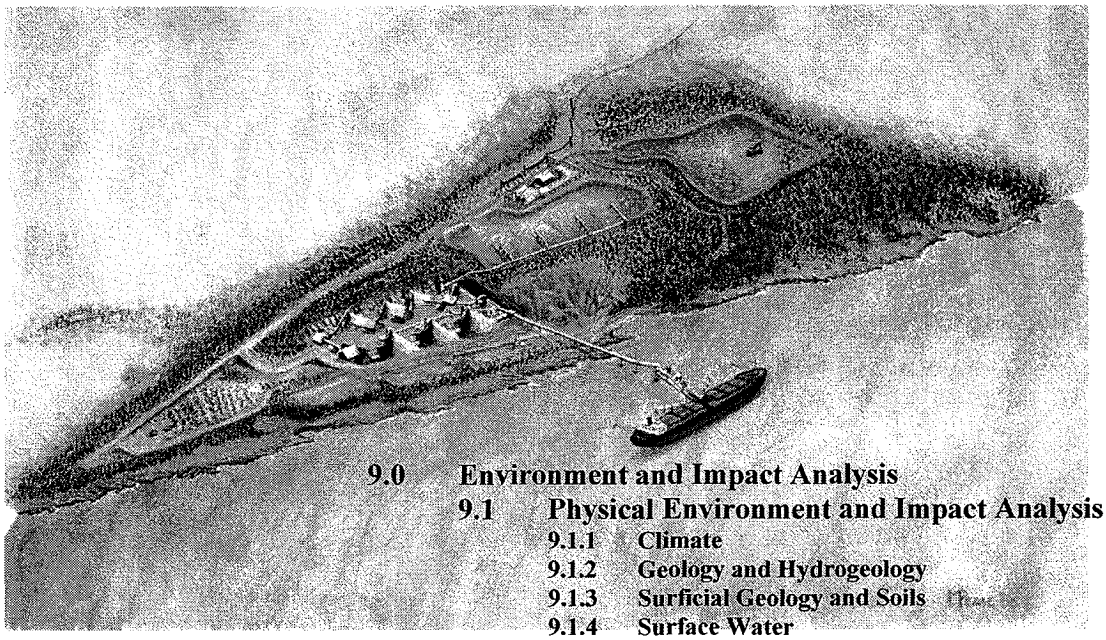
Whites Point Quarry and Marine Terminal

RESPONSES

VOLUME III



BILCON

February 2007

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C0635-001

9.1.1 Climate

INDEX OF COMMENTS

9.0 Environments and Impact Analysis

9.1 Physical Environment and Impact Analysis

9.1.1 Climate

C0635-002

9.1.1 Climate

WP 1431 – Joint Review Panel
IR-1- Question 5
Page 15 of Chapter 7 states that blasting will not be done in the fog yet the Bay of Fundy coast is often foggy.

Information Request - IR-5
Describe the feasible alternatives to blasting under foggy conditions and explain how production levels will be maintained under these conditions. Provide information on the expected days of fog in the area.

RESPONSE
At Saint John, New Brunswick, fog occurs on more than 25% of the days of the year or approximately 91 days during the year. At Yarmouth, Nova Scotia, fog occurs on approximately 118 days of the year. The season with the greatest contrast in temperature between sea surface and overriding air produces the greatest fog. Since July is the warmest month, fog occurs more often, 36% of the time in July in the Saint John area of the Bay. Sea fog is much more prevalent during the night and early morning than during the day. At Saint John, early morning fog occurs on 60% of the fog days; by 2 P.M. the fog occurrence frequently drops to 18%.

Similar to Saint John and Yarmouth, the Whites Point site experiences fog conditions throughout the year. Blasting will not be conducted during foggy conditions. If fog persists the day of a scheduled blast, blasting will be delayed without consequences. Blast holes can be filled for several days and up to 3 or 4 weeks, if necessary, without deteriorization of the ANFO blasting agents. This is referred to in the blasting industry as "sleep time". When wet blast hole conditions are anticipated, or encountered, the use of ANFO/Emulsion blends will be implemented. These blends have infinite sleep time in the borehole. Therefore, fog conditions would not force Bilcon to blast due to any limits on "sleep time".

Please refer to Bilcon's response to WP 1452 - Panel's question on 9.1.1.1.2 – Visibility/Fog in this section.

Reference
Environment Canada – Atlantic Climate Centre – The Climate of New Brunswick. Last reviewed: 2006-07-28
http://atlantic-web1.ns.ec.gc.ca/climatecentre/default.asp?lang=En&n=7A6129C7-1

Environment Canada – Atlantic Climate Centre – The Climate of Nova Scotia. Last reviewed 2006-07-28
http://atlantic-web1.ns.ec.gc.ca/climatecentre/default.asp?lang=En&n=61405176-1

C0635-003

9.1.1 Climate

WP 1452 – Joint Review Panel
9.1 Physical Environment and Impact Analysis
Page 8-The Panel requires more complete and locally relevant climate data and related information to assess the potential effects of the project. The data needs to come from weather stations close to the Project site, and to reflect an appropriate time frame for identifying weather averages and extremes. Traditional knowledge may provide useful information in this case.

RESPONSE
As stated in the EIS, data from two weather stations close to the project site was researched – Prim Point, Digby County and Meteghan River, Digby County. The Prim Point station data records are from 1965 – 1985, while the Meteghan River station records are from 1937 – 1986. Averages and extremes for precipitation are presented in paragraph 9.1.1.1.1 of the EIS. Prim Point is located on the Bay of Fundy approximately 40 km from Whites Point and Meteghan River is located on St. Marys Bay approximately 30 km from Whites Point. Data for these two stations contained in Appendix 14 of the EIS has been revised and are attached as errata sheets in Appendix 1 of this section.

Further, a third weather station more inland from the Whites Point site was also reviewed. Weymouth Falls is located approximately 17 km from the Whites Point site. Data for this station contained in Appendix 14 of the EIS has been revised and is also attached as an errata sheet in Appendix 1 of this section.

Late in 2005, a weather station on Brier Island began recording limited weather data. Data from this station will be used as appropriate during project construction and operation.

9.1.1.1. Precipitation and Temperature

Appendix 14 (Table Pg1) – Provide a title for the table which includes location and years. Provide the most current information on extreme events recorded in this region. (This information is important for the consideration of precipitation in the design of the sediment ponds and constructed wetlands, and the evaluation of the capacity of the coastal bog to deal with suspended and dissolved contaminants.)

Appendix 14 (Tables Pg2-Pg3) – The table values do not make sense (especially in relation to the text in 9.1.1.1.). For instance, the table reports that the greatest rainfall for 1966-1985 in only 6.4mm; lowest temperature cited is minus 14°; greatest snowfall is 5.8 cm. The Panel does not believe that the data adequately represent average and extremes for the Whites Point area.

C0635-004

9.1.1 Climate

RESPONSE

EIS Appendix 14 (Table Pg 1) has been revised to indicate the requested information. This table provides information on average and extreme precipitation events and is included in Appendix 1 in this section.

EIS Appendix 14 (Tables Pg 2 – Pg 3). The wrong tables were inserted in this Appendix. The correct tables are in Appendix 1 in this section.

9.1.1.1.2 Visibility/Fog

Given the potential effect of fog on many of the Project's operations and impacts, the Panel requires good data on the likelihood of fog during the year.

Yarmouth station information is presented. Given the particular conditions of the Bay of Fundy area, how applicable is this data to predicting days of fog at the Project site? If information is available for closer locations, like Meteghan or Grand Manan, that should be provided.

Provide a more appropriate data set. If available, seek traditional knowledge or the records of the whale-watching organizations to provide additional information.

RESPONSE

Review of Environment Canada weather station data indicates visibility and cloud amount is not recorded at stations closer to the Whites Point site than Yarmouth, NS and Saint John, NB. In addition to the visibility data for Yarmouth presented in the EIS, visibility data for Saint John, which also has data for a 30 year period (1971 – 2000) is presented below. Local fishermen have indicated that weather information from the Saint John station is more applicable to the Whites Point area of the Bay than Yarmouth information. The combination of Yarmouth and Saint John data will further the applicability of this data.

Canadian climate normals for the 30 year period (1971 – 2000) presents monthly averages for hours with visibility for distances less than 1 km., 1 to 9 km, and greater than 9 km.

Hours with Visibility: Yarmouth, NS

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
<1 km	41.4	30.2	40.2	38.2	74.8	106.6	153.3	139.5	70.0	40.3	27.0	29.4	791.1
1-9 km	158.63	133.7	117.0	101.8	101.1	121.9	133.4	127.6	100.6	81.8	82.0	136.7	1396.1
>9 km	543.96	514.8	586.7	580.0	568.1	491.5	457.3	477.0	549.4	621.9	611.0	577.9	6579.5

C0635-005

9.1.1 Climate

Hours with Visibility: Saint John, NB

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<1 km	23.9	21.4	29.8	31.5	48.5	84	113.9	106.8	60.8	31.7	19.1	19.2
1-9 km	138.5	125.8	146.1	134.5	118.7	125	128.4	117.3	103.5	111.1	125.6	148.8
>9 km	581.6	530.8	568.1	554.1	576.9	511	501.7	519.9	555.8	601.2	575.3	576

Data from Yarmouth and Saint John both indicate that the month of July has the greatest number of hours with visibility less than 1 km. Using this worst case scenario at Yarmouth of 153.3 hours with visibility less than 1 km would amount to over 6 days of "low" visibility during July. Conversely, during the month of July there would be 457.3 hours with visibility greater than 9 km. This would amount to approximately 19 days of "high" visibility.

The likelihood of fog during the year is presented previously in response to Information Request IR – 5. Additionally, a recent survey, fall 2006, of whale watching organizations operating out of the East Ferry/Tiverton ports was conducted to ascertain the number of days during the whale watching season that trips were cancelled due to fog. Generally, tour operators indicated 5 to 10 trips were cancelled during the 2006 season. This amounts to approximately 8% of the time during the 120 day whale watch season.

Further, the Environment Canada weather stations provide data on cloud amount for Yarmouth, NS and Saint John, NB. This data is recorded for a comparable 30 year period (1971 – 2000) and is presented below.

Cloud Amount (hours with): Yarmouth, NS

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0 – 2 Tenths	82.9	108	183.4	184.6	185.6	170.9	169.3	203	236.7	231.1	121	90.7
3 - 7 Tenths	106.7	110.7	112.3	114.2	121.3	132.9	146.8	135.8	138.4	138.5	129	108.8
8 – 10 Tenths	554.5	459.9	448.3	421.2	437.1	416.2	427.9	405.2	344.9	374.4	470	545.1

Cloud Amount (hours with): Saint John, NB

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0 – 2 Tenths	237.9	224.9	218.5	162.7	153.5	133.8	139	170.4	190.9	203.1	176.2	210.9
3 - 7 Tenths	122.4	108.8	115.7	122.5	156.1	168.9	183.8	180	166.9	142.4	121.7	118.8
8 – 10 Tenths	383.8	344.4	409.8	434.8	434.4	417.3	421.1	393.6	362.2	398.6	442	414.3

C0635-006

9.1.1 Climate

Data from Yarmouth and Saint John indicate December and November respectively have the most hours with cloud amount of 8 to 10 tenths. January and February data are excluded since this is the time of non-quarry production. Using the worst case scenario at Yarmouth with 545.1 hours with cloud amount of 8 to 10 tenths, this would amount to over 22 days of cloud "cover" in December. Conversely, during the month of December there would be 90.7 hours with cloud amount of 0 to 2 tenths. This would amount to approximately 4 days of "little or no" cloud amount. During March through October, the number of days with "little or no" cloud amount would double to approximately 8 days per month.

In accordance with NSDEL's "Pit and Quarry Guidelines" paragraph VIII Blasting (6), blasting will not be conducted if a thermal inversion is anticipated. The presence of a thermal inversion will be determined in consultation with the Environment Canada Weather Service (1-900-565-5555). Cloud cover (ceiling) and visibility information, as applicable, will also be obtained from the Weather Service. This information will be verified on-site by a certified blaster before a blast is initiated. Blasting will generally be conducted between the hours of 1100 and 1600.

Information on weather conditions including ceiling, temperature, and wind speed and direction will be recorded for each blast on the blast report.

9.1.1.1.3 Greenhouse Gas

Provide a GHG compensation plan which negates the emissions from the Project during the construction and operational phases (including the effects of land clearing).

RESPONSE

Bilcon is aware of its broad responsibilities with respect to environmental issues, including those related to the emission of GHGs, and their potential contribution to climate change. The climate change file is being addressed in Canada both by the Federal Government and the Provincial Governments, although there are no definitive policies nor legislation in place which apply to individuals or corporate entities.

In assessing its impacts on the environment, Bilcon has addressed the issue of estimating the resultant annual GHG emissions (approximately 80,000 tonnes CO_{2eq}), which would form some 0.27% of the Provincial total for Nova Scotia, and which would represent a much smaller portion of the emissions in the region of the Atlantic provinces (in the order of 0.01-0.03%). Nonetheless, Bilcon recognizes that there are Provincial, Federal and indeed Global interests and initiatives aimed at actually reducing overall anthropogenic GHG emissions. It is in this regard that Bilcon proposes as a mitigative measure the speedy, incremental reclamation of land after rock extraction. This will create carbon sinks, an acknowledged method of GHG mitigation. Furthermore, Bilcon intends to chip and compost wood fibre which accumulates as a result of land clearing activities.

C0635-007

9.1.1 Climate

Further, Bilcon, in addition to adhering to all present and future legislation relevant to climate change mitigation/adaptation, will continue to examine evolving technologies and methodologies which may assist in reducing or offsetting its GHG emissions. Its first priority would be to reduce its actual emissions through energy conservation and/or the use of alternative energy sources. For example, Bilcon will undertake a future assessment of the feasibility of using biodiesel fuel in its equipment. This assessment will consider equipment maintenance factors, availability of biodiesel supplies, and the overall financial impacts of such a plan. As Provincial and Federal policies mature, Bilcon will also investigate routes by which it could contribute to 'carbon capture' initiatives, such as reforestation projects beyond its own land reclamation program. With reference to the potential of purchasing GHG credits, Bilcon believes that it is too early to make any firm commitments in this regard, and the overall benefit to global climate change of these programs is still the subject of government assessment. In addition, the level of emissions would place Bilcon below the Federal Government's "large emitter" category.

In summary, Bilcon believes that it has fulfilled its requirement to assess the magnitude of its GHG emissions, while recognizing that it has a role to play in minimizing its contribution to overall GHG emissions. In addition, Bilcon understands that it has an obligation to adhere to relevant regulatory obligations. It intends to do so through a continuous program of environmental self-examination, and an exploration of new methodologies and evolving policies respecting climate change.

WP 1619–Department of Foreign Affairs – Sustainable Development and International Trade

With respect to the information on climate change and Protocol provided by the project proponent (Part 6.6.2), this is generally accurate. I would note that the 11th paragraph, third sentence, has a reference to China and India that could be misinterpreted. The sentence states that China and India (not named) have "not signed on" to the Protocol. China and India have ratified the Protocol and so are Parties; they do not have emissions reductions obligations. I would note that the information may now be dated.

RESPONSE

Please refer to Bilcon's response in Section 6.0 – Introduction to the EIS, in this submission.

WP 1525 – Natural Resources Canada

Comment from Reviewer 3

Wave climate statistics were provided in Appendix 46 (Vol. IV) but did not provide any information on extreme conditions – i.e. the anticipated sea levels generated by storm surges

C0635-008

9.1.1 Climate

during extreme storms such as hurricanes or Nor-easters and anticipated extreme wave energy impacting the structure. Also, there was no detailed description about the extent of wave run up and flood levels along this coast and the vulnerability of the infrastructure to storm surges and waves during storm events and the need for shore protection structures.

RESPONSE
Please refer to Section 7.0 Revised Project Description, Pages 149 to 153 and response to Panel IR-23 in Section 7.0 in this document.

Comment Reviewer #3, Paragraph 3, Page 5, NRCan, Sea Level Rise due to Global Climate Change

Coastal processes and sea level rise - the proponent discusses past and present sea level conditions and on page 10 Vol. III – 17 indicates "facilities will be designed for a sea level rise of 30 cm/century with associated change in tidal heights and storm waves". This does not take into account over a life span (50 years) of the project, the anticipated rise in sea level predicted as a consequence of climate change.

RESPONSE
Please refer to Section 7.0 Revised Project Description, Pages 149 to 153.

Since the Revised Project Description was submitted, the UN Intergovernmental Panel on Climate Change has lowered predictions of how much sea levels will rise in comparison with its last report in 2001. The predictions for sea level rise by 2100 have now been reduced by one half.

Comment from Reviewer 4 - Storm surge protection of the infrastructure and re-claimed land

The physical plant and several sediment ponds will be located behind a preservation zone (Figure 1 of Volume V, Chapter 7). The reclamation diagram indicates that the finished grade quarry will be lower than the preservation zone in elevation (Vol. V, 7.10). Storm surges during extreme storms under the scenario of long-term sea level rise could pose erosion and flooding risks. The report did not provide the information on the elevation of the preservation zone above the datum mean sea level. The document mentioned "Necessary studies including wave height and duration, wind speed, and potential sea level rise of 30 cm/century will be conducted during detailed engineering design to ensure adequate infrastructure over the 50 year life of the project". Wind and wave statistics are given in Appendix 48 and 46 (Vol. IV) but the maximum water level that can be reached due to the combination of storm surge, extreme wind and waves, and long-term sea level rise is not given. Thus it is not clear whether the construction and the height of the preservation zone

C0635-009

9.1.1 Climate

offer enough protection against the storm surge under extreme wind and wave conditions (a) for the infrastructure during the life span of the project, and (b) for the low reclaimed land after decommissioning. If this will be dealt with in the detailed engineering design, for the purposes of the environmental assessment, please indicate what is the predicted maximum water level of storm surges, and that detailed engineering design will ensure the elevation of the preservation zone will be safe against the maximum storm surge.

RESPONSE

Please refer to Bilcon's Revised Project Description in Section 7.0, pages 149 – 153 and response to Panel IR-23 in Section 7.0 in this document.

WP 1541 Fisheries and Oceans Canada

VOLUME V – Chapter 7

Page 15 – The document states, "Blasting will not be conducted during periods of fog or atmospheric inversions and will be delayed until clear weather prevails." What does the proponent consider as fog conditions (e.g., level of visibility) given that there could be "fog" conditions in the area for days or longer.

RESPONSE

Please refer to Bilcon's response to WP 1431 – Panel – IR-5 – in this section.
Please refer to Bilcon's response to WP 1452 - Panel under 9.1.1.1.2 Visibility/Fog.

How long can the blast holes be left filled before they create a safety and/or environmental issue? Would these limitations force the proponent to blast in fog conditions?

RESPONSE

Please refer to Bilcon's response to WP 1431 – Panel – IR-5 – in this section.
Please refer to Bilcon's response to WP 1452 - Panel under 9.1.1.1.2 Visibility/Fog in this submission.

Page 15 – What are the proponent's contingency plans for storm surges in excess of normal averages and storm flood events greater than the 10 year average? These larger more extreme events are likely to be more frequent in the future.

RESPONSE

A storm surge of 1.2 metres has been used in pre-design considerations for those areas of the site that could be affected by a storm surge and high wave action. This is primarily the sedimentation pond complex. With respect to storm flood events, Bilcon has designed the sedimentation ponds for a 100 year event and other parts of the facility such as drainage channels will also be designed for 100 year events. Note has been taken that extreme events are likely to be more frequent in the future.

9.1.1 Climate

Page 15 – Section 7.2.1 Potential Environmental Effects on the Project does not describe in any detail the impact of long periods of fog on blasting, impacts of the weather on shipping (fog, wind, waves, icing, etc.) The proponent should provide this information.

RESPONSE
Please refer to Bilcon's response to WP 1431 – Panel – IR-5 Climate 9.1.1 in this section.

There is no doubt that weather (fog, wind, waves, icing etc) will have an impact on shipping activity. The reality is that the captain of the vessel will make all decisions with respect to the ship leaving the shipping lanes and entering Whites Cove. Bilcon will be bound by the decision of the ship's captain and will have to reorganize activities based on that decision.

VOLUME VI – Chapter 9
9.1. Physical Environment and Impact Analysis

Page 14 – The chart showing hours with visibility appears to be based on 24 hours per day. It is unclear how this information can be used to determine the number of fog-free days during daylight hours (presumably blasting would only take place during daylight hours when sighting of marine mammals would be practical). Is it possible for the proponent to determine the average number of daylight hours per month when the visibility is reduced enough to prevent blasting? As the information is currently presented, for the month of July, the visibility is less than 1 km for approximately 20% of the time on average. How would this potentially affect blasting during this month? Are blasting contractors flexible enough to schedule their activities around weather? How long does it take to fill the holes to be ready for blasting? The proponent should describe in detail the limitations on operations anticipated from fog or other weather conditions.

RESPONSE
Please refer to Bilcon's response to WP 1431 – Panel – IR-5 – in this section.

Please refer to Bilcon's response to the Panel under Section 9.1.1.1.2 Visibility/Fog in this section.

Page 57 – The proponent should describe the predicted impact of wind and wave conditions on any potential marine mammal monitoring for shipping or blasting? If fog reduces the ability to blast 20% of the time in July, what is the impact of fog combined with high wind and waves?

C0635-011

9.1.1 Climate

RESPONSE
Please refer to Bilcon's response to WP 1431 – IR5 – in this section.

Please refer to Bilcon's response to WP 1452 – Panel for expected days of fog in the area in this section.

With respect to marine mammal monitoring in adverse weather conditions regarding shipping, please see responses in Section 9.2.3 - Aquatic Ecology and Section 9.1.7 – Noise and Vibration in this submission.

WP 1630 – Environment Canada
Item #6 Accounting for Climate Change and Sea-level Rise
Information Request

Include all pertinent climatic parameters, such as wind and extreme storm events, in the discussion of baseline climatic conditions, and demonstrate how predicted changes in climatic conditions, along with climate-induced sea level rise, are factored into design considerations for Project components. Include references and criteria used in the analysis.

Review and refine criteria related to weather and climatic conditions under which certain activities will not take place.

RESPONSE
Please refer to EIS Volume VI – Chapter 9.1.1 Climate
Please refer to 7.0 Revised Project Description, pages 149-153.

WP 1625 – Partnership for Sustainable Development
Deficiency Statement 65
EIS Guidelines
10.1.4 – Climate – 'Describe and evaluate the potential impacts of the Project on climate by identifying sources, quantities and frequencies of greenhouse gas (GHG) emissions (carbon dioxide, methane, nitrous oxide and halocarbons) by on-site activities as well as land-based and marine transportation related to Project activities, on an annual basis and over the lifespan of the Project from a regional perspective."
EIS
9.1.1.2 – Analysis – The EIS states 'Based on the nature of the operations taking place at this quarry, carbon dioxide emissions will be the primary focus." Does this statement mean that there will be no GHG emissions, other than carbon dioxide, during the construction, operation and decommissioning of the quarry and marine terminal? This is not clearly stated. If there are other GHG emissions anticipated, such as CH_4, NO_2they must be in included in the EIS and a breakdown provided.

9.1.1 Climate

The EIS does not provide information on the frequency of GHG emissions as required by the EIS Guidelines.

