gypsum cliffs of Halfway River in Hants County; several locations in Kings County.	Dry pine and oak forest, pastures, old fields and rocky banks.	NO	NO
Antennaria rosea	Rosy Pussytoes				2- May Be At Risk	Cape d'Or.	Likely restricted to exposed habitats like coastal cliffs (S.B. 2007)	NO	NO

SCIENTIFIC NAME	COMMON NAME *	*SPECIES AT RISK ACT* Status & Schedule	NOVA SCOTIA ENDANGERED SPECIES ACT	COMMITTEE ON THE STATUS OF WILD SPECIES IN CANADA	GENERAL STATUS OF WILD SPECIES IN CANADA- NS /Atlantic	REGION	HABITAT	Step 2 - Possible Occurrence in Region?	Step 3- Possible Occurrence on Site based on habitats present
Arabis drummondii	Drummond's Rockcress				3- Sensitive	The head of the Bay of Fundy and northern Cape Breton. Hayfields in West New Annan, Colchester County.	Dry slopes and talus. Occasionally in fertile areas at lower elevations.	Unlikely	NO
Arabis hirsuta	Western Hairy Rockcress				2- May Be At Risk	Colchester, Victoria, and Cumberland Counties.	Dry cliffs, crevices, ledges, talus slopes and gravels.	NO	NO
Arnica lonchophylla	Northern Arnica				2- May Be At Risk	Waterfall at Grand Anse River (Inverness). Cliff edges at Big Southwest Brook (Victoria), and once in Richmond County.	Calcareous gravel ledges, cliffs.	Unlikely	NO
Artemisia campestris	Field Wormwood				2- May Be At Risk	Lockhart Brook, Salmon River, Victoria County.	Talus slopes in native habitats.	Unlikely	NO
Asplenium trichomanes	Maidenhair Spleenwort				3- Sensitive	rare and local in Northern Cape Breton. Locally common at Big Intervale, Margaree. Infrequent in mainland Nova Scotia except for scattered locations in Cobequid along with Annapolis and Kings counties.	Damp shaded cliffs, and talus slopes. Near acid rocks such as granite, basalt and sandstone.	Unlikely	Infrequent
Asplenium viride (syn. Asplenium trichomanes-ramosum L.)	Green Spleenwort				3- Sensitive	East branch of Five Islands River, Colchester County. Cumberland County and Cape Breton.	Shaded cliffs along streams, on limestone or other basic rocks.	Unlikely	NO
Astragalus robbinsii	Robbins' Milkvetch				2- May Be At Risk	Cape D'or and West Advocate in Cumberland County.	Cliff headlands.	NO	NO
Baccharis halimifolia	Eastern Baccharis	Threatened-No schedule	Threatened 2013	Threatened-Novemeber 2011 (New)	2- May Be At Risk	Southern Yarmouth County (S.B.)	Saltmarsh margins (S.B.) Upland fringes and Tidal Marshes. (http://www.springerlink.com/content/w2184516454610w6/)	NO	NO
Betula glandulosa	Glandular Birch				2- May Be At Risk	Twin Island Lake, Ingonish Barrens	Acidic, rocky barrens, crests, and summits.	NO	NO
Betula michauxii	Newfoundland Dwarf Birch				3- Sensitive	Brier Island east to Guysborough County. Also located in Cape Breton and Inverness counties.	Peat and sphagnous bogs.	YES	YES
Betula minor	Dwarf White Birch				3- Sensitive	Probably northerly.	Rocky slopes, barrens, and subalpine summits	NO	NO
Betula pumila	Bog Birch				3- Sensitive	Northern Victoria and Inverness counties. Black River, Inverness County at 60 m a.s.l.	Bogs and bog meadows. Mixed with alders of the same size.	NO	Infrequent
Bidens beckii	Water Beggarticks				3- Sensitive	Scattered throughout the province .Often abundant from Pictou to Cape Breton	Still or slow-moving waters	YES	NO
Bidens hyperborea	Estuary Beggarticks				2- May Be At Risk	River Philip, Oxford, Cumberland County. The estuaries at Antigonish, and Margaree, Inverness County.	Estuarine, on tidal mud flats.	Unlikely	NO
Bistorta vivipara	Alpine Bistort				2- May Be At Risk	Cape Breton	Moist to wet spruce or mixed woods along shorelines, moist subalpine woods and meadows, alpine meadows, heaths, nutrient-rich sites	NO	NO
Blysmopsis rufa	Red Bulrush				2- May Be At Risk	Yarmouth County, and common in Northern Cape Breton.	Brackish marshes (Hinds)	NO	NO
Boehmeria cylindrica	Small-spike False-nettle				2- May Be At Risk	Le Have River, Annapolis River, Shubenacadie Wildlife Park, and anouther site in the general regions (S.B. 2014)	Wet alluvial woods or rocky shores	Possibly	NO
Botrychium lanceolatum	Triangle Moonwort				3- Sensitive	Kentville Ravine, Kings County. Colchester and Cumberland counties. Indian Brook, Cheticamp River, and Grand Anse in Northern Cape Breton.	Rich, wooded hillsides.	NO	NO

SCIENTIFIC NAME	COMMON NAME *	*SPECIES AT RISK ACT* Status & Schedule	NOVA SCOTIA ENDANGERED SPECIES ACT	COMMITTEE ON THE STATUS OF WILD SPECIES IN CANADA	GENERAL STATUS OF WILD SPECIES IN CANADA- NS /Atlantic	REGION	HABITAT	Step 2 - Possible Occurrence in Region?	Step 3- Possible Occurrence on Site based on habitats present
Botrychium lunaria	Common Moonwort				2- May Be At Risk	New Campbellton and Indian Brook in northern Cape Breton Island. Also Halifax County on Conrad's Beach.	Open, turfy and gravelly slopes, shores, and meadows on basic soils.	YES	NO
Botrychium simplex	Least Moonwort				3- Sensitive	A number of locations from Yarmouth County to northern Cape Breton (gravelly beach at Cedar Lake, Yarmouth County; West Berlin, Queens County; Petpeswick, Halifax County; Antigonish, Victoria, and Inverness counties).	Lakeshores, or mossy edges of streams or waterfalls.	YES	Infrequent
Bromus latiglumis	Broad-glumed Brome				2- May Be At Risk	Yarmouth. Co. to northern Cape Breton	Alluvial Floodplain	YES	NO
Calamagrostis stricta	Slim-stemmed Reed Grass				3- Sensitive	Some lakes near Amherst. Reported at Beaver Lake, Yarmouth County. A larch bog at Big Baddeck, Cape Breton; and at Lockhart Brook, Salmon River, Cape Breton.	Around lakes and bogs, and wet cliff-faces.	Unlikely	Infrequent
Callitriche hermaphroditica	Northern Water-starwort				2- May Be At Risk	Once collected in Lunenburg County.	Quiet, calcareous or brackish waters.	NO	NO
Caltha palustris	Yellow Marsh Marigold				3- Sensitive	The coastal plain of northern Inverness County, near Mabou; Northeast Margaree; Margaree River; St. Joseph du Moine; Cheticamp; and occasionally near the mouth of Grand Anse Brook, Pleasant Bay. Merigomish Island, Pictou County.	Swamps, wet meadows, and wet rocks.	NO	NO
Campanula aparinoides	Marsh Bellflower				3- Sensitive	Cumberland and Hants counties to Antigonish County. One location in Cape Breton County.	Meadows, ditches and river banks.	YES	NO
Cardamine maxima	Large Toothwort				2- May Be At Risk	Isle Haute	Woodland streams or calcareous woods.	NO	NO
Cardamine parviflora	Small-flowered Bittercress				3- Sensitive	The Bay of Fundy from Brier Island to Cape Blomidon and Cape d'Or. Halifax County to Victoria County in Northern Central Cape Breton.	Dry woods, shaded or exposed ledges, and in sandy soils.	Unlikely	NO
Cardamine pratensis	Cuckoo Flower				2- May Be At Risk	Common along Annapolis river. Scattered along Atlantic coast and occasionally along roadsides as in central Cape Breton.	Meadows, low fields and moist areas.	YES	YES
Carex adusta	Lesser Brown Sedge				3- Sensitive	Uncommon and scattered in: Armdale, Halifax County, Victoria Park in Truro, Liscomb Mills Guysborough County, Black Brook and Warren Brook in Victoria County.	Dry open woods, gravels, rocks, and clearings. Also in acidic soils.	YES	YES
Carex alopecoidea	Foxtail Sedge				2- May Be At Risk	St. Georges Bay, east of Antigonish.	Moist, overgrown, clear-cut woods near coast	YES	Infrequent
Carex atratiformis	Scabrous Black Sedge				3- Sensitive	Fairly common in Northern Cape Breton. Only one mainland collection from McAsle Brook, Prospect Cumberland County.	Along river banks, moist cliffs and associated with rock crevices.	NO	NO
Carex bebbii	Bebb's Sedge				2- May Be At Risk	Both local and rare in Hants and Antigonish counties as well as central Cape Breton.	Northern alkaline regions in poorly drained areas.	YES	NO
Carex capillaris	Hairlike Sedge				3- Sensitive	Cape D'or in Cumberland County, and in Northern Cape Breton.	Seepy exposed slopes and cliff tops.	NO	NO
Carex castanea	Chestnut Sedge				2- May Be At Risk	Northern Cape Breton, and expected elsewhere.	Swamps and wet meadows, cliff crevices and ledges.	YES	Infrequent
Carex chordorrhiza	Creeping Sedge				2- May Be At Risk	Gisborne Vict. Co.	Bogs	NO	NO

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Carex comosa	Bearded Sedge				3- Sensitive	Scattered in Annapolis valley near McElmon's Pond in Debert. Local and abundant in Cumberland and Inverness counties. Northern mainland (S.B.2013)	Rich marshes (S.B. 2013)	YES	Infrequent
Carex digitalis	Slender Wood Sedge				2- May Be At Risk	Kejimkujik National Park	Dry, Sandy Woodlands.	NO	NO
Carex eburnea	Bristle-leaved Sedge				3- Sensitive	From Cumberland and Hants counties to Antigonish and Cape Breton.	Cliffs and talus slopes. Under conifers in calcareous soil.	YES	NO
Carex garberi	Garber's Sedge				2- May Be At Risk	St Paul Island CB Co., Black River Inv. Co.	Fen, river or stream	Unlikely	YES
Carex gynocrates	Northern Bog Sedge				2- May Be At Risk	St. Paul Island and bog at Black River, Inverness County.	Sphagnum bogs and coniferous swamps.	Unlikely	YES
Carex haydenii	Hayden's Sedge				2- May Be At Risk	Northern mainland (poorly known) (S.B., 2013)	Wet Meadows and rocky shores.	YES	Infrequent
Carex hirtifolia	Pubescent Sedge				3- Sensitive	Shubenacadie and Brookfield.	Calcareous regions in meadows and thickets on forest slopes.	Unlikely	NO
Carex houghtoniana	Houghton's Sedge				3- Sensitive	Scattered from Queens to Colchester counties.	Sandy soils and roadside banks.	Unlikely	NO
Carex hystericina	Porcupine Sedge				2- May Be At Risk	Uncommon and not noticed. Scattered in Kings County and possibly near Lake Ainslie in Cape Breton.	Swamps, swales and along brooks.	Unlikely	Infrequent
Carex laxiflora	Loose-flowered Sedge				2- May Be At Risk	Rarely seen; known from Annapolis, Hants and Kings counties as well as Ile Haute.	Damp clearings and open rocky woods.	NO	YES
Carex livida	Livid Sedge				2- May Be At Risk	Reported from Windsor, collected at Louisbourg, some in Richmond County.	Calcareous bogs and meadows.	Unlikely	NO
Carex longii	Long's Sedge				2- May Be At Risk	Yarmouth and Shelburne counties	Wet or seasonally wet, sandy soils, fields, thickets, ditches, pond edges, open woods, occasionally bogs	NO	NO
Carex ormostachya	Necklace Spike Sedge				2- May Be At Risk	Across NS (S.B)	Mostly located in rich hardwoods.	YES	NO
Carex peckii	Peck's Sedge				2- May Be At Risk	Across NS (S.B)	Uncommon on rocky slopes, clearing and dry woods, often on calcareous soils.	YES	Possible
Carex pellita	Woolly Sedge				2- May Be At Risk	East River, Pictou County, Wallace River, could be elsewhere (S.B.)	Calcareous and semi-calcareous	Possibly	NO
Carex plantaginea	Plantain-leaved Sedge				2- May Be At Risk	One collection in Brookside near Truro.	Dry hardwood hillsides.	Unlikely	NO
Carex prairea	Prairie Sedge				2- May Be At Risk	Centreville, Kings County	Typha swamps	NO	NO
Carex rariflora	Loose-flowered Alpine Sedge				2- May Be At Risk	Scatarie Island and Baleine in Cape Breton Island.	Fens, calcareous coastal heaths, bogs.	Unlikely	Infrequent
Carex rostrata	Narrow-leaved Beaked Sedge				2- May Be At Risk	Common throughout the province. Usually occupies moderately warm, wet sites.	Wet meadows, swales and around boggy pond margins.	YES	Infrequent

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Carex saxatilis	Russet Sedge				2- May Be At Risk	Collected once in NS at Warren Lake, Victoria County.	Damp, peaty or gravelly soils.	NO	NO
Carex scirpoidea	Scirpuslike Sedge				3- Sensitive	Locally abundant in Cape Breton; Indian and Cheticamp rivers, Lockhart and Corney Books, as well as Big Intervale of Margaree.	Cliff ledges and crevices along rivers.	NO	NO
Carex swanii	Swan's Sedge				3- Sensitive	Local in Yarmouth County scattered east to Annapolis County.	Boggy pastures, dry peaty barrens, forests, clearing and edges.	NO	NO
Carex tenera	Tender Sedge				3- Sensitive	uncommon and not well known; Scattered Cumberland to Antigonish counties.	Meadows, woodlands, moist or dry openings.	YES	YES
Carex tenuiflora	Sparse-flowered Sedge				2- May Be At Risk	Little Harbour, Richmond County.	Wet woods and bogs	Unlikely	YES
Carex tincta	Tinged Sedge				2- May Be At Risk	West of Bay Field in St. Georges Bay, Inverness County.	Rich soils, at the edge of mixed woods.	NO	NO
Carex tuckermanii	Tuckerman's Sedge				2- May Be At Risk	Sweets Corner, Hants County, and along Wallace River in Cumberland County. Also Pugwash River.	Swales	Unlikely	Possible
Carex wiegandii	Wiegand's Sedge				2- May Be At Risk	Cape Breton, Port la Tour Bog in Shelburne County.	Boggy and peaty soils, conifer and alder swamps.	Unlikely	YES
Caulophyllum thalictroides	Blue Cohosh				2- May Be At Risk	Colchester County, Hants County, Kings County and Inverness County.	Deciduous Forests	Unlikely	NO
Cephalanthus occidentalis	Common Buttonbush				3- Sensitive	Shelburne County; Deception Lake and Lake John, Yarmouth County. Along the Medway River in Queens County.	Granite boulders, rocky shores, about lakes.	NO	NO
Ceratophyllum echinatum	Prickly Hornwort				2- May Be At Risk	Quite widespread at least from Yarmouth County to the northern mainland, genrrally away form acidic regions (S.B. 2014)	Fresh water of lakes, ponds, marshes, swamps;	Possibly	NO
Chenopodium rubrum	Red Pigweed				2- May Be At Risk	Common on Sable Island, Northumberland County and in Cape Breton.	Salt marshes, seashores and saline soils.	Unlikely	Infrequent
Cinna arundinacea	Sweet Wood Reed Grass				2- May Be At Risk	Sable Island	Alluvial Floodplain	NO	NO
Clematis occidentalis	Purple Clematis				2- May Be At Risk	One plant found in Amherst Point Bird Sanctuary.	Rocky, calcareous slopes and open woods.	NO	NO
Clethra alnifolia	Sweet Pepperbush		Vulnerable-2000	Threatened-May 2014 (In a higher risk category)	3- Sensitive	Digby County. Canoe Lake, Louis Lake and East Quinan in Yarmouth County. Also in Halifax (introduced).	Shores of Lake headwaters, sandy woods, swamps, thickets.	NO	NO
Cochlearia tridactylites	Limestone Scurvy-grass				2- May Be At Risk	Little-white Island and Big White Island in Halifax County.	Calcareous or brackish soils. Salt loving species	Unlikely	Infrequent
Coeloglossum viride	Long-bracted Frog Orchid				2- May Be At Risk	Sable Island. The northern tip of Cape Breton. Bay St. Lawrence, Victoria County. Black River Lake region, Kings County.	Boggy spots, damp mature woods. Fir or floodplain forests.	Unlikely	NO
Comandra umbellata	Bastard's Toadflax				2- May Be At Risk	Rare and Local in Northern Cape Breton; Sydney Mines, Black Point, a few clumps near South Pond, and Aspy Bay. Common at Pomquet Beach and Antigonish County.	Damp, sandy areas, dunes and exposed headlands; Open coniferous woods.	Possibly	YES
Conioselinum chinense	Chinese Hemlock-parsley				3- Sensitive	Digby Neck. St. Paul Island.	Swamps, mossy coniferous woods or swales, and seepy slopes near the coast.	NO	NO

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Conopholis americana	American Cancer-root				2- May Be At Risk	Located along the LaHave River in Bridgewater, Belcher Street in Kentville, Queen's county and Lake Kedgemakooge in Kejimukujic National park. Also a report from Victoria Beach near Annapolis county.	Associated with Oaks and other deciduous trees.	NO	NO
Coreopsis rosea	Pink Coreopsis,Pink Tickseed		Endangered-2000	Endangered-November 2012 (No Change)	1- At Risk 1	Tusket valley (Yarmouth County).	Sandy or cobbly beaches, wet shores, and margins of lakes and streams. High wave energy shorelines.	NO	NO
Cornus suecica	Swedish Bunchberry				3- Sensitive	St. Paul Island , Scatarie Island, and Canso. Near Port Mouton, Queens County.	Sphagnous depressions in barrens, gravelly shores, and dry exposed headlands.	YES	YES
Crassula aquatica	Water Pygmyweed				3- Sensitive	Shelburne County; Peggy's Cove; Along the coast from Point Michaud to Scatarie Island, Cape Breton County and Richmond County. Locally near coast but often overlooked.	Brackish, muddy shore and muddy flats and borders of muddy ponds near the coast.	YES	Infrequent
Crataegus flabellata	Fan-leaved Hawthorn				3- Sensitive	Eastern NS and northern Cape Breton. Hants County and Kentville.	Hedgerows and thickets.	YES	NO
Cryptogramma stelleri	Steller's Rockbrake				2- May Be At Risk	Hillsborough and Waycobah, Inverness County. The region of Windsor.	Shaded limestone cliffs, and shaded crevices in conglomerate cliff-face.	Unlikely	NO
Cuscuta cephalanthi	Buttonbush Dodder				2- May Be At Risk	Luxuriant at Loch Broom, Pictou County; collected from Hubbards and Antigonish.	Low-lying ground near sea-shores, often parasitic on asters.	Unlikely	YES
Cynoglossum virginianum	Wild Comfrey				2- May Be At Risk	West of Kentville, and near Windsor; not common.	Open beech woods, on dryish soils or gypsum. Woods and thickets.	NO	NO
Cyperus lupulinus(syn. C. filiculmis)	Hop Flatsedge				2- May Be At Risk	Antigonish	Various well-drained, open places. Sandy beaches	YES	NO
Cypripedium arietinum	Ram's-Head Lady Slipper		Endangered-2007		2- May Be At Risk	St. Croix to Brooklyn in Hants County.PLUS Cumberland CO. location	Gypsum sinkholes.	NO	NO
Cypripedium parviflorum	Yellow Lady's-slipper				3- Sensitive	The Windsor-Brooklyn area of Hants County, sparingly west to Kings County, east to Cape Breton (Iona Area).	Calcareous soils, near outcrops of gypsum, or limestone. Occasionally in deciduous forests.	YES	NO
Cypripedium reginae	Showy Lady's-slipper				2- May Be At Risk	Hants and Cumberland Counties to Northern Cape Breton County.	Alkaline swamps and bogs	Unlikely	NO
Cystopteris laurentiana	Laurentian Bladder Fern				2- May Be At Risk	Collected in Victoria and Inerness counties- SEE FLORA NS Note on taxonomy	Cracks and ledges on cliffs, often on calcareous substrates	NO	NO
Decodon verticillatus	Swamp Loosestrife				3- Sensitive	Shelburne County and New Tusket, Digby County. Kejimkujik National Park.	Quaking margins of ponds or lakes.	NO	NO
Desmodium canadense	Canada Tick-trefoil				2- May Be At Risk	Lake Kejimkujik to rivers of Pictou County.	Open woods and river banks	Unlikely	NO
Desmodium glutinosum	Large Tick-trefoil				2- May Be At Risk	Rare. Halfway River in Hants County, Gaspereau River in Kings County, Kejimkujik National Park in Queens County.	Rich, deciduous forests.	NO	NO
Diapensia lapponica	Diapensia				2- May Be At Risk	Lockhart Brook, Salmon River in Victoria County. Upper Cheticamp River gorge above waterfalls.	In clumps on projecting shoulders, and in crevices of steep, north facing slopes.	NO	NO
Dichanthelium linearifolium	Narrow-leaved Panic Grass				3- Sensitive	Annapolis to Pictou County, also some recorded nearly 50 years ago in Coldbrook, Kings County.	Dry, sandy soils. (Hinds 2000: Sandy softwood groves and on gravel banks and roadsides)	Unlikely	NO

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Dichanthelium xanthophysum	Slender Panic Grass				2- May Be At Risk	Collections from Bridgewater from over 50 years ago; no recent collections.	Open thickets in dry, rocky soil. (Hinds 2000: Sandy or rocky ground, or in open woods.)	NO	NO
Dirca palustris	Eastern Leatherwood				2- May Be At Risk	Milford Station in Hants County. St. Croix River near Newport in Hants County.	Rich Deciduous or mixed woods.	NO	NO
Draba arabisans	Rock Whitlow-grass				3- Sensitive	Cumberland and Kings Counties; Northern Cape Breton.	Muddy soils or calcareous rocks. Cliff crevices and ledges.	Unlikely	NO
Draba glabella	Rock Whitlow-grass				2- May Be At Risk	Head of Bay of Fundy, northern and eastern CB Island; Cape Blomidon, Kings County; Isle Haute cliffs; Cape D'Or, and on a high cliff at New Prospect cliffs, all in Cumberland County.	Crevices of cliff ledges and talus slopes.	NO	NO
Draba norvegica	Norwegian Whitlow-grass				2- May Be At Risk	Lockhart Brook, Salmon River, Cape Breton.	On limestone on dry cliff ledges.	NO	NO
Draba pycnosperma	Dense Whitlow-grass				2- May Be At Risk	Lockhart Brook, Salmon River, Cape Breton.	On limestone on dry cliff ledges.	NO	NO
Drosera filiformis	Thread-leaved Sundew	Endangered-Schedule 1	Endangered 2000	Endangered May 2001 (No Change)	1- At Risk 1	Swaines Road bog, Quinns meadows, Port La Tour, West Baccaro bogs in Shelbourne County.	Nutrient poor peat bogs, peaty depressions, intermediate moisture.	NO	NO
Dryopteris fragrans	Fragrant Wood Fern				3- Sensitive	Between Earltown and Parrsboro. Along streams in Northern Cape Breton.	Dry overhanging cliffs, and in cliff crevices along streams or near waterfalls.	Unlikely	NO
Eleocharis fallax	Creeping Spikerush				2- May Be At Risk	Inverness County (probably from Bras d'Or Lake), but likely to occur anywhere in NS with suitable habitat (S.B. 2014)	Coastal, fresh to brackish tidal wetlands and ponds; and lakeshores, marsh	Possibly	NO
Eleocharis flavescens	Yellow Spikerush				3- Sensitive	Very local and mostly known from southwestern counties. Also occurs in Antigonish county.	Bogs, cold springs, dry stream banks, lake and pond margins, maritime mud flats, marshes, moist meadows, swamps;	YES	Infrequent
Eleocharis ovata	Ovate Spikerush				3- Sensitive	Common throughout the province.	Fresh, often drying shores, lake and stream beds, bogs, tidal estuaries, disturbed places;	YES	Possible
Eleocharis quinqueflora	Few-flowered Spikerush				2- May Be At Risk	Digby Neck, and central Cape Breton.	Alkaline bogs and occasionally on Maritime cliffs.	Unlikely	NO
Eleocharis rostellata	Beaked Spikerush				3- Sensitive	Southern western part of the province; Sand Beach, Tusket, Yarmouth County. Also Chebogue and Argyle along the coast of Digby County.	Confined to salt marshes and swales.	NO	NO
Eleocharis tuberculosa	Tubercled Spike-rush,Cone-cupped Spikerush	Special Concern-Schedule 1	Vulnerable-2013	Special Concern-April 2010 (In a lower risk category)	1- At Risk	Harper's Lake, Shelbourne County; Great Pubnico Lake, Yarmouth County.	Sandy or boggy lake margins, as found in coastal plain aras	NO	NO
Elodea nuttallii	Nuttall's Waterweed				2- May Be At Risk	Likely in southern Nova Scotia	Waters, mostly calcareous, of lakes and rivers;	NO	NO
Elymus hystrix	Spreading Wild Rye				2- May Be At Risk	Near Windsor, and in the Cobequid mountains.(Roland and Smith 1969)	Rich hardwoods and clearings.	NO	NO
Elymus wiegandii	Wiegand's Wild Rye				2- May Be At Risk	Sydney, Alma and River John, Pictou County.	Streambanks and meadows	Unlikely	NO
Empetrum eamesii	Pink Crowberry				3- Sensitive	Around the entire coast.	Exposed headlands on top of lichen-bearing rocks with thin soil.	YES	Infrequent

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Epilobium coloratum	Purple-veined Willowherb				3- Sensitive	Scattered in mainland Nova Scotia, from Digby County to Guysborough.	Low-lying ground, springy slopes, and similar locations.	YES	Possible
Epilobium hornemannii	Hornemann's Willowherb				3- Sensitive	Northern Cape Breton.	Damp rocks, margins of rills, and similar locations.	NO	Possible
Epilobium strictum	Downy Willowherb				3- Sensitive	Scattered throughout Cape Breton. Infrequent from Cumberland County to Queens County.	Boggy areas and meadows.	Unlikely	YES
Equisetum palustre	Marsh Horsetail				2- May Be At Risk	Collected in Kings County	Marshes and swamps	NO	NO
Equisetum pratense	Meadow Horsetail				3- Sensitive	No existing collections. (S.B. 2007: rare but fairly widespread in northern Nova Scotia.)	Richer, calcareous soils primarily along river and stream floodplains, usually in fairly deep shade (S.B. 2007)(Hinds 2000: Open woods and wet meadows, usually in circumneutral soils).	Unlikely	NO
Erigeron compositus	Cut-leaved Fleabane				2- May Be At Risk	Northern Cape Breton (ibid.)	A northern species, likely found at a forest edge; likely habitats are cliffs and potentially river shores (S.B. 2007).	NO	NO
Erigeron hyssopifolius	Hyssop-leaved Fleabane				3- Sensitive	Hants County, near Antigonish, and northern Cape Breton.	Gypsum outcrops in central NS, or damp stream banks between flood levels. Banks, ledges, and cliff crevices in northern Cape Breton.	Unlikely	NO
Erigeron philadelphicus	Philadelphia Fleabane				3- Sensitive	Uncommon and scattered in Digby, Halifax and Antigonish counties as well as central Cape Breton.	Old fields, meadows and springy slopes.	Unlikely	Infrequent
Eriophorum gracile	Slender Cottongrass				3- Sensitive	Annapolis eastward.	Wet peat and inundated shores.	YES	YES
Eutrochium dubium	Coastal Plain Joe-pye-weed				2- May Be At Risk	Tusket Valley, and scattered east to Halifax and Lunenburg County.	Rocky shores, swamps and damp thickets.	Unlikely	Infrequent
Fallopia scandens (syn. Polygonum scandens)	Climbing False Buckwheat				3- Sensitive	Scattered throughout province	Low habitats	YES	YES
Festuca prolifera	Proliferous Fescue				3- Sensitive	Abundant at Grey Glen Brook and LeBlanc Brook, Victoria County	Cliff crevices	NO	NO
Festuca subverticillata	Nodding Fescue				2- May Be At Risk	Cape Blomidon, Kings County. Five Mile River in Hants County. Southern Cumberland County.	Rich, deciduous forest, alluvial woods.	Unlikely	NO
Floerkea proserpinacoides	False Mermaidweed			Not at Risk-April 1984 (New)	3- Sensitive	Glenora Falls and central Cape Breton. Antigonish County, Truro, and Shefield Mills, Kings County.	Deciduous ravine slopes, river margins, and intervale forests.	Unlikely	NO
Fraxinus nigra	Black Ash		Threatened		3- Sensitive	Digby and central Lunenburg Counties to northern Cape Breton. Scattered through northern part of NS.	Low ground, damp woods, and swamps.	YES	YES
Fraxinus pennsylvanica	Red Ash				2- May Be At Risk	Central Lunenburg County scattered near Mount Uniacke and at Lakeland in Hants County. (Northern Cape Breton ??)	Near lakes and pond or in other low lying areas.	YES	Infrequent
Galium boreale	Northern Bedstraw				2- May Be At Risk	Cumberland, Annapolis, and Kings County.	The edges of woods in grassy places like pastures.	NO	NO
Galium labradoricum	Labrador Bedstraw				3- Sensitive	Victoria, Inverness and Cape Breton counties.	Wet meadows and Alkaline bogs. Dune slacks and coastal bogs on PEI.	Unlikely	NO
Galium obtusum	Blunt-leaved Bedstraw				2- May Be At Risk	Coastal plains; Tusket Valley in Yarmouth county, in south western counties as well as near Rossignol area in Queens county.	Boggy swale and wet thickets.	NO	NO