The EIS does not include any information on GHG emissions from marine transportation as required by the EIS Guidelines.
The EIS does not include any information on GHG emissions from vehicular traffic associated with the construction, operation and decommissioning of the quarry and marine terminal. For example, employees traveling to the job site, truck traffic to bring construction materials to the site, truck traffic to bring blasting materials to the site, etc.
The EIS does not address the impact of deforestation required to establish the quarry site on GHG emissions.
The EIS Guidelines require that all information on GHG emissions be provided on an annual basis and over the lifespan of the Project. Table GHG-1 appears to provide some information on carbon dioxide emissions on an annual basis but there is no life cycle GHG analysis provided.

RESPONSE
Please refer to EIS Volume VI, Chapter 9.1.1 and Bilcon's responses to the Panel and Agencies in this section.

Deficiency Statement 66
EIS Guidelines
10.1.4 – Climate – Evaluate how changes in climate could affect the Project, or particular Project components'
EIS
9.1.1 – There is no information provided on how changes in climate could affect the Project, or particular Project components'.

RESPONSE
Please refer to EIS Volume VI, Chapter 9.1.1, Bilcon's responses to the Panel and Agencies in this section and to the Revised Project Description.

Deficiency Statement 79
EIS Guidelines
12.3 – Environmental Protection – 'Describe plans to control air emissions (including greenhouse gases) from the Project."
EIS
11.3 – The cross reference Volume II indicates that plans to control greenhouse gases emitted from the Project are included in section 11.3 of the EIS. Section 11.3 does not provide these plans but further references sections 11.0.1, 11.1, and 11.2. Greenhouse gas emissions are not mentioned in any of the referenced sections.

C0635-013

9.1.1 Climate

RESPONSE
Please refer to EIS Volume VI, Chapter 9.1.1 and Bilcon's responses to the Panel and Agencies in this section.

EIS Guidelines
12.5 – Mitigation Measures - 'Describe measure to reduce GHG emissions from the Project through energy efficiency and reduction measures, as well as the use of alternative energy sources.
EIS
9.1.1.3 – Mitigation – The EIS proposes the composting of wood fibre, leaving trees for as long as possible before removing them, leaving a buffer zone of trees and doing reclamation work as the sole mitigation measures for GHG emissions. There are no references to energy efficiency in the context of mitigating greenhouse gas emissions. Alternative energy sources are not mentioned in the EIS.
In addition to failing to provide a comprehensive mitigation plan, the Proponent has not quantified residual emissions and has not committed to purchasing credits to offset these emissions. The EIS should demonstrate how the proposed Project will be GHG neutral in accordance with Kyoto methodologies.

RESPONSE
Please refer to Section 9.1.1 – Climate, in this section.

C0635-014

9.1.1 Climate

Appendix 1

Climate Errata

C0635-015

C0635-016

DIGBY PRIM POINT

Nova Scotia

Latitude: 44°41' N Longitude: 65°47' W

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Temperature:													
Daily (°C)	-3.4	-2.9	0.4	N	9.6	14.1	N	17.1	13.8	9.7	5.3	0	N
Daily Maximum (°C)	0.1	0.5	3.8	8.1	13.7	18.5	N	21.2	17.6	12.9	8.3	3.5	N
Daily Minimum (°C)	-6.9	-6.3	-3	N	5.4	9.7	N	12.9	10	6.4	2.2	-3.6	N
Extreme Maximum (°C)	16.7	18.5	19	22.5	27	30	29	29	29	23.9	23	18.3	
Date(yyyy/dd)	1976/28	1984/15	1979/06	1983/29	1978/30	1984/09	1982/16+	1983/17	1983/07	1968/03	1982/05	1973/17	
Extreme Minimum (°C)	-22.2	-21.1	-14	-7.5	-2.2	1.7	5.6	6	0.6	-2.5	-10	-20	
Date(yyyy/dd)	1968/08	1972/23	1984/13+	1982/08	1977/09+	1971/06	1970/01	1981/26+	1971/27	1978/30	1978/27	1980/26	
Precipitation:													
Rainfall (mm)	82.3	54.6	73	76.7	108.9	102.4	N	N	N	108.3	N	112.6	N
Snowfall (cm)	62.7	40	28.6	8.7	0.7	0	0	0	0	0.9	2	41.6	185.4
Precipitation (mm)	145	94.6	101.6	85.4	109.7	102.4	N	N	N	109.3	N	154.1	N
Snow Depth at Month-end (cm)	7	4	N	N	N	0	0	0	0	N	N	N	
Extreme Daily Rainfall (mm)	106.2	65.3	47.4	55.2	61	106.9	97.3	79.2	73.7	74.7	74.4	97	
Date(yyyy/dd)	1978/14	1970/03	1980/18	1982/27	1978/09	1968/13	1977/13	1974/17	1975/12	1967/10	1979/03	1967/04	
Extreme Daily Snowfall (cm)	35.8	25.4	24.6	25.2	12.2	0	0	0	0	7.6	6.1	25.7	
Date(yyyy/dd)	1982/14	1967/02	1967/07	1985/01	1972/10	1985/30+	1984/31+	1984/31+	1984/30+	1969/22	1975/25	1970/24	
Extreme Daily Precipitation (mm)	117.6	65.3	50.6	55.2	61	106.9	97.3	79.2	73.7	74.7	74.4	97	
Date(yyyy/dd)	1978/14	1970/03	1979/14	1982/27	1978/09	1968/13	1977/13	1974/17	1975/12	1967/10	1979/03	1967/04	
Degree Days:													
Above 18 °C	0	0	0	N	0.4	N	N	19.2	3.2	N	0.1	0	N
Above 5 °C	2.8	2.6	8.3	N	143.8	N	N	374.2	264.4	N	51.8	11.4	N
Below 0 °C	128.9	106.5	44	N	0	N	N	0	0	N	3.7	60.1	N
Below 18 °C	664.7	591.4	546.1	N	261.5	N	N	48	128.8	N	382	560.4	N
Days With:													
Maximum Temperature	15	15	24	N	31	30	N	31	30	N	29	22	N
Measurable Rainfall	6	5	8	8	9	9	N	N	N	9	N	10	N
Measurable Snowfall	10	6	5	1	*	0	0	0	0	*	*	7	30
Measurable Precipitation	14	10	11	9	9	9	N	N	N	9	N	14	N

http://www.climate.weatheroffice.ec.gc.ca/climate_normals/results_1961_1990_e.html?stationID=1541&province=ALL&stationName=Digby%20Prim%20Point&searchType=BeginsWith

C0635-017

METEGHAN RIVER

Nova Scotia

Latitude: 44° 16' N Longitude: 66° 8' W

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Temperature:													
Daily (°C)	-3.1	-3.2	0.4	4.6	9.2	13.2	16	16	13.4	9.5	5.1	-0.3	6.7
Daily Maximum (°C)	0.4	0.3	3.9	8.4	13.2	17.1	19.8	19.8	17.2	13	8.3	3.2	10.4
Daily Minimum (°C)	-6.7	-6.8	-3.1	0.8	5.2	9.2	12.2	12.2	9.4	5.9	1.9	-3.9	3
Extreme Maximum (°C)	17.2	18.3	18	20.5	24	27.8	29.4	30.6	28.3	23.9	22	18.3	
Date(yyyy/dd)	1950/04	1940/18	1977/30	1983/29	1982/31+	1972/23	1949/30+	1944/06	1961/25	1943/02	1982/05	1973/17	
Extreme Minimum (°C)	-21.1	-21.7	-19.4	-8.3	-5	0	2.8	3.3	-1.7	-6.1	-12.2	-20.6	
Date(yyyy/dd)	1943/22	1943/16	1948/14	1946/01	1943/02	1940/24	1965/07	1940/31+	1980/29+	1940/17	1958/30	1942/20	
Precipitation:													
Rainfall (mm)	72.6	66.4	74.8	94.2	97.5	91.6	82	81.5	84.2	99.7	122.9	109.3	1076.8
Snowfall (cm)	33.4	27.3	18.4	4.6	1	0	0	0	0	0.5	2.6	26.1	113.9
Precipitation (mm)	108.2	93.7	94.8	97.9	98.5	91.6	82	81.5	84.2	100.2	125.5	138.2	1196.4
Snow Depth at Month-end (cm)	N	N	N	N	0	0	0	0	0	0	0	N	
Extreme Daily Rainfall (mm)	75.4	74.9	77.5	61	78.7	78.4	120.7	74.4	94	81.8	83.1	92.7	
Date(yyyy/dd)	1949/05	1979/26	1953/13	1973/28	1962/31	1968/13	1942/03	1983/31	1981/22	1963/29	1957/01	1967/04	
Extreme Daily Snowfall (cm)	25.4	26.4	22.9	22.9	13	0	0	0.3	0	7.6	22.9	25.4	
Date(yyyy/dd)	1978/20	1976/15	1939/13	1946/21	1963/10	1986/30+	1985/31+	1938/31	1985/30+	1974/19	1955/20	1939/30	
Extreme Daily Precipitation (mm)	75.4	74.9	77.5	61	78.7	78.4	120.7	74.4	94	81.8	83.1	92.7	
Date(yyyy/dd)	1949/05	1979/26	1953/13	1973/28	1962/31	1968/13	1942/03	1983/31	1981/22	1963/29	1957/01	1967/04	
Degree Days:													
Above 18 °C	0	0	0	0	0	1.2	6.4	5.7	1.6	0.1	0	0	15
Above 5 °C	2.6	1.5	7.7	29.6	132	245.3	341.6	341	250.6	142.7	49.2	10	1554
Below 0 °C	121.1	110.2	41.9	2	0	0	0	0	0	0	3.2	63.9	342
Below 18 °C	656.6	599.3	545.7	401.7	273.1	145.9	67.8	67.7	141	264.5	385.7	568.4	4118
Days With:													
Maximum Temperature	16	14	25	30	31	30	31	31	30	31	29	22	321
Measurable Rainfall	6	5	7	10	11	10	8	8	8	10	12	10	107
Measurable Snowfall	8	6	4	1	*	0	0	0	0	*	*	6	27
Measurable Precipitation	13	10	11	11	11	10	8	8	8	11	13	15	129

http://www.climate.weatheroffice.ec.gc.ca/climate_normals/results_1961_1990_e.html?stationID=1555&province=ALL&stationName=Meteghan%20River&searchType=BeginsWith

Weymouth Falls, Nova Scotia

Latitude: 44° 24' N Longitude: 65° 57' W

1971 - 2000

Temperature	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Daily Average (°C)	-3.7	-3.6	0.3	5.4	10.7	15.4	18.4	18.1	14.0	9.1	4.5	-0.7	7.3	C
Standard Deviation	1.9	2.0	1.3	1.4	1.0	0.8	1.1	1.0	1.0	1.3	1.2	2.5	1.4	C
Daily Maximum (°C)	0.3	0.6	4.6	10.0	16.1	20.8	23.7	23.4	19.1	13.7	8.2	3.2	12.0	C
Daily Minimum (°C)	-7.8	-7.8	-4.1	0.7	5.3	9.9	13.1	12.7	8.8	4.5	0.8	-4.5	2.6	C
Extreme Maximum (°C)	19.0	17.5	22.0	24.0	30.6	33.0	32.5	33.0	29.4	25.5	23.0	18.3		
Date (yyyy/dd)	1995/15	1984/15	1998/28	1987/20	1977/24	1997/30	1988/11	1993/27	1973/01	1990/12	1996/09	1973/17		
Extreme Minimum (°C)	-24.4	-28.3	-23.5	-11.7	-5.6	-1.1	2.8	2.5	-3.0	-6.7	-13.0	-25.0		
Date (yyyy/dd)	1976/20	1967/04	1987/04	1967/13	1966/08+	1967/01	1965/07	1978/25+	1980/25	1974/22	1978/23	1989/30		
Precipitation:														
Rainfall (mm)	78.0	62.9	84.9	91.4	106.7	91.9	97.4	79.4	111.9	104.3	120.4	107.9	1137.1	A
Snowfall (cm)	54.0	34.8	24.5	5.5	0.8	0.0	0.0	0.0	0.0	0.5	4.9	33.2	158.2	A
Precipitation (mm)	131.9	97.7	109.5	97.0	107.5	91.9	97.4	79.4	111.9	104.8	125.2	141.0	1295.2	A
Average Snow Depth (cm)	12	12	6	0	0	0	0	0	0	0	0	4	3	D
Median Snow Depth (cm)	9	12	5	0	0	0	0	0	0	0	0	3	2	D
Snow Depth at Month-end (cm)	12	11	1	0	0	0	0	0	0	0	0	8	3	C
Extreme Daily Rainfall (mm)	46.4	65.5	67.6	71.1	69.9	149.9	108.0	59.0	104.4	69.8	59.6	100.8		
Date (yyyy/dd)	1979/29	1970/03	1998/09	1976/22	1966/28	1968/13	1977/13	1983/31	1999/22	1983/13	1994/01	1967/04		
Extreme Daily Snowfall (cm)	30.5	30.5	37.0	27.0	15.2	0.0	0.0	0.0	0.0	12.7	28.0	33.0		
Date (yyyy/dd)	1968/07	1967/02+	1993/11	1997/01	1972/09	1965/01+	1965/01+	1965/01+	1965/01+	1969/22	1987/26	1970/24		
Extreme Daily Precipitation (mm)	48.0	65.5	67.6	71.1	69.9	149.9	108.0	59.0	104.4	69.8	59.6	100.8		
Date (yyyy/dd)	1981/07	1970/03	1998/09	1976/22	1966/28	1968/13	1977/13	1983/31	1999/22	1983/13	1994/01	1967/04		
Extreme Snow Depth (cm)	96.0	69.0	69.0	30.0	3.0	0.0	0.0	0.0	0.0	15.0	26.0	64.0		
Date (yyyy/dd)	1981/13	1987/11	1967/07+	1967/01	1992/06	1965/01+	1965/01+	1965/01+	1965/01+	1974/20	1989/24	1970/27+		
Days with Maximum Temperature:														
<= 0 °C	15.5	14.0	6.3	0.41	0.0	0.0	0.0	0.0	0.0	0.0	1.4	9.0	46.6	C
> 0 °C	15.5	14.3	24.7	29.6	31.0	30.0	31.0	31.0	30.0	31.0	28.6	22.0	318.7	C
> 10 °C	2.0	1.5	4.3	14.2	27.9	30.0	31.0	31.0	29.8	24.1	10.1	3.7	209.4	C
> 20 °C	0.0	0.0	0.07	0.48	5.4	17.7	27.0	26.1	11.5	2.0	0.17	0.0	90.4	C
> 30 °C	0.0	0.0	0.0	0.0	0.04	0.08	0.52	0.42	0.0	0.0	0.0	0.0	1.1	C
> 35 °C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	C
Days with Minimum Temperature:														
> 0 °C	3.3	2.8	5.8	15.4	26.8	29.9	30.6	31.0	29.0	23.5	15.6	6.1	219.7	C
<= 2 °C	29.9	26.9	27.9	20.5	7.4	0.88	0.0	0.0	2.6	11.2	18.9	27.1	173.2	C
<= 0 °C	27.7	25.4	25.2	14.6	4.2	0.08	0.0	0.0	1.0	7.5	14.4	23.9	144.0	C
< -2 °C	24.8	22.7	19.0	6.7	0.54	0.0	0.0	0.0	0.08	2.4	8.0	18.5	102.7	C
< -10 °C	11.0	10.0	4.2	0.07	0.0	0.0	0.0	0.0	0.0	0.0	0.09	5.3	30.6	C
< -20 °C	0.57	0.39	0.21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.09	1.3	C
< - 30 °C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	C
Days with Rainfall:														
>= 0.2 mm	6.4	5.6	8.0	9.8	10.9	9.7	8.7	7.7	8.9	10.4	11.0	9.3	106.3	A
>= 5 mm	4.6	3.6	5.0	5.2	6.1	5.4	4.8	4.4	5.0	5.4	6.8	5.8	62.1	A
>= 10 mm	3.1	2.4	2.9	3.3	3.9	3.4	3.1	2.9	3.7	3.8	4.5	3.5	40.5	A
>= 25 mm	0.66	0.60	0.67	0.70	0.97	0.83	1.0	0.76	1.3	1.1	1.2	1.2	11.0	A
Days With Snowfall:														
>= 0.2 cm	8.1	5.5	3.8	0.80	0.10	0.0	0.0	0.0	0.0	0.07	0.86	5.0	24.2	A
>= 5 cm	4.2	2.6	2.1	0.40	0.07	0.0	0.0	0.0	0.0	0.07	0.25	2.6	12.3	A
>= 10 cm	1.8	1.1	0.90	0.20	0.03	0.0	0.0	0.0	0.0	0.03	0.14	1.1	5.3	A
>= 25 cm	0.13	0.07	0.07	0.03	0.0	0.0	0.0	0.0	0.0	0.0	0.04	0.04	0.38	A
Days with Precipitation:														
>= 0.2 mm	13.5	10.3	10.7	10.2	10.9	9.7	8.7	7.7	8.9	10.5	11.5	13.2	125.7	A
>= 5 mm	8.5	6.2	6.9	5.6	6.2	5.4	4.8	4.4	5.0	5.5	7.0	8.1	73.5	A
>= 10 mm	5.0	3.5	4.0	3.5	4.0	3.4	3.1	2.9	3.7	3.8	4.8	4.9	46.5	A
>= 25 mm	0.86	0.70	0.90	0.77	0.97	0.83	1.0	0.76	1.3	1.1	1.3	1.4	11.8	A
Days with Snow Depth:														
>= 1 cm	19.0		11.7	0.67	0.04	0.0	0.0	0.0	0.0	0.11	1.1			D
>= 5 cm	16.1		9.7	0.39	0.0	0.0	0.0	0.0	0.0	0.11	0.52			D
>= 10	12.3		7.8	0.28	0.0	0.0	0.0	0.0	0.0	0.07	0.38			D
>= 20	7.4		3.9	0.17	0.0	0.0	0.0	0.0	0.0	0.0	0.14			D
Degree Days:														
Above 24 °C	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.3	0.0	0.0	0.0	0.0	0.7	C
Above 18 °C	0.0	0.0	0.0	0.0	1.0	10.6	41.6	37.8	5.6	0.6	0.1	0.0	97.2	C
Above 15 °C	0.0	0.0	0.0	0.3	7.5	44.1	111.2	103.0	28.8	4.6	0.6	0.0	300.0	C
Above 10 °C	0.9	0.0	1.4	8.0	56.3	163.0	262.1	250.2	125.5	37.7	7.4	1.0	913.5	C
Above 5 °C	5.1	2.7	12.6	50.6	180.2	311.3	417.1	405.2	269.2	133.9	42.7	10.4	1840.9	C
Above 0 °C	26.2	23.5	61.7	167.2	333.7	461.3	572.1	560.2	419.1	282.5	143.8	54.2	3105.5	C
Below 0 °C	143.3	125.8	54.0	2.4	0.0	0.0	0.0	0.0	0.0	0.1	6.3	74.9	406.8	C
Below 5 °C	277.1	246.4	159.9	35.8	1.4	0.0	0.0	0.0	0.0	6.5	55.2	186.1	968.5	C
Below 10 °C	428.0	385.1	303.7	143.1	32.6	1.7	0.0	0.0	6.4	65.2	169.9	331.7	1867.4	C
Below 15 °C	582.0	526.4	457.3	285.5	138.8	32.8	4.1	7.7	59.7	187.2	313.1	485.8	3080.2	C
Below 18 °C	675.0	611.2	550.3	375.2	225.2	89.3	27.6	35.6	126.5	276.1	402.6	578.8	3973.4	C

http://www.climate.weatheroffice.ec.gc.ca/climate_normals/results_e.html?Province=NS%20%20&StationName=&SearchType=&LocateBy=Province&Proximity=25&ProximityFrom=City&StationNumber=&IDType=MSC&CityName=&ParkName=&LatitudeDegrees=&LatitudeMinutes=&LongitudeDegrees=&LongitudeMinutes=&NormalsClass=A&SelNormals=&StnId=6505&

9.1.2 Geology and Hydrogeology

EIS Reference: EIS Volume VI, Chapter 9, Section 9.1.2, and 9.1.3 and 9.1.4

INDEX OF COMMENTS

9.0 Environments and Impact Analysis

9.1 Physical Environment and Impact Analysis

9.1.2 Geology and Hydrogeology

C0635-019

9.1.2 Geology and Hydrogeology

WP 1431 – Joint Review Panel

Issue
The planned settling ponds will receive fine basalt that will contain an elevated copper content. The resulting sediments will leach into the overlying water which can then migrate into the ground water below or spill into the nearby intertidal zones.

Information Request - IR-3
Provide the details and results of leaching tests on finely ground basalt (grain size equivalent to the material in the settling ponds) with a composition typical of the quarried material and dissolution rates of metals (particularly copper) for this material to allow the potential for the transfers outlined above to be quantified. Propose mitigation measures to minimize the risks of adverse effects.

EIS Coverage
The sediment retention ponds (settling ponds) are addressed in several sections of the EIS (e.g., 7.0; 9.1.2; 9.1.4; 9.1.6; 9.3.19). The issue of contamination of groundwater is addressed in Section 9.1.3 of the EIS.

Response to the Panel
The results of leaching tests for basalt samples from the site, as performed by Maxxam Analytics, Inc., are attached to this document in AMEC Earth & Environmental Ltd. – Copper in Section 12. The following is a summary of the results for copper:

Sample ID	Initial Cu (mg/kg)	Initial pH	Final pH	Leached Cu (ug/L)	Percent Leached
N03377	170	10	4.8	21	0.012
O87412	39	9.7	4.9	ND	0.051
O87419	230	9.7	4.9	480	0.209
O87421	91	9.6	4.9	35	0.038
Average	132	9.8	4.9	139	0.078

ND: not detected at RDL = 20 ug/l, used in calculating average.

For further details on this issue including mitigation measures, please see response to the Panel on page 9 in Section 9.2.3 – Aquatic Ecology – Marine in this submission.

C0635-020

9.1.2 Geology and Hydrogeology

Issue
A contradiction appears to exist between statements made by Jacques Whitford, the Pennsylvania consultant and some of the water table drawings presented.

Information Request (IR-10)
Provide a clear delineation of the vertical placement of the water table throughout the project site. Explain the apparent contradictions concerning the water table and provide the data used to reach conclusions about where the water table resides. Provide detailed profiles showing the relationship between the working quarry face at each development phase and the water table.

RESPONSE
There were some differences in the conclusions in the JWEL (2002) and the MVCI (2005) studies. Such differences should be expected because the stage and scope of the study assignments were different. Scientific findings evolve as data gathering and investigation is expanded and refined, particularly in the inexact sciences such as hydrogeology and medicine.

JWEL was directed to conduct a preliminary investigation, which included identifying any potential groundwater concerns that could be associated with mining. The preliminary investigation was an outgrowth of literature research and a precursory inspection of the site. JWEL did not have an opportunity to examine the core data, collaborate with Provincial experts, inspect/investigate comparable quarry operations, conduct geology field mapping, interpret monitoring well data, conduct modeling, etc.