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Gentianella amarella	Northern Gentian				2- May Be At Risk	Meat Cove Victoria County	Moist dunes, borders of abandoned dirt roads, hollows and calcareous ledges (Hinds, 2000)	NO	NO
Geocaulon lividum	Northern Comandra				3- Sensitive	Kingston, Kings County. Auburn, Kings County. Cape Breton and Spicer's Cove Cumberland County.	Sterile soils and damp sands, in acid or peaty areas.	Unlikely	Possible
Geum peckii	Eastern Mountain Avens	Endangered-Schedule 1	Endangered -2000	Endangered-April 2010 (No Change)	1- At Risk	Digby County, Digby Neck.	Boggy areas and sphagnum hummocks.	NO	NO
Goodyera oblongifolia	Menzies' Rattlesnake-plantain				3- Sensitive	Northern Cape Breton.	Deciduous climax forest. Slopes in damp, mixed forests, and ravines.	Unlikely	NO
Goodyera pubescens	Downy Rattlesnake-plantain				2- May Be At Risk	Melanson Mountain and Kentville in Kings County. Annapolis County near Eleven Mile Lake and South Milford.	Woodlands and thickets	NO	NO
Goodyera repens	Lesser Rattlesnake-plantain				3- Sensitive	Local but plentiful where found; Atlantic coast near Shelburne and Queens counties to Guysborough County. Scattered at the head of the Bay of Fundy and in northeren Cape Breton.	Under conifers, growing typically on it's own.	YES	YES
Gratiola neglecta	Clammy Hedge-hyssop				3- Sensitive	Muddy swale at the Stewiacke River in Middle Stewiacke. The Hilden area, Colchester County.	Wet or muddy places.	NO	NO
Halenia deflexa	Spurred Gentian				3- Sensitive	Rare on mainland, spotted on Hall's Harbour in Kings County, and Sherbrooke in Guysborough County. Common in Northern Cape Breton and Scatarie Island.	Bleak exposed headlands.	YES	Unlikely
Hedeoma pulegioides	American False Pennyroyal				3- Sensitive	Common in the slopes of the Annapolis Valley. Scattered collection from Cumberland and Colchester counties westward.	Stony soil and upland pastures throughout northern NS, occasionally near seashores.	NO	NO
Helianthumum canadense	Rockrose /Canada Frostweed		Endangered-2007		2- May Be At Risk	Sand plains between Aylesford and Middleton. Greenfield in Queens County.	Sand Barrens	NO	NO
Hieracium robinsonii	Robinson's Hawkweed				3- Sensitive	Big Intervale Inverness County, Tusket Island Yarmouth County, also Truro and Earltown Colchester County.	Rock crevices, cliffs, cobble shores and along streams.	Unlikely	Infrequent
Hudsonia ericoides	Pinebarren Golden Heather				3- Sensitive	Shelburne to Halifax Counties.	Dry, rocky and sandy barrens. Recently disturbed areas or on open sandy soils	NO	NO
Hudsonia tomentosa	Woolly Beach-heath				2- May Be At Risk	Near coast on sandy shore near Pictou and New Glasgow.	Sandy shores and dunes.	Unlikely	NO
Hydrocotyle umbellata	Water Pennywort	Special Concern-Schedule 1	Endangered-2001	Special Concern-May 2014 (In a lower risk category)	1- At Risk	Wilson's Lake in Yarmouth County. Lake Kejimkujik and George Lake in northern Queens County.	Wet, sandy, and gravelly lake margins.	NO	NO
Hypericum dissimulatum	Disguised St John's-wort				3- Sensitive	Potentially widespread (hybrid-derived taxon of two common spp.) (S.B. 2013);	On shores and in damp open areas (Hinds, 2000); mostly shores (S.B. 2013).	Possibly	Infrequent
Hypericum majus	Large St. John's-wort				2- May Be At Risk	Big Baddeck, Victoria County; and Halifax.	Wet or dry open soil. (Hinds 2000: damp open areas)	YES	YES
Impatiens pallida	Pale Jewelweed				3- Sensitive	Kings County to northern Cape Breton, becoming more frequent eastward. The slope of Isle Haute, Cumberland County.	Rich alluvial soils, damp thickets and along intervales.	YES	NO
Iris prismatica	Slender Blue Flag				2- May Be At Risk	Annapolis, Guysborough, and Inverness. Possibly Louisbourg.	Wet ground near the coast.	YES	Infrequent

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Isoetes acadiensis	Acadian Quillwort				3- Sensitive	Yarmouth County to northern Cape Breton. Lake Kejimkujik, near exit of Grafton Brook.	Water up to 1 m deep, bordering lakes or ponds, and occasionally along rivers.	YES	YES
Isoetes prototypes	Prototype Quillwort	Special Concern-Schedule 1	Vulnerable -2006	Special Concern-May 2005 (New)	3- Sensitive	Sutherland Lake in Cumberland County. Economy Lake in Colchester County. Pottle Lake in North Sydney. Sandy Lake in Annapolis County.	Dark water in nutrient poor acidic water	YES	NO
Iva frutescens	Big-leaved Marsh-elder				3- Sensitive	Kings County, Luneburg County and northern Cape Breton Island	Mostly tidelands, brackish to saline marshes, beaches	Unlikely	NO
Juncus acuminatus	Sharp-fruited Rush				3- Sensitive	Local in Yarmouth County, scacttered eastward to Lunenburg and Kings Counties. Infrequent northward to Cumberland County and in Baddeck in Cape Breton	Shores, swamps, ditches, springs, wet meadows, and rock outcrops; always near the coast	Unlikely	YES
Juncus alpinoarticulatus	Alpine Rush				2- May Be At Risk	Northern Cheticamp and Guysborough county	Wet meadows, sandy and gravelly, often calcareous shores, fens, and clayey pools over rock	YES	Possible
Juncus brachycephalus	Short-headed Rush				2- May Be At Risk	Reported form Yarmouth and Cape Breton, only collected from Seal Island, Yarmouth County	Calcareous marshes, wet meadows, and wetland shores;	Possibly	NO
Juncus caesariensis	New Jersey Rush	Special Concern-Schedule 1	Vulnerable -2001	Special Concern-May 2004 (No Change)	3- Sensitive	Gracieville, Richmond County. Lower L'Ardoise to Fourchu, Cape Breton County, and inland to Loch Lomond.	Bogs and fens along Cape Breton's southeastern coastal plain.	NO	NO
Juncus dudleyi	Dudley's Rush				3- Sensitive	Annapolis, Hants and Lunenburg counties.	Fields, roadsides and open thickets.	NO	NO
Juncus greenei	Greene's Rush				2- May Be At Risk	Halifax; near Pugwash, Cumberland County; Villagedale, Shelburne County; the dunes at Pomquet, Antigonish County.	Sandy soil and dune hollows.	Unlikely	NO
Juncus marginatus	Grass-leaved Rush				3- Sensitive	Yarmouth and Shelburne counties, north to Belleisle in Annapolis County.	Clayey roadsides, damp fields, and brooksides.	NO	NO
Juncus secundus	One-sided Rush				2- May Be At Risk	Collected once in both Queens and Kings counties	Usually in sterile, sandy or clay soil	NO	NO
Juncus stygius	Moor Rush				3- Sensitive	Gracieville, Richmond County. Isle Madame, and Louisbourg.	Wet moss, bogs, and bog pools.	Unlikely	Infrequent
Juncus subcaudatus	Woodland Rush				3- Sensitive	Southwestern mainland, scattered east to Kinsg and Halifax counties	Wet boggy woods and openings in spruce swamps	Unlikely	YES
Juncus trifidus	Highland Rush				3- Sensitive	Margaree, the Cheticamp River, Gray Glen Brook, and Lockhart Brook, all in Cape Breton.	Dry cliff crevices. North-facing cliffs in northern Cape Breton.	NO	NO
Juncus vaseyi	Vasey's Rush				2- May Be At Risk	Reported from Cumberland County	Cranberry bogs, and sandy lakeshore	NO	NO
Lachnanthes caroliana	Redroot /Carolina Redroot	Special Concern-Schedule 1	Vulnerable -2013	Special Concern-November 2009 (In a lower risk category)	1- At Risk	Ponhook, Little Ponhook, Molega, Cameron, Hog, and Beartrap lakes, Queens County.	Peaty Shores and lakeside marshes	NO	NO
Lactuca hirsuta	Hairy Lettuce				3- Sensitive	Scattered to infrequent from Yarmouth and Shelburne counties to Kings and Halifax counties.	Dry open woods, and cut over areas.	Unlikely	YES
Laportea canadensis	Canada Wood Nettle				3- Sensitive	From Coldbrook, Kings County, to northwestern Cape Breton.	Alluvial woods of mixed or deciduous trees. Floodplains on Cape Breton plateau. Only the most fertile places.	YES	NO

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Litaeopsis chinensis	Eastern Lilaeopsis	Special Concern-Schedule 1	Vulnerable-2006	Special ConcernMay 2004 (No Change)	3- Sensitive	Tusket River in Yarmouth County. La Have River in Lunenburg County. Medway River in Queens County.	Muddy and rocky tidal banks in estuaries.	NO	NO
Lilium canadense	Canada Lily				3- Sensitive	Kings and Cumberland counties to Middle River and Margaree in Cape Breton.	In meadows and in stream banks.	Unlikely	NO
Limosella australis	Southern Mudwort				3- Sensitive	The coast near Yarmouth and Shelburne counties. Near Wallace Lake on Sable Island. Cape Breton.	Low areas by ponds, gravel lakeshores, the muddy edges of ponds behind barrier beaches, and muddy river margins.	Unlikely	Infrequent
Listera australis	Southern Twayblade				2- May Be At Risk	Between Hay's River and Lake Ainslie Chapel, south of Inverness. Also one location in King's County and South Shore. Halifax International Airport. Scattered elsewhere	Sphagnum moss bogs or damp woods. Always near small spruce or tamarack.	YES	Infrequent
Lobelia kalmii	Brook Lobelia				2- May Be At Risk	Alkaline bog at Black River, Inverness County. A wet, quaking bog near McAdam Lake, Cape Breton County.	Dripping cliffs, meadows, and bogs. Usually in calcareous or marly locations.	Unlikely	NO
Lobelia spicata	Pale-spiked Lobelia				2- May Be At Risk	Locally abundant near Linden, Cumberland County; local and weedy on top of Cape Blomidon, Kings County.	Dry fields.	NO	NO
Lophiola aurea	Goldencrest	Threatened-Schedule 1	Vulnerable-2013	Special Concern-May 2012 (In a lower risk category)	1- At Risk	Southwestern counties.	Lakeshores, wet savannahs, and sphagnous swale.	NO	NO
Luzula spicata	Spiked Woodrush				2- May Be At Risk	St. Lawrence Bay, north of Cape Breton Is.	Exposed headland, over 300 m A.S.L.	NO	NO
Malaxis monophyllos	White Adder's-mouth				2- May Be At Risk	Rare and local - Recorded in Isle Haute, Cape Blomidon, and along the Five Island River, Colchester County, also found in Guysborough County.	Moss cushions and wet, mossy cliff edges, where there is little competition from other plant species	YES	Possible
Minuartia groenlandica	Greenland Stitchwort				3- Sensitive	Halifax and Lunenburg counties. Collected from rocks at Northwest Arm but not typical. Found in a gorge south of French Lake, Inverness County.	Granitic ledges and gravel. On coasts at higher elevations.	Unlikely	NO
Montia fontana	Water Blinks				2- May Be At Risk	Collected on a mossy bank above the sea on the Northwest Arm, Halifax. Brier Island. Port Hawkesbury, Inverness County. Burke Brook, Advocate, Cumberland County.	Springy or seepy slopes, wet shores and brackish spots.	Unlikely	Infrequent
Myriophyllum farwellii	Farwell's Water Milfoil				3- Sensitive	Scattered across mainland NS.	Ponds and slow moving streams.	YES	NO
Myriophyllum verticillatum	Whorled Water Milfoil				3- Sensitive	Spring pools south of Amherst, Oxbow ponds near Antigonish and Cheticamp in northern Cape Breton. Also in Hants County.	Shallow waters, mainly in fine, muddy settlement or calcareous regions.	Unlikely	NO
Najas gracillima	Thread-like Naiad				2- May Be At Risk	Probably widely sacttered in southern half of mainland	Muddy, peaty, or sandy ponds, pools and shores	NO	NO
Ophioglossum pusillum	Northern Adder's-tongue				3- Sensitive	Yarmouth and Digby Counties, east to Halifax and Amherst, George River in Cape Breton.	Sterile meadows, grassy swamps, and damp, sandy, or cobbly beaches of lakes.	Unlikely	NO
Osmorhiza depauperata	Blunt Sweet Cicely				2- May Be At Risk	Northern tip of Cape Breton around Bay St. Lawrence as well as in Wolfville.	Forests	NO	NO
Osmorhiza longistylis	Smooth Sweet Cicely				2- May Be At Risk	Scattered along North Mountain and Cape Blomidon in Kings County, directly north of Cumberland; Infrequent in Cape Breton.	Rich deciduous forests (intervals)	Unlikely	NO
Oxyria digyna	Mountain Sorrel				2- May Be At Risk	Restricted to Inverness County.	Dripping cliffs and rocky areas.	NO	NO

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Oxytropis campestris	Field Locoweed, Northern Yellow Point-Vetch				2- May Be At Risk	St. Paul Island, north of Inverness County, Cumberland County.	Exposed cliff crevices, rocky or gravelly scree.	NO	NO
Panicum rigidulum	Redtop Panic Grass				3- Sensitive	Yarmouth County to Lake Kejimkujik. Along the Mersey River.	Sandy and peaty beaches. Gravelly lake margins.	NO	NO
Panicum tuckermanii	Tuckerman's Panic Grass				3- Sensitive	very widespread and spreading on roadsides;likely native on rivershores (esp. N mainland) and lakeshores Esp. SW). (S.B. 2014)	Floodplains, sandy shors, cranberry bogs	NO	NO
Parnassia palustris	Marsh Grass-of-Parnassus				2- May Be At Risk	Recorded in Mabou Harbour and northward in Cape Breton.	Grassy hollows in sand dunes and on tussocks in swamps	NO	NO
Pedicularis palustris	Marsh Lousewort				2- May Be At Risk	Specimens reported in Guysborough County, not common.	Marshes and meadows.	YES	Possible
Persicaria arifolia (Syn. Polygonum arifolium)	Halberd-leaved Tearthumb				3- Sensitive	widespread bu uncommon, Yarmouth to Cumberland Cty, plus one Cape Breton record which is likely correct (S.B. 2014)	Thickets, marshy borders usually under alders. It flourishes only in the richest alluvial soils	Possibly	NO
Phleum alpinum	Alpine Timothy				2- May Be At Risk	Along the Cheticamp River and LeBlanc Brook, Inverness County.	River ledges.	NO	NO
Phyllodoce caerulea	Blue Mountain Heather				2- May Be At Risk	Lockhart Brook, Salmon River in Victoria County.	Alpine rocks and peat.	NO	NO
Pilea pumila	Dwarf Clearweed				2- May Be At Risk	Seepage slope in rich maple-beech woods at West Branch, Pictou County.	Cool, moist, shaded places.	Unlikely	Possible
Pinguicula vulgaris	Common Butterwort				2- May Be At Risk	Cape Paul Island, Cheticamp River, Southwest Brook (Inverness). Corney Brook Gorge, South of French Lake.	Moist ledges, especially on limestone or shores.	No	NO
Pipatherum canadensis (syn. Oryzopsis canadensis)	Canada Rice Grass				3- Sensitive	Cumberland and Colchester counties. Near Porters Lake, Halifax County. Near Jordan Falls, Shelburne County.	Dry sandy soils.	NO	NO
Pipatherum pungens (syn. Oryzopsis pungens)	Slender Rice Grass				3- Sensitive	Shelburne County and southwestern Lunenburg County. Also reported from Mira Bay in Cape Breton.	Dry woods and clearings in sandy soils.	Unlikely	Possible
Platanthera flava	Tubercled Orchid				3- Sensitive	Tusket River in Yarmouth County and Medway River in Queens County. Kings County and Kemptown region of Colchester County.	Sand or gravel beaches. Wet peat, and lake or river margins. Bogs, swamps, and meadows.	No	NO
Platanthera macrophylla (syn. Platanthera orbiculata var, macrophylla)	Large Round-leaved Orchid				3- Sensitive	Scattered from Hants County and the Cobequid region to northern Cape Breton.	Damp woods in deep shade	YES	Infrequent
Poa glauca	Glaucous Blue Grass				3- Sensitive	Cumberland County, Cape Breton, Cape Blomidon, and Isle Haute.	Cliff crevices, on shelves, and talus slopes.	Unlikely	NO
Podostemum ceratophyllum	Horn-leaved Riverweed				2- May Be At Risk	La Have River in Cumberland County. New Germany and Dog Falls in Lunenburg County.	Fast flowing gravelly streams.	NO	NO
Polygala sanguinea	Blood Milkwort				3- Sensitive	Cumberland, Annapolis, and Kings County.	Poor or acidic fields, damp slopes, and open woods or bush.	NO	NO
Polystichum lonchitis	Northern Holly Fern				3- Sensitive	Cape North, Bay St. Lawrence, south to Waycobah and River Denys in Cape Breton.	Alkaline areas. On or near limestone or gypsum in rocky areas, and cool shaded places.	Unlikely	NO

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Potamogeton friesii	Fries' Pondweed				2- May Be At Risk	Few reports from Kings, Inverness, and Colchester counties	Calcareous to brackish waters of lakes and slow-flowing streams	Unlikely	NO
Potamogeton nodosus	Long-leaved Pondweed				2- May Be At Risk	one record St. Marys's River, but id. needs checking (S.B 2014)	Pond and streams	Possibly	Possible
Potamogeton oblongus	Cinnamon-Spot Pondweed/ Oblong-leaved Pondweed				2- May Be At Risk	Only on Sable Island.	Freshwater ponds on Sable Island.	NO	NO
Potamogeton obtusifolius	Blunt-leaved Pondweed				3- Sensitive	Cumberland County to Pictou County to north/north central Cape Breton.	Ponds, lakes and slow moving streams, often on substrate of deep muck.	Unlikely	Infrequent
Potamogeton praelongus	White-stemmed Pondweed				3- Sensitive	Kings County to Cape Breton	Usually in deep water	YES	NO
Potamogeton pulcher	Spotted Pondweed		Vulnerable-2013		2- May Be At Risk	Uncommon from Upper Musquoidoboit River to Queens and Digby counties	Muddy lake margins or brook beds	YES	NO
Potamogeton richardsonii	Richardson's Pondweed				2- May Be At Risk	Scattered form Kings and Colchester counties to Cape Breton	Lakes and Rivers, in brackish or alkaline waters	YES	NO
Potamogeton zosteriformis	Flat-stemmed Pondweed				3- Sensitive	Rare in Kings, Colchester, Cumberland, and Halifax counties. Mouth of the Hays River, Inverness County.	Lakes and deep rivers in less acid regions.	Unlikely	NO
Prenanthes racemosa	Glaucous Rattlesnakeroot				2- May Be At Risk	Isle Haute Yarmouth County, along the Atlantic coast to Cape Breton County.	Alpine locations and barrens around the coast.	YES	NO
Primula mistassinica	Mistassini Primrose				3- Sensitive	Common on a bank along Salmon River Truro, Upper Stewiacke Colchester County, and scattered in northern Cape Breton.	Springy stream banks and dripping ledges.	Unlikely	NO
Proserpinaca intermedia (Hybrid of Proserpinaca pectinata)*	Intermediate Mermaidweed				2- May Be At Risk	Boggy Savannah by Butlers Lake Gavelton Yarmouth County, also scattered in south western NS.	In small depressions which are damp or partially filled with water.	NO	NO
Proserpinaca pectinata	Comb-leaved Mermaidweed				3- Sensitive	Scattered throughout mainland NS	Wet savannahs, sphagnous swales, and the sandy, gravelly, or muddy borders of lakes or ponds	YES	Possible
Pyrola minor	Lesser Pyrola/Lesser Wintergreen				3- Sensitive	Scattered north from Digby Neck to Kentville and east Cape Breton.	Mature coniferous woods in northern Cape Breton.	Unlikely	Infrequent
Ranunculus pensylvanicus	Pennsylvania Buttercup				2- May Be At Risk	Northern mainland (S.B.2013)	Muddy shores and moist meadows (Hinds 2000). Richer moist shores and sometimes disturbed ground (S.B.)	YES	Possible
Ranunculus sceleratus	Cursed Buttercup				2- May Be At Risk	Local and rare; Damp roadside at Barrie Beach, edge of marsh at McNabs Island, brackish pond in Eastern Passage Halifax County. Abundant in the water of a swamp pond at Main-a-Dieu Cape Breton County, and on the beach at West Berlin in Queens County.	Pools and rills from brackish to freshwater habitat.	Unlikely	Infrequent
Rhamnus alnifolia	Alder-leaved Buckthorn				3- Sensitive	Central Nova Scotia and southern Inverness County.	Swampy woods and boggy meadows. Alkaline areas, near limestone or in marl bogs in rich, alluvial soil. Poorly drained swamps in Cape Breton.	Unlikely	NO
Rhododendron lapponicum	Lapland Rosebay				2- May Be At Risk	Corney Brook Gorge in the Cape Breton Highlands National Park, Inverness County.	In the one instance found, limited to a single calcareous ledge in a gorge.	NO	NO

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Rhynchospora capillacea	Slender Beakrush				2- May Be At Risk	Southern end of Lake Ainslie at Black River and in the Baddeck Bay region.	Alkaline bogs	Unlikely	NO
Rhynchospora macrostachya	Tall Beakrush			under Review	2- May Be At Risk	2 sites in the Bridgewater- Kejimkujik area: Molega Lake, Carrigan Lake; the only sites in Canada (S.B. 2014)	Acidic sunny wetlands, mostly pond shores, seeps, bogs, marshlands;	NO	NO
Rudbeckia laciniata	Cut-leaved Coneflower				3- Sensitive	Kings County. Isolated from Annapolis and Cumberland counties to Guysborough County.	Swales, the edges of swamps or in gullies, in small colonies.	YES	Infrequent
Rumex persicarioides	Peach-leaved Dock				2- May Be At Risk	Infrequent. Cumberland, Queens, Inverness and/or Victoria counties. Sable Island	Mostly coastal and slightly saline riparian habitats: shores, marshes	Unlikely	NO
Rumex triangulivalvis	Triangular-valve Dock				3- Sensitive	Sweets Corner, Hants county, and River Inhabitants, Inverness county. Also in Kentville.	Coastal sands, shores, and gravel roadsides	Unlikely	YES
Sabatia kennedyana	Plymouth Gentian	Schedule 1- Threatened	Endangered-2013	Endangered- November 2012 (In a higher risk category)	1- At Risk	Tusket River Valley in Yarmouth County.	Cobbly, Sandy Beaches, and peaty margins of lakes, rivers and boggy savannahs.	NO	NO
Salix candida	Sage Willow		Endangered-2013		2- May Be At Risk	Black River fen in Inverness; record from Halifax County was wrong (S.B.2014)	Calcareous bogs and thickets	NO	NO
Salix glauca (Salix glaucophylloides- var. of S.myricoides)	Gray Willow				2- May Be At Risk	Northern Cape Breton	Sandy and gravelly shores adjacent to thickets.	NO	NO
Salix pedicellaris	Bog Willow				3- Sensitive	From Digby County to Cape Breton. Uncommon near the Atlantic coast, and not known in northern Cape Breton.	Swampy thickets, poorly drained soils, bogs, and heavy soils.	YES	YES
Salix reticulata	Net-veined Willow				2- May Be At Risk	Only in Corney Brook gorge in Inverness.	Calcareous Barrens and cliffs.	NO	NO
Salix sericea	Silky Willow				2- May Be At Risk	Western Nova Scotia. Scattered east to Shubenacadie Grand Lake. Brier Island.	Low thickets and streambanks.	NO	NO
Salix uva-ursi	Bearberry Willow				2- May Be At Risk	Cape Breton Island, St. Paul Island, Corney Brook gorge, Cape Breton Highlands park, Inverness County.	Barrens and subalpine areas. On calcareous ledges.	NO	NO
Salix vestita	Hairy Willow				2- May Be At Risk	Corney Brook Gorge in Inverness.	Humid, north facing crevices on cliffs in calcareous soil.	NO	NO
Samolus valerandi	Seaside Brookweed				3- Sensitive	From Tusket River, Yarmouth to Bridgewater. Also Antigonish.	Brackish meadows, and tidal banks. Edge of salt marshes.	Unlikely	NO
Sanicula odorata	Clustered Sanicle				2- May Be At Risk	Five Mile River, Hants County; Cornwallis River at Cambridge, Kings County; West River, Pictou County; Southwest Margaree, Inverness County.	Rich alluvial woods and Intervales. (S.B. (2007): Only the richest intervale forest habitats.)	Unlikely	NO
Saxifraga aizoides	Yellow Mountain Saxifrage				2- May Be At Risk	Big Southwest Brook, south of French Lake at Corney Brook gorge, Cape Breton Highlands.	Dripping cliffs. Within spray of waterfalls on north facing limestone ledges.	NO	NO
Saxifraga cernua	Nodding Saxifrage				2- May Be At Risk	Blair R., Inverness County (S.B. 2014)	Cool, wet areas, mossy banks, tundra, shady rock faces, late snowbeds;	NO	NO
Saxifraga oppositifolia	Purple Mountain Saxifrage				2- May Be At Risk	Corney Brook gorge in Cape Breton Highlands.	Seepage area on partly shaded rock face.	NO	NO

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Saxifraga paniculata	White Mountain Saxifrage				3- Sensitive	Cape Blomidon. Cape d'Or and northern Cape Breton.	Pockets in cliffs, mossy hillsides, dripping cliffs, and limestone ledges.	NO	NO
Schoenoplectus americanus (SYN. Scirpus americanus)	Olney's Bulrush				3- Sensitive	Common	Brackish marshes, and sometime in bogs near the coast. Forms colonies on wet sand around depressions were sand is rather salty.	Possibly	Possible
Schoenoplectus torreyi	Torrey's Bulrush				2- May Be At Risk	Lunenburg and Queens counties	Emergent in fresh ponds and marshes, often with fluctuating water levels	NO	NO
Scirpus longii	Long's Bulrush	Schedule 3-Special Concern	Vulnerable -2001	Special Concern-April 1994 (New)	3- Sensitive	Ponhook Lake and Moosehorn Lake, Queens County. Also Eighteen Mile Brook, Shingle Lake, Dunraven Fen, and Quinn's Meadow, Shelburne County.	Peaty or mucky shores of lakes in the southwest. Stillwater meadows, and ferns.	NO	NO
Selaginella rupestris	Rock Spikemoss				2- May Be At Risk	The Ledges of Shobel's Mountain and Sandy Cove in Digby County. An outcrop in Centerville on Digby Neck.	Dry exposed rocks and sandy soils.	NO	NO
Selaginella selaginoides	Low Spikemoss				2- May Be At Risk	Brier Island. Scattered in Cape Breton	Moist areas bordering bog tussocks, peat bogs, and stream margins	Unlikely	YES
Senecio pseudoarnica	Seabeach Ragwort				3- Sensitive	Scattered along Atlantic coast to Northern Cape Breton.	Gravelly seashores.	YES	YES
Shepherdia canadensis	Soapberry/Canada Buffalo-Berry				3- Sensitive	The roadside between Windsor and Brooklyn, and in northern Cape Breton.	Gypsum or talus slopes. Along the coast in the reach of salt spray. Grows with Shrubby Cinquefoil and Senecio pauperculus.	Unlikely	NO
Silene acaulis	Moss Campion				2- May Be At Risk	Abundant at south west end of St.Paul Island, south of Northeast Channel practically at sea-level.	Gravelly, rocky or turfy cool barrens as well as coastal cliffs.	NO	NO
Silene antirrhina	Sleepy Catchfly				2- May Be At Risk	Annapolis Valley (S.B., 2007)	Sand barren habitat (S.B., pers.com. 2007). Dry railways and roadways, also in open woods and fields (Hinds 2000).	NO	NO
Sisyrinchium fuscatum	Coastal Plain Blue-eyed-grass				2- May Be At Risk	Scattered in southern half of mainland	Sandy plains or banks	NO	NO
Solidago hispida	Hairy Goldenrod				2- May Be At Risk	Infrequent and only occasionally seen Digby, Yarmouth, Halifax counties	Dry wooded banks and rocky shores.	Unlikely	NO
Solidago multiradiata	Multi-rayed Goldenrod				2- May Be At Risk	St.Paul Island in Northern Cape Breton, rare but located at Big Southwest Brook along the Cheticamp River as well as Corney Brook in Inverness County.	Restricted to arctic habitat; Barrens , ledges and mostly shaded cliffs.	NO	NO
Sparganium hyperboreum	Northern Burreed				3- Sensitive	Cape Breton. New Harbour, Guysborough County.	Peaty pools.	YES	YES
Spiranthes casei	Case's Ladies'-tresses				3- Sensitive	Southwestern counties; Jordon Falls to Pubnico and Bellville.	Acid sandy soils, roadsides and open barrens.	NO	NO
Spiranthes lucida	Shining Ladies'-tresses				2- May Be At Risk	Northumberland Strait from Pictou County to Cheticamp, also in Kings, Annapolis and Yarmouth counties.	Alluvial soils and damp rocky shores as well as thickets and meadows.	Unlikely	infrequent
Spiranthes ochroleuca	Yellow Ladies'-tresses				3- Sensitive	Southwestern of Nova Scotia, northeast to West Gore, Hants County.	Driest sand barrens in southwestern counties. Near rivers, and in dry habitats like roadsides and fields.	NO	NO
Stellaria crassifolia	Fleshy Stitchwort				2- May Be At Risk	Tannery Pond near Wolfville. Possibly scattered in the northern part of NS.	Spring rills and the edges of ponds.	Unlikely	NO

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Stellaria humifusa	Saltmarsh Starwort				3- Sensitive	Cumberland, Colchester and Guysborough counties. Shoreward reaches of salt marshes in Cape Breton.	Around salt marshes.	YES	NO
Stellaria longifolia	Long-leaved Starwort				3- Sensitive	The meadow along the Salmon River, Truro, and in neighbouring gardens. From the Musquodoboit and Stewiacke River valleys; Kemptown; Colchester County; Ilse Haute.	Damp or wet grassy places, in sandy to muddy soils.	Unlikely	NO
Suaeda rolandii	Roland's Sea-blite				2- May Be At Risk	Found at bays near the head of the Bay of Fundy; Avenport in Kings County, Sweets Corner in Hants County, and Economy in Colchester County. Also the Amherst marsh in Cumberland County.	Salt marshes and saline shores.	NO	NO
Symphyotrichum boreale	Boreal Aster				3- Sensitive	Scattered from Yarmouth to Cape Breton (Rather uncommon).	Gravelly soil and lake beaches, along streams and the edges of bogs.	YES	Possible
Symphyotrichum ciliolatum	Fringed Blue Aster				3- Sensitive	Scattered from southern Hants County to adjacent Colchester County and to Musquodobit to Halifax County. Also Ile Haute in Cumberland County, Cape Breton and Guysborough Counties.	Open fields, lawns and edges of woods.	YES	NO
Symphyotrichum undulatum	Wavy-leaved Aster				3- Sensitive	Widely scattered in Lunenburg County and from there to Kings, Queens and Halifax counties.	Old fields and edges of thickets.	Unlikely	NO
Teucrium canadense	Canada Germander				3- Sensitive	widespread but uncommon on the coast throughout, except extreme north CB (S.B2014)	Gravel seacoasts, the crest of the beach, beyond the reach of the tide.	Possibly	Infrequent
Thuja occidentalis	Eastern White Cedar				1- At Risk 1	Annapolis, Digby and Cumberland Counties.	Lakesides and swamps or old pastures.	NO	NO
Tiarella cordifolia	Heart-leaved Foamflower				3- Sensitive	Colchester and Pictou counties. Huntington Point, Kings County.	Deciduous forests and gravelly roadsides.	Unlikely	NO
Toxicodendron vernix	Poison Sumac				2- May Be At Risk	Tefler Lake in Queens County.	Swampy lakeshores and marshy areas.	NO	NO
Triantha glutinosa	Sticky False Asphodel				2- May Be At Risk	Black River bog and Cheticamp in Inverness.	Swamps, bogs and rocky beaches.	NO	NO
Triosteum aurantiacum	Orange-fruited Tinker's Weed				3- Sensitive	Rare above Truro. Found in Kemptown in Colchester County. Also near New Glasgow. Meander River, and also in north Cape Breton.	Rich soils along rivers. Limestone banks in one location	Unlikely	NO
Trisetum melicoides	Purple False Oats				2- May Be At Risk	Indian Brook, Victoria County; Digby County, Cumberland County to Pictou County.	Gravel shores and banks, especially alkaline areas.	Unlikely	NO
Utricularia resupinata	Inverted Bladderwort				2- May Be At Risk	Digby Neck. Barren lake in Richmond County, near Argyle (Yarmouth County).	Ponds, lakes and river shores.	Unlikely	NO
Vaccinium boreale	Northern Blueberry				2- May Be At Risk	Cape Breton, and 2 records on the mainland.	Exposed headlands and barrens.	Possibly	YES
Vaccinium caespitosum	Dwarf Bilberry				3- Sensitive	Black River, Gaspereau Valley, Kings County. Northern Victoria and Inverness counties. Halifax County.	Rocky cliffs and crevices. Dry or wet acidic sites from sea level to 3800 m.	YES	YES
Vaccinium ovalifolium	Oval-leaved Bilberry				2- May Be At Risk	North Cape Breton Island	Moist coniferous woods to an elevation of 2100 m.	YES	YES
Vaccinium uliginosum	Alpine Bilberry				3- Sensitive	Northern and eastern Cape Breton. Halifax and Digby counties.	Dry or wet, organic or inorganic acid soils. Tolerant of high copper concentrations.	YES	YES

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Vallisneria americana	Wild Celery (Tape grass)				2- May Be At Risk	Locally abundant in marginal waters; Shorts Lake Brookfield Colchester County. Also reported in several different locations from Musquodoboit River in Halifax County to Northern Cape Breton.	Quiet waters	YES	NO
Viburnum edule	Squashberry				3- Sensitive	Northern Cape Breton.	Cold woods and along streams. Climax coniferous forest	NO	NO
Viola nephrophylla	Northern Bog Violet				3- Sensitive	Wet woods north of Truro. Occasionally in Cape Breton. Also is Wolfville and Shelburne County.	Cool mossy bogs. Borders of streams, and damp woods.	YES	Infrequent
Woodsia alpina	Alpine Cliff Fern				2- May Be At Risk	North Aspy River, Cape Breton. Cheticamp River and Big Southwest Brook, Inverness County; Indian Brook, Victoria County.	Dryish cliffs	NO	NO
Woodsia glabella	Smooth Cliff Fern				3- Sensitive	Jeffers Brook, Cumberland County. Big Southwest Brook, Lockhart Brook, and Skye Glen Mountain, northern Cape Breton.	Shaded vertical cliffs. Along streams in northern Cape Breton.	NO	NO
Woodwardia areolata	Netted Chain Fern				3- Sensitive	Yarmouth and Shelburne counties. A stream at Argyle Head, Yarmouth County.	Swamps, bog margins, and particularly along streams.	NO	NO
Zizia aurea	Golden Alexanders				2- May Be At Risk	Pomquet River and South River, Antigonish County. Upper Musquodobit, Halifax County. Truro area and northeast.	Meadows, shores, damp thickets, and wet woods. Roadsides.	YES	NO
LICHENS									
Anaptychia crinalis	Hanging Fringed Lichen			Special Concern-1994	3- Vulnerable	Europe, Asia, North America,| Arctic.	On bark, cork, plant surfaces trunks, branches, twigs, also rock	YES	YES
Anzia colpodes	Black-foam Lichen				3- Vulnerable	Endemic to eastern NA as far north as NB and NS but avoids the SE coastal plain	Corticolous	YES	Infrequent
Cavernularia hultenii	Powdered Honeycomb Lichen				2- May be at Risk	Eastern and Western NA, also Europe	Wet forested coasts, true oceanic	YES	YES
Cladonia coccifera	Eastern Boreal Pixie-cup Lichen				3- Vulnerable	Circumpolar arctic and boreal	On soil and rotting logs and over rocks	Yes	YES
Cladonia pocillum	Rosette Pixie-cup Lichen				3- Vulnerable	Colchester, Victoria couotnies	On highly calcareous soils	Possibly	NO
Cladonia stygia	Black-footed Reindeer Lichen				3- Vulnerable		Characteristic of northern bogs, but also found in drier areas in boreal and Arctic regions of the Northern Hemisphere	YES	YES
Collema furfuraceum	Blistered Tarpaper Lichen				3- Vulnerable	Broad global range	Usually on bark but sometimes on rock	YES	YES
Collema leptaleum	Crumpled Bat's Wing Lichen				3- Vulnerable	Broad global range	On bark, especially on hardwoods	YES	YES
Collema nigrescens	Blistered Tarpaper Lichen				3- Vulnerable	Throughout NS	Corticolous, on base of poplar and other trees.	YES	YES
Degelia plumbea	Blue Felt Lichen	Special Concern-No schedule	Vulnerable -2013	Special Concern-2010	4-Secure	Very rare in North America, but widespread in NS	Corticolous; moss covered trees and rocks. Prefers hardwoods	YES	Infrequent
Ephebe lanata	Waterside Rockshag Lichen				3- Vulnerable		On wet, siliceous rocks on lake and stream shores or dripping rock walls.Sometimes submerged	YES	Minimal

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Erioderma mollissimum	Vole Ears Lichen, Graceful Felt Lichen	Endangered-Schedule 1	Endangered-2013	Endangered- 2009	2- May be at Risk	Found throughout NS, in lichen rich locations.	Cool, maritime climates. Highly sensitive to acid rain. Grow on bark of coniferous trees. Corticolous	YES	Possible
Erioderma pedicellatum	Boreal Felt Lichen	Endangered-Schedule 1 (Atlantic Population)	Endangered-2003	Endangered- 2002	1- At Risk	Found in Maritime climates throughout NS, NB and NL. A 90 % reduction in NS and NB populations in the past 2 decades; in lichen rich regions	Cool, Maritime climates. Highly sensitive to acid rain. Grow on bark of coniferous trees	YES	Infrequent
Evernia prunastri	Valley Oakmoss Lichen				3- Vulnerable	Incompletely circumpolar	On bark, lignum, and occasionally rocks	YES	YES
Everniastrum catawbiense	Powder-tipped Antler Lichen				2- May be at Risk	NE North America	On conifer branches, and wood, mainly at high elevations	YES	NO
Fuscopannaria leucosticta	Rimmed Shingles Lichen				2- May be at Risk	Throughout NS	Corticolous, occasional on rocks, often among mosses.	YES	YES / Infrequent
Fuscopannaria praetermissa	Moss Shingles Lichen				2- May be at Risk	Circumpolar arctic and sometimes boreal, extending south in mountains. Hants and Inverness counties.	On moss over calcareous rocks or soil	Possibly	NO
Heterodermia squamulosa	Scaly Fringe Lichen				3- Vulnerable	Endemic to eastern NA	On trees, especially mossy tree bases, in hardwood forests	YES	Minimal
Leptogium corticola	Blistered Jellyskin Lichen				3- Vulnerable	Throughout NS	Corticolous; hardwoods, occasionally on White Cedar in the North; sometimes on mossy rocks.	YES	YES
Leptogium lichenoides	Tattered Jellyskin Lichen				2- May be at Risk	Arctic, boreal, and temperate NA and Europe	On calcareous rocks among mosses	YES	no
Leptogium milligranum	Stretched Jellyskin Lichen				3- Vulnerable	Temperate NA, Central and South America	Corticolous, especially on oaks. In NS only found on Red Maple.	YES	YES
Leptogium subtile	Appressed Jellyskin Lichen				3- Vulnerable	Throughout NS	In NS muscicolous, on trees, generally bases of trees.	YES	YES
Leptogium teretiusculum	Beaded Jellyskin Lichen				3- Vulnerable	Boreal NA and Europe	On trees	YES	YES
Nephroma arcticum	Arctic Kidney Lichen				2- May be at Risk	Circumpolar arctic to boreal	Ground, usually among mosses	YES	YES
Nephroma bellum	Naked Kidney Lichen				3- Vulnerable	Boreal to temperate in Northern Hemisphere, also in Africa	On mossy tree trunks and rocks	YES	YES
Nephroma resupinatum	Pimpled Kidney Lichen				2- May be at Risk	Circumpolar boreal	On rocks and tree trunks	YES	YES
Pannaria lurida	Veined Shingle Lichen				2- May be at Risk	Throughout NS, rare	Corticolous or mossy rocks	YES	YES
Parmeliella parvula	Hairless-spined Shield Lichen				2- May be at Risk	Europe, NA.	Prefers moist sheltered mossy woodlands with broad leaved trees, often near streams. Sometimes occurs on coniferous trees but rarely on rocks or timber.	YES	Infrequent
Parmelinopsis minarum	Tree Pelt Lichen				3- Vulnerable	Pan-temperate and montane pan-tropical, reported form NS	ON bark or rock	YES	YES

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Parmeliopsis ambigua	Slender Rosette Lichen				3- Vulnerable	Arctic, boreal, and western NA, Europe, Asia and Australia	Usually on conifer bark and lignum, rarely rocks	YES	NO
Peltigera collina	Bottlebrush Frost Lichen				3- Vulnerable	Eastern and Western NA	On soil, generally in woodlands, fields or sand areas, less commonly on tree bases or mossy rocks	YES	YES
Peltigera hydrothyria	Eyed Mossthorns Woollybear Lichen				2- May be at Risk		Aquatic...	YES	Infrequent
Physcia subtilis	Appalachian Speckleback Lichen				3- Vulnerable	Endemic to temperate NA	On rocks	YES	YES
Physconia detersa	Angelhair Ramalina Lichen				3- Vulnerable	Boreal and northern temperate NA, Europe, and Asia	Mostly on trees, also rocks	YES	YES
Polychidium muscicola	Peppered Moon Lichen				2- May be at Risk	Arctic, boreal, and northern temperate areas. Throughout NS.	Among mosses on exposed or shaded rocks. ON moist arctic ?????? Or occassionally on ground or at base if trees	YES	YES
Punctelia appalachensis	Powdered Moon Lichen				3- Vulnerable	Endemic to eastern North America, mostly in Appalachian region	On deciduous trees	YES	YES
Ramalina thrausta	Petaled Rocktripe Lichen				3- Vulnerable	Circumpolar	On trees, rarely rocks	YES	YES
Sticta fuliginosa	Warty Beard Lichen				3- Vulnerable	Oceanic sites in NS, Europe, SA, Africa, Australia and NZ	Mossy bark, rarely mossy rock	YES	YES
Sticta limbata	Coastal Bushy Beard Lichen				2- May be at Risk		Mossy bark and rock, especially in coastal forest	YES	YES
Umbilicaria polyphylla	Blood-splattered Beard Lichen				3- Vulnerable	NA, SA, Europe, south Africa, Asia, Australia, and NZ. Cape Breton, Victoria, Kings and Cumberland counties	On nutrient -encrusted siliceous rocks	Possibly	YES
Usnea ceratina	Straw Beard Lichen				3- Vulnerable	Eurasia, NA, and SA	Usually on trees, occasionally rocks, near moist lakesides, wetlands or coastal habitats	YES	YES
Usnea flammea	Coastal Bushy Beard Lichen				3- Vulnerable	Oceanic sites of western Europe and ne NA,	On trees and rocks	YES	YES
Usnea flavocardia	Blood-splattered Beard Lichen				3- Vulnerable	Rare in oceanic area of Europe, NS, and south SA	On trees, usually in coastal areas	YES	YES
Usnea mutabilis	Bloody Beard Lichen				3- Vulnerable	Eastern and eastern NA, sw Europe, Japan, especially common in se NA	On trees in deciduous and pine forests.	YES	Infrequent
Usnea scabrata	Straw Beard Lichen				3- Vulnerable	Circumpolar boreal to montane N Hemisphere	On conifers in forests or open habitat	YES	YES
Usnea substerilis	Embossed Beard Lichen				2- May be at Risk	Circumpolar boreal and temperate	On trees	YES	YES
Usnocetraria oakesiana (syn. Cetraria/Allocetraria oakesiana)	Yellow Band Lichen				2- May be at Risk	Endemic to the Great Lakes/Appalachian regions. Annapolis, Colchester, Cumberland and Hants counties	On both conifers and some hardwoods, occassionally on rocks	YES	YES
BIRDS									

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Actitis macularius	Spotted Sandpiper				3- Sensitive		Breeds near water in a variety of habitats, including shorelines, grasslands and forests. Found in both coastal and freshwater habitats during migration.	YES	YES
Alca torda	Razorbill			Special Concern 2008	3- Sensitive	Margaree Island and eastern Cape Breton (including Bird Islands and Scatarie Island); southern NS.	Breeds on inaccessible coastal islands and cliffs. Nesting: typically in crevices on rocky cliffs.	YES	Unlikely
Anas acuta	Northern Pintail				2- May Be At Risk		Open fertile marsh including estuary	YES	Unlikely
Anas clypeata	Northern Shoveler				2- May Be At Risk		Shallow marshes with lots of cover, wetlands, ponds, sloughs, lakes with abundant vegetation	YES	NO
Anas discors	Blue-winged Teal	Threatened--Schedule 1		Special Concern (2011)	2- May Be At Risk		Shallow, freshwater marshes , wetlands, ponds, prairie sloughs, lakes with vegetation and slow-flowing muddy creeks	YES	NO
Anas strepera	Gadwall	Special Concern---Schedule 1		Endangered-2007	2- May Be At Risk		Freshwater marshes, ponds, shallow lakes	YES	NO
Antrostomus (syn. Caprimulgus) vociferus	Eastern Whip-poor-will	Threatened-Schedule 1	Threatened-2007	Threatened-April 2009	1- At Risk 1	Possible breeding records in southern Nova Scotia	Dry deciduous or mixed forests with little or no underbrush; requires shade and proximity to open areas for foraging. Nesting: Eggs laid on leaf litter, usually partially shaded by vegetative cover.	Unlikely	Unlikely
Asio flammeus	Short-eared Owl	Special Concern-Schedule 1		Special Concern - 2008	2- May Be At Risk	Found in middle America, Europe, Asia and Africa, Breeds in every province and territory in Canada. Sparsely scattered throughout coastal NS; most near Amherst and Bay of Fundy.	Usually found in open country supporting cyclic small mammals (voles, lemmings), large expanses of grasslands, heathlands, shrub-steppe, tundra or agricultural areas. Nesting: dry sites with enough vegetation to conceal incubating female.	YES	Yes
Asio otus	Long-eared Owl			Threatened	2- May Be At Risk		Open forests and areas of dense vegetation adjacent to open grassland or shrubland.	YES	Unlikely
Botaurus lentiginosus	American Bittern	Threatened-Schedule 1		Threatened	3- Sensitive		Freshwater marshes, wetlands	YES	NO
Branta bernicla	Brant			Threatened_ Reassed Nov 2009	3- Sensitive	Does not nest in NS. Winter feeding grounds: Northumberland Strait, Cape Sable (late winter), Brier Island, Wallace Harbour in Cumberland county and Minas Basin.	Found in NS during the winter months, mostly in marine habitats	YES	Unlikely
Bucephala islandica	Barrow's Goldeneye	Special Concern-No Schedule		Special Concern (2011)	1- At Risk 1	Small numbers breed and winter in Maritimes. During non-breeding season, species found in coastal waters of Estuary and Gulf. During late fall, winter and early spring, large numbers are found in a few areas of St. Lawrence corridor.	Breeding appear to be restricted to high elevation lakes north of St. Lawrence Estuary and Gulf. Eastern Canada populations have dwindled in recent years as a result of habitat loss due to fish introduction, logging and contamination.	YES	YES
Calidris canutus	Red Knot		Endangered (2007)		1- At Risk 1	Does not breed in NS; found on mud beaches and flats during fall migration.	Sand beaches adjacent to mud flats, typically near estuaries, bays and inlets.	YES	Unlikely
Calidris canutus rufa	Red Knot rufa subspecies	Endangered-Schedule 1	Endangered 2007	Endangered-2007	1- At Risk 1	Does not breed in NS; found on mud beaches and flats during fall migration.	Sand beaches adjacent to mud flats, typically near estuaries, bays and inlets.	YES	Unlikely
Calidris maritima	Purple Sandpiper				3- Sensitive	Rocky shores on the Atlantic and Fundy coasts, Minas Basin.	Coastal environments.	YES	YES
Calidris pusilla	Semipalmated Sandpiper				3- Sensitive		Breeds in subarctic tundra; found in coastal habitats during migration.	YES	YES

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Cardellina (syn. Wilsonia) canadensis	Canada Warbler	Endangered-Schedule 1	Endangered	Threatened	1- At Risk 1	Throughout NS.	Most abundant in moist, mixed forests with a well-developed understory, dense nest site cover. Often near open water. Nesting: Typically on or near the ground, often on slopes, knolls, in earthen banks, or rocky areas.	YES	Possible
Cathartes aura	Turkey Vulture				3- Sensitive		Preferred habitat includes farmland with pasture and abundant carrion close to undisturbed forested areas for perching, roosting, and nesting. This species nests in dark recesses beneath boulders, on cliff ledges, in hollow trees, logs, and stumps, and in abandoned buildings	YES	Possible
Catharus bicknelli	Bicknell's Thrush	Threatened-Schedule 1	Endangered-2013	Threatened (2009)	1- At Risk 1	Primarily breed in Quebec, but some populations breed in New Brunswick and Cape Breton Highlands.	Breed at high elevation, dense and stunted fir/spruce forests (726 m to 914 m a.s.l.) on rocky peaks. Favour a wet, cool, windy climate that increases in severity with elevation. Nesting: usually in dense fir stands, against tree trunk.	YES	Unlikely
Chaetura pelagica	Chimney Swift	Threatened-Schedule 1-Schedule 1	Endangered -2007	Threatened- 2007	1- At Risk 1	Scattered records throughout NS. Large colony in Wolfville.	More concentrated in urban areas where there are large concentrations of chimneys for nest sites and communal roosts. Nesting: primarily chimneys and other artificial sites; occasionally uses hollow trees.	Possible	Unlikely
Charadrius melodus melodus	Piping Plover melodus subspecies	Endangered-Schedule 1	Endangered -2000	Endangered - November 2013 (No Change)	1- At Risk 1	Coastal habitats; mainly in southwestern and southern NS, but some records from Cape Breton Island and Antigonish County.	Sand and gravel beaches. Nesting: on the ground, above normal high water mark.	YES	Unlikely
Charadrius vociferus	Killdeer	Threatened-Schedule 1-		Threatened 2010	3- Sensitive		A variety of open habitats, including sandbars, mudflats, heavily grazed pastures, cultivated fields, athletic fields, airports, golf courses, graveled lots, and graveled rooftops	YES	Possible
Chlidonias niger	Black Tern	Special Concern--No schedule		Not at Risk- April 1996	2- May Be At Risk		Shallow freshwater marshlands.	Unlikely	NO
Chordeiles minor	Common Nighthawk	Threatened-Schedule 1	Threatened 2007	Threatened- April 2007 (new)	1- At Risk 1	Scattered throughout NS, with emphasis to the eastern side as well as Cape Breton.	Coastal sand dunes and beaches, logged or slashburned areas of forest sites, woodland clearings, grassland habitat, farm fields, open forests, rock outcrops, and flat gravel rooftops. Nesting: Nests in open areas on the ground.	YES	YES
Coccyzus erythropthalmus	Black-billed Cuckoo				2- May Be At Risk		Coniferous and deciduous woodlands, deserts, open country, along coast, and urban areas	YES	Unlikely
Contopus cooperi	Olive-sided Flycatcher	Threatened-Schedule 1	Threatened 2013	Threatened-November 2007 (New)	1- At Risk 1	Throughout NS	Along forest edges and openings with tall snags for foraging and singing. Nesting: generally well out toward tip of horizontal branch in coniferous tree.	YES	YES
Contopus virens	Eastern Wood Peewee	Special Concern--No schedule	Vulnerable -2013	Special Concern-Nov 2012 (new)	3- Sensitive	Throughout NS.	Damp boreal forests, spruce bogs, swamps, coniferous forests, wet areas with sphagnum-moss ground cover	YES	YES
Dendroica castanea	Bay-breasted Warbler				3- Sensitive		Spruce-fir forests	YES	YES
Dendroica striata	Blackpoll Warbler				3- Sensitive		Deciduous and mixed forests, damp woodlands	YES	YES
Dendroica tigrina	Cape May Warbler				3- Sensitive		Mixed and deciduous forests with thick undergrowth, rhododendron thickets, beech and maple forests	YES	Possible