MVCI was directed to supplement and expand JWEL's preliminary study and to vet the salient issues raised by the general public, the neighbours, and local, provincial, and federal regulators/experts. MVCI's study was an outgrowth of:

- Regional and local field investigations conducted in collaboration with recognized experts at the Nova Scotia Department of Natural Resources (NSDNR).
- Analysis of the data obtained from the four core holes and the six monitoring wells drilled by Bilcon subsequent to the publication of the JW report.
- Discussions and meetings with geology, mining and environmental experts at the Nova Scotia Department of Natural Resources (NSDNR) and the Nova Scotia Department of Environment and Labour (NSDEL).
- Inspection and/or analysis of numerous quarry operations in Nova Scotia and New Brunswick with NSDNR and NBDNR geology and quarry experts
- Review of geological, hydrogeological, mining, and environmental reports, maps, and databases published by the NSDNR, NSDEL, etc.

C0635-021

9.1.2 Geology and Hydrogeology

- Review of the public comments regarding the draft guidelines for the Whites Point Quarry Environmental Impact Study.
- Discussions with water well drillers, water purveyors, and water consumers in Nova Scotia and New Brunswick.
- Review and analysis of the Jacques Whitford report.
- Review of NSDEL's Terms and Conditions for Environmental Assessment Approval for Groundwater Resources for comparable projects .
- Discussions with the individuals and groups that attended the "open house" held on Digby Neck in November 2005. The local knowledge and experience gleaned from these discussions helped MVC to better understand and address areas of public concern.
- Experience with comparable quarry projects in the United States, Canada, and elsewhere. Specifically, hydrogeologically sensitive water supply, enhancement, and protection projects located in, and near, construction aggregate operations, which included clients such as State and city governments and conservation groups like The Nature Conservancy and the Trust for Public Land.

Bilcon recently retained Conestoga-Rovers & Associates (CRA), an internationally recognized and locally based hydrogeological consulting company, to prepare an end-stage supplement to the JWEL and MVCI reports. CRA conducted hydrogeological tests and modeling to address the theoretical topics raised by two of the technical experts who reviewed the EIS. CRA's findings are discussed in the hydrogeological supplement to the EIS. As expected, because of the stage and scope the CRA investigation, some of CRA's findings differ from Jacques Whitford's and MVCI's conclusions.

Detailed profiles, which show the relationship between the working quarry face at each development phase and the water table, were recently submitted to the Panel in the Revised Project Description. The data used to compile the profiles are included as Appendix1 in this section. The profiles delineate the vertical displacement of the water table throughout the project site. The differences on the profiles submitted by JW and MVCI are simply a reflection of the differences in the stage and scope of the study assignments.

Health Canada prepared a table contrasting several of the JWEL and MVCI conclusions. The salient topics are presented below along with a brief comment that addresses the reason for the difference in the conclusion.

TOPIC	COMMENT
Gradient of the wells in relationship to the quarry	The gradient of the wells in relationship to the quarry is clearly shown on the cross-sections. See also the CRA findings and conclusions in Section 12 of this submission.

C0635-022

9.1.2 Geology and Hydrogeology

Blasting and well siltation	See the response dealing with blasting and turbidity in this section.
Relationship of the quarry to the groundwater table	The relationship of the quarry to the groundwater table is shown on the cross-sections. See also the CRA findings and conclusions in Section 12 of this submission.
Impact of the quarry on the local wells.	See also the CRA findings and conclusions in Section 12 of this submission.

WP 1452 – Joint Review Panel

Geology and Hydrogeology
9.1 Physical Environment and Impact Analysis
9.1.2 Geology
The Panel requires better scientific data on site geology and hydrogeology to assess the possible effects of quarrying on the environment.

The Proponent states that quarry operations will not intersect or breach the middle basalt flow unit (identified as an aquifer). Keeping in mind that the tops of basalt flows can show a significant amount of local topography (i.e., the intersection of flows cannot be delineated by planar interpolation/extrapolation from a few boreholes), the Panel requires additional detail in the mining plan (not just conceptual diagrams) as to how the Proponent will avoid intersecting the middle flow unit.

What thickness of basalts in the upper flow will remain as a cap on the middle flow unit? What mitigation strategies will the Proponent employ if the middle flow unit is inadvertently breached? (The precautionary approach suggest planning for such worst-case scenarios.)

Explain the contradiction between the claim that quarrying will not intersect the middle unit or the water table(Figure 6A) even though the final site drawing (Figure 7 in map volume) shows that such an intersection could have occurred.

RESPONSE
The Panel's assertion that the tops of basalt flows can show a significant amount of local topography is correct. One of the objectives of the geologic investigation conducted by Bilcon was to test this assertion by delineating the structure and the stratigraphy of the UFU and MFU and the contact between the units.

Ten boreholes were drilled. Eight holes were drilled on the Bilcon property. Five of these holes penetrated the contact between the UFU and MFU unit. The contact was not penetrated in the remaining holes because it dips and plunges below sea level to the

C0635-023

northwest. Core data were analyzed and sampled by MVC and Dr. Kontak, Ph.D., Regional Geologist with the NSDNR, Minerals and Energy Branch, the recognized expert on the North Mountain Basalt. The drill data were supplemented with local and regional field work conducted in December 2004 and May 2005 by MVC and Dr. Kontak. The JRP is encouraged to examine the core data, the drill samples, and the field data. The subsurface structure and the outcrop of the UFU-MFU contact were mapped. The findings are recapped below.

The stratigraphy of the upper portion of the MFU can be variable because it can contain multiple flows. The stratigraphy of the lower portion of the UFU appears to be consistent.

The outcrop and subsurface drill data indicate that the local paleotopography of the upper portion of the MFU is relatively subdued and that the UFU-MFU contact is fairly planar and predictable. Nonetheless, Bilcon will implement the following measures in advance of quarrying to ensure that the MFU is not intersected:

- Additional boreholes will be drilled to refine the subsurface delineation of the contact between the UFU and the MFU.
- Blast hole samples will be examined prior to blasting to provide a check of the geologic horizon intersected by the drill holes.
- The structural geology and stratigraphy of the quarry faces will be examined on a routine basis.
- A 1 to 2 metre cap of the UFU will be left over the MFU.

In the unlikely event that the MFU is inadvertently intersected during quarrying, the breach will be localized and limited by the size of the blast, or the extent of the blast hole layout. Bilcon's experts and independent reviewers have indicated that such a localized breach will not adversely impact the groundwater regime. Nonetheless, in the unlikely event that the MFU is inadvertently intersected, Bilcon will adjust its blast depth.

The chemistry of the basalts is currently characterized by only three analyses from different levels of a single borehole. Copper values, which are of special concern to the assessment, range from 27 to 170 ppm from those three samples. (Considerably higher values have been determined by others in tests of the North Mountain Basalts.) Provide statistically meaningful averages, especially for copper, from the basalts that are to be quarried, along with the range of values encountered. Document the sampling protocol used for the analysis. (For this purpose, "statistically meaningful" may be defined as +/- 10% at 95% confidence level of the measured statistic.)

C0635-024

9.1.2 Geology and Hydrogeology

RESPONSE

Field surveys and borings found the Upper Flow Unit (UFU) to be a uniform, hard, massive, vesicle free, medium dark gray to black basalt. The thickness of the upper flow unit reportedly varies from 0 to 154 m deep. Basalt bedrock samples from core #1 were laboratory analyzed by PSC Analytical Services for baseline metals. Three rock samples from depths of 5 m, 33 m, and 61 m were analyzed – see Appendix 2 for analytical test results for metals in the bedrock.

The results of copper analysis of the basalt from core #1 are 27, 48, and 170 mg/kg for depths 5, 33, and 61 metres respectively.

In order to characterize basalt and determine a "statistically meaningful" average for any constituent there would be a requirement for extensive boring and sampling. It was stated that "considerably higher values have been determined by others in tests of the North Mountain Basalts". Available data on North Mountain Basalt could be used to estimate a range of values that would be expected to occur, as well as estimate the sampling size. An estimate of the sampling effort that would be required to meet the suggested +/- 10% at 95% probability, statistically meaningful average, was completed using North Mountain Basalt glacial till data from NSDME (1982) and with data available from the Ocean Drilling Program for basalt off the coast of Greenland (Hooper et al. 1999). Based on these data roughly 60 to 66 samples would be necessary to allow for the derivation of a "statistically meaningful" average. As this is an extreme amount of effort, it is suggested that the available data are evaluated. In addition, Bilcon of Nova Scotia Corporation has undertaken a reduced sampling program with 3 additional samples, one from each of 3 boreholes in the basalt of the UFU (since this is the unit to be mined). Bilcon had these basalt samples from other cores in storage and has initiated the proposed analysis. Preliminary results indicate copper levels of 39, 230, and 91 mg/kg for depths of approximately 36, 34, and 16 metres respectively. The sampling protocol used for the sampling and analysis will be described or included with any report of the results.

9.1.3 Hydrogeology

Watershed Delineation

All plans and maps show both the surface water divide and groundwater divide coinciding with the maximum topographic elevations. However, data provided indicate that the middle flow is a confined aquifer that recharges in the valley to the east of the property (designated as the Little River surface watershed).

Based on sound scientific analysis, the mining plan and the wells on adjacent properties. provide concrete evidence either that the two divides coincide or properly delineate the groundwater divide. If the two do not coincide, re-evaluate the effect on the mining plan and the wells on adjacent properties.

C0635-025

9.1.2 Geology and Hydrogeology

RESPONSE

Plans and maps in the EIS show both the surface water divide and groundwater divide coinciding with the maximum topographic elevations. The groundwater regime and the hydrostratigraphic units are shown on Figure 6A and Figure 6B in EIS Map Volume III. These two cross sections depict a snapshot of the water table, the hydraulic gradient etc. in the fall of 2005. The data show that the local water table mimics the topography. The well monitoring data collected since September 2005 reinforces this position and Figures IR8-1 to IR8-7 reflect the location of the water table based on all the data collected.

Groundwater Usage

The EIS states that groundwater will not be used at any point for the quarry operations. Provide quantitative information in the water budget to verify this statement. Include conditions for exceptionally arid summers derived from the climate data.

The Hydrologic Budget Analysis by CRA (Reference Documents V.5 Tab 30) appears to be based solely on average historic climate records. The Panel requires an analysis that also considers extremes.

RESPONSE

Please refer to Water Budget in Section 7.0 Revised Project Description and Appendix 1 – CRA Report, November 17th, 2007 in the revised Project Description.

Water Table Data

In section 9.1.3.2 water table data was obtained from "existing bore holes, the six monitoring wells and neighbouring wells" in the fall of 2005. Provide the data obtained during this survey.

The chemistry of a single groundwater sample from the property is inadequate to establish a baseline. Provide chemical analyses for a representative set of groundwater samples.

RESPONSE

Please refer to Bilcon's Revised Project Description in Section 7.0 Four boreholes were drilled and cored during the spring of 2002 (the "NS-02" series). Well #2 and #3 were subsequently vandalized and could not be used for groundwater monitoring.

Six monitoring wells were drilled in the fall of 2005 (the "MW" series). Wells #1 and #6 were vandalized in early 2006.

The monitoring data obtained from Borehole #1 and #4 and the six monitoring wells through December 31, 2005 is provided in Appendix 1 in this section.

C0635-026

9.1.2 Geology and Hydrogeology

Hydrogeology of Upper Flow Unit

The EIS concludes that the upper flow unit is "dry"(i.e., above the water table). An alternative perspective would suggest that this unit is fracture-dominated and that water storage and transport in it occurs along both horizontal and vertical fractures as well as isolated vertical shear zones. Such flow would be more rapid and localized than due to the pore spaces in the middle flow unit. The Preliminary Hydrogeological Assessment by Jacques Whitford (Reference Documents V.5 Tab 28) states that "This observation suggests the presence of possible perched water table conditions associated with shallow bedrock fractures, and a downward vertical hydraulic gradient."

Provide a hydrogeological analysis that fully evaluates the role of fracturing on the hydrogeological properties of the upper flow unit.

Impact of Blasting on Groundwater

Pg 28, Bullet 3 asserts that blasting will not affect groundwater quality and quantity. Provide specific information on the studies that have been used to evaluate the effects of blasting on groundwater supplies and wells. Describe their relevance and applicability to this site. Identify the "comparable mines" at which no change in groundwater quality or quantity was observed as a result of blasting.

RESPONSE

A concern has been raised regarding the effect of blasting on the quality and quantity of the local water supply. This response will summarize relevant research and projects (see "Bibliography" and "Relevant Aggregate Projects and Mines") pertaining to the impact of blasting on water wells and aquifers. Several sections of the response have been excerpted from the paper titled "Blasting Near Domestic Wells-Facts and Myths" (Rudenko, et al., 2003).

Blasting Effects on Groundwater Movement

There have been many studies on the impact of blasting on aquifers. Bond (1975), Berger (1980), Beaver (1984), etc. have all concluded that "there is no significant long-term mechanical change in the aquifer that can be attributed to blasts detonated at distances greater than 500 feet" (Rudenko, et al., 2003). These studies are relevant to the Whites Point project because they were conducted on shallow aquifers located close to the blasting source. The Berger (1980) study was conducted primarily in low yield (<1 gpm), fractured aquifers.

Blasting Effects on Bedrock Fracturing

There must be permanent rock deformation in order to impact a well by fracturing of the rock strata. The U.S. Bureau of Mines, military agencies, private consultants, etc. have conducted extensive research and studies on this topic. This research has shown "when an explosive

C0635-027

charge is confined in the ground and detonated, the volume of material that is permanently deformed is ideally cone-shaped. The cone-shape of deformation has the point of the cone within the rock at the location of the explosive charge, and the circular opening of the cone is at the ground surface. Additionally, these studies have shown that the radius of the zone of deformation at the ground surface is no more than the blast hole depth and that the rock outside this zone is undamaged. This fact is supported by the daily drilling and blasting process at most blasting operations. The reason blast holes are drilled in a pattern a few feet from each other is because the explosive energy is insufficient to fracture the rock at a great distance from the blast hole" (Rudenko, et al., 2003).

Blasting Effects on Wells

Siskind (2000) notes that there is no scientific basis for claims of physical damage to wells from vibrations close to or below the thresholds for cosmetic plaster damage. He notes that "Outside the immediate blast zone of a few dozen blast-hole diameters, there is no permanent ground displacement or block movement and consequently no differential displacements. Nonetheless, some field studies have examined these issues despite the highly unlikely probability of damage...Results were as expected and also consistent with theory. Based on the studies...it is difficult to conceive of a situation where 2 in/s would not be a conservative safe-level criteria for water wells, utilities, and similar structures".

Turbidity

Blast vibrations can sometimes cause local and temporary turbidity in wells. However, the "blast vibrations do not permanently degrade ground water quality...This problem is only temporary and aesthetic. It is not the result of improper blasting procedures, and not suggestive of any physical damage to either the aquifer or the well" (Rudenko, et al., 2003). It should be noted that Bilcon was unable to document any anecdotal or literature reports of well turbidity for projects with blasting parameters similar to those of the Whites Point project.

References

Berger, P.R. (1980), "Survey of Blasting Effects on Groundwater Supplies in Appalachia", U.S. Department of Interior, Bureau of Mines, Washington, D.C.

Beaver, F.W. (1994), "The Effects of Seismic Blasting on Shallow Water Wells and Aquifers in Western North Dakota, Masters Thesis", University of North Dakota.

Bond, E.W. (1975), "A Study of the Influence of Seismic Shotholes on Groundwater and Aquifers in Eastern Montana", Montana Bureau of Mines, Butte, MT.

Lizak, J., O'Reilly, S. and Schmitz, G., (1998), "Aquifer Protection In and Near Aggregate Operations", National Stone Association Regional Conference Proceedings.

C0635-028

9.1.2 Geology and Hydrogeology

Robertson, D.A. (1988), "Should blasting take the blame for damaged wells?", Pit and Quarry.

Rudenko, D., Love, G., and Novotny, T., (2002), "Blasting Near Domestic Water Supplies – Facts and Myths", Vibra-Tech Engineers, Inc., 4th Blasting Vibration Technical Conference.

Siskind, D.E., (2000), "Vibration Effects on Structures", 3rd Biennial Vibration Conference.

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Straw, J. and J.P. Shinko, (1994), "Blast Vibration Effects Upon a Deep Injection Well and the Reduction of Ground Vibration Over Depth", Proceedings 10th Conference on Explosives and Blasting Research, International Society of Explosives Engineers.

Relevant Aggregate Projects and Mines

The contributors to the EIS have direct experience with water supply, enhancement, and protection projects located in, and near, aggregate operations in the United States, Canada, and elsewhere. These projects include numerous groundwater and water supply investigations dealing with aggregate operations in environmentally sensitive locales.

The contributors also inspected and/or analyzed quarry operations in Nova Scotia and New Brunswick with NSDNR and NBDNR quarry and hydrogeology experts. Investigation of these quarries is relevant to the proposed project because, like the Whites Point quarry, there are wells in proximity to the quarry and they occur in crystalline bedrock. Most of the quarries have been operating and monitored for at least fifteen years. The practical insight obtained from the experience at these quarries has been integrated into the EIS.

Some of the aggregate projects and mines located in the Canadian Maritime Provinces and the northeastern U.S., which are relevant to the Whites Point project, are listed below. Virtually all of these operations are located in areas that are more hydrogeologically sensitive than the Whites Point site. Like Whites Point, many of the quarries are located in basalt. The Martin Marietta (Mulgrave, Nova Scotia, Canada) and Florida Rock (St. Andrew, New Brunswick, Canada) quarries are large operations located on tidewater, which export in excess of 3 million tons of stone per year.

Quarry Operator	**Location**
Atcon	Belledune, New Brunswick, Canada
Blanchard	Belledune, New Brunswick, Canada
Florida Rock	St. Andrew, New Brunswick, Canada
RTL	Belledune, New Brunswick, Canada

C0635-029

9.1.2 Geology and Hydrogeology

Lafarge	Mulgrave, Nova Scotia, Canada
Martin Marietta Materials	Mulgrave, Nova Scotia, Canada
Mosher Limestone	New Harris, Nova Scotia, Canada
NRL	Georgeville, Nova Scotia, Canada
Parker Mountain	Digby Neck, Nova Scotia, Canada
Cemex	Sparta, New Jersey, USA
Eastern Concrete Products	Hamburg, New Jersey, USA
Pinnacle Materials	Glen Gardner, New Jersey, USA
Stavolla	Chimney Rock, New Jersey, USA
Stavolla	Oldwick, New Jersey, USA
Tilcon	Byram, New Jersey, USA
Tilcon	Millington, New Jersey, USA
Tilcon	Mount Hope, New Jersey, USA
Tilcon	Oxford, New Jersey, USA
Tilcon	Pompton Lakes, New Jersey, USA
Tilcon	Riverdale, New Jersey, USA
Traprock	Kingston, New Jersey, USA
Traprock	Lambertville, New Jersey, USA
Traprock	Moores Station, New Jersey, USA
Traprock	Pennington, New Jersey, USA
Weldon	Fanwood, New Jersey, USA
Weldon	Lake Hopatcong, New Jersey, USA
3M	Hillsborough, New Jersey, USA
CRH	Columbus, Ohio, USA
Olen	Hilliard, Ohio, USA
Olen	Columbus, Ohio, USA
Wagner	Sandusky, Ohio, USA
Eastern Industries	Kunkletown, Pennsylvania, USA
Eastern Industries	Kutztown, Pennsylvania, USA
Eastern Industries	Little Gap, Pennsylvania, USA
Eastern Industries	Nazareth, Pennsylvania, USA
Eastern Industries	Ormrod, Pennsylvania, USA
Eastern Industries	Whitehall, Pennsylvania, USA
Huss	Andreas, Pennsylvania, USA
ISP	Blue Ridge Summit, Pennsylvania, USA
Lafarge	Northampton, Pennsylvania, USA
Penroc-Consolidated	York, Pennsylvania, USA
Penroc-Ensminger	York, Pennsylvania, USA
York Building Products	York, Pennsylvania, USA
Renda	Palmerton, Pennsylvania, USA

C0635-030

9.1.2 Geology and Hydrogeology

Saltwater Intrusion
The EIS concludes (Pg 28, Bullet 6) that "Construction of aggregate mines have been used in coastal areas to prevent saltwater intrusion". Provide evidence that this concept applies to the Project.

RESPONSE
The conclusive evidence that the concept applies to the Project would be an outgrowth of a large scale collaborative investigation involving not only Bilcon but also various regulatory agencies, the Provincial and County governments, local regulated and unregulated water purveyors, etc. Such an investigation is beyond the scope of the EIS. The concept was mentioned simply to initiate a strategic dialogue about a possible water supply challenge unrelated to the Project, and a potentially feasible remedy for the problem.

Groundwater Mitigation
The Proponent says that it will use four existing bore holes along the access road (three of which have been vandalised and are not usable) for monitoring.

What is the Proponent's plan for replacing the vandalised bore holes to obtain the information?

RESPONSE
Wells that were vandalized initially were repaired but further vandalism took place and repairs were again carried out in October 2006. The bore holes which have been vandalized will be re-cored when a core drilling rig is moved to the site.

What criteria will the Proponent apply in adjudicating claims that quarrying operations have affected water supply or quality? Will the claimants be expected to litigate: Describe the process for resolving conflicts?

RESPONSE
Bilcon stated in the EIS that "*in any event, Bilcon of Nova Scotia Corporation, will replace, at their expense, any water supply, identified as lost or damaged as a result of the quarry operation*". Bilcon will not expect claimants to litigate and has established a process for dealing with claimants as follows:

Bilcon will replace any well within 800 metres of the active quarry which has been affected either in supply or quality.

Bilcon will carry out an investigation as to the cause of the problem for informational purposes but regardless of the cause, Bilcon will replace the water supply at no cost to the property owner.

C0635-031

9.1.2 Geology and Hydrogeology

This procedure was carried out in September 2006 when a property owner at the corner of Whites Cove Road and Highway #217 notified Bilcon that their dug well had gone dry. Bilcon reviewed the situation and identified the water source for their dug well as surface water which had dried up due to lack of rainfall in September. A Bilcon monitoring well was drilled in the same general area in September 2005, but water has not been removed from this well and there is no doubt that the drilling of the monitoring well had no relationship to the water supply to the dug well. Notwithstanding the findings, Bilcon drilled a well on the subject property, provided a pump, and connected the new well to the property owners dwelling, at no cost to the property owner.

This process will be used in the future when instances of any affect to water supply or quality within 800 metres of the active quarry are brought to the attention of Bilcon.

Groundwater Monitoring
The EIS states that on-site and adjacent property groundwater data is essential for establishing reliable, pre-Project baseline conditions. The Guidelines (9.1.3.2) provided to the Proponent requested this information. Include this information in the EIS

RESPONSE
Bilcon did state in the EIS that on-site and adjacent property groundwater data was essential for the establishment of reliable pre-project baseline conditions of groundwater quantity and quality.

It was Bilcon's intent to carry out investigation of all wells in the 800 metre zone from the active quarry face prior to commencing blasting operations. Indeed, this is a requirement of the Nova Scotia Pit and Quarry Guidelines. Notwithstanding the fact that Bilcon views this data as the establishment of reliable pre-project baseline conditions, Bilcon has proceeded to gather this information and it is set out in Section 12 – Conestoga Rovers Domestic Well Survey, November, 2006.

WP 1498 - Nova Scotia Department of Environment and Labour

Environmental Monitoring and Compliance Division – Bruce Arthur –Acting District Manager and Scott Lister – Hydrogeologist

6. *Chapter 9.3.18 discusses groundwater from one borehole only. It states that "the existing baseline groundwater quality data from the quarry site meets existing drinking water guidelines for MACs and IMAC and on-site wells, for domestic use are expected to provide good quality drinking water" This seems to be more a statement of faith rather than fact since no baseline samples were taken from any of the existing domestic wells and compared to the single borehole water quality.*

C0635-032

9.1.2 Geology and Hydrogeology

Additional on-site and off-site baseline monitoring should be required prior to commencement of operation in the event that an approval to operate is issued.