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Dolichonyx oryzivorus	Bobolink	Threatened-No schedule	Vulnerable	Threatened-April 2010	3- Sensitive	Throughout NS, especially farming areas	Grasslands and pastures; agricultural fields. Nesting: on ground, beneath vegetation.	YES	Unlikely
Dumetella carolinensis	Gray Catbird				2- May Be At Risk		Open woodlands, suburban areas, thickets	YES	Possible
Empidonax flaviventris	Yellow-bellied Flycatcher				3- Sensitive		Birch forests, bogs, edges of marshes, damp thickets of alder or willows	YES	YES
Empidonax traillii	Willow Flycatcher				3- Sensitive		Breeds in a variety of usually shrubby, often wet habitats	YES	Unlikely
Euphagus carolinus	Rusty Blackbird	Special Concern--Schedule 1	Endangered 2013	Special Concern-April 2006 (new)	2- May Be At Risk	Uncommon, but present throughout NS.	Frequent cool habitats in forest openings, including spruce bogs, swamps, and damp alder swales. Nesting: In trees and shrubs, 0.5 m to 6 m above ground or over water.	YES	YES
Falco peregrinus anatum/tundrius	Peregrine Falcon anatum/tundrius	Special Concern--Schedule 1	Vulnerable (2007)	Special Concern-April 2007 (Reassigned)	3- Sensitive	The *anatum* subspecies is scattered sparsely through mainland NS, primarily around Bay of Fundy. (The *tundrius* ssp.: is not found in NS).	Wide variety of habitats, with suitable cliffs or platforms for nest. Nesting: on cliff ledges or platforms ranging from about 8 to 400 m high; cliffs 50–200 m preferred.	YES	Unlikely
Fratercula arctica	Atlantic Puffin				3- Sensitive	Machais Seal Island, NB; scattered islands on the south shore of NS (e.g. Pearl Island); and Bird Islands in Cape Breton.	Breeding colonies on islands that permit excavation of nesting burrows, also rocky seacoasts. Nesting: burrows; occasionally cliff crevices.	Unlikely	Unlikely
Gallinago delicata (form. G. gallinago)	Wilson's Snipe				3- Sensitive		Sedge bogs, fens, alder or willow swamps, and pond and river edges.	YES	YES
Gavia immer	Common Loon	Special Concern--Schedule 1		Not at Risk - April 1997	2- May Be At Risk	Throughout NS	Prefers lakes larger than 24 ha with clear water, an abundance of small fish, numerous small islands, and an irregular shoreline. Nesting: ground-nesting; prefers to nest on islands.	YES	YES
Hirundo rustica	Barn Swallow	Threatened-No schedule	Endangered-2013	Threatened-May 2011 (New)	3- Sensitive	Throughout NS, especially farming areas	Open areas (fields, meadows) for foraging. Nesting: Mud nest fastened to a vertical wall or ledge underneath an overhang.	YES	Unlikely
Histrionicus histrionicus	Harlequin Duck	Special Concern-Schedule 1	Endangered 2000	Special Concern-November 2013 (No Change)	1- At Risk 1	Two probable nesting records, one in western Cape Breton and another in southwestern NS. Winter in east and south coasts of NL, southern NS, NB, Maine and Cape Cod.	Nests built on ground on islands or banks of fast-flowing streams. Favour marine environments, but move inland to breed. In winter, occurs along headlands where surf breaks against rocks. Feed close to rocky shorelines or skerries.	YES	YES
Hylocichla mustelina	Wood Thrush	Threatened-No schedule		Threatened-November 2012	5- Undetermined		Moist woodlands, swamps, forest edges	Unlikely	Unlikely
Icterus galbula	Baltimore Oriole				2- May Be At Risk		Open coniferous forests or mixed woodlands	YES	Unlikely
Ixobrychus exilis	Least Bittern	Threatened-Schedule 1		Threatened April 2009 (No Change)	5- Undetermined	Not known to nest in NS.	Tall emergent vegetation in marshes, primarily freshwater, less commonly in coastal brackish marshes	Unlikely	Unlikely
Limosa haemastica	Hudsonian Godwit				3- Sensitive		During migration, found in inland and coastal wetlands, including estuaries, mudflats, salt marshes, sandy shores, lakes, fresh-water marshes. Roost sites include salt marshes, sand spits, small islands. Nests on coastal arctic tundra.	Possible	Unlikely
Myiarchus crinitus	Great Crested Flycatcher				2- May Be At Risk		Open woodlands, clearings	Unlikely	Unlikely

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Numenius borealis	Eskimo Curlew	Endangered-Schedule 1		Endangered-November 2009 (No Change)	5- Undetermined	Possibly extinct. Does not breed in NS; historically, flew east to Maritimes during migration, using a variety of coastal and open terrestrial habitats.	Tundra to transitional woodland in arctic regions of Canada.	Unlikely	NO
Numenius phaeopus	Whimbrel				3- Sensitive		Arctic tundra, bogs, marshes at edge of boreal forests	YES	Possible
Nycticorax nycticorax	Black-crowned Night-Heron				2- May Be At Risk	Southwestern NS, and historically near Amherst	Wide variety of wetland habitats; essentials seem to be good cover, and freshwater, saltwater, or brackish foraging area. Nesting: colonially, in trees; usually on islands, in swamps, or over water	Unlikely	NO
Passerculus sandwichensis ssp. principes	Savannah Sparrow (Ipswich ssp.)	Special Concern--Schedule 1		Special Concern - November 2009	1- At Risk 1	Ipswich Sparrows nest almost exclusivly on Sable Island. Some nest on beaches in southern NS, and occasionally winter elsewhere in the province.	Found in heath-dominated terrain in dense marram grass on coastal dunes and upper beaches; prefer outer dune beaches with good grass coverage. Nesting: Nests of grass and vegetation built on hollows scratched in ground under shelter of shrub, small tree or tussock of grass.	Unlikely	Unlikely
Perisoreus canadensis	Canada Jay				3- Sensitive	Scattered throughout NS.	Favours coniferious or mixed-coniferous forests. Nesting: in trees, generally near edge of small forest openings (bogs, trails).	YES	YES
Petrochelidon pyrrhonota	Cliff Swallow				2- May Be At Risk		Nests in often large colonies, under rock ledges, highway culverts, bridges, and buildings	YES	NO
Phalacrocorax carbo	Great Cormorant				3- Sensitive		Rocky islands, cliffs facing water, stands of trees near water	YES	Possible
Phalaropus fulicarius	Red Phalarope				3- Sensitive		Pelagic outside the breeding season. Nests on low, swampy arctic tundra	YES	NO
Phalaropus lobatus	Red-necked Phalarope				3- Sensitive		Pelagic outside the breeding season. Nests on arctic tundra	YES	NO
Pheucticus ludovicianus	Rose-breasted Grosbeak				3- Sensitive		Woodland edges, weedy fields, thickets	YES	YES
Picoides arcticus	Black-backed Woodpecker				3- Sensitive		Open woodlands, mature forests	YES	YES
Pinicola enucleator	Pine Grosbeak				2- May Be At Risk		Open woodlands, conifer forests	YES	YES
Pluvialis dominica	American Golden-Plover				3- Sensitive		During migration, found in a variety of open inland and coastal habitats, both natural and human-made. Nests on muskeg to edge of tundra, grassy marshes.	Possible	Unlikely
Podilymbus podiceps	Pied-billed Grebe				3- Sensitive		Breeds in freshwater marshes, lakes, and slow-moving rivers.	YES	NO
Poecile hudsonicus	Boreal Chickadee				3- Sensitive	Throughout NS.	Boreal forests	YES	YES
Pooecetes gramineus	Vesper Sparrow				2- May Be At Risk	Northern mainland Nova Scotia, Cape Breton Highlands.	Breeds in dry, open habitats with short, sparse, and patchy herbaceous vegetation; some bare ground; and low to moderate shrub or tall forb cover. Found in a wide variety of grassland habitats. Nesting: Nests on ground, usually near vegetative cover.	Possible	Unlikely

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Progne subis	Purple Martin				2- May Be At Risk	Scattered breeding records in Amherst, Guysborough Co., northern Bay of Fundy	Found almost exclusively near human settlement, even in highly urban areas. Nesting: in tree cavities or (more commonly) in birdhouses.	Unlikely	Unlikely
Regulus calendula	Ruby-crowned Kinglet				3- Sensitive	Throughout NS.	Coniferous and mixed forests.	YES	YES
Regulus satrapa	Golden-crowned Kinglet				3- Sensitive	Throughout NS.	Coniferous forests during breeding season; in winter, may be found in coniferous, mixed and deciduous forests.	YES	YES
Riparia riparia	Bank Swallow			Threatened	2- May Be At Risk	Throughout NS.	Along rivers, streams, lakes, and coasts. Nesting: burrows in banks, cliffs and bluffs; may also use artificial sites such as sand and gravel quarries and road cuts.	YES	NO
Rissa tridactyla	Black-legged Kittiwake				3- Sensitive		Inaccessible coastal cliffs and offshore islands. Largely pelagic outside of breeding season.	YES	NO
Sayornis phoebe	Eastern Phoebe				3- Sensitive		Open deciduous and coniferous woodlands	YES	YES
Sialia sialis	Eastern Bluebird			Not at Risk- April 1996	3- Sensitive	Throughout NS.	Prefers open habitat with little or no understory, such as orchards and clear cut areas amid forests. Nesting: In nest boxes or abandoned nest cavities; prefers nesting in dead trees.	Possible	Unlikely
Spinus pinus	Pine Siskin				3- Sensitive	Throughout NS.	Generally inhabits coniferous or mixed coniferous-deciduous forests	YES	YES
Sterna dougallii	Roseate Tern	Endangered--Schedule 1	Endangered 2000	EndangeredApril 2009 (No Change)	1- At Risk	Colonies sparsely scattered on southern shore of NS (Brothers Islands, Grassy Island, and Country Island Complex)	Colonies on rocky offshore islands, barrier beaches, or salt marsh islands, usually close to shallow-water fishing sites with sandy bottoms, bars, or shoals. Nesting: Typically use dense vegetation, rocks, or other shelter and hide their nests, but occasionally nest in open. Readily use inverted boxes or half-buried tires, which provide covered nest sites.	YES	Possible
Sterna hirundo	Common Tern			Not at Risk- April 1998	3- Sensitive	Throughout NS, particularly the southern coast and Cape Breton.	Usually nests on islands, sometimes on barrier beaches or promontories attached to mainland, or salt marshes; occasionally freshwater marshes. Nesting: on ground, primarily in open areas with loose substrate, with scattered vegetation or other cover	YES	YES
Sterna paradisaea	Arctic Tern				2- May Be At Risk	Lower Bay of Fundy, south shore of mainland NS, south and east shores of Cape Breton Island	Generally nests close to water, frequently on small rocky, gravelly, grassy, or peaty islands; also barrier beaches and sand or gravel spits, gravel bars in rivers, or glacial moraines, as well as marshes, bogs, and grassy meadows. For feeding, uses streams, ponds, lakes, estuaries, and inshore waters. Nesting: On ground or low vegetation in open areas.	YES	YES
Sturnella magna	Eastern Meadowlark	No Status-No Schedule		Threatened- May 2011	3- Sensitive	Throughout NS	Grassland habitats	Possible	Possible
Tachycineta bicolor	Tree Swallow				3- Sensitive		Open fields, meadows, marshes. Nesting: Typically in standing dead trees, or nest boxes where available.	YES	YES
Tringa melanoleuca	Greater Yellowlegs				3- Sensitive		Breeds in muskeg, wet bogs with small wooded islands, and forests (usually coniferous) with abundant clearings. During migration, uses a variety of coastal habitats and wetlands.	YES	Yes

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Tringa semipalmata	Willet				2- May Be At Risk	Occurs thoughout	Breeds most commonly on salt marshes, barrier islands, and barrier beaches; also pastures and farmlands in Nova Scotia	YES	Yes
Tyrannus tyrannus	Eastern Kingbird				3- Sensitive		Open habitats, frequently along woodland edges.	YES	Yes
Vermivora peregrina	Tennessee Warbler				3- Sensitive		Open woodlands, brushy areas, cut-over and burned woods, second-growth woodlands, edges of bogs	YES	Yes
Wilsonia pusilla	Wilson's Warbler				3- Sensitive		Undergrowth in moist mature forests, dense woodlands near streams or swamps	YES	YES
HERPETILES (TERRESTRIAL)									
Chelydra serpentina	Common Snapping Turtle	Special Concern- Schedule 1	Vulnerable -2013	Special Concern- November 2008 (New)	4 - Secure	Mainland NS	All types of freshwater habitats, especially those with soft mud bottom and abundant aquatic vegetation or submerged brush and logs. In brackish water in some areas. Mostly a bottom dweller. Hibernates singly or in groups in streams, lakes, ponds, or marshes	YES	YES
Emydoidea blandingii	Blandings' Turtle- NS population	Endangered- Schedule 1		Endangered-May 2005 (In a higher risk category)	1- At Risk 1		Forested wetlands in southern NS	NO	NO
Glyptemys insculpta	Wood Turtle	Threatened- Schedule 1	Threatened -2000	Threatened- November 2007 (In a higher risk category)	3- Sensitive	The species has been reported in most of New Brunswick, north-central Nova Scotia (including Cape Breton Island), southern Quebec, and both south-central and north-central Ontario.	The species is associated with moving water; it frequents streams, creeks and rivers. It is also one of the most terrestrial members of its family and occupies a great variety of habitats, including forests, but favours riparian areas with open canopy.	YES	YES
Thamnophis sauritus septentrionalis	Northern Ribbon Snake (Eastern Ribbonsnake.)	Threatened- Schedule 1	Threatened 2003	Threatened November 2012 (No Change)	1- At Risk 1	Southwestern, Nova Scotia - Queens County and Lunenburg County.	Quiet, Vegetated ponds, coves of lakes and grassy places along streams. Enjoy an abundance of aquatic vegetation.	NO	NO
ODONATES									
Coenagrion resolutum	Taiga Bluet				2- May Be At Risk	Known to occur in Guysborough County	Found at sedge marshes and fens and well-vegetated pond and lake edges, at large lakes in sedge beds. Often in stands of water horsetail *Equisetum hiemale*.	YES	Yes
Enallagma signatum	Orange Bluet				2- May Be At Risk		Lentic habitat, including ponds and lakes. Flight period: late June to early September.	YES	yes
Enallagma vesperum	Vesper Bluet				3- Sensitive		Lentic habitat; found in small lakes with lots of floating vegetation and occasionally slow-moving streams.. Flight period: early July to mid August.	YES	Yes
Epitheca princeps	Prince Baskettail				3- Sensitive		Rivers, Streams and Lakes. Only active wave-washed shores of lakes, and slow running streams and rivers.	YES	Unlikely
Erythrodiplax berenice	Seaside Dragonlet				3- Sensitive	Known to occur in Guysborough County	Salt-marsh habitats	YES	No
Gomphaeschna furcillata	Harlequin Darner				3- Sensitive	Known to occur in Guysborough County	Swamps or bogs	YES	YEs
Gomphus descriptus	Harpoon Clubtail				3- Sensitive		Live in streams in particularly open forest.	YES	Possible

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Gomphus ventricosus	Skillet Clubtail				2- May Be At Risk		Breed in deep rivers where they can burrow into mud in deep pools.	YES	No
Ophiogomphus aspersus	Brook Snaketail				2- May Be At Risk	Known to occur in Guysborough County	Clear sand bottomed streams with intermittent rapids. Sand or gravel; Current may be slow to strong.	YES	No
Ophiogomphus mainensis	Maine Snaketail				2- May Be At Risk		This species is mainly associated with clear, rocky woodland streams and smaller rivers, frequently where they drain marshes or lakes.	YES	No
Ophiogomphus rupinsulensis	Rusty Snaketail				2- May Be At Risk	Known to occur in Guysborough County	Common along rivers. Inhabits generally low-flowing mesotrophic rivers with diverse substratum.	Unlikely	Unlikely
Somatochlora albicincta	Ringed Emerald				2- May Be At Risk		Near mountain lakes	No	No
Somatochlora septentrionalis	Muskeg Emerald				3- Sensitive	In Nova Scotia, confined to the Cape Breton Highlands	Shallow *Sphagnum*-choked ponds within bogs	No	No
Somatochlora williamsoni	Williamson's Emerald				2- May Be At Risk	Known to occur in Guysborough County	Occurs throughout southeastern Canada and northeastern United States, including the Appalachian Mountains, it is usually found at slow streams and lakes, and sometimes bog lakes. It seems to prefer shaded habitats.	YES	Possible
Williamsonia fletcheri	Ebony Boghaunter				2- May Be At Risk	Known to occur in Guysborough County	Lentic; Bogs and fens, also found sometimes water suspended/saturated sphagnum.	YES	Yes
BUTTERFLIES									
Boloria chariclea	Arctic Fritillary				3- Sensitive	Historic record from Parrsboro area; two MBA records, one in central Cape Breton and the other in northern NB.	Boreal forest clearings and along transmission lines and bogs. Host plants include willow (*Salix* spp.) and possibly violets (*Viola* spp.)	NO	NO
Callophrys lanoraieensis	Bog Elfin				2- May Be At Risk	Reported in New Brunswick and central Nova Scotia, Early May to late June.	Bogs, wood roads and sandy pine forests with black spruce. Host plant: Black spruce.	YES	YES
Danaus plexippus	Monarch	Special Concern- Schedule 1		Special Concern - April 2010 (No Change)	3- Sensitive	Several MBA records from all three provinces; none from eastern NS. The eastern population includes all Monarchs east of the Rocky Mountains, from the Gulf coast to southern Canada, and from the Great Plain States and Prairie Provinces east to the Atlantic coast.	Primarily found in places where milkweed (Asclepius) and wildflowers such as goldenrod, asters, and purple loosestrife exist. This includes abandoned farmland, along roadsides, and other open spaces.	YES	Yes
Erora laeta	Early Hairstreak				2- May Be At Risk	Recorded in the Wentworth Valley and Annapolis Valley. No Maritimes Butterfly Atlas (MBA) records to date.	Deciduous woods where beech is present. Larvae feed on beech nuts. Adults seldom leave forest canopy.	NO	NO
Oeneis jutta	Jutta Arctic				2- May Be At Risk	Known to occur in NB and northern Cape Breton. Thirteen MBA records to date for NB, and five for NS (Guysborough Co. and Cumberland Co.)	Typically obseved around margins of bogs and fens. Host plants include a variety of sedges, such as Carex sp. and tussock cotton-grass.	YES	YES
Papilio brevicauda	Short-tailed Swallowtail				3- Sensitive	Only found in the Atlantic provinces and eastern Quebec. Single MBA record for NS in Victoria Co.; seven records for northern NB.	Coastal marshes, dunes and headlands in the presence of its primary larval foodplant, Scotch lovage. Rarely occurs inland, and infrequently uses other members of the carrot family.	NO	NO
Pieris oleracea	Mustard White				3- Sensitive	Widespread.Adults present early May to mid June, and mid July to late August. Two broods per year.	Along roadsides and in open spaces in forested areas. Host plant: Various members of the Mustard family, particularly rock cresses and toothworts.	YES	YES
Polygonia gracilis	Hoary Comma				3- Sensitive	Three MBA records, all in northern NB.	Often seen visiting flowers, typically goldenrod and pearly everlasting. Host plants include a variety of currants (*Ribes* spp.)	NO	NO

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Polygonia satyrus	Satyr Comma				3- Sensitive	Five MBA records, all from northern NB.	Woodlands, often found sitting on wood roads and trails. Attracted to animal droppings and carrion, as well as sap and fermented fruit. Host plant is the stinging nettle.	NO	NO
Thorybes pylades	Northern Cloudywing				3- Sensitive	Three historic records from Pictou and Colchester counties. Three MBA records for NS (Antigonish Co. and Guysborough Co.), and several for northern NB and Fredericton area.	Variety of open forest and meadow habitats, where it regularly visits flowers. Highly colonial and can be locally common. Host plants include vetch, beach pea and other legumes.	YES	YES
FISHES (FRESHWATER)									
Acipenser oxyrinchus	Atlantic Sturgeon	No Status-No schedule		Threatened-May 2011 (New)	2- May Be At Risk	New Brunswick, Nova Scotia, Atlantic Ocean-Located along the Fundy coast of NS, and in the northern tip of the Cape Breton Highlands.Adults may occur all around coast of NS	Important habitat for Atlantic Sturgeon is a river with access to the sea, preferably with deep channels; an estuary with relatively warm, partially saline water and a coastal shelf region. Atlantic Sturgeon spawn in freshwater over rocky-gravel substrates at a depth of 1 - 3 m in areas with a strong current, and also under waterfalls, and in deep pools.	YES	Possible (marine environment)
Alosa pseudoharengus	Alewife				3- Sensitive		Rivers, freshwater lakes, ponds and streams	YES	Unlikely
Anguilla rostrata	American Eel	No Status-No schedule		Threatened-May 2012 (In a higher risk category)	2- May Be At Risk		A variety of marine and freshwater habitats over the course of its life history.	YES	YES (marine environment)
Coregonus huntsmani	Atlantic Whitefish	Endangered-Schedule 1	Endangered	Endangered- Nov 2012	1- At Risk		Cool water streams and some natural lakes. Prefers streams with moderate currents over sand and gravel bottoms with clean to slightly turbid water.	NO	NO
Culaea inconstans	Brook Stickleback				3- Sensitive		Cool water streams and some natural lakes. Prefers streams with moderate currents over sand and gravel bottoms with clean to slightly turbid water.	YES	Unlikely
Margariscus margarita	Pearl Dace				3- Sensitive		Lakes, cool bog ponds, creeks, and cool springs	YES	Unlikely
Morone saxatilis	Striped Bass-Gulf of St. Lawrence population	Special Concern-No schedule		Special Concern-November 2012 (In a lower risk category)	1- At Risk (Atlantic) (2005)		Steady-flowing, turbid rivers that have low slopes and large estuaries, also marine	YES	NO
Salmo salar	Atlantic Salmon	Endangered-No schedule			2- May Be At Risk	Nova Scotia, Atlantic Ocean	Atlantic Salmon rivers are generally clear, cool and well oxygenated, with low to moderate gradient, and possessing bottom substrates of gravel, cobble and boulder.	YES	Possible (marine environment)
Salvelinus fontinalis	Brook Trout				3 -Sensitive (Atlantic, 2005)	Maritime provinces, Newfoundland and Labrador west to Manitoba	Cool clear waters of 10 - 18C with a lot of cover. Usually they live in spring-fed streams with many pools and riffles.	YES	Unlikely
FRESHWATER									
Alasmidonta varicosa	Brook Floater (Swollen Wedge Mussel)	Special Concern-Schedule 1	Threatened -2013	Special Concern-April 2009	3- Sensitive	From Nova Scotia and New Brunswick to North Carolina	Usually found in rapids or riffles on rocky or gravel substrates and in sandy shoals. Most abundant in small rivers and creeks.	YES	NO
Lampsilis cariosa	Yellow Lampmussel	Special Concern-Schedule 1	Threatened -2006	Special Concern-November 2013 (No Change)	2- May Be At Risk	From Sydney River, Cape Breton to Georgia.	Predominantly a river species. Occurs in swift currents on shoals or in riffles and principally on sand bottom. Occasionally found in ponds.	NO	NO

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Lampsilis radiata	Eastern Lampmussel				3- Sensitive	Throughout NS	Occupies a wide range of freshwater habitats, occurring in small to large river systems and lakes of various sizes. Prefers gravel or sand bottoms, occasionally found in silty or muddy bottoms	YES	NO
Leptodea ochracea	Tidewater Mucket				3- Sensitive	Atlantic coastal plain from Cape Breton to Savannah River, Georgia	Occurs in quiet water, that is ponds, canals, and slow moving parts of rivers. Found in mud or sand bottoms. Occurs only near the seacoast.	YES	NO
Margaritifera margaritifera	Esatern Pearlshell				3- Sensitive	Throughout NS	Small and medium-sized cold-water streams and rivers, occasionally in lake outlets. Can be found quite far upstream in small, permanent, fast-running streams.Occur in habitats characterized by low calcium carbonate levels which are especially well oxygenated. Commonly occurs in shallow sandy or gravel shoals, as well as in pools.	YES	NO
Strophitus undulatus	Creeper				2- May Be At Risk	From Nova Scotia to South Carolina; Cumberland Co., Westcolchester Co., NB Fundy Coast	Occurs in rivers and creeks but occasionally in lakes. Inhabits all substrates.	YES	NO
FISHES (MARINE)									
Acipenser oxyrinchus	Atlantic Sturgeon	No Status-No schedule		Threatened	2-May Be At Risk (Atlantic, 2005)	New Brunswick, Nova Scotia, Atlantic Ocean	Important habitat for Atlantic Sturgeon is a river with access to the sea, preferably with deep channels; an estuary with relatively warm, partially saline water and a coastal shelf region. Atlantic Sturgeon spawn in freshwater over rocky-gravel substrates at a depth of 1 - 3 m in areas with a strong current, and also under waterfalls, and in deep pools.	YES	Possible (marine environment)
Alopias vulpinus	Thresher Shark				3 -Sensitive (Atlantic, 2005)	Cosmopolitan in temperate and tropical seas	A pelagic oceanic species occuring at depths of 0 - 550 m, usually 0 - 200 m.	NO	Possible
Amblyraja radiata	Thorny Skate	No Status-No schedule		Special Concern-Mayl 2012 (New)	2-May Be At Risk (Atlantic, 2005)	Nunavut, Quebec, New Brunswick, Prince Edward Island, Nova Scotia, Newfoundland and Labrador, Arctic Ocean, Atlantic Ocean	Occurs on the bottom over a wide range of depths (primarily 18-1200 m) and typically in water temperatures of 0° to 10°C. They can be found on a variety of bottom types including sand, gravel, mud and broken shells.	YES	Unlikely
Anarhichas denticulatus	Northern Wolffish	Threatened-Schedule 1		Threatened-November 2012 (No Change)	1- At Risk (Atlantic) (2005)	Arctic Ocean, Atlantic Ocean	The northern wolffish is a benthopelagic fish found in a broad range of depths, but most often at depths greater than 100 m in offshore waters over soft bottoms and in proximity to boulders at temperatures below 5°C; it is usually found in deep waters between 151 and 900 m.	YES	Unlikely
Anarhichas lupus	Atlantic Wolffish	Special Concern-Schedule 1		Special Concern-November 2012 (No Change)	3 -Sensitive (Atlantic, 2005)	Arctic Ocean, Atlantic Ocean	This species primarily inhabits the cold, deep waters of the continental shelf.	YES	Unlikely
Anarhichas minor	Spotted Wolffish	Threatened-Schedule 1		Threatened-November 2012 (No Change)	1- At Risk (Atlantic) (2005)	Arctic Ocean, Atlantic Ocean	Occurring in waters between 50 and 600 m deep and at temperatures lower than 5°C, it lives offshore over sand or mud bottoms and often in proximity to boulders.	YES	Unlikely
Antimora rostrata	Blue Hake				3 -Sensitive (Atlantic, 2005)	Occurs in all oceans	Deep water species, maximum catches reported at 1400 m depth.	NO	NO
Anguilla rostrata	American Eel	Threatened-May 2012 (In a higher risk category)			2- May Be At Risk		A variety of marine and freshwater habitats over the course of its life history.	YES	YES
Brosme brosme	Cusk	No Status-No schedule		Endangered-November 2012 (In a higher risk category)	1- At Risk (Atlantic) (2005)	Atlantic Ocean	Brosme are commonly taken on hard, rough, and rocky substrate). Fish in coral habitats tended to be larger in size than those in non-coral habitats.	YES	Unlikely

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Carcharodon carcharias	White Shark	Endangered-Schedule 1		Endangered-April 2006 (New)	1- At Risk (Atlantic) (2005)	Atlantic Ocean	Occurs in both inshore and offshore waters, from the intertidal to the upper continental slope and mesopelagic zone. Known bathymetric range is from just below the surface to just above the bottom down to a depth of at least 1,280 m . It occurs in the breakers off sandy beaches, off rocky shores, and readily enters enclosed bays, lagoons, harbours, and estuaries, but does not penetrate brackish or fresh waters to any extent..	YES	Unlikely
Coregonus huntsmani	Atlantic Whitefish	Endangered-Scheule 1	Endangered	Endangered	1- At Risk (Atlantic) (2005)	Occurs only in the Tusket and Petite Riviere watersheds in southern Nova Scotia. Introduced to Anderson lake in Dartmouth.	The specific habitat requirements are largely unknown. It is salmon-like in that is spawns in freshwater and runs to sea in the spring. Most populations are land locked however.	NO	NO
Cetorhinus maximus	Basking Shark	No schedule-No Status		Special Concern-November 2009 (New)	2-May Be At Risk (Atlantic, 2005)	Atlantic Ocean	Areas where oceanographic events concentrate zooplankton appear to be the favoured summer habitat of Basking Sharks, typically including fronts where water masses meet, headlands, and around islands and bays with strong tidal flow. There is recent evidence that Basking Sharks also utilize deepwater habitats greater than 1000 m. The quality of foraging habitat changes over short spatial and temporal scales based on oceanographic conditions.Bycatch in fisheries is the most important known threat in the northwest Atlantic.	YES	Unlikely
Coryphaenoides rupestris	Roundnose Grenadier	No schedule-No Status		Endangered-November 2008 (New)	2-May Be At Risk (Atlantic, 2005)	Arctic Ocean, Atlantic Ocean	In the western North Atlantic, Roundnose Grenadier has been reported at depths between 200 and 2600 m.. Proportion of mature individuals tends to increase with depth. Reported preferred temperatures are 3.5-4.5ºC in Canada, somewhat warmer in European waters. The species is reported to occur frequently some distance off bottom (ca 100 m) although factors affecting vertical movements are not well known.	YES	Unlikely
Dipturus laevis	Barndoor Skate			Not at Risk-November 2010 (New)	3 -Sensitive (Atlantic, 2005)	Western Atlantic: Grand Bank and southern Gulf of St. Lawrence in Canada to North Carolina, USA. Threatened with extinction by intensive trawling.	A demersal species, usually at depth range 0 - 750 m, usually 0 - 150	YES	NO
Glyptocephalus cynoglossus	Witch Flounder				3 -Sensitive (Atlantic, 2005)		lives on soft bottoms between 45 and 1460 m and prefers temperatures of 2–6 °C	NO	NO
Gadus morhua	Atlantic Cod	No Status-No schedule		Endangered-April 2010 (Reassigned)	3 -Sensitive (Atlantic, 2005)		Knowledge of the habitat requirements is rather poor, however it is reasonable to predict that habitat requirements change significantly with age in this species. Small resident non–migratory populations may exist in inshore bays and likely complete their life cycle in a restricted geographic area and hence have very different habitat requirements in comparison to migratory populations.	YES	YES
Hippoglossoides platessoides	American Plaice	No Status-No schedule		Threatened-April 2009 (New)	2-May Be At Risk (Atlantic, 2005)		Adult plaice prefer prefer areas with sediment suitable for burrowing but the range of suitable particle sizes probably increases with fish size. Plaice may occupy non-preferential physical habitats (temperature, sediment type, etc.) in order to gain access to abundant prey.	YES	YES

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Hippoglossus hippoglossus	Atlantic Halibut			Not at Risk-November 2011 (New)	2-May Be At Risk (Atlantic, 2005)	Temperate and arctic waters of the northern Atlantic, from Labrador and Greenland to Iceland, the Barents Sea and as far south as the Bay of Biscay and Virginia.	Demersal fish living on or near sand, gravel or clay bottoms at depths of between 50 and 2,000 m. Halibut are strong swimmers and are able to migrate long distances. Larvae are pelagic until tehy reach about 4m in length.	YES	YES
Lamna nasus	Porbeagle	No Status-No schedule		Endangered-May 2014 (No Change)	1- At Risk (Atlantic) (2005)	Atlantic Ocean	The porbeagle is a pelagic, epipelagic, or littoral shark that is usually more common on continental shelves, but is also found far from land in ocean basins and occasionally close inshore. Most porbeagle in Canadian waters occur between 5-10ºC with little variation throughout the year, suggesting that they adjust their location to occupy this preferred temperature range	YES	Possible
Lycodes vahlii	Checker Eelpout				3 -Sensitive (Atlantic, 2005)		Checker eelpouts occur in the Atlantic from Davis Strait in the north, through the Gulf of St. Lawrence and the northern Scotian Shelf. They have been caught at depths ranging from 201–650 m, and in waters from 2.1 °C to 4.5 °C.	NO	NO
Leucoraja ocellata	Winter Skate	No Status-No schedule		Threatened-May 2005 (New)	3 -Sensitive (Atlantic, 2005)	Atlantic Ocean	Aa benthic species closely confined to sandy or gravelly bottoms.. On the Scotian Shelf, Scott and Scott (1998) indicate a preferred depth of 37–90 m.Winter skate have been reported in waters ranging between -1.2°and 19° C. On the Scotian Shelf, they are most frequently found at depths where temperatures range between 5°and 9° C). The salinity of the waters inhabited by skate typically ranges between 32.ppt and 34.4 ppt	YES	Possible
Makaira nigricans	Blue Marlin				3 -Sensitive (Atlantic, 2005)		Blue marlin are distributed throughout the tropical and subtropical waters of the Atlantic, Indian, and Pacific Oceans. A bluewater fish that spends the majority of its life in the open sea far from land, the blue marlin preys on a wide variety of marine organisms, mostly near the surface	NO	NO
Macrourus berglax	Roughead Grenadier			Special Concern-April 2007 (New)	2-May Be At Risk (Atlantic, 2005)	Atlantic Ocean	A benthopelagic species that can be found in the deep waters of the subarctic along the continental slope and on deep shelves.Predominant in depths ranging from 400 to 1200 m, although they may inhabit depths between 200-2000 m	YES	Unlikely
Morone saxatilis	Striped Bass-Gulf of St. Lawrence population	Special Concern-No schedule		Special Concern-November 2012 (In a lower risk category)	1- At Risk (Atlantic) (2005)		Steady-flowing, turbid rivers that have low slopes and large estuaries, also marine	NO	NO
Malacoraja senta	Roughead Grenadier	Special Concern-No schedule		Special Concern	3 -Sensitive (Atlantic, 2005)	Quebec, New Brunswick, Prince Edward Island, Nova Scotia, Atlantic Ocean	These fish live on the sea bottom and prefer soft mud and clay substrates. They are found over a fairly wide range of depths although this is narrower at specific latitudes. The shallowest/deepest records of this species are 25/1436 m. The densest concentrations occur between 150 and 550 m. The fish are found over a relatively narrow range of temperatures, avoiding the coldest areas. The densest concentrations, comprising 90% of survey occurrences, were found where bottom temperature was between 3 and 10° C.	YES	Unlikely
Nezumia bairdii	Marlin-Spike Grenadier				3 -Sensitive (Atlantic, 2005)	Northwest Atlantic: Newfoundland, Canada to the northern end of the Straits of Florida, USA	Benthopelagic; non-migratory; depth range 16 - 1000 m, usually 90 - 700 m Benthic, reported as deep as 2295m. Taken much shallower in areas with cold surface waters	YES	Unlikely

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Pollachius virens	Pollock				3 -Sensitive (Atlantic, 2005)		Common in northern parts of the Northern Atlantic, including the Bay of Biscay and Palmas Altas Campus. Adults can grow up to 130 centimetres (51 in) and weigh up to 32 kilograms (71 lb); the species is of great commercial value to fisheries.[5] The fish can be found close to the shore, particularly in rocky areas, but larger examples tend to be found around off-shore wrecks and reefs	YES	yES
Prionace glauca	Blue Shark				3 -Sensitive (Atlantic, 2005)		An oceanic and epipelagic shark found worldwide in deep temperate and tropical waters from the surface to about 350 meters	YES	Unlikely
Salmo salar	Altantic Salmon	Endangered- Schedule 1		Endangered- November 2010 (New)	2- May Be At Risk (Atlantic, 2005), 4- Secure (NS, 2005)		Salmon move, as juvenile smolts or post-spawning 'kelts', from fresh water to brackish estuaries and then to the open ocean. Detailed information on migration routes and distribution is generally unavailable for specific populations.	YES	Unlikely
Tetrapturus albidus	White Marlin				3 -Sensitive (Atlantic, 2005)		Usually above the thermocline. Its distribution varies seasonally, reaching higher latitudes in both the northern and southern hemispheres only during the respective warm seasons. Usually found in deep (over 100 m) blue water with surface temperatures over 22 °C and salinities of 35 to 37 ppt.	NO	NO
Squalus acanthias	Spiny Dogfish	No Status- No schedule		Special Concern- April 2010 (New)	3 -Sensitive (Atlantic, 2005)	Spiny Dogfish occurs world–wide on the continental shelf, from the intertidal to the shelf slope, in temperate and boreal waters. In the northwest Atlantic, abundance is highest between Nova Scotia and Cape Hatteras (North Carolina).. The Atlantic Canada population is thought to consist of both resident and migrating components.	This species can survive in a variety of habitats, and have been observed at depths ranging from surface waters to 730 m, and from intertidal areas to well offshore. They are usually located where water temperatures are 5–15 °C and can tolerate a wide range of salinities, including estuarine waters. R	YES	Possible
Thunnus alalunga	Albacore				3 -Sensitive (Atlantic, 2005)		Undertakes feeding migrations to productive areas of the Northeast Atlantic during the summer. An epipelagic and mesopelagic, oceanic species that is abundant in surface waters of 15.6–19.4 °C. Deeper swimming, large albacore are found in waters of 13.5–25.2 °C. Temperatures as low as 9.5 °C may be tolerated for short periods.	YES	Possible
Thunnus albacares	Yellowfin Tuna				3 -Sensitive (Atlantic, 2005)		Pelagic waters of tropical and subtropical oceans worldwide.Seasonal migrants to Canadian waters in search of food	YES	Possible
Thunnus obesus	Bigeye Tuna				3 -Sensitive (Atlantic, 2005)		Found in the open waters of all tropical and temperate oceans. Seasonal migrants to Canadian waters in search of food.	YES	Possible
Urophycis chesteri	Longfin Hake				3 -Sensitive (Atlantic, 2005)	Western Atlantic: Canada to straits of Florida, found in the outer continental shelves and slopes, but not abundant to south of Cape Hatteras.	Epibenthic species most abundant between 360 and 800 m	NO	NO
Urophycis chuss	Red Hake				3 -Sensitive (Atlantic, 2005)	Northwest Atlantic: North Carolina to southern Nova Scotia, straying to the Gulf of St. Lawrence	Marine demersal species found at depths from 35 - 1152 m	NO	NO

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Thunnus thynnus	Bluefin Tuna	No Status- No schedule		Endangered-May 2011 (New)	2-May Be At Risk (Atlantic, 2005)	Atlantic Ocean	Atlantic Bluefin Tuna are seasonal migrants to Canadian waters in search of food. They arrive in summer and move southward in late fall. They may form schools, generally of less than 50 individuals (Scott and Scott 1988). Their spatial distribution is both coastal and oceanic . Two spawning locations are known: the western Atlantic population spawns in the Gulf of Mexico and the eastern Atlantic / Mediterranean population spawns in the Mediterranean.	YES	Likely - Fished Nearby
Urophycis tenuis	White Hake			Threatened-November 2013 (New)	2-May Be At Risk (Atlantic, 2005)	Western Atlantic: Labrador and the Grand Banks of Newfoundland to the coast of North Carolina.	Demersal spcies occurring at depths from 180 - 1000 m	YES	Possible
Zoarces americanus	Ocean Pout				3 -Sensitive (Atlantic, 2005)	Northwest Atlantic: Labrador, Canada to Delaware, USA.	Marine to brackish water demersal species found at depths from 0 - 388 m	YES	NO
MAMMALS									
Balaenoptera musculus	Blue Whale- Atlantic Population	Endangered-Schedule 1		Endangered-May 2012 (No Change)	1- At Risk (Atlantic) (2005)	Atlantic Ocean	Blue Whales range widely, inhabiting both coastal waters and the open ocean. Individuals belonging to the Atlantic population are frequently observed in estuaries and shallow coastal zones where the mixing of waters ensures high productivity of krill (small shrimp-like crustaceans about 2 cm long), the whales' main food.	NO	NO
Balaenoptera physalus	Fin Whale				3 -Sensitive (Atlantic, 2005)	Atlantic Ocean	Fin whales are associated with low surface temperatures and oceanic fronts during summer months. In the western North Atlantic, they are found from close inshore to well beyond the shelf break. The defining characteristic of fin whale feeding habitat is likely high concentrations of prey,particularly euphausiids and small schooling fish. Characteristics of preferred breeding grounds are unknown.In the North Atlantic, they eat euphausiids, capelin and herring, with considerable variation by location and time of year.	YES	NO
Eubalaena glacialis	Northern Right Whale	Endangered-Schedule 1		Endangered-November 2013 (No Change)	1- At Risk (Atlantic) (2005)	Atlantic Ocean	In Canadian waters, individuals congregate in the summer and fall in the lower Bay of Fundy, mainly east of Grand Manan Island, and in the vicinity of Roseway Basin between Browns and Baccaro banks on the western Scotian Shelf	YES	Unlikely
Hyperoodon ampullatus	Northern Bottlenose Whale-Scotian Shelf population	Endangered-Schedule 1		Endangered-May 2011 (No Change)	3 -Sensitive (Atlantic, 2005)	Atlantic Ocean	Occur in deep (>500m), northern waters of the North Atlantic, generally with depths between 800 and 1,500m, along the continental slope. These water depths seem to coincide with their dive depths, perhaps indicating that the whales often forage near the bottom.	NO	NO
Mesoplodon bidens	Sowerby's Beaked Whale	Special Concern-Schedule 1		Special Concern-November 2006 (No Change)	3 -Sensitive (Atlantic, 2005)	Atlantic Ocean	Sowerby's beaked whales are generally found in deep waters, including continental shelf edges and continental slopes. They have been observed in waters deeper than 1500m.	NO	NO
Orcinus orca	Killer Whale	No Status- No schedule		Not at Risk	3 -Sensitive (Atlantic, 2005)	Arctic Ocean, Atlantic Ocean	Killer Whales can tolerate wide ranges of salinity, temperature and turbidity, and their distribution appears to be determined mainly by the distribution and accessibility of their prey.	Unlikely	Unlikely

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Phocoena phocoena	Harbour Porpoise			Special Concern	3 -Sensitive (Atlantic, 2005)	Northwest Atlantic population	Harbour porpoises are widely distributed over the continental shelves of the temperate Northern Hemisphere. Sometimes found in bays and harbours.	YES	YES
MAMMALS									
Alces alces americana	Eastern Moose- Mainland NS populaiton		Endangered-April 2010 (No Change)-		1- At Risk 1	Cobequid Mountains and Tobeatic Wildlife Reserve, other small herds scattered throughout the Province	Young deciduous shrubs and trees.	YES	YES
Glaucomys volans	Southern Flying Squirrel- NS population			Not at Risk-April 2006 (Reassigned)	3- Sensitive	In Canada, Southern Flying Squirrels are found in southern Ontario, southwestern Québec and southern Nova Scotia.	Southern Flying Squirrels inhabit hardwood forests in eastern North America. Dead hollow trees are used as den sites.	NO	NO
Lynx canadensis	Canada Lynx		Endangered -2002	Not at Risk-May 2001 (No Change)	1- At Risk 1	Highlands of Cape Breton Island	Dense climax Boreal Forest with a dense undercover of thickest and windfalls.	NO	NO
Martes americana	American Marten		Endangered -2001		1- At Risk 1		Mature softwood forest.	NO	NO
Martes pennanti	Fisher				3- Sensitive	Throughout NS. Mostly in Cumberland, Colchester and Pictou Counties	Mixed forests.	NO	YES
Myotis lucifugus	Little Brown Myotis	No status-No schedule	Endangered -2013	Endangered November 2013 (No Change)	3- Sensitive	Nova Scotia, Newfoundland, Labrador, Quebec, West	Caves, mine tunnels, hollow trees, buildings. Dead trees close to lakes and ponds. Hibernate in caves. Colonial. Most hibernate together in caves.	NO	YES
Myotis septentrionalis	Northern Long-eared Myotis	No status-No schedule	Endangered -2013	Endangered November 2013 (No Change)	3- Sensitive	Nova Scotia, New Brunswick, Newfoundland	Dense forest and caves.	NO	YES
Sorex dispar	Long-tailed Shrew				3- Sensitive	Only known in Cumberland and Colchester Counties	Talus slopes and rock slides in deciduous and coniferous forests. Mountainous regions.	NO	NO
Sorex gaspensis	Gaspe Shrew	Not at Risk- Schedule 3		Not at RiskApril 2006 (No longer at risk)	3- Sensitive	At the present time there are four populations of the Gaspé Shrew in Canada: one in the Gaspé peninsula, two in New Brunswick, and one in northern Nova Scotia.	The Gaspé Shrew prefers rock outcrops and talus slopes in highlands where there are steep slopes.	NO	NO
MOLLUSCS									
Barnea truncata	Atlantic Mud-piddock	No Status- No schedule		Threatened- November 2009 (New)	1- At Risk (ATLANTIC)	One location in the Minas Basin	This intertidal marine bivalve species bories into hard clay and soft rock, and in Canada is entirely dependent on a single geological formation, the red-mudstone facies within the Minas basin. The total available habitat for this species is < 0.6 km^2. This species settles on and bores into the mudstone, and once settled, is immobile.	NO	NO
REPTILES (MARINE)									
Caretta caretta	Loggerhead Turtle	No schedule- No Status		Endangered-April 2010 (New)	1- At Risk (Atlantic) (2005)	Atlantic Ocean	Juvenile Loggerhead Sea Turtles are found routinely in Atlantic Canadian waters well offshore on the Scotian Shelf, Scotian Slope, Georges Bank, the Grand Banks, and waters further offshore .Research suggests Loggerhead Sea Turtles are present in Canadian waters in greatest numbers during the spring, summer and fall.	NO	NO

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Dermochelys coriacea	Leatherback Turtle	No schedule- No Status		Endangered-May 2012 (Reassigned)	3 -Sensitive (Atlantic, 2010)	Atlantic Ocean	Migratory speces which breeds in tropical or subtropical waters and moves to temperate waters in search of food (chiefly jellyfish) at other times of the year. Leatherbacks in Atlantic Canada occur in both offshore and coastal waters (range 2 to 5,033 m depth). Most sightings are from continental shelf (waters inside the 200 m isobath). Median depth of sightings is 113 m and mean sea surface temperature (SST) is 16.6°C.	YES	Possible

ATTACHMENT F
Moose Survey Results

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

Please See Appendix H 2014 Fall Moose Survey

Appendix 0 – Air Dispersion Modelling Study 2015

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

Black Point Quarry Air Dispersion Modelling Study

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February 6, 2015

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APPENDIX A Isopleth Contours of Ground Level Concentrations from Phase 3 Operations

Appendix B Isopleth Contours of Ground Level Concentrations from Phase 5 Operations

1.0 INTRODUCTION

Vulcan Materials Company (Vulcan) retained Stantec Consulting Ltd. (Stantec) to conduct a dispersion modelling study of air contaminant emissions from the operation of the proposed development of a granite rock quarry and marine terminal at Black Point in Guysborough County, Nova Scotia (NS). This study was conducted to support the Environmental Impact Statement being prepared by Vulcan for the Project.

Dispersion modeling was completed Dispersion modeling was completed using AERMOD, developed by the American Meteorological Society (AMS) and United States Environmental Protection Agency (US EPA). AERMOD is the US EPA preferred model for regulatory air dispersion modelling of industrial sources and Nova Scotia Environment (NSE) has approved its use in various modelling projects to demonstrate compliance in Nova Scotia.

Air contaminants that are of most concern from project operations include total suspended particulate (TSP), particulate matter less than 10 and 2.5 microns in diameter (PM_{10} and $PM_{2.5}$, respectively), nitrogen oxides (NO_x), carbon monoxide (CO) and sulphur dioxide (SO_2). Table 1.1 shows the air contaminants and averaging times modeled in this study. Also shown in Table 1.1 are the applicable regulatory thresholds for each contaminant and averaging time.

Contaminant	Averaging Period	Regulatory Threshold (µg/m³)	
		Federal[1]	Provincial[2]
Total Suspended Particulate (TSP)	24-hour	-	120
	Annual	-	70
Particulate Matter Less than 10 microns (PM_{10})	24-hour	-	-
Particulate Matter Less than 2.5 microns ($PM_{2.5}$)	24-hour	28 (2015) 27 (2020)	-
	Annual	10 (2015) 8.8 (2020)	-
Sulphur Dioxide (SO_2)	1-hour	-	900
	24-hour	-	300
	Annual	-	60
Nitrogen Dioxide (NO_2)	1-hour	-	400
	Annual	-	100
Carbon Monoxide (CO)	1-hour	-	34600
	8-hour	-	12700

[1]Canadian Council of Ministers of the Environment Canada-Wide Standards for $PM_{2.5}$
[2]Nova Scotia Air Quality Regulations (N.S. Reg. 179/2014)

This report is presented in five sections. General information and the dispersion modelling methodology are presented in Sections 1 and 2. The results of the dispersion modelling are presented and discussed in Section 3, and the conclusions of the study and closure are presented in Sections 4 and 5, respectively. References are provided in Section 6.

2.0 DISPERSION MODELLING

2.1 MODEL DESCRIPTION

The most recent version of the plume dispersion model AERMOD was used for this project (version 14134). AERMOD is the US EPA preferred model for regulatory air dispersion modelling of industrial sources and Nova Scotia Environment (NSE) has approved its use in various modelling projects to demonstrate compliance in Nova Scotia.

It is applicable to rural and urban areas, flat and complex terrain, surface and elevated releases, and multiple sources (including, point, area and volume sources). AERMOD currently contains algorithms for:

- dispersion in both the convective and stable boundary layers;
- plume rise and buoyancy;
- plume penetration into elevated inversions;
- treatment of elevated, near-surface, and surface level sources;
- computation of vertical profiles of wind, turbulence, and temperature; and
- the treatment of receptors on all types of terrain (from the surface up to and above the plume height).

Terrain handling is done with a simple approach while still considering the dividing streamline concept in stable-stratified conditions. Where appropriate, the plume is modelled as either impacting and/or following the terrain.

2.2 MODELLING METHODOLOGY

2.2.1 Overview of Project Interactions with Air Quality

This air dispersion modelling study has been conducted in support of the preparation of the Environmental Impact Statement for the proposed development, operation and decommissioning and abandonment of a granite quarry and marine terminal at Black Point in Guysborough County. It is common and accepted practice to use mathematical dispersion modeling techniques to simulate the transport of contaminants released from a proposed operation, and to compare the concentrations at significant points of reception (all of which

are residences in this project) to the applicable limits. In order to do this, the project must be represented in the model in terms of activities which result in the emissions of air contaminants. In this project, activities responsible for such emissions are primarily internal combustion engine operation, mechanical abrasion, wind erosion, and blasting.

The proposed Project will involve the extraction and processing of granite rock using industry standard drilling, blasting, crushing, screening and washing procedures, stockpiling on site and loading into Panamax-sized bulk carrier ships via a deep water marine terminal. During peak production the anticipated annual production rate is 7.5 MT per year, which equates to roughly 5.0 MT per year of salable product.

To predict the potential effects that the operation of the proposed Project could have on air quality within and surrounding the proposed Project area air dispersion modelling was conducted. To capture the potential "worse case" operating scenario ground level concentrations were predicted for Phase 5 of the Project, which represents peak production and includes the greatest amount of mobile combustion equipment. Phase 3 of the project was also modeled due to the need for large diesel power generators on site.

2.2.2 Modeling Inputs

Input preparation for the dispersion modelling study consists of three main components:

1) Meteorological data acquisition and pre-processing;

2) Receptor grid and terrain data processing; and

3) Source and emissions characterization

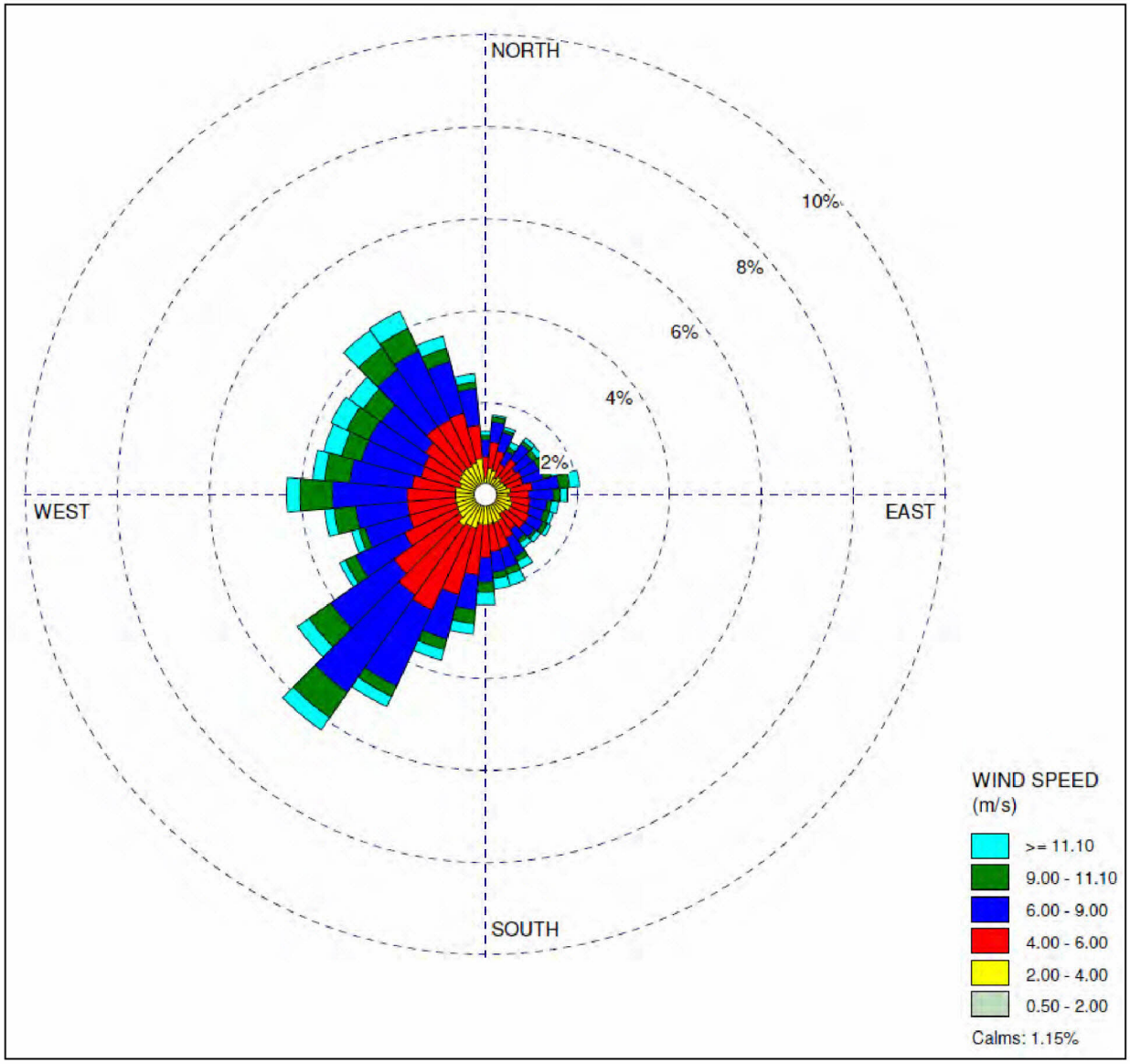
These components are described briefly in the following sections.

2.2.2.1 Meteorology Data

The accuracy of a dispersion model is dependent on the quality of meteorological data. For this dispersion modeling study, meteorological data preprocessed for use in AERMOD was acquired from Lakes Environmental for 2009 through 2013, inclusive. The data were generated using the MM5 meteorological model developed by the National Center for Atmospheric Research. The MM5 dataset comes ready to be immediately integrated into AERMET, the meteorological sub model for the AERMOD dispersion modeling system.

A joint wind direction and speed frequency diagram, or "wind rose", of these data is presented in Figure 2.1 (conventionally, wind roses show the direction from which the wind blows). Winds near the proposed quarry are dominated by north westerly winds hugging the coastline along the Atlantic Ocean, with appreciably frequent winds from the southwest. Winds are typically moderate to high with few calm periods, as expected from a coastal region.