RESPONSE
Bilcon advises that baseline groundwater quality data from all six new monitoring wells has been obtained and is attached in Appendix 1 in this section, further Bilcon advises that partial baseline water quality data from offsite existing domestic wells has been obtained and is set out in Section 12 – Conestoga Rovers - Domestic Well Survey, November 2006.

Water and Wastewater Branch – John Drage – Hydrogeologist

1. *The EIS is well organized, well written and well presented. I agree with the statement made in the report which indicates that the main potential impacts from the proposed quarry include the temporary siltation of nearby wells due to blasting and possible reduced water levels in wells (refer to page 9, Volume V, Tab 28). However, further information is required to evaluate the extent and magnitude of potential effects of the proposed quarry on groundwater. Specifically, clarification is needed on the proposed depth of the quarry and a quantitative assessment is needed to assess the potential drawdown effects at off-site water wells if the quarry extends below the water table. These issues are discussed in further detail below.*

RESPONSE
Comment noted.

2. *The proposed depth of the quarry, relative to the elevation of the water table, is one of the most critical parameters needed to evaluate the potential effects of the quarry on groundwater. The deeper the quarry extends below the water table, the greater the potential for groundwater levels to be lowered on-site and adjacent to the site.*

   Clarification is needed on the proposed depth of the quarry. On page 16 of the Plain Language Summary, it is stated that "Quarrying will be carried out above the normal water table." However, information provided in several other sections of the EIS indicates that the quarry may extend up to 20 m below the water table. For example, on page 10 of Volume V, Tab 28 it is stated that the"...quarry face could cut 20 m below the inferred existing water table..." Furthermore, comparisons of the quarry and water table cross-sections in Figures 6A and 7 in the Plain Language Summary also indicates that the quarry will extend below the water table, by up to approximately 20 m. In addition, on page 3 of Volume V, Tab 28, the water table elevation at borehole NS-02-01 was reported to be 35.9m, above sea level (asl). If the quarry floor will be at approximately 15 m, asl, as reported on page 1, Volume V, Tab 28 and depicted in Figure 5 in Chapter 7, Volume V, then the quarry floor will

C0635-033

extend below the water table by approximately 20 m at this location (i.e., 35.9 m-15m = 19.9 m).

Data should be provided on the proposed quarry floor elevation versus the water table elevation at the site. If the quarry floor will extend below the water table, quantitative estimates of the resulting off-site drawdown at the nearest water wells should be provided.

RESPONSE

For clarification of the proposed depth of the quarry and its relationship to the water table, please refer to Figures IR8-1 to Figures IR8-7 in Section 7.0 Revised Project Description.

Quantitative estimates can be made using the analytical model, which was requested in the EIS Guidelines (March 2005) for the project, as long as appropriately conservative input parameters are used in the model. More realistic quantitative estimates could be obtained using a numerical model. The EIS report suggests on page 14, Volume V, Tab 29, that a model was not constructed for the site because "...groundwater models can have serious limitations in crystalline bedrock." It should be noted that properly constructed and calibrated groundwater models can be very useful and are commonly used by hydrogeologists for assessing groundwater flow in bedrock, including quarry and mine sites, in Nova Scotia and world-wide. The documentation and assessment of model limitations and uncertainty is a standard part of a groundwater modelling exercise.

RESPONSE

Please refer to Groundwater Monitoring and Aquifer Testing – Whites Point Quarry, Conestoga Rovers, February 2007, Section 5 – Conceptual Hydrogeological Model for Site on page 8, in Section 12 of this document.

3. *With respect to blasting, it is stated on page 16 of the Plain Language Summary that "Studies by the US Bureau of Mines, the Montana Bureau of Mines and Geology among others have shown that blasting does not affect groundwater quality or quantity in comparable mines." As suggested on page 10 of Volume V, Tab 28, a critical factor controlling whether or not blasting has potential to affect a water well is the distance between the blast site and the water well. How close were the water wells to the blasting sites in these studies? Complete references for these studies should be provided so they can be reviewed. The above referenced comment from the Plain Language Summary differs somewhat from statements made in Volume V, Tab 28, which indicate that blasting impact is considered the most likely source of complaint from the proposed quarry and that the sensitivity of individual wells to blasting should be addressed through a residential well survey and reducing the size of individual blasts. This discrepancy should be clarified.*

C0635-034

RESPONSE
The studies referenced below describe a range of distances between the blast site and the water well. Also please refer to text on page 10 in this section.

References
Berger, P.R. (1980), "Survey of Blasting Effects on Groundwater Supplies in Appalachia", U.S. Department of Interior, Bureau of Mines, Washington, D.C.

Beaver, F.W. (1994), "The Effects of Seismic Blasting on Shallow Water Wells and Aquifers in Western North Dakota, Masters Thesis", University of North Dakota.

Bond, E.W. (1975), "A Study of the Influence of Seismic Shotholes on Groundwater and Aquifers in Eastern Montana", Montana Bureau of Mines, Butte, MT.

Lizak, J., O'Reilly, S. and Schmitz, G., (1998), "Aquifer Protection In and Near Aggregate Operations", National Stone Association Regional Conference Proceedings.

Robertson, D.A. (1988), "Should blasting take the blame for damaged wells?", Pit and Quarry.

Rudenko, D., Love, G., and Novotny, T., (2002), "Blasting Near Domestic Water Supplies – Facts and Myths", Vibra-Tech Engineers, Inc., 4th Blasting Vibration Technical Conference.

Siskind, D.E., (2000), "Vibration Effects on Structures", 3rd Biennial Vibration Conference.

Siskind, D.E., et al., (1994), "Surface Mine Blasting Near Pressurized Transmission Pipelines", U.S. Bureau of Mines RI 9523, U.S. Bureau of Mines, Washington, D.C.

Straw, J. and J.P. Shinko, (1994), "Blast Vibration Effects Upon a Deep Injection Well and the Reduction of Ground Vibration Over Depth", Proceedings 10th Conference on Explosives and Blasting Research, International Society of Explosives Engineers.

A residential well survey (partial) has been conducted and is attached in Section 12 – Conestoga Rovers – Domestic Well Survey, November 2006.

4. *On page 16 of the Plain Language Summary, it is indicated that the quality and quantity of local groundwater supplies will not be affected because quarrying will take place in the upper basalt flow, which is not the same geologic unit that the neighbouring wells are located in. Note that this may not be true if there is sufficient hydraulic communication between the upper basalt flow and the other geologic units. Is there any hydraulic testing data available from the site to confirm that there is no*

C0635-035

hydraulic connection? A pumping test would normally be used by hydrogeologists to determine whether or not a hydraulic connection exists.

RESPONSE

Please refer to Groundwater Monitoring and Aquifer Testing – Whites Point Quarry, Conestoga Rovers, February 2007, Section 4, page 4 in Section 12 of this submission.

5. *On page 16 of the Plain Language Summary, it is indicated that the quality and quantity of local groundwater supplies will not be affected by the quarry because the neighbouring wells are located on the opposite side of the groundwater divide. Although, this statement is reasonable for contaminant migration, it is not necessarily true for groundwater quantity. The potential effects on groundwater flow and groundwater quantity is more realistically described on page 10 of Volume 5, Tab 28, where it is indicated that the quarry would cause the groundwater divide to shift to the southeast and gradual lowering of the water levels in the bedrock south of the quarry face, and possibly in the vicinity of Highway 217. It is further indicated in this section of the EIS that the degree of impact will depend on individual well yields, distance from the drainage face, well depth and time of year.*

RESPONSE

Comment noted, please refer to Groundwater Monitoring and Aquifer Testing – Whites Point Quarry, Conestoga Rovers, February 2007 in Section 12 of this submission.

6. *On page 13 of Volume V, Tab 29, it is indicated that a six well, multi-level monitoring program was completed at the site. However, the drill reports in the EIS for the 4 boreholes and 6 monitoring wells that were installed at the site indicate that none of these were completed as multi-level monitoring wells. This discrepancy should be clarified. Note that hydrogeologists typically define multi-level wells to be 2 or more wells installed at the same location (i.e. within a few metres of each other or within the same borehole), with screened intervals at different depths.*

RESPONSE

No multi-level wells were drilled on-site. Please refer to Groundwater Monitoring and Aquifer Testing – Whites Point Quarry, Conestoga Rovers, February 2007 – Section 6 – Recommendations, page 13, bullet 3, in Section 12 of this submission.

7. *I cannot find a conceptual model and analytical model of the hydrological cycle of the site, as required under "Section 9.1.3.2 Groundwater "of the EIS Guidelines (March 2005). Please clarify where these models can be found in the EIS.*

RESPONSE

C0635-036

9.1.2 Geology and Hydrogeology

Please refer to Groundwater Monitoring and Aquifer Testing – Whites Point Quarry, Conestoga Rovers, February 2007 – Section 5 – Conceptual Hydrogeologic Model for the Site, page 8, in Section 12 of this submission.

Conestoga Rovers have provided a conceptual model in the report, but did not complete any numeric modelling as the minimum data requirements for a meaningful model can not be met at this time. Bilcon intends to use collected hydrogeological information from Year 1 of Operation to complete a numeric modelling exercise to assist in the long-term understanding of quarrying effects on local hydrogeology and to aid in better understanding the North Mountain Basalt Aquifer. Bilcon sees this as a project benefit as the North Mountain basalts have not been studied extensively by private or government agencies.

8. *In several sections of the EIS there are indirect references made to documents in support of the EIS conclusions; however, complete references have not been provided. Examples of these incompletely referenced documents include:*

"...a classic groundwater report..."(See page 7, Volume V, Tab 29);
"...studies have shown that water wells have a life expectancy of less than 20 years..." (See page 14, Volume V, Tab 29); and
"...studies by the U.S. Bureau of Mines, the Montana Bureau of Mines and Geology among others..." (See page 16, Plain Language Summary).

Complete references should be provided for all documents, studies and reports referred to in the EIS so that reviewers can have the opportunity to locate and review these.

RESPONSE

References

American Institute of Professional Geologists, (1985), "Groundwater Issues and Answers".

Berger, P.R. (1980), "Survey of Blasting Effects on Groundwater Supplies in Appalachia", U.S. Department of Interior, Bureau of Mines, Washington, D.C.

Beaver, F.W. (1994), "The Effects of Seismic Blasting on Shallow Water Wells and Aquifers in Western North Dakota, Masters Thesis", University of North Dakota.

Bond, E.W. (1975), "A Study of the Influence of Seismic Shotholes on Groundwater and Aquifers in Eastern Montana", Montana Bureau of Mines, Butte, MT.

Brawner, C.O., Argall, G.O., et al, (1979), "Mine Drainage", International Mine Drainage Symposium.

C0635-037

9.1.2 Geology and Hydrogeology

Core Lab, "Fracture Analysis of Core".

Johnson Division, UOP, Inc., (1975), "Ground Water and Wells".

Kontak, D.J., (2002), "Internal Stratigraphy of the North Mountain Basalt, southern Nova Scotia", Nova Scotia Department of Natural Resources Mines and Minerals Branch Report of Activities 2001.

Kontak, D.J., et al, (2005), "Geology and volcanology of the Jurassic North Mountain Basalt, southern Nova Scotia", Atlantic Geoscience Society.

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Pyne, D.G., (1994), "Groundwater Recharge and Wells-A Guide to Aquifer Storage Recovery".

Robertson, D.A. (1988), "Should blasting take the blame for damaged wells?", Pit and Quarry.

Roebuck, I.F., (1979), "Applied Petroleum Reservoir Technology", IED.

Rudenko, D., Love, G., and Novotny, T., (2002), "Blasting Near Domestic Water Supplies – Facts and Myths", Vibra-Tech Engineers, Inc., 4th Blasting Vibration Technical Conference.

Trescott, P.C., (1968), "Groundwater resources and hydrogeology of the Annapolis-Cornwallis Valley, Nova Scotia, N.S. Dept. of Mines, Groundwater Section, Memoir 6, 1968.

Trescott, P.C., (1969), "Groundwater resources and hydrogeology of the Western Annapolis-Cornwallis Valley, Nova Scotia, N.S. Dept. of Mines, Groundwater Section, Report 69-1.

Siskind, D.E., (2000), "Vibration Effects on Structures", 3rd Biennial Vibration Conference.

Siskind, D.E., et al., (1994), "Surface Mine Blasting Near Pressurized Transmission Pipelines", U.S. Bureau of Mines RI 9523, U.S. Bureau of Mines, Washington, D.C.

C0635-038

9.1.2 Geology and Hydrogeology

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U.S. Geological Survey, (1963), "A Primer on Ground Water".

Westly, R.L., (1993), "Using Specific Capacity Testing To Evaluate Aquifer Producing Zones During Borehole Advancement", The Professional Geologist.

Williams, et al, (1983), "Mine Hydrology", Society of Mining Engineers, Inc. and U.S. Bureau of Mines.

WP 1525 – Natural Resources Canada

NRCan's technical review comments on the Whites Point Quarry and Marine Terminal Project in Nova Scotia – Environmental Impact Statement (March 2006)
B – Comments from Reviewer 2
Areas of Expertise -Groundwater and hydrogeology
NRCan's specific comments are related to Volume VI, Chapters 9.1 and 9.2

- *Section 9.1.3.1 (page 26): Six new monitoring wells were drilled in the project area in September 2005. Groundwater levels in these wells were used for the definition of the water table and gradients given in Figures 6. Water yields from these wells were used as an indicator of the low permeability of the bedrock. It seems that these monitoring wells were not hydraulically tested and no water samples were collected. Why? Simple slug tests could provide quantitative estimates of the local transmissivity.*

RESPONSE
Please refer to Groundwater Monitoring and Aquifer Testing – Whites Point Quarry, Conestoga Rovers, February 2007, in Section 12 of this submission.

- *Section 9.1.3.2 (page 27): The groundwater levels in the recharge areas such as North Mountain are located deep below the ground surface. As discussed in the text, the groundwater levels measured there do not represent a 2D surface (water table). Because of the vertical downward gradient, the deeper monitoring wells usually indicate deeper groundwater levels whereas shallower wells show shallower water levels. Thus, because of the different depths intercepted, it is less probable that the Domestic/Commercial well and the neighbouring monitoring well #4 have almost the*

C0635-039

same groundwater levels. For which depth – geologic horizon was the water table indicated in Figures 6 defined:

RESPONSE
The water table indicated in Figure 6 was defined from the data obtained from monitoring well #4, rather than the domestic/commercial well.

- *Section 9.1.3.2 Figures 6a and 6b: The level of the water table line close to the UFU-MFU contact (Figure 6a) and between bore hole #3 and monitoring well #3 (Figure 6b) seems to be too low and not following the variation of the terrain altitudes as elsewhere. Why? These are exactly the locations where the anticipated quarrying operations will take place. The planned base of the quarry seems to be below the water table indicated in Figures 6. If yes, the quarry operations will undoubtedly affect the groundwater flow regime in the area.*

RESPONSE
For further clarification of the relationship of the water table to the planned base of the quarry, please refer to Figures IR8-1 to Figure IR8-7 in Section 7.0 Revised Project Description.

- *Section 9.1.3.2, Figures 6a and 6b: The anticipated lateral and vertical limits of the quarry operations should be clearly indicated on these figures, the same way it is done in Figure 7.*

RESPONSE
Please refer to Figures IR8-1 to Figure IR8-7 in Section 7.0 Revised Project Description.

- *Section 9.1.3.2, Map 12: All inventoried neighbouring private wells should be indicated on this map.*

RESPONSE
Please refer to Map 2-R1, page 31 in Section 7.0 Revised Project Description.

- *Section 9.1.3.2 (page 27): Besides the groundwater flow in the bedrock units, there is a subsurface flow at the base of the Quaternary deposits and just above the bedrock surface. If vertical fracture is encountered, part of this water will infiltrate further downward. The other part will continue to flow in the lateral direction toward the shore. By intercepting this lateral subsurface flow the quarry operation can*

C0635-040

eventually affect dug wells located downgradient. Information on neighbouring dug wells is not presented.

RESPONSE
Please refer to Domestic Well Survey in Section 12 – Conestoga Rovers - Domestic Well Survey, November 2006.

- *Section 9.1.3.2 (page 27): Quarrying will be carried out above the "natural water table". What is the definition of "natural water table"? As discussed above, it depends on the depth of the intercepted geologic horizon.*

RESPONSE
Please refer to Groundwater Monitoring and Aquifer Testing – Whites Point Quarry, Conestoga Rovers, February 2007, in Section 12 of this submission.

- *It is not clear what the position of the base of the quarry is in comparison with the groundwater levels in the study area.*

RESPONSE
Please refer to Figure IR8-1 to IR8-7 in Section 7.0 Revised Project Description.

- *The monitoring wells should have been finished at the planned base of the quarry in order to have a more precise estimate of the "natural water table" at that level.*

RESPONSE
The monitoring well program was designed in collaboration with recognized experts at the Nova Scotia regulatory agencies, recognized consultants, and the public. These advisors have specialized expertise in mine hydrogeology, the hydrogeology of the North Mountain Basalt, etc. The issue raised by NRCan was discussed during the planning stage of the monitoring program and it was concluded that it could be addressed with the data obtained from the existing program. The existing program can be expanded or modified in the future if additional monitoring is warranted.

- *Section 9.1.3.2 (page 27): If, at certain locations, the base of the quarry is deepened below the water table, the supposed groundwater divide occurring below the crest of the North Mountain will change its supposed altitude and will move laterally. How will this affect the water levels in neighbouring private wells?*

RESPONSE
Bilcon does not intend at any time to quarry below the water table.

9.1.2 Geology and Hydrogeology

- *Section 9.1.3.3 (Page 29): The pre-quarrying survey will consist of water quality analysis in the neighbouring private wells to establish baseline water quality data. Water levels and actual yields of these wells will not be measured. Instead, newly drilled monitoring wells will be used to monitor the water level fluctuations and/or groundwater quality. In the eventuality of other adverse effects of the quarry operations on these wells, the proponent will replace affected water supply units. It is, however, not clear how can the eventual negative effects (e.g., decreased water level; decreased yield) be related to the quarry operation and be proven by the residents as there are no baseline data. The possible difficulties have already been discussed by the proponent in the Mineral Valuation & Capital Inc report (Reference Document Volume V). NRCan is not confident that the proposed monitoring program can effectively serve to protect the neighbouring residents.*

RESPONSE

Please refer to the partial Domestic Well Survey in Section 12 – Conestoga Rovers - Domestic Well Survey, November 2006.

This has not yet been completed due to the absence of some homeowners. However, the water level and the discharge rate were measured and will be measured for those wells not yet completed.

Please refer to Bilcon's statement with respect to compensation for affected wells. Bilcon has made it clear that it will fully compensate a homeowner for decreased yield or decreased quality on a non-litigation basis. Please refer to Panel question (outlined at the beginning of this document and placed below for ease of reference) in this section.

Panel Question

What criteria will the Proponent apply in adjudicating claims that quarrying operations have affected water supply or quality? Will the claimants be expected to litigate: Describe the process for resolving conflicts?

Bilcon's Response to Panel

Bilcon stated in the EIS and reiterated in this response document on page 14 that "*in any event, Bilcon of Nova Scotia Corporation, will replace, at their expense, any water supply, identified as lost or damaged as a result of the quarry operation*". Bilcon will not expect claimants to litigate and has established a process for dealing with claimants as follows:

Bilcon will replace any well within 800 metres of the active quarry which has been affected either in supply or quality.

C0635-042

9.1.2 Geology and Hydrogeology

Bilcon will carry out an investigation as to the cause of the affect for informational purposes but regardless of the cause, Bilcon will replace the water supply at no cost to the property owner.

This procedure was carried out in September 2006 when a property owner at the corner of Whites Cove Road and Highway #217 notified Bilcon that their dug well had gone dry. Bilcon reviewed the situation and identified the water source for their dug well as surface water which had dried up due to lack of rainfall in September. A Bilcon monitoring well was drilled in the same general area in September 2005, but water has not been removed from this well and there is no doubt that the drilling of the monitoring well had no relationship to the water supply to the dug well. Notwithstanding the findings, Bilcon has drilled a well on the subject property, provided a pump, and connected the new well to the property owners dwelling, at no cost to the property owner.

This process will be used in the future when instances of any effect to water supply or quality within 800 metres of the active quarry are brought to the attention of Bilcon.

WP 1542 – Health Canada
Drinking Water Quality – Comments on EIS

1 *Section 9.1.3.2, Analysis – Only five of the 17 drilled residential wells in the vicinity of the proposed quarry had provincial well logs, and as such, the depths of the other twelve wells are not known. The report then states that these other twelve are either "pre-1965 drilled wells, non-registered wells, dug wells, or springs", which contradicts the previous statement that indicates the 17 wells are drilled. Health Canada recommends that a detailed well survey of all 24 wells in the vicinity of the project be conducted to determine their depth and to verify the aquifer that they are utilizing.*

RESPONSE
A detailed well survey of all wells in the vicinity of the project will be conducted to determine their depth, yield and water quality. Please note that this has been partially completed and the results are contained in Section 12 – Conestoga Rovers - Domestic Well Survey, November 2006.

2 *Section 9.1.3.2 Analysis – The report assumes that all of the drilled wells are in a different hydrostratigraphic unit than the quarry, indicating that quarrying will occur in the upper flow unit of the North Mountain basalt (fractured bedrock) whereas "drilled wells are constructed in the middle or lower flow units of the North Mountain Basalt or in the deeper Blomidon Formation". The report thus concluded that "local wells will be located hydraulically down-gradient of the quarry and/or in*

C0635-043

different geologic horizons and groundwater watersheds". Given that there are no well logs for 12 of the 17 drilled wells in the vicinity of the proposed project site, Health Canada believes it is not possible to make this conclusion with certainty.

RESPONSE

One of the primary objectives of the geologic investigation conducted by Bilcon was to delineate the structure and the stratigraphy of the UFU and MFU and the contact between the units.

Ten boreholes were drilled. Eight holes were drilled on the Bilcon property. Two holes were drilled in the valley south of North Mountain. Five of these holes penetrated the contact between the UFU and MFU unit. The contact was not penetrated in the remaining holes because it dips and plunges below sea level to the northwest. Core data were analyzed and sampled by MVC and Dr. Kontak, Ph.D., Regional Geologist with the NSDNR, Minerals and Energy Branch, the recognized expert on the North Mountain Basalt. The drill data were supplemented with detailed local and regional field work conducted in December 2004 and May 2005 by MVC and Dr. Kontak.

The aforementioned data enabled the investigators to clearly delineate the subsurface structure and the outcrop of the contact between the UFU-MFU, and the surficial bedrock geology. Consequently, it is possible to conclude with confidence that the surveyed drilled wells are constructed in the middle or lower flow units of the North Mountain Basalt or in the deeper Blomidon Formation, and thus, in a different geologic horizon than the quarry.

Please refer to Map 2-R1 in Section 7.0 – Revised Project Description.

Health Canada, the JRP, etc. are strongly encouraged to visit the project field. Inspection of the site geology will validate this conclusion and allay the concerns of the reviewer.