Figure 2.1 Joint Wind Speed and Frequency Wind Rose near Project Location



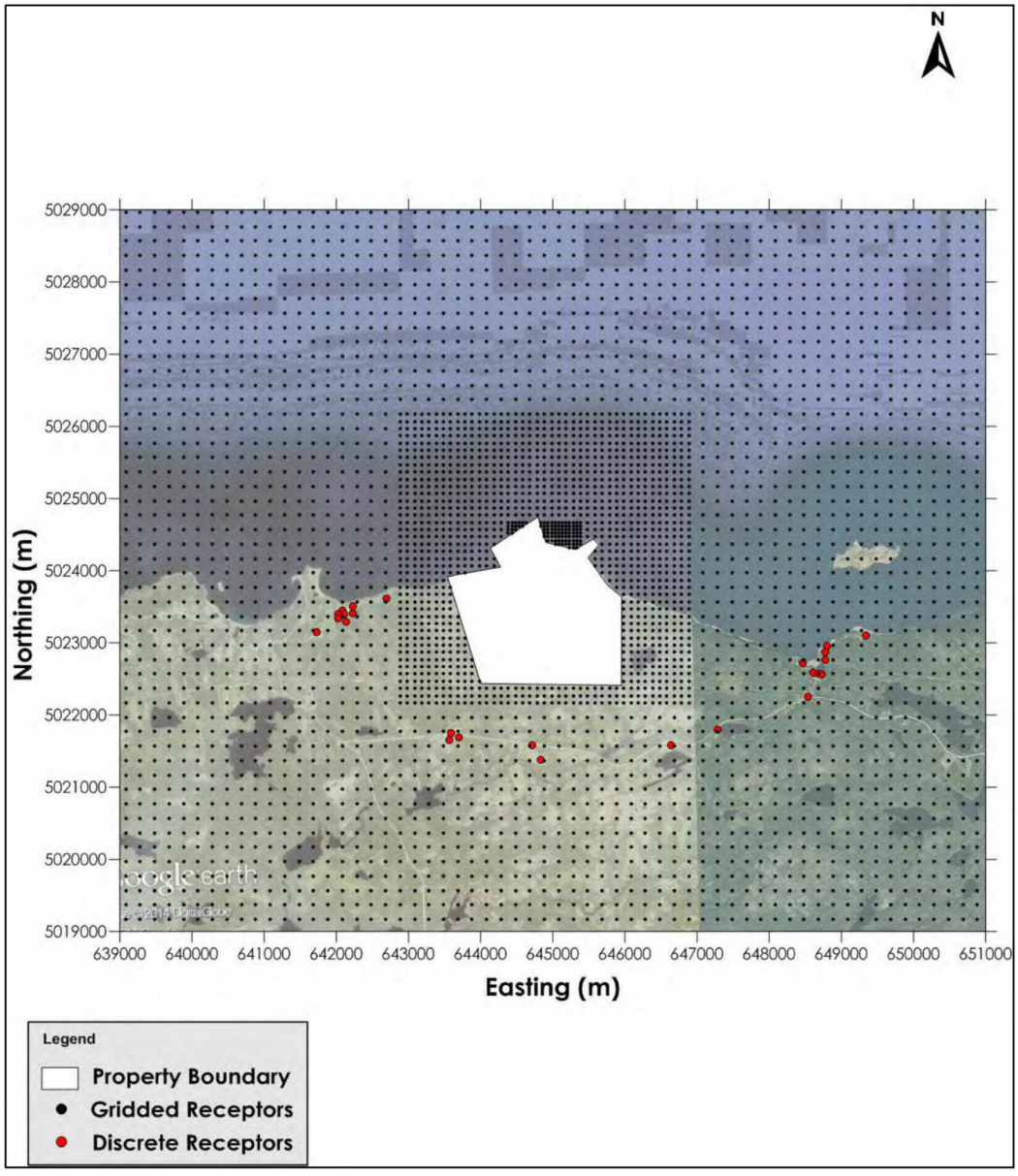
2.2.2.2 Receptor Grid and Terrain Data

AERMOD predicts ground-level concentrations at defined receptor locations. Straight-line plume transport is assumed to occur between the source and the downwind receptors. The Receptor Plan, which illustrates the locations of the receptors modelled, is presented in Figure 2.2.

A 10 km x 10 km nested Cartesian receptor grid was created with the quarry near the center. A grid spacing of 50 m was established from the property boundary to 500 m, 100 m spacing

between 500 m and 1,500 m from the property line, and 200 m spacing from 1,500 m to 5,000 m. Twenty-five discrete receptors, representing the nearest residents to the Project site (based on well location information) were also included in each model. These locations are also presented in Figure 2.2.

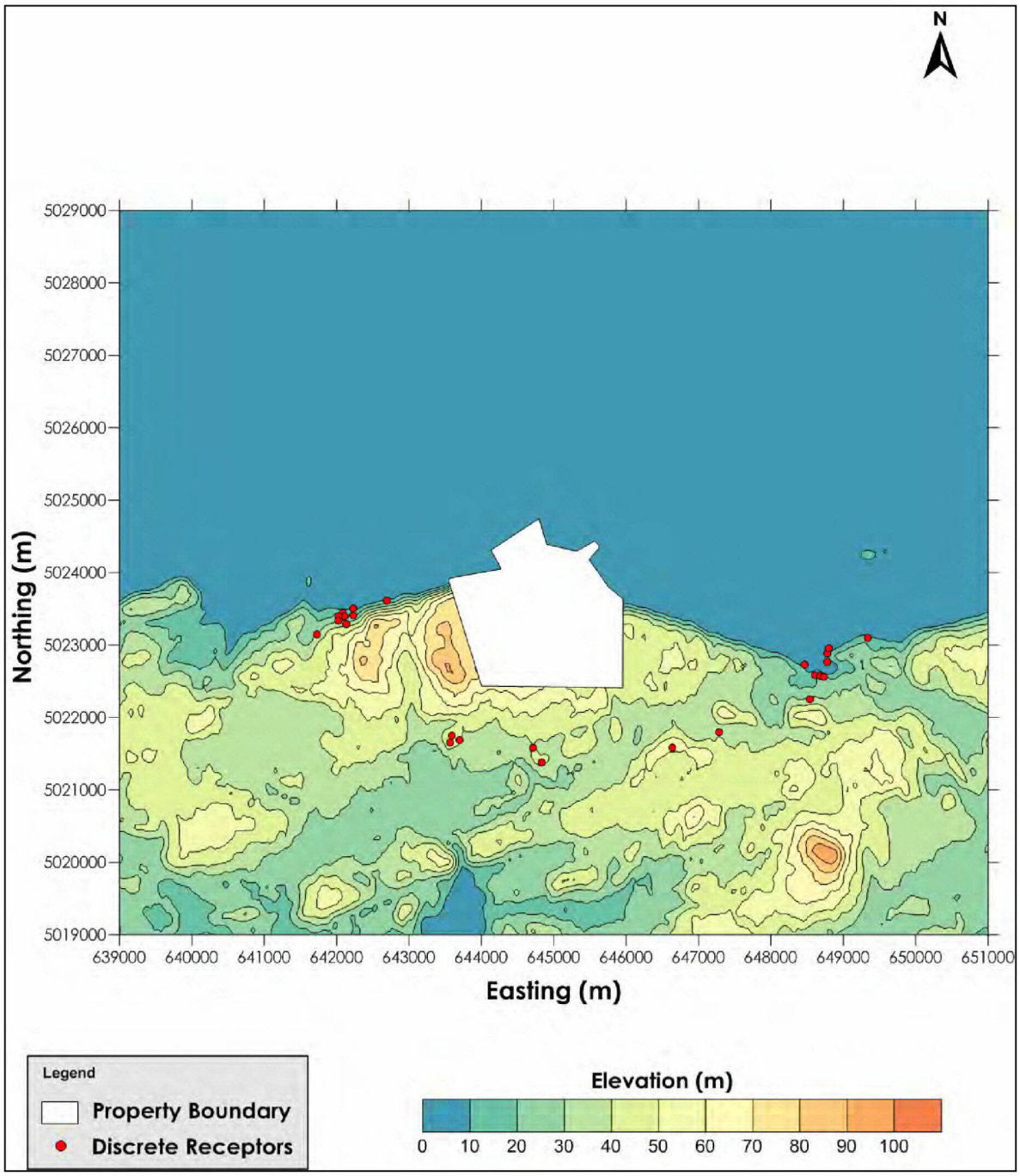
Figure 2.2 Receptor Locations for Dispersion Modeling



Terrain elevation data for sources and receptors were obtained from Natural Resources Canada's Canadian Digital Elevation Data (CDED) dataset using their Digital Elevation Model

(DEM) at a grid resolution range of 0.75 to 3 arc-seconds depending on latitude. Terrain contours based on the CDED DEM are illustrated in Figure 2.3.

Figure 2.3 Terrain Elevations for Dispersion Modeling



2.2.2.3 Source Characteristics

Source information data is required by AERMOD to characterize the release of air contaminants during Project operations. The operation of the proposed Project will involve the following activities:

- Rock quarrying (drilling and blasting);
- Rock haulage;
- Processing of the extracted rock (crushing, screening, washing, conveying, storage, reclaiming); and
- Ship loading.

The main sources of air emissions from the above activities are released through fuel combustion from drills, haul trucks, loaders and other earth-moving equipment, power generators, ship hotelling during product loading, blasting, and fugitive releases of dust from material handling and haul truck travel on unpaved roads.

As defined by the United States Environmental Protection Agency (US EPA 1995), fugitive dust is dust that is released to the atmosphere from open sources instead of being discharged to the atmosphere via a confined flow stream, and is created from the mechanical disturbance of granular material. Fugitive dust can remain suspended during airborne transport when less than 30 microns in diameter and this threshold is typically used to estimate emissions of TSP. Emissions of PM_{10} and $PM_{2.5}$ are further estimated as a source-dependent fraction of TSP.

Fugitive releases of dust will occur during Project operations through the following operational activities:

- Drilling and blasting;
- Material handling – through the loading and unloading of extracted rock, stockpiling, reclaiming, conveying and conveyor transfer points, and ship loading;
- Processing of the ore – crushing, screening and washing;
- Unpaved road travel –Haul truck travel on unpaved roads; and
- Wind erosion – rock stockpiles.

Several measures for mitigating particulate emissions during the operation of the Project are planned and include, but are not limited to, the following:

- Use of qualified blasting contractors with blast design plans that incorporate dust emission controls;
- Use of water suppression on unpaved roads and working areas;

- Construction of the haul roads using material with a low silt content;
- Use of a binder substance within the dust suppression application (e.g. calcium chloride) during drier periods of the year to aid in keeping the roads moist for longer periods of time;
- Dust collection systems and/or wet sprays on conveyor transfer points to reduce the fugitive releases of dust during the transfer of material; and
- Water sprays on the crushed rock stockpiles and transfer points.
- Dust suppression systems for secondary and tertiary crushing units, and
- Enclosures for screening towers

See Section 3.5 for additional information regarding on site mitigation.

The source information and emission rates required for the dispersion modelling study were obtained primarily from information provided to Stantec from Vulcan, with the exception of the emissions from the bulk carriers during product loading. Ship hotelling emissions were calculated using US EPA guidance as per the following document, "Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories" (2009).

Emissions related to blasting within the quarry pit were not included in the dispersion model but were handled separately because the impact over longer time periods is very small.

As discussed above, stockpiles can also be a source of fugitive particulate emissions during quarry operations. The stockpiles planned for this Project will be equipped with rain birds and the water trucks used for dust suppression will be equipped with a canon to further provide wet suppression to these piles during times when needed. Further, most piles are prescreened and washed so that the fines that would generate airborne dust have been removed. As such emissions can be managed to the point where emissions of dust will be negligible they were not included as sources within the dispersion modelling.

2.2.2.3.1 Phase 3

Tables 2.1 and 2.2 present the point source parameters and emission factors used for dispersion modeling, respectively. Source parameters and emission rates for volume sources and pit sources can be found in Tables 2.3 and 2.4, respectively. Emission rates are prorated in the tables by duty cycles for the averaging periods specified.

Table 2.1 Phase 3 Point Source Exit Parameters

Source	Stack Height (m)	Stack Diameter (m)	Exhaust Gas Velocity (m/s)	Exhaust Gas Temperature (K)
Drill	4	0.3	30	373
Yard Loaders	4	0.3	30	373
Pit Loaders	4	0.3	30	373
Bobcats	4	0.3	30	373
Dozers	4	0.3	30	373
Excavators	4	0.3	30	373
Haul Trucks	7	0.3	30	373
Service Trucks	4	0.3	30	373
Ship Hotelling	25	2	15	673
Generators				
Station 1 LT160	3	0.127	28	737
Station 2 LT120	3	0.127	21	698
Station 3 LT300HP	3	0.127	25	696
Station 4 ST620	5	0.127	0	698
Station 5 LT300HP	3	0.127	25	696
Station 6 ST620	3	0.127	21	698
Station 7 LT300HP	3	0.127	25	696

Table 2.2 Phase 3 Emission Factors for Point Sources

Source	Emission Rate (g/s)											
	TSP		$PM_{2.5}$		PM_{10}	NO_x		CO		SO_2		
	24-hr	Annual	24-hr	Annual	24-hr	1-hr	Annual	1-hr	8-hr	1-hr	24-hr	Annual
Mobile Sources[1,2]												
Drill	0.002	0.000	0.002	0.000	0.002	0.005	0.001	0.008	0.008	0.00019	0.00013	0.00003
Yard Loaders	0.003	0.002	0.003	0.002	0.003	0.001	0.004	0.014	0.014	0.00033	0.00022	0.00013
Pit Loaders	0.012	0.008	0.012	0.008	0.012	0.120	0.055	0.191	0.191	0.00050	0.00033	0.00023
Bobcats	0.002	0.000	0.002	0.000	0.002	0.002	0.000	0.002	0.002	0.00006	0.00004	0.00001
Dozers	0.012	0.002	0.012	0.002	0.012	0.120	0.013	0.191	0.191	0.00050	0.00033	0.00006
Excavators	0.012	0.008	0.012	0.008	0.012	0.120	0.055	0.191	0.191	0.00050	0.00033	0.00023
Haul Trucks	0.025	0.017	0.025	0.017	0.025	0.262	0.119	0.418	0.418	0.00109	0.00073	0.00050
Service Trucks	0.005	0.001	0.005	0.001	0.005	0.014	0.002	0.019	0.019	0.00050	0.00033	0.00006
Ship Hotelling	0.156	0.015	0.156	0.015	0.170	0.194	0.018	0.381	0.381	0.147	0.147	0.014
Generators[2]												
Station 1 LT160	0.009	0.006	0.009	0.006	0.009	0.094	0.043	0.149	0.149	0.00039	0.00026	0.00018

Table 2.2 Phase 3 Emission Factors for Point Sources

Source	Emission Rate (g/s)											
	TSP		$PM_{2.5}$		PM_{10}	NO_x		CO		SO_2		
	24-hr	Annual	24-hr	Annual	24-hr	1-hr	Annual	1-hr	8-hr	1-hr	24-hr	Annual
Station 2 LT120	0.005	0.004	0.005	0.004	0.005	0.055	0.025	0.088	0.088	0.00023	0.00015	0.00011
Station 3 LT300HP	0.007	0.005	0.007	0.005	0.007	0.072	0.033	0.115	0.115	0.00030	0.00020	0.00014
Station 4 ST620	0.002	0.001	0.002	0.001	0.002	0.017	0.008	0.028	0.028	0.00007	0.00005	0.00003
Station 5 LT300HP	0.007	0.005	0.007	0.005	0.007	0.072	0.033	0.115	0.115	0.00030	0.00020	0.00014
Station 6 ST620	0.002	0.001	0.002	0.001	0.002	0.017	0.008	0.028	0.028	0.00007	0.00005	0.00003
Station 7 LT300HP	0.007	0.005	0.007	0.005	0.007	0.072	0.033	0.115	0.115	0.00030	0.00020	0.00014

[1]Exhaust and Crankcase Emission Factors for Non-road Engine Modeling - Compression-Ignition." US EPA.

[2]Information Provided by Vulcan

Table 2.3 Phase 3 Volume Source Information

Source[1]	Release Height (m)	Sigma Y (m)	Sigma Z (m)	Emission Rate (g/s)[2]				
				TSP		PM_{10}	$PM_{2.5}$	
				24-hr	Annual	24-hr	24-hr	Annual
Grizzly Feeder	8.4	0.93	0.93	0.173	0.128	0.058	0.004	0.003
Jaw Crusher	8.4	1.16	1.16	0.094	0.070	0.043	0.008	0.006
Feed to Conveyor C1	6	0.93	0.93	0.011	0.008	0.004	0.001	0.001
Discharge from C1 to Grizzly	6.6	0.93	0.93	0.011	0.008	0.004	0.001	0.001
Jaw Crusher	5	1.16	1.16	0.173	0.128	0.058	0.004	0.003
Grizzly Feeder	5	0.93	0.93	0.094	0.070	0.043	0.008	0.006
Oversize Feed to C3	3	0.93	0.93	0.011	0.008	0.004	0.001	0.001
Discharge to C3	3	0.93	0.93	0.011	0.008	0.004	0.001	0.001
Discharge to C2	5	0.93	0.93	0.011	0.008	0.004	0.001	0.001
Feed to Grizzly from C2	6.6	0.93	0.93	0.011	0.008	0.004	0.001	0.001
Feed to Grizzly from C3	6.6	0.93	0.93	0.011	0.008	0.004	0.001	0.001
Grizzly Feeder	5	0.93	0.93	0.173	0.128	0.058	0.004	0.003
Cone Crusher	5	1.16	1.16	0.094	0.070	0.043	0.008	0.006
By-Pass Conveyor Feed	2.75	0.93	0.93	0.011	0.008	0.004	0.001	0.001
By-Pass Conveyor Discharge	8.8	0.93	0.93	0.011	0.008	0.004	0.001	0.001
Cone Crusher Discharge Conveyor to Next Stage	4	0.93	0.93	0.011	0.008	0.004	0.001	0.001
Feed to Screen Transfer Point	6	0.93	0.93	0.011	0.008	0.004	0.001	0.001
Screen	2.5	0.93	0.93	0.173	0.128	0.058	0.004	0.003
Screen Discharge To Dust	8.77	0.93	1.86	0.011	0.008	0.004	0.001	0.001

Table 2.3 Phase 3 Volume Source Information

Source[1]	Release Height (m)	Sigma Y (m)	Sigma Z (m)	Emission Rate (g/s)[2]				
				TSP		PM_{10}	$PM_{2.5}$	
				24-hr	Annual	24-hr	24-hr	Annual
Pile								
Screen Discharge to 57s Pile	8.77	0.93	1.86	0.011	0.008	0.004	0.001	0.001
Product Conveyance to Next Stage	3	0.93	0.93	0.011	0.008	0.004	0.001	0.001
Feed to feed conveyor	6.6	0.93	0.93	0.011	0.008	0.004	0.001	0.001
Cone Crusher	5	1.16	1.16	0.094	0.070	0.043	0.008	0.006
Discharge to C11	6.6	0.93	0.93	0.011	0.008	0.004	0.001	0.001
Recycle to C11	8.77	0.93	0.93	0.011	0.008	0.004	0.001	0.001
C11 Discharge to Feed Conveyor	8.77	0.93	0.93	0.011	0.008	0.004	0.001	0.001
Screen	6	0.93	0.93	0.173	0.128	0.058	0.004	0.003
Screen Discharge to C12	3	0.93	0.93	0.011	0.008	0.004	0.001	0.001
Screen Discharge to C4	3	0.93	0.93	0.011	0.008	0.004	0.001	0.001
Screen Discharge to C14	3	0.93	0.93	0.011	0.008	0.004	0.001	0.001
Screen Discharge to C15	3	0.93	0.93	0.011	0.008	0.004	0.001	0.001
Transfer Conveyors to C12 and C4	6.6	0.93	0.93	0.011	0.008	0.004	0.001	0.001
Cone Crusher	5	1.16	1.16	0.094	0.070	0.043	0.008	0.006
Transfer to 78s Stockpile	8.77	0.93	1.86	0.018	0.014	0.009	0.001	0.001
Transfer to Dust Stockpile	8.77	0.93	1.86	0.018	0.014	0.009	0.001	0.001
Dump to Hopper	3	0.93	0.93	0.018	0.014	0.009	0.001	0.001
Conveyor Transfer Points	16	0.93	0.93	0.011	0.008	0.004	0.001	0.001
Overburden Removal	2	2.09	2.09	0.382	0.061	0.079	0.040	0.006

[1]C refers to a conveyor
[2]calculated using Information provided by Vulcan and US EPA AP-42 Chapter 11.19.2

Table 2.4 Phase 3 Pit Source Information

Source	Release Height (m)	Volume of Pit (m^3)	Area of Pit (m^2)	Emission Factor (g/s)[1,2]				
				TSP		PM_{10}	$PM_{2.5}$	
				24-hr	Annual	24-hr	24-hr	Annual
Pit	4.5	6,863,400	381,300	0.461	0.215	0.171	0.098	0.006

[1]Emissions include: (1) fugitive emissions from travel on unpaved haul roads and drilling; (2) 90% control applied to haul roads to account for wet suppression;
[2]Calculated from US EPA AP-42 Chapter 13.2.2, and information provided by Vulcan

2.2.2.3.2 Phase 5

Tables 2.5 and 2.6 present the point source parameters and emission factors used for dispersion modeling, respectively. Source parameters and emission rates for volume sources and pit sources can be found in Tables 2.7 and 2.8, respectively.

Table 2.5 Phase 5 Point Source Exit Parameters

Source	Stack Height (m)	Stack Diameter (m)	Exhaust Gas Velocity (m/s)	Exhaust Gas Temperature (K)
Drill	4	0.3	30	373
Yard Loaders	4	0.3	30	373
Pit Loaders	4	0.3	30	373
Bobcats	4	0.3	30	373
Dozers	4	0.3	30	373
Excavators	4	0.3	30	373
Haul Trucks	7	0.3	30	373
Service Trucks	4	0.3	30	373
Long Reach Excavators	4	0.3	30	373
Ship Hotelling	25	2	15	673

Table 2.6 Phase 5 Emission Factors for Point Sources

Source	Emission Factor (g/s)[1]											
	TSP		$PM_{2.5}$		PM_{10}	NO_x		CO		SO_2		
	24-hr	Annual	24-hr	Annual	24-hr	1-hr	Annual	1-hr	8-hr	1-hr	24-hr	Annual
Drill	0.002	0.001	0.002	0.001	0.002	0.005	0.002	0.008	0.008	0.000	0.000	0.000
Yard Loaders	0.006	0.004	0.006	0.004	0.006	0.018	0.008	0.028	0.028	0.001	0.000	0.000
Pit Loaders	0.023	0.017	0.023	0.017	0.023	0.239	0.118	0.382	0.382	0.001	0.001	0.000
Bobcats	0.002	0.000	0.002	0.000	0.002	0.002	0.000	0.002	0.002	0.000	0.000	0.000
Dozers	0.012	0.002	0.012	0.002	0.012	0.120	0.014	0.191	0.191	0.001	0.000	0.000
Excavators	0.012	0.009	0.012	0.009	0.012	0.120	0.059	0.191	0.191	0.001	0.000	0.000
Haul Trucks	0.063	0.047	0.063	0.047	0.063	0.654	0.323	1.046	1.046	0.003	0.002	0.001
Service Trucks	0.008	0.003	0.008	0.003	0.008	0.023	0.006	0.031	0.031	0.001	0.001	0.000
Long Reach Excavators	0.012	0.002	0.012	0.002	0.012	0.120	0.016	0.191	0.191	0.001	0.000	0.000
Ship	0.170	0.021	0.156	0.020	0.170	0.192	0.024	0.381	0.381	0.147	0.147	0.018

[1]Emission factors calculated using "Exhaust and Crankcase Emission Factors for Non-road Engine Modeling - Compression-Ignition" from the US EPA and information provided by Vulcan.

Table 2.7 Phase 5 Volume Source Information

Source	Release Height (m)	Sigma Y (m)	Sigma Z (m)	Emission Factor (g/s)[1]				
				TSP		PM_{10}	$PM_{2.5}$	
				24-hr	Annual	24-hr	24-hr	Annual
Primary Crusher	52	1.16	1.16	0.282	0.209	0.127	0.024	0.017
Feed to Conveyor (CNV001)	2	0.93	0.93	0.035	0.026	0.013	0.003	0.002
Discharge from Conveyor (CNV001) to Conveyor (CNV002)	10	0.93	0.93	0.035	0.026	0.013	0.003	0.002
Discharge from Conveyor (CNV002) to Surge Pile	29	0.93	1.86	0.059	0.044	0.028	0.003	0.002
Scalping Screen (SCR01)	22	0.93	0.93	0.554	0.410	0.186	0.013	0.009
Discharge to Conveyor (CNV005) from Scalping Screen Tower (SCR001)	3	0.93	0.93	0.007	0.005	0.003	0.001	0.000
Discharge from Conveyor (CNV005) to Crusher Run Stockpile	8	0.93	1.86	0.012	0.009	0.006	0.001	0.001
Secondary Crusher (CRS002)	7	1.16	1.16	0.228	0.169	0.103	0.019	0.014
Screen Discharge to Conveyor (CNV004)	2	0.93	0.93	0.008	0.006	0.003	0.001	0.001
Discharge from Conveyor (CNV004) to Secondary Surge Pile	29	0.93	1.86	0.055	0.041	0.026	0.004	0.003
Discharge from Conveyor (CNV006) to Hopper/bin	27	0.93	0.93	0.035	0.026	0.013	0.003	0.002
Feed to Belt Feeder #1	3	0.93	0.93	0.277	0.205	0.093	0.006	0.005
Feed to Belt Feeder #2	3	0.93	0.93	0.277	0.205	0.093	0.006	0.005
Screen 1 of 2	22	0.93	0.93	0.259	0.191	0.087	0.006	0.004
Screen 2 of 2	22	0.93	0.93	0.259	0.191	0.087	0.006	0.004
Screen Discharge to Conveyor (CNV007)	2	0.93	0.93	0.003	0.002	0.001	0.000	0.000
Conveyor (CNV007) transfer to Conveyor (CNV008)	2	0.93	0.93	0.003	0.002	0.001	0.000	0.000
Conveyor (CNV008) Feed to Stockpile	8	0.93	1.16	0.005	0.004	0.003	0.000	0.000
Screens (SCR02A and SCR02B) Feed to Bins	15	0.93	0.93	0.061	0.045	0.021	0.005	0.003
Crushers (CRS03A and CRS03B)	9	1.16	1.16	0.119	0.088	0.054	0.010	0.007
Transfers from Conveyors (CNV09A and CNV09B) to Conveyors (CNV10A,B,C,D)	8	0.93	0.93	0.047	0.035	0.017	0.004	0.003
Diester Screen Transfer to	5	0.93	0.93	0.001	0.001	0.000	0.000	0.000

Table 2.7 Phase 5 Volume Source Information

Source	Release Height (m)	Sigma Y (m)	Sigma Z (m)	Emission Factor (g/s)[1]				
				TSP		PM_{10}	$PM_{2.5}$	
				24-hr	Annual	24-hr	24-hr	Annual
Conveyor (CNV013)								
Diester Screen Transfer to Conveyor (CNV015)	5	0.93	0.93	0.006	0.004	0.002	0.001	0.000
Diester Transfer Points to Conveyors (CNV17A,B,C,D)	3	0.93	0.93	0.028	0.021	0.010	0.003	0.002
Conveyors (CNV17A,B,C,D) Transfers to Conveyors (CNV18A,B,C,D,E,F)	10	0.93	0.93	0.028	0.021	0.010	0.003	0.002
Screens (SCR04A,C,D,F)	14	0.93	0.93	0.267	0.197	0.090	0.006	0.004
Screens (SCR04B,E)	14	0.93	0.93	0.131	0.097	0.044	0.003	0.002
Discharge to Conveyor (CNV024)	3	0.93	0.93	0.007	0.005	0.003	0.001	0.000
Conveyor (CNV024) Discharge to Conveyor (CNV025)	6	0.93	0.93	0.007	0.005	0.003	0.001	0.000
Conveyor (CNV025) Discharge to Crusher Run Pile	9	0.93	1.86	0.012	0.009	0.006	0.001	0.001
Screens Discharge to Conveyor (CNV021)	5	0.93	0.93	0.012	0.009	0.004	0.001	0.001
Conveyor (CNV021) to Conveyor (CNV022)	6	0.93	0.93	0.012	0.009	0.004	0.001	0.001
Conveyor (CNV022) Discharge to Product Stockpile	9	0.93	1.86	0.020	0.015	0.009	0.001	0.001
Screens Discharge to Conveyor (CNV015)	2	0.93	0.93	0.006	0.004	0.002	0.001	0.000
Conveyor (CNV015) to Conveyor (CNV016)	7	0.93	0.93	0.006	0.004	0.002	0.001	0.000
Conveyor (CNV016) Discharge to Product Stockpile	9	0.93	1.86	0.010	0.007	0.005	0.001	0.001
Screen Discharge to Conveyor (CNV013)	2	0.93	0.93	0.001	0.001	0.000	0.000	0.000
Conveyor (CNV013) to Conveyor (CNV014)	6	0.93	0.93	0.001	0.001	0.000	0.000	0.000
Conveyor (CNV014) to Product Stockpile	9	0.93	1.86	0.002	0.001	0.001	0.000	0.000
Screen to Conveyor (CNV019)	2	0.93	0.93	0.005	0.004	0.002	0.000	0.000
Conveyor (CNV019) to Conveyor (CNV020)	6	0.93	0.93	0.005	0.004	0.002	0.000	0.000
Conveyor (CNV020) to Product Stockpile	9	0.93	1.86	0.009	0.007	0.004	0.001	0.000
Conveyor (CNV026) to	12	0.93	0.93	0.035	0.026	0.013	0.003	0.002

Table 2.7 Phase 5 Volume Source Information

Source	Release Height (m)	Sigma Y (m)	Sigma Z (m)	Emission Factor (g/s)[1]				
				TSP		PM_{10}	$PM_{2.5}$	
				24-hr	Annual	24-hr	24-hr	Annual
Bins								
Bins to Conveyor (CNV028)	2	0.93	0.93	0.035	0.026	0.013	0.003	0.002
Conveyor (CNV027) to Bins	12	0.93	0.93	0.035	0.026	0.013	0.003	0.002
Transfer to Conveyor (CNV028)	2	0.93	0.93	0.035	0.026	0.013	0.003	0.002
Conveyor (CNV028) to Conveyor (CNV029A,B)	6	0.93	0.93	0.035	0.026	0.013	0.003	0.002
Dual Diester Screens	6	0.93	0.93	0.554	0.410	0.186	0.013	0.009
Transfer to Conveyors (CNV023A,B)	17.2	0.93	0.93	0.002	0.002	0.001	0.000	0.000
Transfer to Conveyors (CNV11A,B)	2	0.93	0.93	0.014	0.010	0.005	0.001	0.001
Conveyors (CNV11A,B) to Conveyors (CNV12A,B)	2	0.93	0.93	0.014	0.010	0.005	0.001	0.001
Conveyor (CNV12A,B) Dump to Feeders	4	0.93	0.93	0.199	0.147	0.067	0.005	0.003
Crushers (4)	18.5	1.16	1.16	0.108	0.080	0.049	0.009	0.007
Conveyor (CNV12) Dump to Feeders	18.5	0.93	0.93	0.199	0.147	0.067	0.005	0.003
Load-out Product Transfer to Conveyor (CNV038)	12	0.93	0.93	0.053	0.039	0.019	0.005	0.004
Load-out Product Transfer to Conveyor (CNV039)	18	0.93	0.93	0.053	0.039	0.019	0.005	0.004
Loading of Product Into Ship	20	0.93	1.86	0.354	0.262	0.169	0.025	0.019
Overburden Removal	2	2.09	2.09	0.382	0.164	0.079	0.040	0.017

[1]Calculated from information in US EPA AP-42 Chapter 11.19.2, and information provided by Vulcan.

Table 2.8 Phase 5 Pit Source Information

Source	Release Height (m)	Volume of Pit (m^3)	Area of Pit (m^2)	Emission Factor (g/s)[1,2]				
				TSP		PM_{10}	$PM_{2.5}$	
				24-hr	Annual	24-hr	24-hr	Annual
Pit	4.5	43,750,000	1,250,000	1.02	0.627	0.326	0.113	0.017

[1]Emissions include: (1) fugitive emissions from travel on unpaved haul roads and drilling; (2) 90% control applied to haul roads to account for wet suppression.
[2]Calculated from US EPA AP-42 Chapter 13.2.2, and information provided by Vulcan

2.2.2.4 Building Downwash

Downwash effects due to wind interaction of aerodynamic masses and emission sources can be modeled using AERMOD. Air contaminants released within the wake zone of buildings can be drawn down to the ground sooner than if release at higher elevations, and can change the ground-level concentration profile.

AERMOD implements downwash modeling using the Plume Rise Model Enhancements (PRIME) submodel. PRIME allows for streamline ascent/descent effects and enhanced dilution due to building induced turbulence. PRIME addresses the entire structure of the building wake, from the cavity immediately downwind of the building, to the far wake zone (US EPA 1997).

To model building downwash in AERMOD, wind direction dependent building information such as width and height were provided to Stantec by Vulcan. The Building Profile Input Program (BPIP) submodel in AERMOD was then used to generate dispersion parameters representing building downwash.

2.2.3 Existing Air Quality

Background air contaminant concentrations are typically added to the maximum predicted concentrations for comparison with the regulated ambient air quality objective or standard. Background concentrations are usually based on measured ambient air quality data from the nearest representative monitoring station. In this study, there is no ambient air quality monitoring station located near the Project site that could be reasonably used to characterize the existing air quality within the Project area. The closest monitoring station is located in Port Hawkesbury, approximately 30 km north of the Project, which is representative of an urban area containing industrial activity. As a result, based on its rural location, the background concentrations for this study are assumed to be negligible.

For a reference, the ambient concentrations (annual means) of SO_2, CO, $PM_{2.5}$ and NO_2 as measured in Port Hawkesbury are presented in Table 2.9.

Table 2.9 Summary of 2013 Annual Mean Ambient Air Quality Monitoring Data from Port Hawkesbury and Sydney, Nova Scotia

Contaminant	Annual Mean (µg/m³)*	Station Location
$PM_{2.5}$	6	Port Hawkesbury
NO_2	9.4	Port Hawkesbury
CO	0.1**	Sydney
SO_2	2.6	Sydney

*Source: Environment Canada
**Data from 2012

2.2.4 NOx Conversion

Oxides of nitrogen (NO_X) comprise nitric oxide (NO) and nitrogen dioxide (NO_2). Most combustion sources emit primarily NO that can react with ambient ozone (O_3) to produce NO_2. The final quantity of NO_2 then becomes a function of the available O_3 in the atmosphere during the release.

Only ground-level concentrations of NO_2 are regulated in Nova Scotia. The US EPA three-tiered screening approach was used to consider conversion of NO to NO_2 (US EPA 2012). The tiered approach is as follows:

- **Tier 1 –** assume complete conversion of all emitted NO to NO_2;
- **Tier 2 –** multiply Tier 1 results by a representative equilibrium NO_2/NO_X ratio (*e.g.* ambient ratio method - ARM); and
- **Tier 3 –** perform detailed analysis on a case by case basis (*e.g.* ozone limiting method - OLM).

The Tier 2 approach was applied in the study. An NO_2/NO_x in stack ratio of 0.2 was applied to the NO_x emissions for all sources of diesel combustion for both operational phases.

3.0 DISPERSION MODELLING RESULTS

3.1 PHASE 3 OPERATIONS

3.1.1 Particulate Matter

The highest predicted 24-hour maximum and annual average ground-level concentrations (GLCs) for total suspended particulate matter (TSP) and particulate matter less than 2.5 microns in diameter ($PM_{2.5}$) at each discrete receptor location for Phase 3 are presented in Table 3.1. The highest predicted 24-hour maximum for particulate matter less than 10 microns in diameter (PM_{10}) are also presented in this table. Background concentrations of particulate matter in the Project area are assumed to be negligible.

Table 3.1 Maximum Predicted Ground Level Concentrations of Particulate Matter at Discrete Receptor Locations - Phase 3

Receptor	UTM Coordinates		Maximum Predicted GLC				
	Easting (m)	Northing (m)	24-hr TSP (µg/m³)	Annual TSP (µg/m³)	24-hr PM_{10} (µg/m³)	24-hr $PM_{2.5}$ (µg/m³)	Annual $PM_{2.5}$ (µg/m³)
1	642692	5023616	58.6	0.75	21.5	7.79	0.049
2	642232	5023505	54.5	0.58	18.4	7.73	0.038

Table 3.1 Maximum Predicted Ground Level Concentrations of Particulate Matter at Discrete Receptor Locations - Phase 3

Receptor	UTM Coordinates		Maximum Predicted GLC				
	Easting (m)	Northing (m)	24-hr TSP (µg/m³)	Annual TSP (µg/m³)	24-hr PM_{10} (µg/m³)	24-hr $PM_{2.5}$ (µg/m³)	Annual $PM_{2.5}$ (µg/m³)
3	642231	5023406	52.8	0.65	18.7	5.96	0.042
4	642088	5023441	61.0	0.62	22.0	6.50	0.041
5	642106	5023396	53.3	0.54	19.2	5.78	0.036
6	642132	5023296	26.0	0.32	9.4	5.32	0.024
7	642030	5023399	53.2	0.50	19.3	5.87	0.034
8	642025	5023336	33.7	0.40	11.7	4.92	0.029
9	641731	5023150	30.6	0.35	9.5	4.15	0.025
10	643569	5021658	25.1	0.27	8.2	3.96	0.019
11	643589	5021745	27.9	0.27	8.8	4.23	0.019
12	643696	5021694	28.4	0.32	7.4	3.97	0.022
13	644835	5021376	25.0	0.33	9.1	5.17	0.023
14	644710	5021586	36.9	0.36	13.0	7.39	0.024
15	646643	5021585	24.2	0.55	9.0	5.21	0.037
16	647285	5021794	25.4	0.61	9.4	5.10	0.043
17	648538	5022253	21.0	0.54	7.7	2.87	0.041
18	648615	5022586	27.6	0.72	9.8	4.33	0.049
19	648680	5022576	27.0	0.71	9.1	4.26	0.048
20	648724	5022566	26.6	0.69	8.6	4.21	0.047
21	648781	5022762	25.7	0.62	9.7	4.27	0.043
22	648776	5022879	26.4	0.66	9.1	4.26	0.046
23	648805	5022959	34.9	0.66	11.4	4.33	0.045
24	648466	5022724	25.2	0.67	8.2	4.32	0.046
25	649335	5023096	25.7	0.64	9.2	2.48	0.044
Regulatory Limit	-	-	**120**	**70**	-	**28**	**10**

Isopleths of maximum predicted GLCs for 24-hour TSP can be found in Figure A.1 in Appendix A. GLCs for 24-hour TSP are highest on the shore on the northeastern corner of the property boundary. The highest 24-hour TSP GLC for the discrete receptors is 61 µg/m³ occurring at Receptor 1, approximately 50% of the provincial maximum permissible value of 120 µg/m³.

The highest predicted annual TSP GLC is 0.71 µg/m³ and occurs at Receptor 18. Annual TSP GLCs are predicted to be well below the maximum permissible value of 70 µg/m³.

Isopleths of maximum predicted GLCs for 24-hour $PM_{2.5}$ can be found in Figure A.2 in Appendix A. GLCs for 24-hour $PM_{2.5}$ are highest near the western side of the property boundary. The

highest 24-hour $PM_{2.5}$ GLC for the discrete receptors is 7.39 µg/m³ and occurs at Receptor 14, or approximately 25% of the Canada-wide Standard of 28 µg/m³. The maximum annual average GLC for $PM_{2.5}$ was predicted to be 0.049 µg/m³, occurring at Receptor 18, well below the Canada-wide Standard of10 µg/m³.

3.1.2 Combustion Gases

The highest predicted 1-hour and annual average ground-level concentrations for nitrogen dioxide (NO_2) at each discrete receptor for Phase 3 are presented in Table 3.2. Background concentrations of NO_2 in the Project area are assumed to be negligible.

Table 3.2 Maximum Predicted Ground Level Concentrations of Nitrogen Dioxide at Discrete Receptor Locations - Phase 3

Receptor	UTM Coordinates		Maximum Predicted GLC	
	Easting (m)	Northing (m)	1-hr NO_2 (µg/m³)	Annual NO_2 (µg/m³)
1	642692	5023616	34.9	0.057
2	642232	5023505	31.2	0.046
3	642231	5023406	39.2	0.050
4	642088	5023441	36.3	0.048
5	642106	5023396	35.4	0.047
6	642132	5023296	75.5	0.051
7	642030	5023399	36.3	0.046
8	642025	5023336	53.6	0.049
9	641731	5023150	43.0	0.046
10	643569	5021658	31.3	0.039
11	643589	5021745	29.8	0.039
12	643696	5021694	35.3	0.043
13	644835	5021376	21.5	0.047
14	644710	5021586	32.4	0.048
15	646643	5021585	26.7	0.073
16	647285	5021794	43.0	0.094
17	648538	5022253	61.6	0.092
18	648615	5022586	28.6	0.084
19	648680	5022576	29.0	0.083
20	648724	5022566	27.9	0.081
21	648781	5022762	22.8	0.078
22	648776	5022879	21.9	0.081
23	648805	5022959	22.0	0.080
24	648466	5022724	23.9	0.081
25	649335	5023096	23.0	0.075
Regulatory Limit	**-**	**-**	**400**	**100**

The predicted 1-hour maximum ground-level concentrations of NO_2 are presented in Figure A.3 in Appendix A. The highest ground-level concentrations are predicted to occur near the western side of the property boundary. The highest 1-hour NO_2 GLC for the discrete receptors is 75.6 µg/m³ occurring at Receptor 6, approximately 20% of the provincial regulatory threshold of 400 µg/m³. The maximum annual average GLC for NO_2 was predicted to be 0.094 µg/m³, occurring at Receptor 16, well below the Provincial regulatory limit of100 µg/m³.

Maximum predicted GLCs for CO and SO_2 can be found in Tables 3.3 and 3.4, respectively. GLCs for both contaminants were predicted to be well below regulatory thresholds for all averaging periods.

Table 3.3 Maximum Predicted Ground Level Concentrations of Carbon Monoxide at Discrete Receptor Locations - Phase 3

Receptor	UTM Coordinates		Maximum Predicted GLC	
	Easting (m)	Northing (m)	1-hr CO (µg/m³)	8-hr CO (µg/m³)
1	642692	5023616	55.3	16.9
2	642232	5023505	49.6	14.7
3	642231	5023406	62.6	21.6
4	642088	5023441	58.0	15.3
5	642106	5023396	56.8	18.4
6	642132	5023296	123	19.6
7	642030	5023399	58.4	14.6
8	642025	5023336	88.6	21.3
9	641731	5023150	70.9	18.6
10	643569	5021658	50.8	9.2
11	643589	5021745	48.3	8.7
12	643696	5021694	57.4	11.7
13	644835	5021376	35.0	10.8
14	644710	5021586	52.7	13.8
15	646643	5021585	43.0	15.0
16	647285	5021794	69.1	16.3
17	648538	5022253	101	16.7
18	648615	5022586	45.6	20.2
19	648680	5022576	46.2	20.4
20	648724	5022566	44.5	19.9
21	648781	5022762	36.4	15.8
22	648776	5022879	35.0	14.2
23	648805	5022959	35.2	13.5
24	648466	5022724	38.1	17.3
25	649335	5023096	36.8	16.1
Regulatory Limit	**-**	**-**	**34,600**	**12,700**

Table 3.4 Maximum Predicted Ground Level Concentrations of Sulphur Dioxide at Discrete Receptor Locations - Phase 3

Receptor	UTM Coordinates		Maximum Predicted GLC		
	Easting (m)	Northing (m)	1-hr SO_2 ($\mu g/m^3$)	24-hr SO_2 ($\mu g/m^3$)	Annual SO_2 ($\mu g/m^3$)
1	642692	5023616	0.29	0.04	0.0004
2	642232	5023505	0.37	0.05	0.0003
3	642231	5023406	0.32	0.04	0.0003
4	642088	5023441	0.38	0.05	0.0003
5	642106	5023396	0.36	0.05	0.0003
6	642132	5023296	0.37	0.05	0.0004
7	642030	5023399	0.38	0.05	0.0003
8	642025	5023336	0.34	0.04	0.0003
9	641731	5023150	0.30	0.04	0.0003
10	643569	5021658	0.66	0.15	0.0004
11	643589	5021745	0.84	0.19	0.0004
12	643696	5021694	0.45	0.10	0.0004
13	644835	5021376	0.61	0.15	0.0004
14	644710	5021586	0.40	0.07	0.0004
15	646643	5021585	1.66	0.20	0.0012
16	647285	5021794	0.46	0.07	0.0007
17	648538	5022253	0.43	0.04	0.0006
18	648615	5022586	0.28	0.03	0.0005
19	648680	5022576	0.26	0.03	0.0005
20	648724	5022566	0.25	0.03	0.0005
21	648781	5022762	0.21	0.05	0.0005
22	648776	5022879	0.22	0.06	0.0005
23	648805	5022959	0.23	0.07	0.0005
24	648466	5022724	0.26	0.03	0.0005
25	649335	5023096	0.33	0.05	0.0004
Regulatory Limit	**-**	**-**	**900**	**300**	**60**

3.2 PHASE 5 OPERATIONS

3.2.1 Particulate Matter

The highest predicted 24-hour maximum and annual average GLCs for TSP and $PM_{2.5}$ at each discrete receptor location for Phase 5 are presented in Table 3.5. The highest predicted 24-hour maximum GLCs for PM_{10} are also presented in this table for reference purposes only as there are

no provincial or federal regulations associated with PM_{10}. Background concentrations of particulate matter in the Project area are assumed to be negligible.

Table 3.5 Maximum Predicted Ground Level Concentrations of Particulate Matter at Discrete Receptor Locations - Phase 5

Receptor	UTM Coordinates		Maximum Predicted GLC				
	Easting (m)	Northing (m)	24-hr TSP (µg/m³)	Annual TSP (µg/m³)	24-hr PM_{10} (µg/m³)	24-hr $PM_{2.5}$ (µg/m³)	Annual $PM_{2.5}$ (µg/m³)
1	642692	5023616	33.7	0.89	12.1	3.12	0.05
2	642232	5023505	30.3	0.67	10.1	3.04	0.04
3	642231	5023406	41.2	0.75	14.6	2.93	0.04
4	642088	5023441	30.9	0.73	11.2	3.07	0.04
5	642106	5023396	31.1	0.66	11.3	2.92	0.04
6	642132	5023296	42.4	0.59	14.8	2.88	0.03
7	642030	5023399	29.3	0.63	9.8	2.93	0.04
8	642025	5023336	29.7	0.57	10.6	2.80	0.03
9	641731	5023150	33.8	0.51	12.0	2.94	0.03
10	643569	5021658	47.8	0.71	13.7	4.78	0.05
11	643589	5021745	50.0	0.74	13.9	5.04	0.05
12	643696	5021694	58.1	0.84	15.8	5.74	0.05
13	644835	5021376	43.4	0.96	9.8	4.56	0.07
14	644710	5021586	40.7	1.27	11.5	4.12	0.08
15	646643	5021585	31.6	1.12	10.4	3.46	0.07
16	647285	5021794	36.0	1.44	12.8	2.85	0.07
17	648538	5022253	36.7	1.13	11.1	3.60	0.06
18	648615	5022586	27.8	1.23	10.2	2.37	0.07
19	648680	5022576	26.3	1.20	9.9	2.33	0.07
20	648724	5022566	26.5	1.18	10.0	2.31	0.07
21	648781	5022762	20.6	1.02	7.7	1.64	0.06
22	648776	5022879	22.9	1.03	8.4	1.47	0.06
23	648805	5022959	19.2	1.01	6.6	1.41	0.06
24	648466	5022724	24.9	1.15	8.6	2.13	0.06
25	649335	5023096	26.8	0.97	9.7	1.51	0.05
Regulatory Limit	-	-	**120**	**70**	-	**28**	**10**

Isopleths of maximum predicted GLCs for 24-hour TSP can be found in Figure B.1 in Appendix B. GLCs for 24-hour TSP for Phase 5 are predicted to continue to be highest on the shore on the northern edge of the property boundary. The highest 24-hour TSP GLC for the discrete receptors is 58.1 µg/m³ occurring at Receptor 12, approximately 50% of the provincial maximum permissible value of 120 µg/m³.

The highest predicted annual TSP GLC is 1.44 µg/m³ and occurs at Receptor 18. Annual TSP GLCs are predicted to be well below the maximum permissible value of 70 µg/m³.

Isopleths of maximum predicted GLCs for 24-hour $PM_{2.5}$ can be found in Figure B.2 in Appendix A. GLCs for 24-hour $PM_{2.5}$ are highest near the western side of the property boundary. The highest 24-hour $PM_{2.5}$ GLC for the discrete receptors is 5.74 µg/m³ occurring at Receptor 16, approximately 25% of the Canada-wide Standard of 28 µg/m³. The maximum annual average GLC for $PM_{2.5}$ was predicted to be 0.08 µg/m³, occurring at Receptor 14, well below the Canada-wide standard of 10 µg/m³.

3.2.2 Combustion Gases

The highest predicted 1-hour and annual average GLCs NO_2 at each discrete receptor for Phase 5 are presented in Table 3.6. Background concentrations of NO_2 in the Project area are assumed to be negligible.

Table 3.6 Maximum Predicted Ground Level Concentrations of Nitrogen Dioxide at Discrete Receptor Locations - Phase 5

Receptor	UTM Coordinates		Maximum Predicted GLC	
	Easting (m)	Northing (m)	1-hr NO_2 (µg/m³)	Annual NO_2 (µg/m³)
1	642692	5023616	15.9	0.042
2	642232	5023505	15.1	0.034
3	642231	5023406	15.4	0.035
4	642088	5023441	15.5	0.032
5	642106	5023396	15.4	0.033
6	642132	5023296	15.8	0.035
7	642030	5023399	15.4	0.032
8	642025	5023336	16.1	0.033
9	641731	5023150	13.4	0.029
10	643569	5021658	14.5	0.051
11	643589	5021745	14.0	0.055
12	643696	5021694	14.7	0.054
13	644835	5021376	16.3	0.071
14	644710	5021586	17.8	0.070
15	646643	5021585	11.9	0.101
16	647285	5021794	11.4	0.083
17	648538	5022253	9.8	0.071
18	648615	5022586	10.5	0.067
19	648680	5022576	10.4	0.067
20	648724	5022566	10.3	0.066
21	648781	5022762	10.0	0.059
22	648776	5022879	10.5	0.054

Table 3.6 Maximum Predicted Ground Level Concentrations of Nitrogen Dioxide at Discrete Receptor Locations - Phase 5

Receptor	UTM Coordinates		Maximum Predicted GLC	
	Easting (m)	Northing (m)	1-hr NO_2 (µg/m³)	Annual NO_2 (µg/m³)
23	648805	5022959	11.2	0.052
24	648466	5022724	11.8	0.065
25	649335	5023096	11.3	0.048
Regulatory Limit	**-**	**-**	**400**	**100**

The predicted 1-hour maximum GLCs of NO_2 are presented in Figure B.3 in Appendix B for Phase 5. The highest ground-level concentrations are predicted to occur near the western side of the property boundary. The highest 1-hour NO_2 GLC for the discrete receptors is 17.8 µg/m³ occurring at Receptor 14, well below the provincial regulatory threshold of 400 µg/m³. The maximum annual average GLC for NO_2 was predicted to be 0.101 µg/m³, occurring at Receptor 15, also well below the Provincial regulatory threshold of 100 µg/m³.

Maximum predicted GLCs for CO and SO_2 for Phase 5 can be found in Tables 3.7 and 3.8, respectively. GLCs for both contaminants were predicted to be well below regulatory thresholds for all averaging periods.

Table 3.7 Maximum Predicted Ground Level Concentrations of Carbon Monoxide at Discrete Receptor Locations - Phase 5

Receptor	UTM Coordinates		Maximum Predicted GLC	
	Easting (m)	Northing (m)	1-hr CO (µg/m³)	8-hr CO (µg/m³)
1	642692	5023616	25.4	10.3
2	642232	5023505	24.0	11.5
3	642231	5023406	24.5	16.4
4	642088	5023441	24.7	13.8
5	642106	5023396	24.5	15.8
6	642132	5023296	25.2	14.6
7	642030	5023399	24.6	15.1
8	642025	5023336	25.7	15.7
9	641731	5023150	21.4	10.1
10	643569	5021658	23.0	10.2
11	643589	5021745	22.2	11.0
12	643696	5021694	23.3	11.8
13	644835	5021376	26.1	13.4
14	644710	5021586	28.4	21.6
15	646643	5021585	19.1	10.0
16	647285	5021794	18.2	8.4
17	648538	5022253	15.7	7.6

Table 3.7 Maximum Predicted Ground Level Concentrations of Carbon Monoxide at Discrete Receptor Locations - Phase 5

Receptor	UTM Coordinates		Maximum Predicted GLC	
	Easting (m)	Northing (m)	1-hr CO (µg/m³)	8-hr CO (µg/m³)
18	648615	5022586	16.8	8.8
19	648680	5022576	16.6	8.7
20	648724	5022566	16.5	8.6
21	648781	5022762	15.9	8.3
22	648776	5022879	16.7	10.8
23	648805	5022959	17.9	10.2
24	648466	5022724	18.8	8.2
25	649335	5023096	18.0	8.4
Regulatory Limit	-	-	**34,600**	**12,700**

Table 3.8 Maximum Predicted Ground Level Concentrations of Sulphur Dioxide at Discrete Receptor Locations - Phase 5

Receptor	UTM Coordinates		Maximum Predicted GLC		
	Easting (m)	Northing (m)	1-hr SO_2 (µg/m³)	24-hr SO_2 (µg/m³)	Annual SO_2 (µg/m³)
1	642692	5023616	0.27	0.04	0.0004
2	642232	5023505	0.34	0.05	0.0004
3	642231	5023406	0.28	0.04	0.0004
4	642088	5023441	0.35	0.05	0.0003
5	642106	5023396	0.32	0.04	0.0003
6	642132	5023296	0.26	0.05	0.0004
7	642030	5023399	0.34	0.05	0.0003
8	642025	5023336	0.30	0.04	0.0004
9	641731	5023150	0.27	0.04	0.0003
10	643569	5021658	0.65	0.15	0.0005
11	643589	5021745	0.83	0.18	0.0006
12	643696	5021694	0.44	0.09	0.0005
13	644835	5021376	0.56	0.15	0.0006
14	644710	5021586	0.35	0.08	0.0006
15	646643	5021585	1.65	0.20	0.0016
16	647285	5021794	0.44	0.07	0.0008
17	648538	5022253	0.42	0.04	0.0006
18	648615	5022586	0.28	0.03	0.0005
19	648680	5022576	0.26	0.03	0.0005
20	648724	5022566	0.25	0.03	0.0005

Table 3.8 Maximum Predicted Ground Level Concentrations of Sulphur Dioxide at Discrete Receptor Locations - Phase 5

Receptor	UTM Coordinates		Maximum Predicted GLC		
	Easting (m)	Northing (m)	1-hr SO_2 ($\mu g/m^3$)	24-hr SO_2 ($\mu g/m^3$)	Annual SO_2 ($\mu g/m^3$)
21	648781	5022762	0.21	0.05	0.0005
22	648776	5022879	0.22	0.06	0.0004
23	648805	5022959	0.22	0.07	0.0004
24	648466	5022724	0.26	0.03	0.0005
25	649335	5023096	0.32	0.05	0.0004
Regulatory Limit	-	-	900	300	60

3.3 BLASTING

Blasting is a short term event resulting in a near-instantaneous puff of air contaminants to be carried downwind. The emissions are dispersed horizontally and vertically, as in continuous plumes, and also are dispersed in the direction of the wind due to turbulence and wind shear. For this Project, the effects of a single blast were calculated on a worst-case basis, and used to derive the daily and annual impacts.

The basic puff model was derived by Turner (1994) and enhanced in the work by Schulze and Turner (1996). The period of maximum production used to calculate particulate concentrations downwind was based on a 50 hole-average blast. A low wind speed (low dilution) has been used, and temperature was assumed to be ambient to reduce thermal plume rise. Deposition is assumed to be negligible so that the estimates are a reasonable worst-case. Based on information provided by Vulcan, the estimated TSP and $PM_{2.5}$ generated by the blast is 9.7 kg and 0.3 kg, respectively.

The maximum 24 hour GLC of $PM_{2.5}$ at the nearest resident distance of 500 m was predicted to be 0.15 $\mu g/m^3$, well below the Canada-wide standard of 28 $\mu g/m^3$. Long term averages would be much lower due to wind direction and speed variability. AS shown by the wind rose in Figure 2.1, winds blow in the same direction less than 7% of the time toward any given receptor. At a maximum of 182 blasts per year, the annual average GLC would be well below the annual Canada-Wide Standard of10 $\mu g/m^3$. The results here are therefore expected to represent an over-estimate of the anticipated exposure levels to nearby residents.

3.4 SHIP TRANSIT

Ships approaching and berthing at the dock will have emissions from propulsion engines, while docked ships run onboard power requirements via "hotelling" emissions from the auxiliary power units. Although emissions from the propulsion engines are larger than the auxiliary units, propulsion unit are expected to operate for a much shorter duration and will be non-stationary; that is, the plume is only a temporary exposure due to ship motion. Virtually all of North America,

including the project area, is within an Emission Control Area (ECA) protected by International Maritime Organization (IMO) regulations that reduce the acceptable levels of NOx and SO_2 from marine engines. In January 2016, Tier III limits replace those of Tier II, with a consequent reduction in NOx of about 74% in ECAs that include all of coastal Nova Scotia. With these reductions, model predictions for NOx indicate that hourly limits for NOx would be met on the order of 100 m from a steaming vessel. The expected exposure for hourly and annual averaging periods is therefore expected to be well below regulatory thresholds as vessels are expected to be of the order of 1 km offshore of any residences.