3 *Section 9.1.3.2, Analysis and Mineral Valuation and Capital Inc. (2005) – The report and supporting documentation indicates that several of the neighbouring domestic and industrial wells are locate hydraulically downgradient of the quarry, however, if they are downgradient of the site, wouldn't any contaminants entering the groundwater as a result of site activities flow downgradient and potentially enter these wells? In addition, if groundwater drawdown occurred at the site, would this not decrease the quantity of groundwater available downgradient?*

According to the Oregon Department of Environmental Quality, "groundwater outside and upgradient of the facility is generally presumed to be unaffected by the source. Groundwater beneath and downgradient from the area of facility operations is most likely to be affected by pollutant discharges. Once pollutants affect

C0635-044

groundwater, the contaminants usually move in the direction of groundwater flow downgradient and away from area of immediate impact"
(http://www.deq.state.or.us/wq/groundwa/IMDMonitoringBGGQuality.pdf).

RESPONSE

It is possible that contaminants entering the groundwater as a result of site activities could potentially enter these wells. However, all quarry activities with the exception of the access road from Highway #217 will be conducted on the west side of the groundwater divide. In addition, the contaminant, barring an accident or malfunction, would be basalt fines, which testing has shown to contain no toxic materials.

There is no intention to use groundwater in any site activity other than the office facility and quarrying of the rock will not take place below the water table, however, it is true that changing the topography could change the water table to the east of the groundwater divide. However, as noted elsewhere all wells in the vicinity of Highway #217 are either in the upper till unit (dug wells) or drilled wells in the middle flow unit or lower flow unit. A significant loss of yield in domestic wells in considered to be highly unlikely. In the event that this occurs, Bilcon has established a no litigation compensation policy which would involve drilling new wells at Bilcon's expense – please refer to Bilcon's response to WP 1452 - Panel.

4 *Section 9.1.3 – Hydrogeology – No mention is made about the on-site groundwater use. Will groundwater be used on-site for such purposes as for drinking and in office facilities? If so, please identify the frequency and parameters to be tested as part of the monitoring program.*

RESPONSE

Groundwater will be used in the office facilities for drinking and washing. This water will be tested every six months for bacteriology and once per year for general chemistry and trace metals.

Groundwater Monitoring

1 *Section 9.1.3.3, Mitigation, Section 9.1.3.4, Monitoring 9.3.18.4, Monitoring and Table ECM-2 outline different proposed groundwater monitoring programs:*

- *Section 9.1.3.3 – "Groundwater from all neighbouring properties will be analysed for bacteriology, general chemistry and trace metals once prior to quarry operations to establish baseline conditions". Will this be conducted for all 24 wells?*

RESPONSE

C0635-045

9.1.2 Geology and Hydrogeology

An analysis for bacteriology, general chemistry and trace metals will be conducted prior to quarry operations for all wells in the vicinity of the quarry.

- *Section 9.1.3.3 Section Water table levels will be monitored in the six new monitor wells and the four existing boreholes as quarrying proceeds. The number times water levels will be monitored is not stated here, but found later in Table ECM-2 that it will be weekly. The water table levels are intended to be monitored in the four existing boreholes, three of which were unable to be sampled in 2002(JWEL) because of damage, have these boreholes been repaired: In addition there is no mention of collecting water table levels prior to quarry operations. Will this be done in order to establish baseline conditions?*

RESPONSE

The monitoring wells have now been repaired twice as a result of vandalism, but the bore holes have not yet been repaired. These latter will be repaired immediately a drill rig is brought to the site capable of recoring these core holes. It should be noted that water table levels have been collected on a weekly basis since September 2005 to the present time and will be collected on a weekly basis in the future.

- *Section 9.1.3.4 – states that an "on-site groundwater monitoring program was selected", however it indicates that both on-site and adjacent property groundwater data is essential for establishment of baseline conditions and to further demonstrate no diminution in groundwater quantity or quality"*

RESPONSE

A partial domestic well survey has been completed for the domestic wells along Highway #217 and this will be completed prior to any work on the quarry site in order to establish baseline conditions.

- *Section 9.1.3.4 – "A comprehensive groundwater monitoring program was initiated in the fall of 2005 for the six monitoring wells", although details of this program are not presented (i.e. parameters tested, frequency of sample collection etc.)*

RESPONSE

Please refer to Appendix 1 in this section.

- *Section 9.1.3.4 – Monitoring – the report states that "water quality monitoring will be performed by Bilcon of Nova Scotia Corporation on an annual basis for bacteriology, general chemistry and trace metals", however, the locations of this monitoring is not clear – will it be samples from the boreholes, the monitor wells and/or the off-site residential/commercial wells?*

C0635-046

9.1.2 Geology and Hydrogeology

RESPONSE

Monitoring will be conducted on an annual basis for bacteriology, general chemistry and trace metals for the six monitoring wells. Monitoring will be conducted on the domestic wells adjacent to the Highway #217 every five years unless a complaint is received from a homeowner in which case testing will be conducted immediately. NSDEL advises that there are no registered commercial wells on Digby Neck.

- *Section 9.1.3.4 Monitoring – the report states that "summary reports of groundwater levels and water quality will be provided to the NSDEL monthly during operation of the quarry". It is previously stated that groundwater levels will be measured in the six new monitoring wells and four existing boreholes monthly, but it is unclear as to what water quality parameters will also be analysed and submitted to NSDEL on a monthly basis.*

RESPONSE

Water levels in the six new monitoring wells and four existing boreholes will be collected on a weekly basis and reported to NSDEL on a monthly basis. Water quality parameters, bacteriology, general chemistry and trace metals will be monitored annually and submitted to NSDEL in the month in which the monitoring was undertaken.

- *Section 9.3.18.4 Monitoring – "chemical, physical and biological well water parameters will be monitored both on-site and off-site at the specially constructed monitoring wells" and "water samples will be taken from a monitoring well located on the quarry property line" and "off-site monitoring will be conducted in the same groundwater source as existing deep, domestic wells located in the immediate area". Health Canada would like to see the proposed groundwater monitoring program, including sampling locations, parameters, and frequency of sampling specified in the report.*

RESPONSE

Monitoring of groundwater both on-site and off site is discussed in the EIS Volume VI, Chapter 9.1.3.4 and 9.3.18.4, and as responses to the previous six questions. Bilcon will prepare a detailed monitoring program for the approval of NSDEL during the industrial permit stage of the project.

- *Table ECM-2 indicates that only water levels will be measured monthly at the 6 monitoring well locations on the property and bacteriology, general chemistry and trace metals will be analysed annually. The locations where these samples will be collected are not clear.*

RESPONSE

Please refer to response to previous Health Canada questions.

C0635-047

9.1.2 Geology and Hydrogeology

2 *Section 9.3.18.4 – Monitoring – "since the groundwater from on-site sources meets the Summary Guidelines for Canadian Drinking Water Quality for MACs and IMACs parameters, this would result in a long term, neutral (no) effect of local scale." The report assumes that the project will have no impact on future groundwater quality, which is not necessarily correct. It is important to monitor during construction and operation to ensure that this quality is not deteriorated due to project activities.*

RESPONSE
Please refer to previous responses in this section.

3 *More frequent monitoring than what was recommended in the EIS may be appropriate to ensure quarry activities do not adversely affect water quality and levels, such as during periods of intensive blasting and rock cutting. Monitoring of the proposed perimeter and on-site wells should occur at a schedule that ensures that water quality is tested during periods of high quarry activity, especially in the initial phases of construction and operation. If water quality declines for any reason during these activities, immediate measures should be taken to provide adequate water supplies to local residents (I.E. bottled water and/or adequate treatment). In addition, monitoring for water level changes should take place over several years to confirm seasonal water level variations in addition to possible effects of quarry operations.*

Long term annual monitoring should continue to provide further information on the impact of quarry activity in addition to seasonal variations in water quality and water table levels.

RESPONSE
Please refer to previous responses in this section.

Comment Related to References #28 and #29 – JWEL (2002) and Mineral Valuation and Capital Inc (MVCI) (2005) Reports
The two studies (JWEL, 2002 and MVCI, 2005) appear to have conflicting conclusions, for the JWEL (2002) report, based on a small project footprint (9.6 acres/-4 hectares), indicated potential adverse effects to water quality and quantity, including on-site groundwater intrusion at the quarry site. In contrast, the MVCI (2005) study, based on the larger project footprint (indicated in the EIS to be approximately 300 acres of the 380 acre site over 50 years) concluded that there would be no adverse effects on water quality or quantity associated with larger project and there will be no groundwater intrusion at the quarry site. The following Table presents the conclusion from the JWEL(2002) study in comparison to the conclusions and rationale provided in MVCI (2005)

C0635-048

9.1.2 Geology and Hydrogeology

JWEL Study Conclusions	MVCI Study Conclusions
Deterioration in water quality is not expected Since the residential wells are located up-gradient of the proposed quarry	The local domestic and commercial wells will be located hydraulically down-gradient of the quarry
Blasting may result in temporary siltation Of nearby wells	Based on several U.S. studies, blasting will not Impact the groundwater quality or quantity (including groundwater chemistry, water well stability and turbidity, yield etc)
Site activities may result in reduced water levels in wells hydraulically up-gradient to the quarry.	Quarrying will be initiated above the natural water table, and, as a result, mine dewatering and pumping will not be needed and there will be no groundwater withdrawal or drawdown.
Short-term impacts from blasting vibrations may include temporary discoloration of water and that mitigation could include reducing the size of individual blast units, or provision of a dirt filter or bottled water during periods of intensive blasting.	Based on several U.S. studies, blasting will not impact the groundwater quality or quantity (including groundwater chemistry, water well stability and turbidity, yield etc).
Bedrock in the vicinity of the quarry has a low to moderate degree of permeability, suggesting that a moderate inflow of groundwater could occur to the quarry.	Quarrying will be initiated above the natural water table, and, as a result, mine dewatering and pumping will not be needed and there will be no groundwater withdrawal or drawdown.
As the proposed quarry advances northeast and east into the side of North Mountain, the water table in the immediate vicinity of the quarry wall will begin to decline as water drains into the quarry through numerous fractures in the bedrock.	Quarrying will be initiated above the natural water table, and, as a result, mine dewatering and pumping will not be needed and there will be no groundwater withdrawal or drawdown.
Significant decline in water level and/or loss of yield are not anticipated during the proposed 9.6 acre quarry operation, however, if the quarry extends further into the property and beyond the proposed 9.6 acres, the degree of impact would be related to individual well yields, distance from the drainage face, well depth and time of year. The conclusion of the report was that water level declines are possible under the large long term mining scenario.	Quarrying will be initiated above the natural water table, and, as a result, mine dewatering and pumping will not be needed and there will be no groundwater withdrawal or drawdown. In addition, the wells will be in a different groundwater watershed and/or hydraulically down-gradient of the quarry

RESPONSE

Please refer to Bilcon's response to WP 1431 – Panel (IR10) on page 1 in this section.

The MVCI (2005) study does not provide empirical evidence that the removal of 100 million tonnes of basalt rock (2 million tonnes per year for 50 years as presented in Section 7.0, Project Description) will not have an impact on the water table or will not result in groundwater drawdown or groundwater infiltration at the project site. In addition, the MVCI (2005) study does not provide mitigation measures in the event that off-site drinking water wells are affected by site operations. The JWEL (2002) report provides adequate mitigation measures for possible adverse effect to off-site drinking water wells resulting from

C0635-049

quarry construction and activity, and Health Canada recommends that these proposed mitigation measures be implemented if adverse effects are identified during monitoring or as a result of public complaints.

RESPONSE

The MVCI 2005 study does not provide empirical evidence defined as "based on actual observations" since it is not possible to test mine 100 million tons. The opinion is based on work completed and is put forward in recognition that a number of mitigative, monitoring and compensation programs will be put in place to ensure that damage either does not occur or is fully compensated for under the compensation plan described elsewhere in this document.

It was noted in Section 4.5 of the JWEL (2002) that quarry groundwater sampling showed that all water chemistry parameters met Health Canada guideline values for drinking water quality with the exception of manganese. Table 4 indicated that the baseline level of manganese was 0.1 mg/L, which is 2-fold higher than the current Health Canada aesthetic objective of 0.05 mg/L. Is there any data available on manganese levels in residential wells and/or perimeter monitoring wells?

RESPONSE

The results with respect to manganese levels for residential wells currently tested are as follows:
8 wells showed non detected
1 well showed 2 micrograms per litre (µg/L)
1 well showed 11 micrograms per litre (µg/L)

WP 1625 – Partnership for Sustainable Development

EIS Guidelines – Section 4.0 – Guidance on the Preparation of the EIS
Deficiency Statement 11
EIS Guidelines
4.1 – Use of Existing Information – This section requires the Proponent when relying on existing information to, "...comment on its appropriateness and/or relevance over space and time, along with any perceived limitations regarding the inferences or conclusions that have been drawn."
EIS
9.1.3.1 – Research - Approximately one third of this section is spent discussing results from the NSDEL well logs database. Information gathered from this database should be used with caution as it is generally known to be an unreliable source of information.[24] *The Proponent has failed to meet the requirements of EIS Guidelines section 4.1 by not commenting on the appropriateness of this information.*

C0635-050

RESPONSE
The information from the NSDEL wells logs database was used, though it was recognized that this was not a totally reliable source of information.

However, a survey was undertaken in 2006 which identified wells in the area of study and this data was further supplemented in October, 2006 by a partial well survey carried out by Conestoga-Rovers & Associates. This data is appended to this submission.

Please refer to Bilcon's responses to the Panel and Agencies in this section.

Deficiency Statement 38
EIS Guidelines
8.1 - Methods – This section requires the Proponent to 'Explain and justify the methods used to predict potential impacts of the Project on the VECs..." 'Identify and justify any assumptions made. Indicate the degree of certainty in the impact predictions..." "...support analyses and conclusions with reference to appropriate literature and provide all relevant references."
EIS
9.1.2.2 – Analyses – The EIS states that, "Quarrying of the upper flow unit and the related activities will not adversely impact the bedrock stability, the thermal regime, or the infrastructure within and near the Whites Point site. The evidence to support this conclusion comes from the investigation of local and provincial quarries, assessments of local infrastructure and construction projects and the physical and chemical characterization of the surficial material and bedrock." This description fails to meet the EIS Guidelines requirements of section 8.1 because specific references to studies completed are not provided, nor is the relevance of these studies and the similarity between these sites and the Whites Point site discussed in any way. As well, the degree of certainty in the impact prediction is not provided.

RESPONSE
Please refer to Bilcon's responses to the Panel and Agencies in this section.

Deficiency Statement 39
EIS Guidelines
8.1 – Methods – see above
EIS
9.1.3.2 – Analyses – The EIS states, "Blasting will not impact the groundwater supply. Agencies such as the U.S. Bureau of Mines & Geology, etc have done studies...." This description fails to meet the EIS Guidelines requirements of section 8.1 because specific references to studies completed are not provided, nor is the relevance of these studies and the

C0635-051

similarity between these sites and the Whites Point site discussed in any way. As well, the degree of certainty in the impact prediction is not provided.

RESPONSE
Please refer to Bilcon's responses to the Panel and Agencies in this section.

Deficiency Statement 40
EIS Guidelines
8.1 – Methods – see above
EIS
9.1.3.2 – Analyses – The EIS states, "Construction aggregate operations have been used to enhance recharge via artificial surface recharge. Quarrying at Whites Point may enhance the local groundwater regime by increasing storm water retention and aquifer recharge." "Construction aggregate mines have been used in coastal areas to prevent saltwater intrusion." This description fails to meet the EIS Guidelines requirements of section 8.1 because specific references to studies completed are not provided and the relevance to the Whites Point site is not made.

RESPONSE
Please refer to Bilcon's responses to the Panel and Agencies in this section.

Deficiency Statement 50
EIS Guidelines
9.1.1 – Terrain, Geology, and Soils – 'For the Project site, provide specific information on the bedrock geology that includes geologic structures (e.g. faults, joint patterns and frequency), bedrock type (lithology), and stratigraphy."
EIS
The possibility exists for a weak geological fault to result in ground water contamination on the south side of the North Mountain. Such a fault may or may not follow the bedding planes. The EIS fails to establish if such a problem exists or not. The Proponent should undertake field geological and geotechnical investigations to establish the presence or absence of such of fault and revise the EIS accordingly.

RESPONSE
Please refer to Bilcon's responses to the Panel and Agencies in this section.

Deficiency Statement 52
EIS Guidelines
9.1.3.2 – Groundwater - "Describe the characteristics of surface water and groundwater interactions (e.g., physical features or mechanisms influencing recharge or discharge

C0635-052

characteristics potentially affecting shallow and deep groundwater resources...) under different climatic and seasonal conditions".

EIS

9.1.3 – Hydrogeology - Stripping of the land (removal of trees and overburden) will essentially drain off all future precipitation, thereby reducing the recharge into the basalt aquifer from the NW (Bay of Fundy) side of the Existing Hydrologic Divide (EHD), which is illustrated in Map 12, Vol. III of the EIS. This process has been going on since the stripping of the hills in the originally proposed, 3.9-hectare quarry site in 2002 (see Appendix I, Exhibit One, to this Report derived from Fig. 5 of Mahtab et. al, 2004). Removal of the rock mass by the quarry operation will reduce the recharge area for the aquifer, which provides the common water storage to both sides of the EHD. The vertical recharge into the aquifer from the un-mined basalt, adjacent to the quarry walls, will also be reduced due to the increased flow of water out of the quarry walls because of: (i) the fractures induced, or opened, by blasting, (ii) eventual tensile fracturing of the quarry walls due to lack of horizontal confinement, and (iii) the increased hydraulic gradient resulting from the excavation.

The cumulative impact of the lack of recharge, the sustained pumping of water by the community, and lowering of the water table during and beyond the life of the proposed quarry are some of the critical issues that need to be examined in detail. The recharge from the quarry site constitutes only a part of the source for storage of water in the basalt aquifer. However, as pointed out by Fetter (1994, p.26), "As the well draws water only from storage in the aquifer, drawdown proceeds as a function of the logarithm of time".

RESPONSE

Please refer to Bilcon's responses to the Panel and Agencies in this section.

Deficiency Statement 53

EIS Guidelines

9.1.3.2 – Groundwater - "Also, identify and describe the hydrostratigraphic units in the region that could potentially be affected by the Project in terms of depth and thickness of the aquifers, their water quality and yield characteristics".

EIS

The multi-stage, 49-year quarrying operation will remove a significant portion of the rock mass on the quarry site from about 10-15m elevation to about 95-100m elevation above sea level (see Appendix I, Exhibit Two to this Report). [Note that Exhibit Two was prepared by changing the horizontal scale of Figure 5, Vol. III of EIS, to match it with the scale of Figures 6A and 7 and to enable the reader to readily compare the group of figures. The existing water table outline was drawn by superimposition with Figure 6A.]. Because the water table follows the topography, the drastic change in the topography of the quarry site (depicted in Exhibit Two) will lower the water table on the NW (Bay of Fundy) side to near the sea level, from the sea shore to the boundary of the property. The significant lowering of

C0635-053

the water table on the Bay of Fundy side will also lower the water table on St. Mary's Bay side of the EHD to a measurable extent.
As shown in Appendix I, Exhibit Five to this Report, the bottom outline of the Quarry Area crosses the contact between the Upper Flow Unit (UFU) and the Middle Flow Unit (MFU). Excavation of columnar basalt near the (probably) highly permeable bottom of the UFU will create a conduit for rapid drawdown and lowering of the water table on both sides (Bay of Fundy and St. Mary's Bay) of the EHD.
The reduced recharge on the NW side of the EHD and the sustained drawdown of water by the community wells on the NE (or Little River) side of the EHD will lower the water table on both sides of the Divide. The Proponent should redraft the EIS to a common scale on diagrams and assess the implications as required by the EIS.

RESPONSE
Please refer to Bilcon's responses to the Panel and Agencies in this section.

Deficiency Statement 54

EIS Guidelines
9.1.3.2 – Groundwater - "Synthesize the groundwater and surface water data to produce a conceptual/analytical model of the hydrological cycle under and around the Project site".
EIS
The Conceptual Quarry Plans shown in EIS Vol. III Maps OP-1 to OP-7 (depicted collectively in Appendix I, Exhibit Three to this Report) are in fact "conceptual" and provide no design or scheme for quarrying the basalt during stages 1 to 7 over a period of 49 years. Therefore, the EIS does not address the issue of cumulative impact of drawdown of water on the neighbouring lands and communities.
Research on the cumulative impact of drawdown needs to be done by using numerical models and software for ground flow analysis. An example of widely accepted software for this purpose is MODFLOW, which was developed by US Geological Survey. It is important that the input data should have a statistically meaningful base. The opinion expressed in Reference Volume V, Tab. 29, and p.14: "--- groundwater models can have serious limitations in crystalline bedrock" cannot be used as an excuse for not performing the basic research on this issue.
There is a noticeable discrepancy between the hydrogeology Section of Vol. III, Fig. 6A of 2005 and the hydrogeology Section A-A, Drawing 17221-2 of Reference Volume V, Tab. 28 of 2002. A superimposition of Drawing 17221-2 on Figure 6A is provided in Exhibit Four of this submission. A part of the discrepancy between these figures may be attributed to the data obtained from two additional "monitoring" wells as well as a slight difference in the azimuth of the Section AA used in developing the two figures. However, the magnitude of the discrepancy points to an insufficiency of the database. The statement made in the EIS, "The two cross-sections – see Map 12 – (i.e., Figures 6A & 6B showing Sections A-A & B-B)

C0635-054

depict a 'snapshot' of the water table, the hydraulic gradient etc. in the fall of 2005" does not help in creating confidence in the database.
A clear demonstration of the low degree of confidence associated with the hydrogeologic parameters used by the Proponent is furnished in Exhibit Five, which is a superimposition of Figures 6A and 7 of the EIS. Both figures relate to Section AA (of Map 12) and use the same scales (Horizontal and Vertical). However, there is a significant difference in the topographic outline of the two figures. Since the topography influences the outline of the water table, the baseline data used for the EIS appears to be inadequate; it needs to be examined for its accuracy and statistical significance.
For a reasonable assessment of the environmental impact of the 50-year quarrying operation, it is essential to define the hydrogeologic parameters with an assigned and acceptable "degree of confidence". This would require the use of a database that would be significantly larger than the one hitherto used by the Proponent. Numerical & water flow analysis needs to be performed to determine the cumulative impact of the quarry operations on the water table over a period that goes beyond the 50 year life of the quarry.

RESPONSE
Please refer to Bilcon's responses to the Panel and Agencies in this section.

Deficiency Statement 55
EIS Guidelines
9.1.3.2 – Groundwater – 'Synthesize the groundwater and surface water data to produce a conceptual/analytical model of the hydrological cycle under and around the Project site."
10.1.3.2 – Ground Water – Provide information on anticipated changes in yield characteristics of aquifers due to Project-related groundwater withdrawal or topographic and terrain changes."
8.1 – Methods – Indicate the degree of certainty in the impact predictions and determination of significance (identify measures used).
EIS
The EIS states that 'The ground water regime and the hydrostratigraphic units are shown on Figure 6A and 6B. The two cross-sections – see Map 12 – depicts a 'snapshot' of the water table, the hydraulic gradient etc. in the fall of 2005." No comment is made though on the degree to which the 'snapshot' representative of the temporal scale (50 years) of the Project. The EIS does not provide a numerical analysis or model to support the conclusions drawn concerning impacts on groundwater.

RESPONSE
Please refer to Bilcon's responses to the Panel and Agencies in this section.

C0635-055

9.1.2 Geology and Hydrogeology

Deficiency Statement 56
EIS Guidelines
9.1.3.2 – Groundwater – "Provide a pre-development well-water survey to establish baseline well-water quality and quantity."
EIS
9.1.3.3 – Mitigation – The EIS states that, "Due to the lack of water well data for residential wells in the immediate area of the quarry, a pre-quarrying survey of water quality of neighbouring properties is proposed by Bilcon of Nova Scotia Corporation."[118] *The EIS fails to meet the requirements of section 9.1.3.2 of the EIS Guidelines.*

RESPONSE
Please refer to Bilcon's responses to the Panel and Agencies in this section.

Deficiency Statement 63
EIS Guidelines
10.1.3.2 – Groundwater – "Describe and evaluate the potential impacts of the Project on groundwater quantity and quality through alteration to the groundwater regime(s) and neighbouring regimes by Project-related changes in topography, terrain and soil cover."
EIS
9.1.3.2 – Analyses – The EIS states "...the quarry will not adversely impact the relevant recharge regime." The EIS does not provide clear information on the type of methodology that was used to determine recharge/discharge patterns. For example, if seasonal groundwater level measurements were collected, if there is sufficient data, if enough wells were drilled, etc. Furthermore, conclusions regarding the future well water quality and quantity for the area are based on a 'Preliminary Hydrogeological Assessment' completed by Jacques Whitford in 2002.[136] *Section 6.1.1 of the JW Assessment appears to be a theoretical/conceptual discussion of the impacts two quarry scenarios may have on water level impacts. The JW assessment does not provide diagrams showing the potential future groundwater flow scenarios and relative neighbouring well locations. Nor does it provide the well depth, yield, construction type, etc. for those wells located closest to the quarry Project to provide an evaluation of potential impact to those specific (and most susceptible) wells. More detailed information must be presented in the EIS to meet the requirements of section 10.1.3.2 of the EIS Guidelines.*

RESPONSE
Please refer to Bilcon's responses to the Panel and Agencies in this section.

C0635-056

9.1.2 Geology and Hydrogeology

Deficiency Statement 64
EIS Guidelines
10.1.3.2 – Ground Water - "Provide information on anticipated changes in yield characteristics of aquifers due to Project-related groundwater withdrawal or topographic and terrain changes."
EIS
The EIS states that pump or aquifer testing will not be included as part of the monitoring program. The EIS states that since the yield in the upper flow unit is very low and that quarrying will not occur in the middle flow unit, the yield of the middle flow unit will not be impacted. The evidence to support this finding is not clearly referenced. Quarrying will change the topography, soil cover, and geology of the area, which may or may not affect the yield of the middle flow unit. Failure to include pump testing as part of the monitoring program is not consistent with the requirements of Section 10.1.3.2 of the EIS Guidelines.

RESPONSE
Please refer to Bilcon's responses to the Panel and Agencies in this section.

Deficiency Statement 80
EIS Guidelines
12.4 – Monitoring – "Describe timing, frequency, methods and agents responsible for monitoring." "Describe the criteria used in selecting subjects and indicators." "Describe quality assurance and quality control measures to be applied to monitoring programs."
EIS
9.1.3.4 – Monitoring – In the discussion of hydrogeology issues, the EIS indicates that the Proponent will use six monitoring wells to implement a multi-level monitoring program. The depths and locations of the monitoring wells relative to neighbouring wells are unclear. It is uncertain if these wells provide adequate monitoring coverage for all potentially affected neighbouring residents, including those with shallow dug wells, drilled wells, wells in different units...etc. The lack of detailed information provided for this proposed monitoring program fails to meet the requirements of Section 12.4 of the EIS Guidelines.

RESPONSE
Please refer to Bilcon's responses to the Panel and Agencies in this section.

Deficiency Statement 85
EIS Guidelines
12.5 – Mitigation Measures – "Identify trigger points when an adverse effect uncovered by monitoring will result in remedial action, mitigation or cessation of activity." "Describe how Aboriginal and community organizations will be involved in the development, application and ongoing evaluation of these measures." "Describe criteria for evaluating the success of mitigation or reclamation measures;"

C0635-057

9.1.2 Geology and Hydrogeology

EIS

9.1.3.3 - Mitigation – The EIS states that, "...Bilcon of Nova Scotia Corporation will replace, at their expense, any existing water supply, identified as lost or damaged as a result of their quarrying operation."[184] *There is no information provided to determine what constitutes a "damaged" water supply. Is it a change in taste, water quality parameters above guidelines, a drop in well yield by >10%? There is no information to identify how a water quality problem will be communicated or addressed. This mitigation measures fails to meet the requirements of section 12.5 of the EIS Guidelines because it does not describe how the determination for mitigation will be made or provide criteria for evaluating the success of the mitigation measure.*

RESPONSE

Please refer to Bilcon's responses to the Panel and Agencies in this section.

C0635-058

9.1.2 Geology and Hydrogeology

Appendix 1
Whites Point Well Monitoring Data

C0635-059

MONITORING WELL: MW-1 **Elevation: 275.5 ft.** **Total Depth: 245.0 ft.** **Recorded By:**				
DATE	TIME	Water Level Depth (ft.)	RAINFALL (inches)	COMMENT
9-21-05	9:00 AM	242.0		
9-22-05	9:00 AM	237.0		
9-23-05	1:00 PM	232.0		
9-24-05	9:00 AM	229.0		
10-18-05	10:00 AM	222.25		
10-28-05	10:50 AM	222.2		
11-04-05	9:40 AM	222.3		Road and well being used for target practice
11-11-05	10:30 AM	222.25	19mm	
11-18-05	10:00 AM	222.3	23mm	
11-25-05	10:02 AM	221.5	41mm	
12-02-05	11:40 AM	222	45 mm	
12-12-05	1:11 PM	221.6	22 mm	
12-17-05	1:19 PM	222.1	10mm	
12-30-05	11:48 AM	221.7	18mm	
01-06-06	3:01 PM	221.4	23mm	
01-13-06	11:02 AM	221.8	15mm	
01-21-06	11:56 AM	222.2	25mm	
01/27/06	2:16 PM	221.9	9mm	
02/03/06	11:17 AM	221.9	2mm	
02/10/06	10:45 AM	221.5	30mm	
02/19/06	11:50 AM	No measure	0mm	Well is damaged due to vandalism
02/24/06	11:50 AM	No measure	5mm	Well out of service
03/03/06	2:15 PM	No measure	0mm	Well out of service And rain gauge vandalized- has since been fixed
03/10/06	12:42 PM	No measure	5mm	"
03/17/06	11:35 AM	No measure	13mm	"
03/24/06	11:26 AM	No measure	1.5mm	"
03/31/06	1:41 PM	No measure	0mm	"
04/04/06	9:18 AM	No measure	24mm	"
4/14/06	10:05 AM	No measure	22mm	"
4/21/06	8:21 AM	No measure	29mm	"
05/05/06	9:41 AM	No measure	31mm	"
05/12/06	10:29 AM	No measure	28mm	"
05/20/06	1:08 PM	No measure	36mm	"
05/26/06	2:10 PM	No measure	0mm	"
06/03/06	10:18 AM	No measure	27mm	"
06/10/06	3:30 PM	196.8	141mm	Well has been repaired

C0635-060

MONITORING WELL: MW-2 **Elevation: 296.4 ft.** **Total Depth: 220.0 ft.** **Recorded By:**				
DATE	TIME	Water Level Depth (ft.)	RAINFALL (inches)	COMMENTS
9-22-05	9:00 AM	182.0		
9-23-05	1:30 PM	179.0		
9-24-05	9:45 AM	177.0		
10-18-05	10:00 AM	165.0		
10-28-05	11:02 AM	164.7		
11-04-05	10:00 AM	164.0		
11-11-05	10:46 AM	164.8	19mm	
11-18-05	10:15 AM	165.5	23mm	
11-25-05	10:15 AM	165.5	41mm	
12-02-05	11:47 AM	165.1	45 mm	
12-12-05	1:23 PM	164.6	22 mm	
12-17-05	1:31 PM	165.5	10mm	
12-30-05	12:00 PM	166	18mm	
01-06-06	3:10 PM	165.6	23mm	
01-13-06	11:14 AM	166.5	15mm	
01-21-06	12:12 PM	167.7	25mm	
01/27/06	2:35 PM	167.5	9mm	
02/03/06	11:28 AM	168.3	2mm	
02/10/06	10:35 AM	168.5	30mm	
02/19/06	11:42 AM	168.8	0mm	
02/24/06	2:45 PM	168.6	5mm	
03/03/06	2:30 PM	No measure	0mm	Well has been vandalized - no clear measure as a result And rain gauge vandalized- has since been fixed.
03/10/06	12:50 PM	170.7	5mm	New lock put on well
03/17/06	11:25 AM	172.6	13mm	
03/31/06	1:36 PM	172.6	0mm	
04/07/06	9:12 AM	173.5	24mm	
04/14/06	10:58 AM	174.1	22mm	
4/21/06	8:13 AM	174.4	29mm	
05/05/06	9:25 AM	173.6	31mm	
05/12/06	10:23 AM	173.5	28mm	
05/20/06	1:01 PM	173.0	36mm	
05/26/06	2:01 PM	172.9	0mm	
06/03/06	10:09 AM	173.0	27mm	
06/10/06	3:22 PM	170.3	141mm	

MONITORING WELL: MW-3 **Elevation: 286.3 ft.** **Total Depth: 260.0 ft.** **Recorded By:**				
DATE	TIME	Water Level Depth (ft.)	RAINFALL (inches)	COMMENTS
9-22-05	1:00 PM	172.0		
9-23-05	2:00 PM	165.0		
9-24-05	10:45 AM	165.0		
10-18-05	11:00 AM	142.5		
10-28-05	1:00 PM	153.6		
11-04-05	10:40 AM	153.2		
11-11-05	10:20 AM	154.5	19mm	
11-18-05	9:45 AM	154.8	23mm	
11-25-05	9:44 AM	154.8	41mm	
12-02-05	12:00 PM	154.8	45 mm	Someone hauled a tree and left it at well
12-12-05	12:49 PM	154.0	22 mm	
12-17-05	1:51 PM	155.0	10mm	
12-30-05	11:25 AM	155.3	18mm	
01-06-06	4:23PM	154.5	23mm	
01-13-06	11:45 AM	156	15mm	
01-21-06	12:20 PM	157	25mm	
01/27/06	3:37 PM	156.8	9mm	
02/03/06	11:05 AM	157.7	2mm	
02/10/06	10:30 AM	157.5	30mm	
02/19/06	11:30 AM	158	0mm	
02/24/06	2:38 PM	158.4	5mm	
03/03/06	2:19 PM	158.8	0mm	Rain gauge vandalized- has since been fixed.
03/10/06	12:35 PM	160.0	5mm	
03/17/06	11:15 AM	160.0	13mm	
03/24/06	11:07 AM	155.5	1.5mm	
03/31/06	1:27 PM	155.4	0mm	
04/07/06	9:00AM	151.1	24mm	
04/14/06	10:48 AM	150.3	22mm	
04/21/06	8:00 AM	152.4	29mm	
05/05/06	9:19 AM	163.2	31mm	
05/12/06	10:01 AM	163.3	28mm	
05/20/06	12:56 PM	162.5	36mm	
05/26/06	1:47 PM	162.2	0mm	
06/03/06	10:01 AM	162.3	27mm	
06/10/06	3:13 PM	159.2	141mm	

MONITORING WELL: MW-4 **Elevation: 167.7 ft.** **Total Depth: 120.0 ft.** **Recorded By:**				
DATE	TIME	Water Level Depth (ft.)	RAINFALL (inches)	COMMENTS
9-22-05	4:00 PM	27.0		
9-23-05	3:00 PM	22.0		
9-24-05	11:15 AM	22.0		
10-18-05	11:00 AM	21.3		
10-28-05	1:15 PM	21.35		
11-04-05	12:10 PM	21.6		
11-11-05	1:30 PM	21.2	19mm	
11-18-05	12:00 PM	21.4	23mm	
11-25-05	11:55 AM	21.3	41mm	
12-02-05	12:35 PM	21.3	45 mm	
12-12-05	3:00 PM	21.3	22 mm	
12-17-05	2:20 PM	21.4	10mm	
12-30-05	12:30PM	21.4	18mm	
01-06-06	4:15PM	21.4	23mm	
01-13-06	1:00 PM	21.4	15mm	
01-21-06	12:45 PM	21.6	25mm	
01/27/06	4:13 PM	21.6	9mm	
02/03/06	12:45 PM	21.6	2mm	
02/10/06	11:40 AM	21.6	30mm	
02/19/06	1:42 PM	21.5	0mm	
02/24/06	2:10 PM	21.5	5mm	
03/03/06	4:08 PM	21.4	0mm	Rain gauge vandalized- has since been fixed.
03/10/06	2:35 PM	21.4	5mm	Culvert painted
03/17/06	1:00 PM	21.5	13mm	
03/24/06	12:49 PM	23.5	1.5mm	
03/31/06	11:00 PM	23.5	0mm	
04/07/06	8:00 AM	23.5	24mm	
04/14/06	9:35 AM	23.5	22mm	
04/21/06	9:30 AM	24	29mm	
05/05/06	11:10 AM	21.6	31mm	
05/12/06	9:30 AM	21.4	28mm	
5/20/06	2:30 PM	21.3	36mm	
5/26/06	1:21 PM	21.6	0mm	
06/03/06	12:25 PM	21.5	27mm	
06/10/06	5:00 PM	20.7	141mm	

C0635-063

MONITORING WELL: MW-5 **Elevation: 156.9 ft.** **Total Depth: 150.0 ft.** **Recorded By:**				
DATE	TIME	Water Level Depth (ft.)	RAINFALL (inches)	COMMENTS
9-23-05	2:45 PM	32.0		
9-24-05	11:00 AM	30.3		
10-18-05	12:00 PM	23.7		
10-28-05	10:35 AM	23.4		
11-04-05	12:10 AM	23.2		
11-11-05	10:00 AM	23.7	19mm	
11-18-05	9:31 AM	24.1	23mm	
11-25-05	9:31 AM	24.1	41mm	
12-02-05	12:15 PM	24.2	45 mm	
12-12-05	12:31PM	23.5	22 mm	
12-17-05	2:10 PM	24.1	10mm	
12-30-05	11:11AM	24.5	18mm	
01-06-06	2:40PM	24.3	23mm	
01-13-06	10:40 AM	25	15mm	
01-21-06	12:45 PM	21.6	25mm	
01/27/06	3:49 PM	25.6	9mm	
02/03/06	12:15 PM	26.3	2mm	
02/10/06	10:15AM	26.3	30mm	
02/19/06	11:14 AM	26.5	0mm	
02/24/06	3:30 PM	26.5	5mm	
03/03/06	2:00 PM	No measure	0mm	Lock has been vandalized Rain gauge vandalized- has since been fixed.
03/10/06	12:10 PM	No measure	5mm	
03/17/06	11:00 AM	No measure	13mm	
03/24/06	10:52 AM	29.9	1.5mm	New locks put on
03/31/06	1:15 PM	29.9	0mm	
04/07/06	8:45 AM	30.3	24mm	
4/21/06	7:48 AM	31.4	29mm	
05/05/06	10:55 AM	30.9	31mm	
05/12/06	9:47 AM	31.1	28mm	
5/20/06	12:43 PM	29.3	36mm	
5/26/06	1:35 PM	29.4	0mm	
06/03/06	9:47 AM	29.5	27mm	
06/10/06	4:34 PM	29.1	141mm	

MONITORING WELL: MW-6 **Elevation: 147.2 ft.** **Total Depth: 130.0 ft.** **Recorded By:**				
DATE	TIME	Water Level Depth (ft.)	RAINFALL (inches)	COMMENTS
9-23-05	12:30 AM	129.2		
9-23-05	3:15 PM	129.8		
9-24-05	10.15 AM	128.0		
10-18-05	11:30 AM	67.1		Well Vandalized
10-28-05	11:35 AM	52.2		
11-04-05	10:30 AM	45.5		
11-11-05	11:45 AM	38.65	19mm	
11-18-05	11:14 AM	34.3	23mm	
11-25-05	10:46 AM	34	41mm	
12-02-05	10:42 PM	28	45 mm	
12-12-05	2:00 PM	30.0	22 mm	
12-17-05	2:10 PM	25.6	10mm	
12-30-05	12:30 PM	24	18mm	
01-06-06	3:35 PM	23.5	23mm	
01-13-06	12:35 PM	23.2	15mm	
01-21-06	11:40 AM	22.9	25mm	
01/27/06	3:08 PM	22.9	9mm	
02/03/06	12:05 PM	22.8	2mm	
02/10/06	11:03AM	22.8	30mm	
02/19/06	12:35 PM	22.6	0mm	
02/24/06	3:15 PM	22.6	5mm	
03/03/06	3:10 PM	No measure	0mm	Well has been vandalized. Rain gauge vandalized- has since been fixed.
03/10/06	1:30 PM	No measure	5mm	
03/17/06	11:40 AM	No measure	13mm	
03/24/06	11:38 AM	No measure	1.5mm	
03/31/06	2:00 PM	No measure	0mm	
04/07/06	9:49 AM	No measure	24mm	
04/14/06	11:30 AM	No measure	22mm	
04/21/06	8:48 AM	No measure	29mm	
05/05/06	10:05 AM	No measure	31mm	
05/12/06	10:48 AM	No measure	28mm	
5/20/06	1:33 PM	No measure	36mm	
5/26/06	2:47 PM	No measure	0mm	
06/03/06	10:36 AM	No measure	27mm	
06/10/06	4:09 PM	22.6	141mm	Well has been repaired

C0635-065

MONITORING WELL: NS-02-01 **Elevation: 291.6 ft.** **Total Depth: 206.6 ft.** **Recorded By:**				
DATE	TIME	Water Level Depth (ft.)	RAINFALL (inches)	COMMENTS
9-22-05	9:00 AM	177.0		
9-23-05	2:30 PM	173.0		
9-24-05	10:30 PM	172.0		
10-28-05	11:45 AM	158.9		
11-04-05	11:20 AM	158.7		
11-11-05			19mm	Couldn't get cover off
11-18-05	10:35 AM	159.6	23mm	
11-25-05	10:22 AM	159.6	41mm	
12-02-05	11:25 PM	159.5	45 mm	
12-12-05	1:33 PM	-	22 mm	Ground frozen and cover won't come off
12-17-05	1:05 PM	-	10mm	
12-30-05	1:35 PM	159.8	18mm	
01-06-06	4:15 PM	160	23mm	
01-13-06			15mm	Couldn't get cover off
01-21-06	12:15 PM	160.6	25mm	
01/27/06	2:45 PM	159.8	9mm	
02/03/06	11:40 AM	163.0	2mm	
02/10/06	11:20AM	163.0	30mm	
02/19/06	12:10 PM	163.5	0mm	
02/24/06	2: 55 PM	163.4	5mm	
03/03/06	3:50 PM	163.4	No measure	Rain gauge vandalized- has since been fixed.
03/10/06	11:00 PM	161.7	5mm	
03/17/06	12:40 PM	P161.9	13mm	
03/24/06	12:40 PM	161.9	1.5mm	
03/31/06	2:45 PM	162.0	0mm	
04/07/06	9:31 AM	168.7	24mm	
04/14/06	11:12 AM	168.8	22mm	
04/21/06	8:20 AM	168.5	29mm	
05/05/06	10:45 AM	167.9	31mm	
05/12/06	10:23 AM	168.2	28mm	
5/20/06	2:13 PM	168.4	36mm	
5/26/06	2:18 PM	167.4	0mm	
06/03/06	12:00 PM	167.2	27mm	
06/10/06	3:43 PM	161.5	141mm	

MONITORING WELL: NS-02-04 **Elevation: 40.7 ft.** **Total Depth: 65.6 ft.** **Recorded By:**				
DATE	TIME	Water Level Depth (ft.)	RAINFALL (inches)	COMMENTS
10-28-05				Unable to access well due to not having the right equipment to open bolts. Brent will get the correct equipment prior to monitoring next week.
11-04-05	10:45 AM	4.5		
11-11-05	11:16 AM	3.7		
11-18-05	11:00 AM	3.8	23mm	
11-25-05	10:58 AM	3.8	41mm	
12-02-05	10:55 PM	3.6	45 mm	
12-12-05	12:25 PM	-	22 mm	A lot of surface water around well, with deep puddle
12-17-05	-	-	10mm	
12-30-05	12:43 PM	3.5	18mm	
01-06-06	3:46 PM	3.3	23mm	.
01-13-06	12:02 PM	3.9	15mm	
01-21-06	11:25 AM	4.4	25mm	
01/27/06	3:20 PM	4.5	9mm	
02/03/06	12:15 PM	4.4	2mm	
02/10/06	11:13AM	4.5	30mm	
02/19/06	12:40 PM	4.5	0mm	
02/24/06	3:30 PM	4.4	5mm	
03/03/06	3:19 PM	4.4	No measure	Rain gauge vandalized- has since been fixed.
03/10/06	1:45 PM	4.5	5mm	
03/17/06	11:55 AM	4.4	13mm	
03/24/06	11:46 AM	4.5	1.5	
03/31/06	2:10 PM	4.4	0mm	
04/07/06	10:00 AM	4.5	24mm	
04/14/06	11:39 AM	4.6	22mm	
04/21/06	9:00 AM	4.2	29mm	
05/05/06	10:20 AM	4.5	31mm	
05/12/06	10:58 AM	4.5	28mm	
5/20/06	1:43 PM	4.7	36mm	
5/26/06	3:00 PM	4.5	0mm	
06/10/06	4:17 PM	4.4	141mm	06/10/06

C0635-067

MONITORING WELL: MW-1 **Elevation: 275.5 ft.** **Total Depth: 245.0 ft.** **Recorded By:**				
DATE	TIME	Water Level Depth (ft.)	RAINFALL (mm)	COMMENT
6/17/06	3:30 PM	168	50 mm	Still debris in this well
6/23/06	12:40 PM	143.4	33 mm	"
7/02/06	11:42 AM	143.4	27 mm	"
07/09/06	4:52 PM	143.3	3 mm	"
07/16/06	12:10 PM	76.8	78 mm	"
07/22/06	11:09 AM	63.1	66 mm	"
7/30/06	1:38 PM	52.2	9 mm	"
08 05 06	11:52 AM	44	17 mm	"
08 13 06	12:25 PM	37.6	2mm	"
08 17 06	12:15 PM	33.7	13mm	"
08 27 06	12:25 PM	30.2	0mm	"
09 03 06	3:05 PM	28.1	4mm	"
09 17 06	11:42 AM	25.1	0 mm	"
09 22 06	2:55 PM	24.2	36mm	"
10 01 06	11:30 AM	23.4	11mm	"
10 08 06	10:23 AM	22.3	78mm	"
10 14 06	1:00 PM	21.4	15mm	"
10 21 06	9:42 AM	22.7	26mm	"
10 28 06	1:12 PM	22.9	2mm	"
11 04 06	9:52 AM	22.3	10 mm	"
11 12 06	11:22 AM	23.6	No measurement taken	
11 18 06	11:05 AM	24.7	5.0 mm	"
11 25 06	12:28 PM	28	No measurement taken	
12 02 06	11:30 AM	98	1.3 inches	New rain gauge – old one destroyed
12 09 06	11:38 AM	69.5	1 inch	"
12 16 06	12:27 PM	51.1	0.3 inches	
12 23 06	10:05 AM	40.4	0.7 inches	
12 31 06	12:59 PM	36.2	0	