3.5 ADAPTIVE MANAGEMENT

In addition to mitigation measures identified in Section 2.2.2.3, additional controls will be implemented through adaptive management. Adaptive management is a systematic application of monitoring programs to learn optimum procedures for reducing exposure from air contaminants. For example, dust generation from haul roads is a function of several factors including moisture in the roadway and speed of the vehicle. Through adaptive management, the proponent may learn that immediate reductions are possible through speed reductions, while watering trucks may be deployed as a more long-term control that does not compromise productivity. Adaptive management therefore implies a willingness by quarry operators to continually monitor conditions on site and respond to changing environmental conditions to achieve predicted control efficiencies.

One contributing source to the overall impacts that can be controlled through adaptive management is the removal of overburden. This is an essential part of the development of the quarry, but is not an activity that needs to be continuous in order to sustain maximum production. It will be possible to incorporate in mitigation planning the suspension of activities such as overburden removal until such times that soil moisture conditions provide greater control on the emissions that will be generated, and the weather promotes adequate dispersion of any material that is released.

4.0 CONCLUSIONS

Air quality impacts of the quarry were estimated using a dispersion modelling approach to calculate ground level concentrations to be compared against applicable provincial and federal standards. The plume dispersion model AERMOD was used to predict the 1-hour and 24-hour maximum, and the annual average concentrations for nitrogen dioxide (NO_2), sulphur dioxide (SO_2), and particulate matter (including TSP, PM_{10} and $PM_{2.5}$), as well as the 1-hour and the 8-hour maximum concentrations for carbon monoxide (CO).

The maximum ground-level concentrations predicted within the 10 km x 10 km model domain were compared with the applicable ambient standards described in Schedules A of the Nova Scotia *Air Quality Regulation* and the CCME Canada-Wide Standards.

The predicted ground-level concentrations of the air contaminants were found to be at least 50% below their respective objectives, standards and criteria at the nearest discrete receptors.

5.0 CLOSURE

This report has been prepared for the sole benefit of Vulcan Materials Company (Vulcan). The report may not be relied upon by any other person or entity without the express written consent of Stantec Consulting Ltd. (Stantec) and Vulcan.

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This report was prepared by Gillian Hatcher, MASc, and Brian Bylhouwer, MRM, and was reviewed by John Walker, PhD. If you have any questions regarding the contents of this report, or require any additional information, please do not hesitate to contact the undersigned.

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6.0 REFERENCES

Environment Canada. 2013. National Air Pollutant Surveillance (NAPS) Monitoring Results, 2012 and 2013.

Shulze, R.H., and D. B. Turner. 1996. Practical Guide to Atmospheric Dispersion Modeling, Trinity Consultants, Incorporated.

Turner, D.B. 1994. *Workbook of atmospheric dispersion estimates: an introduction to dispersion modeling* (2nd ed.). CRC Press.

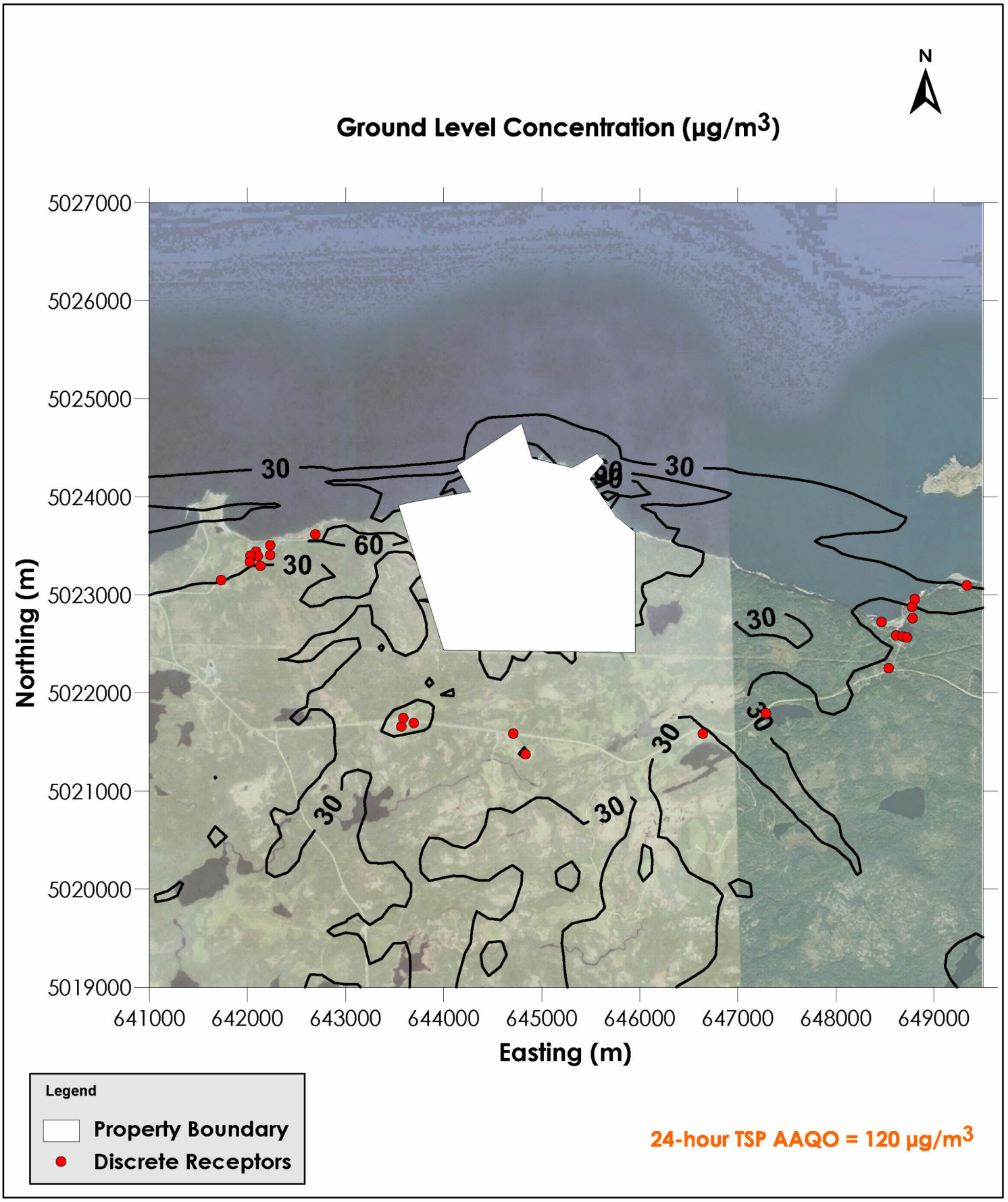
US EPA. 1995. Compliation of Air Pollutant Emission Factors, Section 13.2, Introduction to Fugitive Dust Sources.

US EPA. 1997. The Prime Plume Rise and Building Downwash Model, addendum to ISC3 user's guide, November 1997.

US EPA. 2009. Current Methodologies in preparing Mobile Source Port-Related Emission Inventories. Final Report.

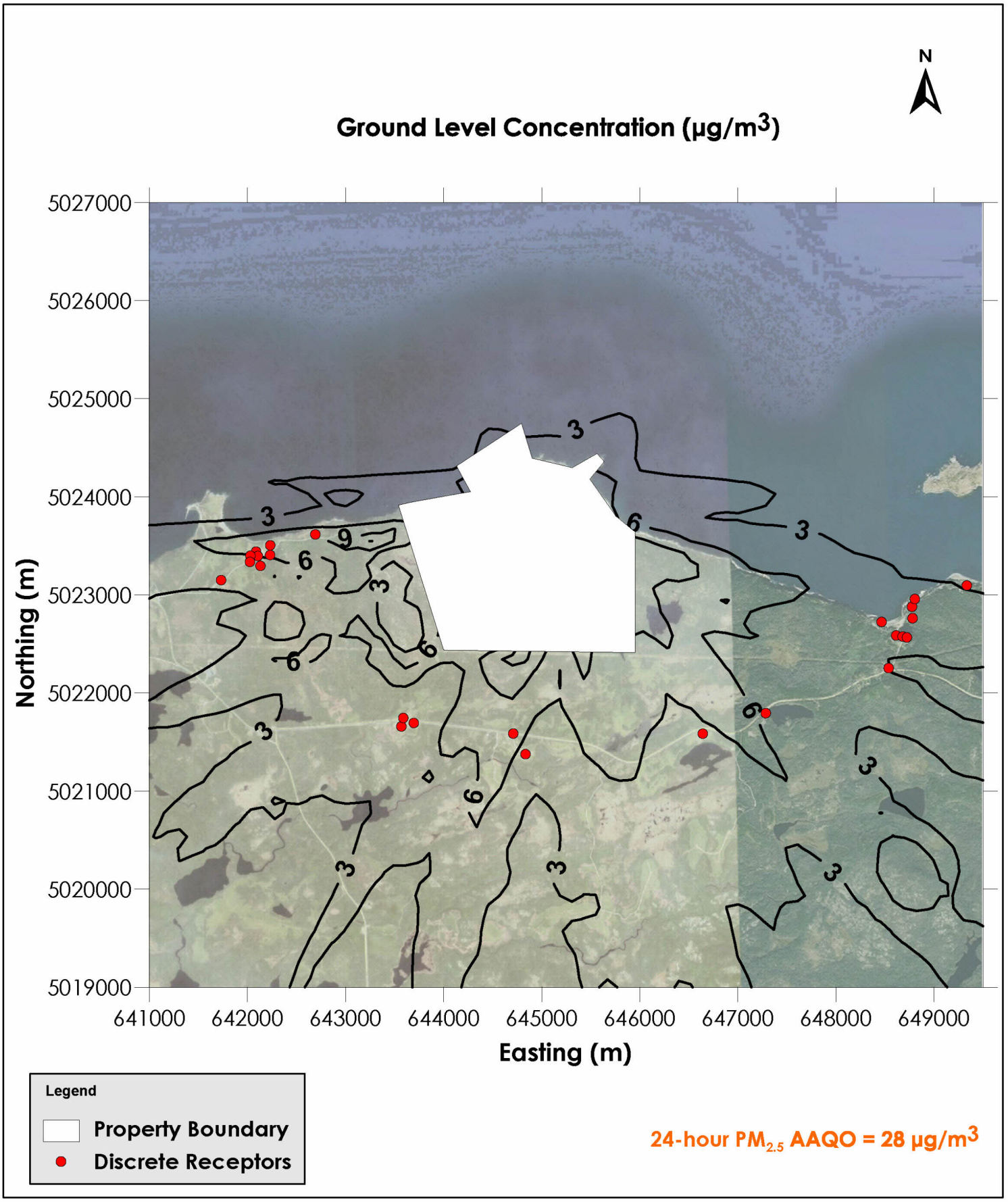
APPENDIX A

ISOPLETH CONTOURS OF GROUND LEVEL CONCENTRATIONS FROM PHASE 3 OPERATIONS



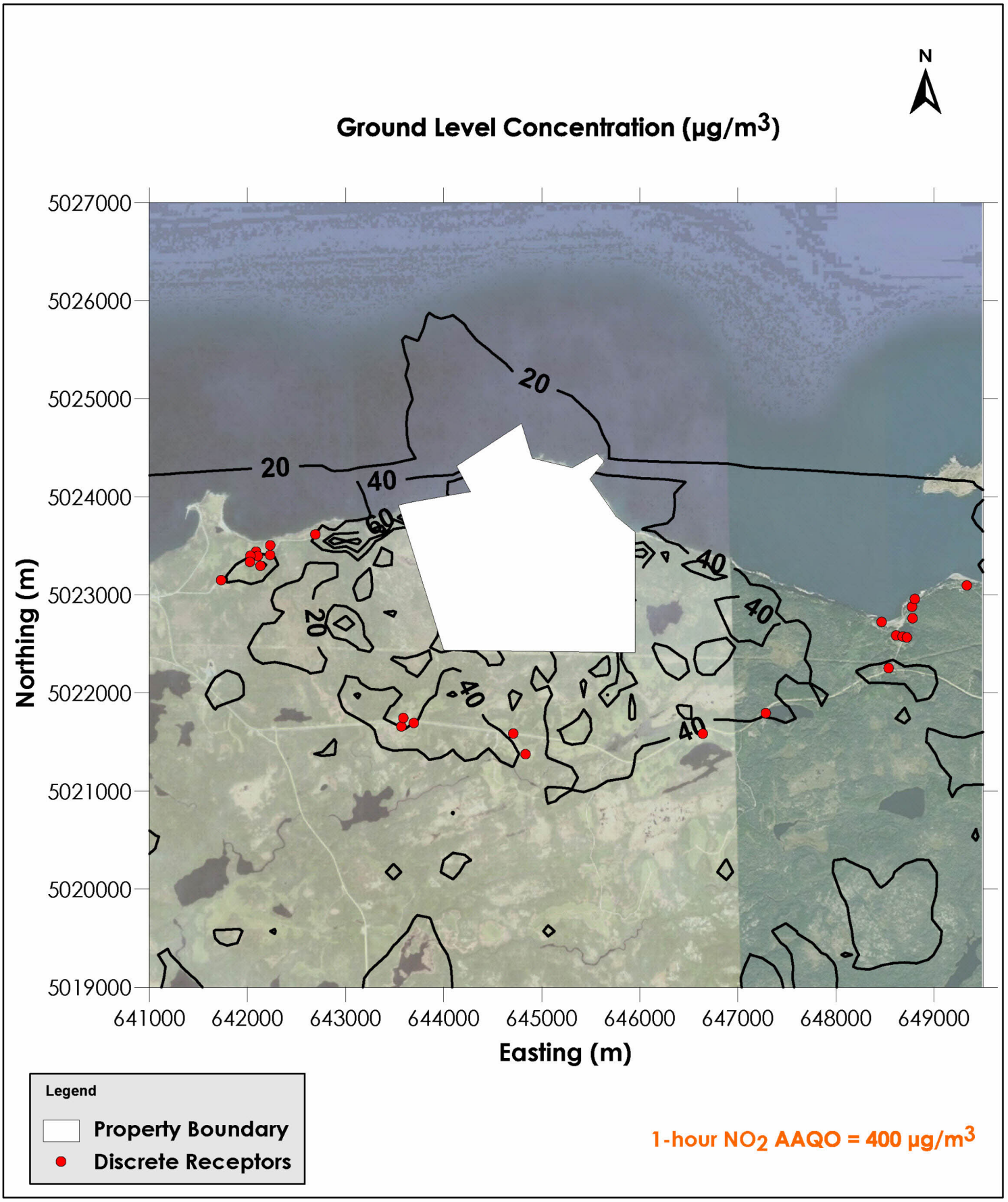
Stantec	Vulcan Materials Company	Maximum Predicted 24-hour Ground Level TSP Concentrations (µg/m3)	PROJECTION UTM	DRAWN BY BB	
			DATUM NAD 83 - ZONE 20	CHECKED BY JW	
			DATE February 2, 2015	FIGURE NO. Fig. A1	

C 1340-2231



Stantec	Vulcan Materials Company	Maximum Predicted 24-hour Ground Level $PM_{2.5}$ Concentrations (µg/m^3)	PROJECTION UTM	DRAWN BY BB
			DATUM NAD 83 - ZONE 20	CHECKED BY JW
			DATE February 2, 2015	FIGURE NO. Fig. A2

C 1340-2232



Stantec / Vulcan Materials Company	Maximum Predicted 1-hour Ground Level NO_2 Concentrations (µg/m3)	PROJECTION UTM	DRAWN BY BB	
		DATUM NAD 83 - ZONE 20	CHECKED BY JW	
		DATE February 2, 2015	FIGURE NO. Fig. A3	

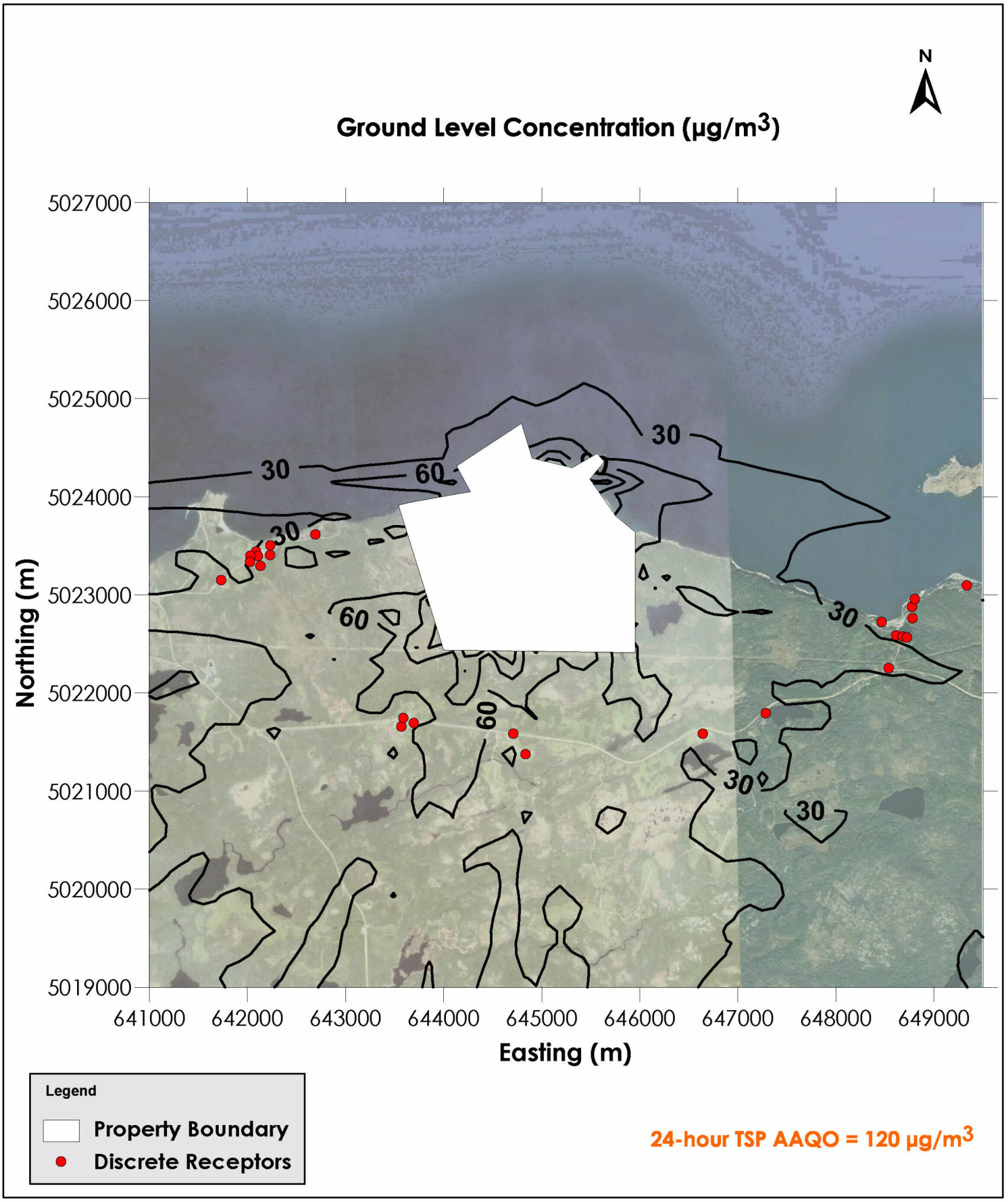
C 1340-2233

February 6, 2015

APPENDIX B

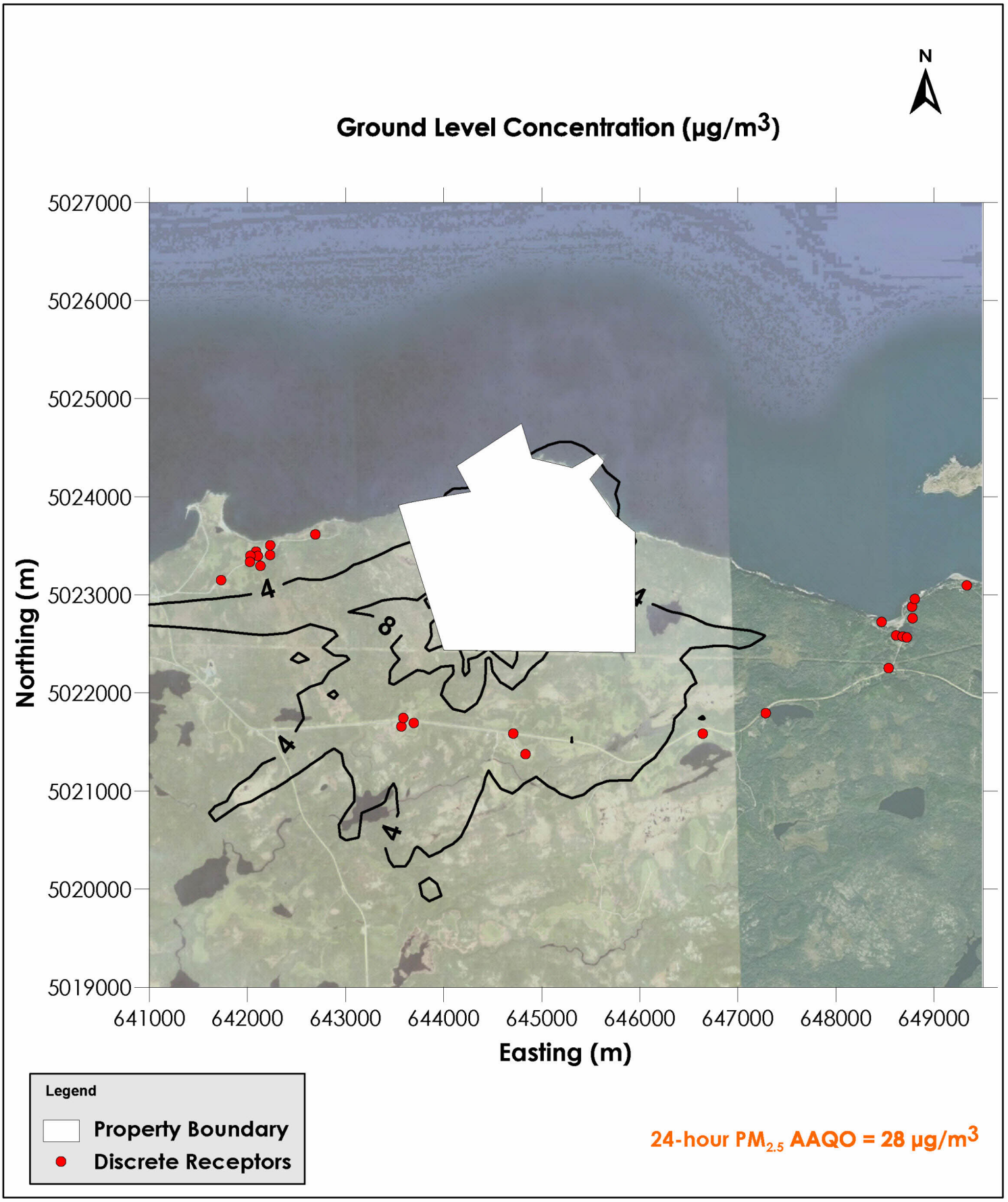
ISOPLETH CONTOURS OF GROUND LEVEL CONCENTRATIONS FROM PHASE 5 OPERATIONS

Stantec



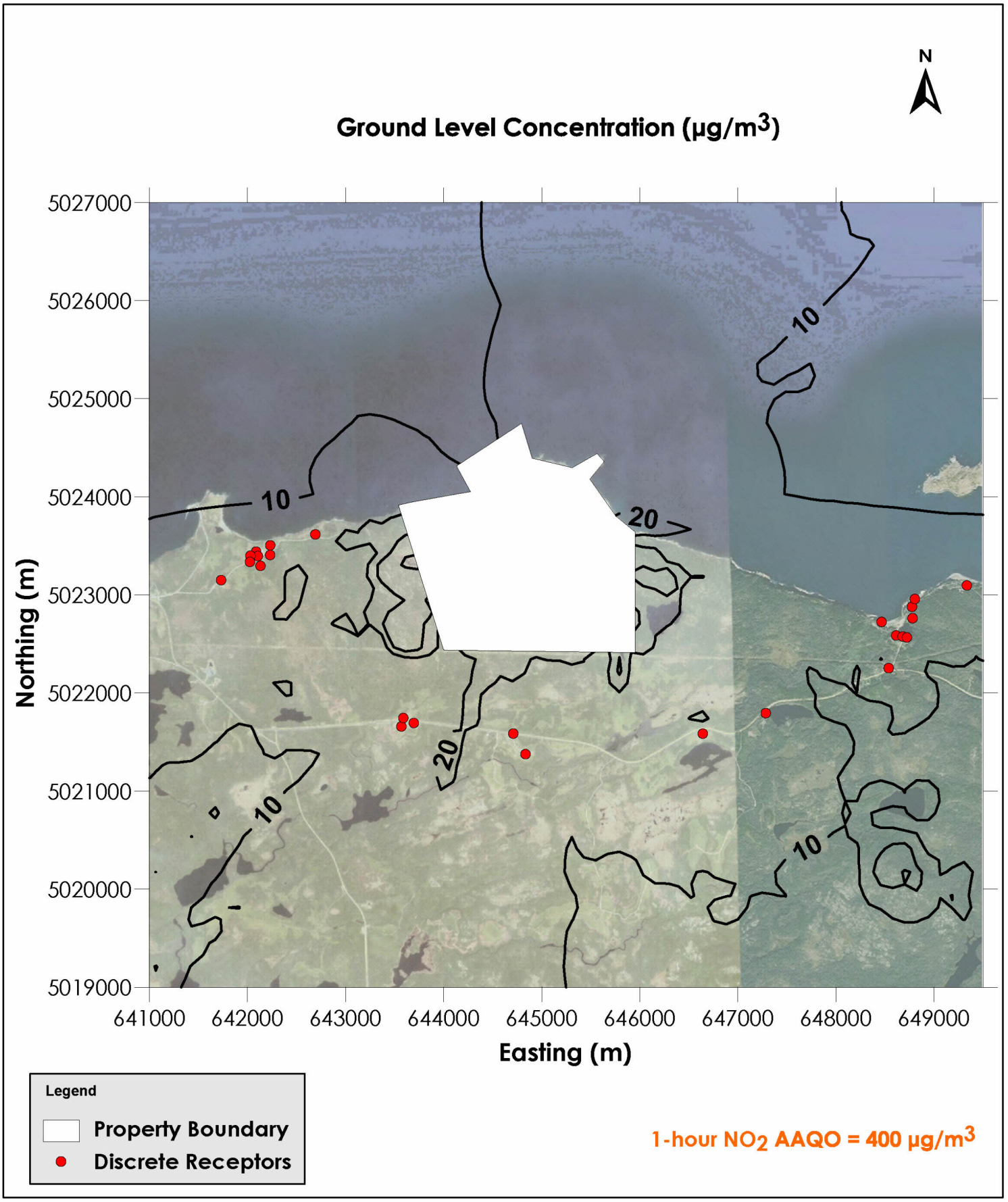
Stantec	Vulcan Materials Company	Maximum Predicted 24-hour Ground Level TSP Concentrations (µg/m3)	PROJECTION UTM / DATUM NAD 83 - ZONE 20 / DATE February 2, 2015	DRAWN BY BB / CHECKED BY JW / FIGURE NO. Fig. B1

C 1340-2235



Stantec / Vulcan Materials Company	Maximum Predicted 24-hour Ground Level $PM_{2.5}$ Concentrations (µg/m^3)	PROJECTION: UTM	DRAWN BY: BB	
		DATUM: NAD 83 - ZONE 20	CHECKED BY: JW	
		DATE: February 2, 2015	FIGURE NO.: Fig. B2	

C 1340-2236



Stantec	Vulcan Materials Company	Maximum Predicted 1-hour Ground Level NO_2 Concentrations (µg/m3)	PROJECTION UTM / DATUM NAD 83 - ZONE 20 / DATE February 2, 2015	DRAWN BY BB / CHECKED BY JW / FIGURE NO. Fig. B3

C 1340-2237