MONITORING WELL: MW-2 **Elevation: 296.4 ft.** **Total Depth: 220.0 ft.** **Recorded By:**				
DATE	TIME	Water Level Depth (ft.)	RAINFALL (mm)	COMMENTS
6/17/06	3:24 PM	170.2	50 mm	
6/23/06	12:56 PM	167.5	33 mm	
7/02/06	11:35 AM	167.1	27 mm	
07/09/06	4:40 PM	167.1	3 mm	
07/16/06	12:20 PM	167.4	78 mm	
07/22/06	11:01 AM	166.8	66 mm	
7/30/06	1:46 PM	165.7	9 mm	
08 05 06	11:56 AM	166.7	17 mm	
08 13 06	12:17 PM	167.7	2mm	
08 17 06	12:25 PM	169.1	13mm	
08 27 06	12:30 PM	170.0	0mm	
09 03 06	3:12 PM	172.4	4mm	
09 17 06	11:49 AM	174.6	0 mm	
09 22 06	3:01 PM	175.3	36mm	
10 01 06	11:35 AM	177.0	11mm	
10 08 06	10:29 AM	176.8	78mm	
10 14 06	1:06 PM	177.2	15mm	
10 21 06	9:47 AM	177.6	26mm	
10 28 06	1:18 PM	177.5	2mm	
11 04 06	9:58 AM	177.7	10 mm	
11 12 06	11:28 AM	177.1	No measurement taken	
11 18 06	11:11 AM	177.2	5.0 mm	
11 25 06	11:58 AM	174.1	No measurement taken	
12 02 06	11:20 AM	161.6	1.3 inches	New rain gauge – old one destroyed
12 09 06	11:45 AM	169.5	1 inch	* Cover not welded back on
12 16 06	12:34 PM	167.4	0.3 inches	
12 23 06	9:59 AM	167.6	0.7 inches	
12 31 06	1:07 PM	168.4	0	

MONITORING WELL: MW-3 **Elevation: 286.3 ft.** **Total Depth: 260.0 ft.** **Recorded By:**				
DATE	TIME	Water Level Depth (ft.)	RAINFALL (mm)	COMMENTS
6/17/06	3:17 PM	159.3	50 mm	
6/23/06	12:24 PM	157	33 mm	
7/02/06	11:30 AM	157.1	27 mm	
07/09/06	3:54 PM	156.5	3 mm	
07/16/06	12:01 PM	156.3	78 mm	
07/22/06	10:55 AM	150.1	66 mm	
7/30/06	1:28 PM	162.5	9 mm	
08 05 06	11:43 AM	161.8	17 mm	
08 13 06	12:09 PM	157.3	2mm	
08 17 06	12:00 PM	158.7	13mm	
08 27 06	10:40 AM	158.6	0mm	
09 03 06	2:55 PM	162.0	4mm	
09 17 06	11:22 AM	164.1	0 mm	
09 22 06	2:45 PM	163	36mm	
10 01 06	11:23 AM	166.6	11mm	
10 08 06	10:10 AM	165.5	78mm	
10 14 06	12:55 PM	165.0	15mm	
10 21 06	9:29 AM	166.5	26mm	
10 28 06	1:00 PM	167	2mm	
11 04 06	9:37 AM	167.4	10 mm	
11 12 06	11:07 AM	166.7	No measurement taken	
11 18 06	10:58 AM	166.6	5.0 mm	
11 25 06	10:40 AM	163.1	No measurement taken	
12 02 06	10:42 AM	159.1	1.3 inches	New rain gauge – old one destroyed
12 09 06	11:26 AM	143.3	1 inch	
12 16 06	12:10 PM	156.5	0.3 inches	
12 23 06	9:48 AM	156.5	0.7 inches	
12 31 06	1:52 PM	157.1	0	

MONITORING WELL: MW-4 **Elevation: 167.7 ft.** **Total Depth: 120.0 ft.** **Recorded By:**				
DATE	TIME	Water Level Depth (ft.)	RAINFALL (mm)	COMMENTS
6/17/06	4:40 PM	21.4	50 mm	
6/23/06	2:07 PM	21.5	33 mm	
7/02/06	12:25 PM	21.4	27 mm	
07/09/06	5:03 PM	21.6	3 mm	
07/16/06	11:41 AM	21.4	78 mm	
07/22/06	12:04 PM	21.3	66 mm	
7/30/06	2:53 PM	21.6	9 mm	
08 05 06	12:45 PM	21.5	17 mm	
08 13 06	1:22 PM	21.8	2mm	
08 17 06	1:35 PM	21.7	13mm	
08 27 06	12:50 PM	21.7	0mm	
09 03 06	3:55 PM	22.1	4mm	
09 17 06	11:12 AM	22.2	0 mm	
09 22 06	3:54 PM	21.8	36mm	
10 01 06	12:38 PM	21.9	11mm	
10 08 06	11:30 AM	21.8	78mm	
10 14 06	2:05 PM	21.6	15mm	
10 21 06	10:31 AM	21.7	26mm	
10 28 06	2:25 PM	21.7	2mm	
11 04 06	11:15 AM	21.7	10 mm	
11 12 06	10:55 AM	21.3	No measurement taken	
11 18 06	10:47 AM	21.3	5.0 mm	
11 25 06	12:47 PM	21.3	No measurement taken	
12 02 06			1.3 inches	1)New rain gauge – old one destroyed. 2) No water level measurement taken in well as the well was being worked on.
12 09 06	12:40	21.4	1 inch	
12 16 06	1:37 PM	21.3	0.3 inches	
12 23 06	10:48 AM	21.5	0.7 inches	
12 31 06	2:15 PM	21.5	0	

MONITORING WELL: MW-5 **Elevation: 156.9 ft.** **Total Depth: 150.0 ft.** **Recorded By:**				
DATE	TIME	Water Level Depth (ft.)	RAINFALL (mm)	COMMENTS
6/17/06	3:09 PM	25.6	50 mm	
6/23/06	12:14 PM	25.5	33 mm	
7/02/06	11:22 AM	25.4	27 mm	
07/09/06	3:35 PM	25.5	3 mm	
07/16/06	11:53 AM	25.4	78 mm	More vandalism – someone put rocks into the keyhole.
07/22/06	10:47 AM	24.6	66 mm	
7/30/06	1:19 PM	24.2	9 mm	
08 05 06	11:38AM	25.2	17 mm	
08 13 06	11:57 AM	26.1	2mm	
08 17 06	11:55 AM	27.2	13mm	
08 27 06	10:30 AM	28.6	0mm	
09 03 06	2:45 PM	29.7	4mm	
09 17 06	11:18 AM	31.4	0 mm	
09 22 06	2:35 PM	32.4	36mm	
10 01 06	11:15 AM	33.4	11mm	
10 08 06	10:05AM	32.9	78mm	
10 14 06	12:48 PM	33.2	15mm	
10 21 06	9:25 AM	32.8	26mm	
10 28 06	12:50 PM	33.2	2mm	
11 04 06	9:32 AM	33.7	10 mm	
11 12 06	11:02 AM	33.6	No measurement taken	
11 18 06	11:40 AM	33.5	5.0 mm	
11 25 06	10:30 AM	29.8	No measurement taken	
12 02 06			1.3 inches	1)New rain gauge – old one destroyed. 2) No water level measurement taken in well as the well was being worked on.
12 09 06	11:22 AM	27.2	1 inch	
12 16 06	12:01 PM	25.6	0.3 inches	
12 23 06	9:44 AM	26.6	0.7 inches	
12 31 06	2:00 PM	26.4	0	

C0635-072

MONITORING WELL: MW-6 **Elevation: 147.2 ft.** **Total Depth: 130.0 ft.** **Recorded By:**				
DATE	TIME	Water Level Depth (ft.)	RAINFALL (mm)	COMMENTS
6/17/06	3:57 PM	22.6	50 mm	Still has debris in well
6/23/06	1:21 PM	22.5	33 mm	"
7/02/06	11:50 AM	22.5	27 mm	"
07/09/06	4:07 PM	22.5	3 mm	"
07/16/06	12:36 PM	22.5	78 mm	"
07/22/06	11:35 AM	22.6	66 mm	"
7/30/06	2:08 PM	22.5	9 mm	"
08 05 06	12:18PM	22.6	17 mm	"
08 13 06	12:48 PM	22.6	2mm	"
08 17 06	12:55 PM	21.6	13mm	"
08 27 06	10:50 AM	22.6	0mm	"
09 03 06	3:26 PM	22.6	4mm	"
09 17 06	12:20 PM	22.8	0 mm	"
09 22 06	3:25 PM	22.8	36mm	"
10 01 06	12:05 PM	22.7	11mm	"
10 08 06	10:41AM	22.7	78mm	"
10 14 06	2:30 PM	22.8	15mm	"
10 21 06	10:05 AM	22.6	26mm	"
10 28 06	1:40 PM	94.5	2mm	"
11 04 06	10:10 AM	62.2	10 mm	"
11 12 06	11:55 AM	43.6	No measurement taken	
11 18 06	12:28 PM	33.4	5.0 mm	"
11 25 06	11:17 AM	27.6	No measurement taken	
12 02 06	10:52 AM	97.7	1.3 inches	1)New rain gauge – old one destroyed.
12 09 06	12:00 PM	69.3	1 inch	"
12 16 06	1:00 PM	41.8	0.3 inches	
12 23 06	10:30 AM	40.6	0.7 inches	
12 31 06	1:27 PM	39.8	0	

MONITORING WELL: NS-02-01 **Elevation: 291.6 ft.** **Total Depth: 206.6 ft.** **Recorded By:**				
DATE	TIME	Water Level Depth (ft.)	RAINFALL (mm)	COMMENTS
6/17/06	3:41 PM	161.6	50 mm	
6/23/06	1:02 PM	161.4	33 mm	
7/02/06	12:15 PM	161.8	27 mm	
07/09/06	4:30 PM	161.7	3 mm	
07/16/06	1:10 PM	161.5	78 mm	
07/22/06	11:20 AM	162.5	66 mm	
7/30/06	1:49 PM	162.4	9 mm	
08 05 06	12:23PM	162.0	17 mm	
08 13 06	12:33 PM	162.2	2mm	
08 17 06	12:30 PM	162.1	13mm	
08 27 06	11:45 AM	166.4	0mm	
09 03 06	3:18 PM	166.5	4mm	
09 17 06	11:54 AM	164.5	0 mm	
09 22 06	3:10 PM	170.4	36mm	
10 01 06	11:42 PM	174.6	11mm	
10 08 06	10:35AM	175.1	78mm	
10 14 06	1:45 PM	174.8	15mm	
10 21 06	9:55 AM	171.8	26mm	
10 28 06	2:10 PM	170.6	2mm	
11 04 06	10:42 AM	170.1	10 mm	
11 12 06	11:35 AM	172	No measurement taken	
11 18 06	11:18 AM	172.1	5.0 mm	
11 25 06	11:35 AM	172	No measurement taken	
12 02 06	11:12 AM	166.6	1.3 inches	1)New rain gauge – old one destroyed.
12 09 06	12:22 PM	166.4	1 inch	
12 16 06	1:24 PM	167	0.3 inches	
12 23 06	10:17 AM	166	0.7 inches	
12 31 06	1:12 PM	168.2	0	

C0635-074

MONITORING WELL: NS-02-04 **Elevation: 40.7 ft.** **Total Depth: 65.6 ft.** **Recorded By:**				
DATE	TIME	Water Level Depth (ft.)	RAINFALL (mm)	COMMENTS
6/17/06	4:08 PM	4.4	50 mm	
6/23/06	1:32 PM	4.4	33 mm	
7/02/06	12:00 PM	4.4	27 mm	
07/09/06	4:14 PM	4.4	3 mm	
07/16/06	12:50 PM	4.3	78 mm	
07/22/06	11:40 AM	3.8	66 mm	
7/30/06	2:14 PM	3.8	9 mm	
08 05 06	12:07PM	3.9	17 mm	
08 13 06	12:58 PM	3.9	2mm	
08 17 06	12:55 PM	3.8	13mm	
08 27 06	11:00 AM	0	0mm	
09 03 06	3:35PM		4mm	
09 17 06	12:07 PM	0	0 mm	
09 22 06	3:35 PM	0	36mm	
10 01 06	12:15 PM	0	11mm	
10 08 06	10:55AM	0	78mm	
10 14 06	2:40 PM	0	15mm	
10 21 06	10:16 AM	3.8	26mm	
10 28 06	1:51 PM	4.7	2mm	
11 04 06	10:21 AM	4.5	10 mm	
11 12 06	12:12 AM	4	No measurement taken	
11 18 06	12:37 PM	4.1	5.0 mm	
11 25 06	10:58 AM	3.9	No measurement taken	
12 02 06	11:00 AM	3.9	1.3 inches	1)New rain gauge – old one destroyed.
12 09 06	12:15 PM	3.8	1 inch	
12 16 06			0.3 inches	
12 23 06			0.7 inches	
12 31 06			0	

9.1.2 Geology and Hydrogeology

Appendix 2
Analytical Test Results for Metals in Bedrock

C0635-076

Your C.O.C. #: B 18467

Attention: Josephine Lowry
Bilcon of Nova Scotia
305 Hwy 303 Suite 3
PO Box 2113
Digby, NS
B0V 1A0

Report Date: 2006/10/25

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: A6B0331
Received: 2006/10/16, 14:25

Sample Matrix: LIQUID
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Tot ICPMS Metals in Leachates (1)	3	N/A	2006/10/24	ATL SOP 00024	Based on EPA6020A

Sample Matrix: Soil
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
CGSB extraction - Init and Final pH (1)	3	N/A	2006/10/24	SOP 4091_1_1	CGSB 164-GP-1 MP
CGSB extraction - volume of extractant (1)	3	N/A	2006/10/24	SOP 4091_1_1	CGSB 164-GP-1 MP
CGSB extraction - Dry Weight (1)	3	N/A	2006/10/24	SOP 4091_1_2	CGSB 164-GP-1 MP
Moisture (1)	3	N/A	2006/10/19		MOE Handbook 1983

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) This test was performed by Bedford

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

MARIE MCNAIR, Project Manager
Email: marie.mcnair.reports@maxxamanalytics.com
Phone# (902) 420-0203

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. SCC and CAEAL have approved this reporting process and electronic report format.

Total cover pages: 1

Maxxam Job #: A6B0331
Report Date: 2006/10/25

Bilcon of Nova Scotia
Client Project #:
Project name:
Sampler Initials:

ATLANTIC CGSB LEACHATE+ METALS (LIQUID)

Maxxam ID		O87412	O87419	O87421	
Sampling Date		2006/09/28	2006/09/28	2006/09/28	
COC Number		B 18467	B 18467	B 18467	
	Units	**NS-02-01 (O56860)**	**NS-02-02 (O56870)**	**NS-02-03 (O56875)**	**RDL**
Elements (ICP-MS)					
Leachable Copper (Cu)	ug/L	ND	480	35	20

ND = Not detected
RDL = Reportable Detection Limit

200 Bluewater Rd, Suite 105, Bedford, Nova Scotia Canada B4B 1G9 Tel:902-420-0203 Toll-free:800-565-7227 Fax:902-420-8612 www.maxxamanalytics.com

Maxxam Job #: A6B0331
Report Date: 2006/10/25

Bilcon of Nova Scotia
Client Project #:
Project name:
Sampler Initials:

ATLANTIC CGSB LEACHATE+ METALS (SOIL)

Maxxam ID		O87412	O87419	O87421	
Sampling Date		2006/09/28	2006/09/28	2006/09/28	
COC Number		B 18467	B 18467	B 18467	
	Units	**NS-02-01 (O56860)**	**NS-02-02 (O56870)**	**NS-02-03 (O56875)**	**RDL**
CONVENTIONALS					
Final pH	N/A	4.9	4.9	4.9	N/A
Initial pH	N/A	9.7	9.7	9.6	N/A
INDUSTRIAL					
Dry Weight	g	50	50	50	0.01
INORGANICS					
Volume of Acetic Acid	mL/L	46	20	10	N/A
INORGANICS					
Moisture	%	2	ND	ND	1

ND = Not detected
RDL = Reportable Detection Limit

200 Bluewater Rd, Suite 105, Bedford, Nova Scotia Canada B4B 1G9 Tel:902-420-0203 Toll-free:800-565-7227 Fax:902-420-8612 www.maxxamanalytics.com

Maxxam Job #: A6B0331
Report Date: 2006/10/25

Bilcon of Nova Scotia
Client Project #:
Project name:
Sampler Initials:

GENERAL COMMENTS

Results relate only to the items tested.

200 Bluewater Rd, Suite 105, Bedford, Nova Scotia Canada B4B 1G9 Tel:902-420-0203 Toll-free:800-565-7227 Fax:902-420-8612 www.maxxamanalytics.com

9.1.3 Surficial Geology and Soils

EIS Reference: EIS Volume VI, Chapter 9.1, Section 9.1.4

INDEX OF COMMENTS

9.0 Environment and Impact Analysis

9.1 Physical Environment and Impact Analysis

9.1.3 Surficial Geology and Soils

C0635-081

9.1.3 Surficial Geology and Soils

WP 1452 - Joint Review Panel
9.1.4 Surficial Geology and Soils
Soil Analyses
Only two soil samples were analyzed for inorganic parameters on the property. Soils are thin and developed on top of Beaver River Till. No information on total soil depth at the sampling sites or sampling depth is provided. Beaver River Basalt Till (Table SG-1) shows considerable variability, with copper values ranging from 80 – 218 ppm.

RESPONSE
Two soil samples were taken on the quarry site and analyzed for inorganic parameters. The location of the sample site is shown on **Map 12** of the EIS as S.W.P. – 1. Sample site S.W.P. – 1 is located on the coastal plain and adjacent to the abandoned pit. Excavations in the area indicate the till is 1m to 3m deep. Actual surface soil depth ranges from 15 to 30 cm. Sampling depth was approximately 15 to 20 centimetres. Details regarding copper concentrations are discussed in Section 9.3.6 Human Health and Wellness and Socio-cultural Environment in this submission.

In view of the ISQG guidelines for copper in marine (18.7 ppm) and freshwater sediments (35.7 ppm), provide statistically meaningful averages for concentration levels of inorganic parameters, particularly for copper, from the soils on the property. Describe the range of values encountered. Document the sampling protocol and spatial distribution used for the analysis. (For this purpose, "statistically meaningful may be defined as =/-10% at 95% probability of the measured statistic).

On page 36, the Proponent should note that the sample taken from the existing sediment pond is not typical of material that is expected to be in the sediment ponds during operation of the Project. (It is the product of surface runoff from grubbing the site, not the result of basalt-crushing process).

RESPONSE
Soil Analyses
The EIS states site specific soil samples were taken from the same site location (S.W.P. 1) on May 22, 2002 and again on June 4, 2002 for analysis regarding available metals and BTEX/TPH MUST – Hydrocarbons for baseline data. The analytical data are presented in Appendices 38 and 38A. The results indicate that the concentration of copper in both samples was 39 mg/kg.

A sediment sample was taken (sediment sample site 7) on July 14, 2005 for the purpose of documenting sediment contamination levels from the land disturbance due to grubbing of a four hectare quarry site. The results for the sediment pond sample are stated in the subsequent section (9.1.4.2 Analyses) as 52 mg/kg.

C0635-082

9.1.3 Surficial Geology and Soils

The sampling effort that was utilized to characterize the soil copper levels on a site wide basis was not optimum, but not considered insufficient given a weight of evidence approach. Since the sediment that was sampled from the retention pond is a result of soil runoff from the four hectare quarry site, it is in essence an "integrated" soil sample. The sediment pond samples were analyzed by Maxxam Analytics Inc. (Analytical Report 2005/08/31). Appendix 36 of the EIS containing the laboratory analysis of these samples was not included with the EIS. Appendix 36 is included here as an attached errata sheet. Sample SSP is the relevant sample.

The retention pond sediment sample can be considered a conservative representation of the soil copper level considering that, in general, (1) soil copper levels diminish with depth, (2) greater concentrations of copper would be expected in the upper 5–10 centimetres of soil (Breslin 1999), (3) soil particle runoff is most likely from the upper soil layer, and (4) the two previous samples of actual soil from the site were 39 mg/kg. Average soil copper levels have been reported for the U.S. and Canada. The national average concentration for copper in U.S. soils is 30 mg/kg (Davies 1986). In Canada, average copper concentration in uncontaminated soils is 25 mg/kg and in sludge amended soils is 41 mg/kg (Webber and Singh 1995). The maximum trace element concentration limit for copper in compost is 100 mg/kg (Composting Council of Canada 2006).

With the current information, it is not possible to provide statistically meaningful averages for concentration levels of inorganic parameters, particularly for copper, from the soils on the property. Historical soil concentrations on site are relatively unknown, so derivation of the expected variability for use in sample size determinations would be guesswork. The Nova Scotia Department of Mines and Energy (NSDME 1982) performed background geochemical analysis of the Beaver River Till at sample sites at Whites Cove (341A) and Whale Cove (342A). Copper in these samples ranged from 80 mg/kg at 341A to 107 mg/kg at 342A. Site 341A is located on the quarry property and 342A approximately 3 km from the quarry property. Given the totality of what is known about copper concentrations in soil, glacial till, basalt, and in the sediment retention pond at the site, reasonably good estimates of copper concentrations in soil can be made (39 to 52 mg/kg). Additional sampling is not likely to yield additional useful information.

With regard to the sediment retention pond sample, the Panel is correct in stating the sample taken from the existing sediment pond is not typical of material that is expected to be in the sediment ponds during the operation of the Project. This was made clear in the EIS. The basalt crushing process is expected to generate slurry with a pH approaching 10. At that pH, high copper concentrations are not expected given that, on average, only 0.078% leached out of the basalt at a pH of 4.9 (Maxxam Analytics Inc., *Atlantic CGSB Leachate + Metals (Leachate) 2006/07/20*, and *Atlantic CGSB Leachate+ Metals (Liquid),* attached). The proposed sampling of pond effluents will provide confirmation (please see Response to Panel under Fisheries and Oceans Canada).

C0635-083

9.1.3 Surficial Geology and Soils

Appendix 1
Errata – Sediment Pond Samples

Note: Sample SSP is the relevant sample

C0635-084

Your C.O.C. #: 317877

Attention: Mike BryLinsky
Acadia University
ACER
Box 115
Wolfville, NS
CANADA B4P 2R6

Report Date: 2005/08/31

ANALYTICAL REPORT

MAXXAM JOB #: A567371
Received: 2005/07/19, 9:20

Sample Matrix: Soil
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Mercury (CVAA) (1)	4	N/A	2005/08/03	3425_1_2	Based on EPA245.5
Elements by ICPMS (FIAS, HF)	4	N/A	2005/07/26	3013_1_1	Based on EPA6020A
Moisture	4	N/A	2005/07/20		MOE Handbook 1983
PAH Compounds by GCMS (SIM)	4	2005/07/21	2005/07/22	SOP 7010_1_3	Based on EPA8270C
PCB/DDT in Soil by GC-ECD	4	N/A	2005/07/22	8024_1_5	Based EPA8082
Particle size in solids (1)	4	N/A	2005/07/26	1050_1_1	based on MSAMS-1978
Total Carbon in Solids by Ind.	4	N/A	2005/08/02	15840_1_4	LECO 203-601-224
TIC in soil	4	N/A	2005/08/02	15840_1_4	LECO 203-601-224
Total Organic Carbon in Soil	2	N/A	2005/07/26	15840_1_4	LECO 203-601-224
Total Organic Carbon in Soil	1	N/A	2005/07/27	15840_1_4	LECO 203-601-224
Total Organic Carbon in Soil	1	N/A	2005/08/02	15840_1_4	LECO 203-601-224

(1) SCC/CAEAL

MAXXAM ANALYTICS INC.

MARIE MCNAIR
Project Manager

MMC/mmc
encl.

Total cover pages: 1

C0635-085

Maxxam Job #: A567371
Report Date: 2005/08/31

Acadia University
Client Project #:
Project name:
Sampler Initials:

ATLANTIC ODCA PKG IN SEDIMENT - OLD (SOIL)

Maxxam ID		H22546		H22581		H22584		
Sampling Date								
COC Number		317877		317877		317877		
	Units	**SSP**	**QC Batch**	**SS-1**	**QC Batch**	**SC-1**	**DL**	**QC Batch**
CONVENTIONALS								
Total Inorganic Carbon (C)	g/kg	31	791501	40	791501	11	N/A	791501
Total Carbon-combustion IR	g/kg	90	790964	48	790964	13	0.2	790964
Industrial								
< +1 Phi	%	96	786890	57	786890	6.7	0.1	786890
< +2 Phi	%	90	786890	48	786890	4.4	0.1	786890
< +3 Phi	%	80	786890	43	786890	4.3	0.1	786890
< +4 Phi	%	50	786890	25	786890	3.8	0.1	786890
< +5 Phi	%	38	786890	21	786890	3.5	0.1	786890
< +6 Phi	%	27	786890	18	786890	3.3	0.1	786890
< +7 Phi	%	16	786890	14	786890	2.8	0.1	786890
< +8 Phi	%	14	786890	12	786890	2.6	0.1	786890
< +9 Phi	%	10	786890	8.7	786890	2.0	0.1	786890
< 0 Phi	%	99	786890	62	786890	21	0.1	786890
< -1 Phi	%	100	786890	71	786890	57	0.1	786890
< -2 Phi	%	100	786890	100	786890	100	0.1	786890
< -3 Phi	%	100	786890	100	786890	100	0.1	786890
< -4 Phi	%	100	786890	100	786890	100	0.1	786890
Moisture	%	60	782994	31	782994	16	1	782994
SOIL								
Clay	%	14	786890	12	786890	2.6	0.1	786890
Gravel	%	ND	786890	29	786890	43	0.1	786890
Sand	%	50	786890	46	786890	54	0.1	786890
Silt	%	36	786890	13	786890	1.1	0.1	786890
INORGANICS								
Organic Carbon (TOC)	g/kg	60	790961	7.5	788017	1.1	0.2	786942
OC PESTICIDES								
o,p-DDD	mg/kg	ND	784732	ND	784732	ND	0.01	784732
o,p-DDE	mg/kg	ND	784732	ND	784732	ND	0.01	784732
o,p-DDT	mg/kg	ND	784732	ND	784732	ND	0.01	784732
p,p-DDD	mg/kg	ND	784732	ND	784732	ND	0.01	784732
p,p-DDE	mg/kg	ND	784732	ND	784732	ND	0.01	784732

ND = Not detected
QC Batch = Quality Control Batch

C0635-086

Maxxam Job #: A567371
Report Date: 2005/08/31

Acadia University
Client Project #:
Project name:
Sampler Initials:

ATLANTIC ODCA PKG IN SEDIMENT - OLD (SOIL)

Maxxam ID		H22546		H22581		H22584		
Sampling Date								
COC Number		317877		317877		317877		
	Units	**SSP**	**QC Batch**	**SS-1**	**QC Batch**	**SC-1**	**DL**	**QC Batch**
p,p-DDT	mg/kg	ND	784732	ND	784732	ND	0.01	784732
PCBs								
Total PCB	mg/kg	ND	784732	ND	784732	ND	0.01	784732
Elements								
Mercury (Hg)	mg/kg	0.08	791750	0.01	791750	ND	0.01	791750
Total Cadmium (Cd)	mg/kg	0.28	786950	ND	786950	ND	0.15	786950
Total Copper (Cu)	mg/kg	52	786950	11	786950	17	2.0	786950
Total Lead (Pb)	mg/kg	23	786950	17	786950	14	0.50	786950
Total Zinc (Zn)	mg/kg	87	786950	42	786950	52	5.0	786950
PAHs								
1-Methylnaphthalene	mg/kg	ND	784209	ND	784209	ND	0.05	784209
2-Methylnaphthalene	mg/kg	ND	784209	ND	784209	ND	0.05	784209
Acenaphthene	mg/kg	ND	784209	ND	784209	ND	0.05	784209
Acenaphthylene	mg/kg	ND	784209	ND	784209	ND	0.05	784209
Anthracene	mg/kg	ND	784209	ND	784209	ND	0.05	784209
Benzo(a)anthracene	mg/kg	ND	784209	ND	784209	ND	0.05	784209
Benzo(a)pyrene	mg/kg	ND	784209	ND	784209	ND	0.05	784209
Benzo(b)fluoranthene	mg/kg	ND	784209	ND	784209	ND	0.05	784209
Benzo(g,h,i)perylene	mg/kg	ND	784209	ND	784209	ND	0.05	784209
Benzo(k)fluoranthene	mg/kg	ND	784209	ND	784209	ND	0.05	784209
Chrysene	mg/kg	ND	784209	ND	784209	ND	0.05	784209
Dibenzo(a,h)anthracene	mg/kg	ND	784209	ND	784209	ND	0.05	784209
Fluoranthene	mg/kg	ND	784209	ND	784209	ND	0.05	784209
Fluorene	mg/kg	ND	784209	ND	784209	ND	0.05	784209
Indeno(1,2,3-cd)pyrene	mg/kg	ND	784209	ND	784209	ND	0.05	784209
Naphthalene	mg/kg	ND	784209	ND	784209	ND	0.05	784209
Perylene	mg/kg	ND	784209	ND	784209	ND	0.05	784209
Phenanthrene	mg/kg	ND	784209	ND	784209	ND	0.05	784209
Pyrene	mg/kg	ND	784209	ND	784209	ND	0.05	784209
Surrogate Recovery (%)								
Decachlorobiphenyl	%	100	784732	110	784732	99		784732
2,4,5,6-Tetrachloro-m-xylene	%	89	784732	102	784732	88		784732
D14-Terphenyl (FS)	%	88	784209	89	784209	85		784209

ND = Not detected
QC Batch = Quality Control Batch

Maxxam Job #: A567371
Report Date: 2005/08/31

Acadia University
Client Project #:
Project name:
Sampler Initials:

ATLANTIC ODCA PKG IN SEDIMENT - OLD (SOIL)

Maxxam ID		H22546		H22581		H22584		
Sampling Date								
COC Number		317877		317877		317877		
	Units	**SSP**	**QC Batch**	**SS-1**	**QC Batch**	**SC-1**	**DL**	**QC Batch**
D10-Anthracene	%	97	784209	102	784209	90		784209
D8-Acenaphthylene	%	92	784209	95	784209	88		784209

QC Batch = Quality Control Batch

Maxxam Job #: A567371
Report Date: 2005/08/31

Acadia University
Client Project #:
Project name:
Sampler Initials:

ATLANTIC ODCA PKG IN SEDIMENT - OLD (SOIL)

Maxxam ID		H22595		
Sampling Date				
COC Number		317877		
	Units	**SN-1**	**DL**	**QC Batch**
CONVENTIONALS				
Total Inorganic Carbon (C)	g/kg	36	N/A	791501
Total Carbon-combustion IR	g/kg	42	0.2	790964
Industrial				
< +1 Phi	%	46	0.1	786890
< +2 Phi	%	41	0.1	786890
< +3 Phi	%	37	0.1	786890
< +4 Phi	%	30	0.1	786890
< +5 Phi	%	27	0.1	786890
< +6 Phi	%	22	0.1	786890
< +7 Phi	%	17	0.1	786890
< +8 Phi	%	15	0.1	786890
< +9 Phi	%	11	0.1	786890
< 0 Phi	%	54	0.1	786890
< -1 Phi	%	64	0.1	786890
< -2 Phi	%	100	0.1	786890
< -3 Phi	%	100	0.1	786890
< -4 Phi	%	100	0.1	786890
Moisture	%	39	1	782994
SOIL				
Clay	%	15	0.1	786890
Gravel	%	36	0.1	786890
Sand	%	34	0.1	786890
Silt	%	15	0.1	786890
INORGANICS				
Organic Carbon (TOC)	g/kg	6.0	0.2	786942
OC PESTICIDES				
o,p-DDD	mg/kg	ND	0.01	784732
o,p-DDE	mg/kg	ND	0.01	784732
o,p-DDT	mg/kg	ND	0.01	784732
p,p-DDD	mg/kg	ND	0.01	784732
p,p-DDE	mg/kg	ND	0.01	784732

ND = Not detected
QC Batch = Quality Control Batch

Maxxam Job #: A567371
Report Date: 2005/08/31

Acadia University
Client Project #:
Project name:
Sampler Initials:

ATLANTIC ODCA PKG IN SEDIMENT - OLD (SOIL)

Maxxam ID		H22595		
Sampling Date				
COC Number		317877		
	Units	**SN-1**	**DL**	**QC Batch**
p,p-DDT	mg/kg	ND	0.01	784732
PCBs				
Total PCB	mg/kg	ND	0.01	784732
Elements				
Mercury (Hg)	mg/kg	0.01	0.01	791750
Total Cadmium (Cd)	mg/kg	ND	0.15	786950
Total Copper (Cu)	mg/kg	11	2.0	786950
Total Lead (Pb)	mg/kg	14	0.50	786950
Total Zinc (Zn)	mg/kg	43	5.0	786950
PAHs				
1-Methylnaphthalene	mg/kg	ND	0.05	784209
2-Methylnaphthalene	mg/kg	ND	0.05	784209
Acenaphthene	mg/kg	ND	0.05	784209
Acenaphthylene	mg/kg	ND	0.05	784209
Anthracene	mg/kg	ND	0.05	784209
Benzo(a)anthracene	mg/kg	ND	0.05	784209
Benzo(a)pyrene	mg/kg	ND	0.05	784209
Benzo(b)fluoranthene	mg/kg	ND	0.05	784209
Benzo(g,h,i)perylene	mg/kg	ND	0.05	784209
Benzo(k)fluoranthene	mg/kg	ND	0.05	784209
Chrysene	mg/kg	ND	0.05	784209
Dibenzo(a,h)anthracene	mg/kg	ND	0.05	784209
Fluoranthene	mg/kg	ND	0.05	784209
Fluorene	mg/kg	ND	0.05	784209
Indeno(1,2,3-cd)pyrene	mg/kg	ND	0.05	784209
Naphthalene	mg/kg	ND	0.05	784209
Perylene	mg/kg	ND	0.05	784209
Phenanthrene	mg/kg	ND	0.05	784209
Pyrene	mg/kg	ND	0.05	784209
Surrogate Recovery (%)				
Decachlorobiphenyl	%	95		784732
2,4,5,6-Tetrachloro-m-xylene	%	83		784732
D14-Terphenyl (FS)	%	94		784209

ND = Not detected
QC Batch = Quality Control Batch

Maxxam Job #: A567371
Report Date: 2005/08/31

Acadia University
Client Project #:
Project name:
Sampler Initials:

ATLANTIC ODCA PKG IN SEDIMENT - OLD (SOIL)

Maxxam ID		H22595		
Sampling Date				
COC Number		317877		
	Units	**SN-1**	**DL**	**QC Batch**
D10-Anthracene	%	94		784209
D8-Acenaphthylene	%	97		784209

QC Batch = Quality Control Batch

Maxxam Job #: A567371
Report Date: 2005/08/31

Acadia University
Client Project #:
Project name:
Sampler Initials:

GENERAL COMMENTS

Results relate only to the items tested.

Acadia University
Attention: Mike BryLinsky
Client Project #:
P.O. #:
Project name:

Quality Assurance Report

Maxxam Job Number: DA567371

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
784209 RDE	MATRIX SPIKE	D14-Terphenyl (FS)			TBA	%	30 - 130
		1-Methylnaphthalene			TBA	%	30 - 130
		2-Methylnaphthalene			TBA	%	30 - 130
		Acenaphthene			TBA	%	30 - 130
		Acenaphthylene			TBA	%	30 - 130
		Anthracene			TBA	%	30 - 130
		Benzo(a)anthracene			TBA	%	30 - 130
		Benzo(a)pyrene			TBA	%	30 - 130
		Benzo(b)fluoranthene			TBA	%	30 - 130
		Benzo(g,h,i)perylene			TBA	%	30 - 130
		Benzo(k)fluoranthene			TBA	%	30 - 130
		Chrysene			TBA	%	30 - 130
		D10-Anthracene			TBA	%	30 - 130
		D8-Acenaphthylene			TBA	%	30 - 130
		Dibenzo(a,h)anthracene			TBA	%	30 - 130
		Fluoranthene			TBA	%	30 - 130
		Fluorene			TBA	%	30 - 130
		Indeno(1,2,3-cd)pyrene			TBA	%	30 - 130
		Naphthalene			TBA	%	30 - 130
		Perylene			TBA	%	30 - 130
		Phenanthrene			TBA	%	30 - 130
		Pyrene			TBA	%	30 - 130
	Spiked Blank	D14-Terphenyl (FS)	2005/07/22		90	%	30 - 130
		1-Methylnaphthalene	2005/07/22		85	%	30 - 130
		2-Methylnaphthalene	2005/07/22		85	%	30 - 130
		Acenaphthene	2005/07/22		82	%	30 - 130
		Acenaphthylene	2005/07/22		85	%	30 - 130
		Anthracene	2005/07/22		86	%	30 - 130
		Benzo(a)anthracene	2005/07/22		82	%	30 - 130
		Benzo(a)pyrene	2005/07/22		87	%	30 - 130
		Benzo(b)fluoranthene	2005/07/22		81	%	30 - 130
		Benzo(g,h,i)perylene	2005/07/22		91	%	30 - 130
		Benzo(k)fluoranthene	2005/07/22		81	%	30 - 130
		Chrysene	2005/07/22		82	%	30 - 130
		D10-Anthracene	2005/07/22		95	%	30 - 130
		D8-Acenaphthylene	2005/07/22		94	%	30 - 130
		Dibenzo(a,h)anthracene	2005/07/22		89	%	30 - 130
		Fluoranthene	2005/07/22		63	%	30 - 130
		Fluorene	2005/07/22		83	%	30 - 130
		Indeno(1,2,3-cd)pyrene	2005/07/22		81	%	30 - 130
		Naphthalene	2005/07/22		78	%	30 - 130
		Perylene	2005/07/22		75	%	30 - 130
		Phenanthrene	2005/07/22		79	%	30 - 130
		Pyrene	2005/07/22		68	%	30 - 130
	Method Blank	D14-Terphenyl (FS)	2005/07/22		90	%	30 - 130
		1-Methylnaphthalene	2005/07/22	ND, DL=0.05		mg/kg	
		2-Methylnaphthalene	2005/07/22	ND, DL=0.05		mg/kg	
		Acenaphthene	2005/07/22	ND, DL=0.05		mg/kg	
		Acenaphthylene	2005/07/22	ND, DL=0.05		mg/kg	
		Anthracene	2005/07/22	ND, DL=0.05		mg/kg	
		Benzo(a)anthracene	2005/07/22	ND, DL=0.05		mg/kg	
		Benzo(a)pyrene	2005/07/22	ND, DL=0.05		mg/kg	
		Benzo(b)fluoranthene	2005/07/22	ND, DL=0.05		mg/kg	
		Benzo(g,h,i)perylene	2005/07/22	ND, DL=0.05		mg/kg	
		Benzo(k)fluoranthene	2005/07/22	ND, DL=0.05		mg/kg	
		Chrysene	2005/07/22	ND, DL=0.05		mg/kg	

Acadia University
Attention: Mike BryLinsky
Client Project #:
P.O. #:
Project name:

Quality Assurance Report (Continued)

Maxxam Job Number: DA567371

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
784209 RDE	Method Blank	D10-Anthracene	2005/07/22		95	%	30 - 130
		D8-Acenaphthylene	2005/07/22		87	%	30 - 130
		Dibenzo(a,h)anthracene	2005/07/22	ND, DL=0.05		mg/kg	
		Fluoranthene	2005/07/22	ND, DL=0.05		mg/kg	
		Fluorene	2005/07/22	ND, DL=0.05		mg/kg	
		Indeno(1,2,3-cd)pyrene	2005/07/22	ND, DL=0.05		mg/kg	
		Naphthalene	2005/07/22	ND, DL=0.05		mg/kg	
		Perylene	2005/07/22	ND, DL=0.05		mg/kg	
		Phenanthrene	2005/07/22	ND, DL=0.05		mg/kg	
		Pyrene	2005/07/22	ND, DL=0.05		mg/kg	
	RPD	1-Methylnaphthalene	2005/07/22	62.6 (1)		%	50
		2-Methylnaphthalene	2005/07/22	28.7		%	50
		Acenaphthene	2005/07/22	16.2		%	50
		Acenaphthylene	2005/07/22	NC		%	50
		Anthracene	2005/07/22	30.8		%	50
		Benzo(a)anthracene	2005/07/22	22.0		%	50
		Benzo(a)pyrene	2005/07/22	50.4 (1)		%	50
		Benzo(b)fluoranthene	2005/07/22	47.8		%	50
		Benzo(g,h,i)perylene	2005/07/22	NC		%	50
		Benzo(k)fluoranthene	2005/07/22	47.5		%	50
		Chrysene	2005/07/22	13.3		%	50
		D14-Terphenyl (FS)	2005/07/22	26.7		%	N/A
		Dibenzo(a,h)anthracene	2005/07/22	NC		%	50
		Fluoranthene	2005/07/22	35.5		%	50
		Fluorene	2005/07/22	35.7		%	50
		Indeno(1,2,3-cd)pyrene	2005/07/22	NC		%	50
		Naphthalene	2005/07/22	79.3 (1)		%	50
		Perylene	2005/07/22	NC		%	50
		Phenanthrene	2005/07/22	3.3		%	50
		Pyrene	2005/07/22	28.6		%	50
784732 RST	MATRIX SPIKE						
	[H22584-01]	Decachlorobiphenyl	2005/07/22		103	%	70 - 130
		2,4,5,6-Tetrachloro-m-xylene	2005/07/22		93	%	70 - 130
		o,p-DDD	2005/07/22		88	%	N/A
		o,p-DDE	2005/07/22		98	%	N/A
		o,p-DDT	2005/07/22		92	%	N/A
		p,p-DDD	2005/07/22		92	%	N/A
		p,p-DDE	2005/07/22		98	%	N/A
		p,p-DDT	2005/07/22		103	%	N/A
		Total PCB	2005/07/22		102	%	N/A
	Spiked Blank	Decachlorobiphenyl	2005/07/22		97	%	70 - 130
		2,4,5,6-Tetrachloro-m-xylene	2005/07/22		86	%	70 - 130
		o,p-DDD	2005/07/22		76	%	N/A
		o,p-DDE	2005/07/22		81	%	N/A
		o,p-DDT	2005/07/22		83	%	N/A
		p,p-DDD	2005/07/22		84	%	N/A
		p,p-DDE	2005/07/22		84	%	N/A
		p,p-DDT	2005/07/22		101	%	N/A
		Total PCB	2005/07/22		92	%	N/A
	Method Blank	Decachlorobiphenyl	2005/07/22		98	%	70 - 130
		2,4,5,6-Tetrachloro-m-xylene	2005/07/22		87	%	70 - 130
		o,p-DDD	2005/07/22	ND, DL=0.01		mg/kg	
		o,p-DDE	2005/07/22	ND, DL=0.01		mg/kg	
		o,p-DDT	2005/07/22	ND, DL=0.01		mg/kg	
		p,p-DDD	2005/07/22	ND, DL=0.01		mg/kg	
		p,p-DDE	2005/07/22	ND, DL=0.01		mg/kg	

Acadia University
Attention: Mike BryLinsky
Client Project #:
P.O. #:
Project name:

Quality Assurance Report (Continued)

Maxxam Job Number: DA567371

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
784732 RST	Method Blank	p,p-DDT	2005/07/22	ND, DL=0.01		mg/kg	
		Total PCB	2005/07/22	ND, DL=0.01		mg/kg	
	RPD [H22584-01]	o,p-DDD	2005/07/22	NC		%	50
		o,p-DDE	2005/07/22	NC		%	50
		o,p-DDT	2005/07/22	NC		%	50
		p,p-DDD	2005/07/22	NC		%	50
		p,p-DDE	2005/07/22	NC		%	50
		p,p-DDT	2005/07/22	NC		%	50
		Total PCB	2005/07/22	NC		%	50
786942 CAC	QC STANDARD	Organic Carbon (TOC)	2005/07/26		94	%	75 - 125
	Method Blank	Organic Carbon (TOC)	2005/07/26	ND, DL=0.2		g/kg	
786950 KMC	MATRIX SPIKE	Total Cadmium (Cd)	2005/07/26		8190	%	N/A
		Total Copper (Cu)	2005/07/26		35	%	N/A
		Total Lead (Pb)	2005/07/26		95	%	N/A
		Total Zinc (Zn)	2005/07/26		300	%	N/A
	QC STANDARD	Total Cadmium (Cd)	2005/07/26		103	%	75 - 125
		Total Copper (Cu)	2005/07/26		98	%	75 - 125
		Total Lead (Pb)	2005/07/26		102	%	75 - 125
		Total Zinc (Zn)	2005/07/26		102	%	75 - 125
	Spiked Blank	Total Cadmium (Cd)	2005/07/26		98	%	75 - 125
		Total Copper (Cu)	2005/07/26		101	%	75 - 125
		Total Lead (Pb)	2005/07/26		99	%	75 - 125
		Total Zinc (Zn)	2005/07/26		99	%	75 - 125
	Method Blank	Total Cadmium (Cd)	2005/07/26	ND, DL=0.15		mg/kg	
		Total Copper (Cu)	2005/07/26	ND, DL=2.0		mg/kg	
		Total Lead (Pb)	2005/07/26	ND, DL=0.50		mg/kg	
		Total Zinc (Zn)	2005/07/26	ND, DL=5.0		mg/kg	
	RPD	Total Cadmium (Cd)	2005/07/26	NC		%	25
		Total Copper (Cu)	2005/07/26	49.4 (1)		%	25
		Total Lead (Pb)	2005/07/26	0.1		%	25
		Total Zinc (Zn)	2005/07/26	10.4		%	25
788017 CAC	QC STANDARD	Organic Carbon (TOC)	2005/07/27		94	%	75 - 125
	Method Blank	Organic Carbon (TOC)	2005/07/27	ND, DL=0.2		g/kg	
	RPD	Organic Carbon (TOC)	2005/07/27	11.1		%	35
790961 CAC	QC STANDARD	Organic Carbon (TOC)	2005/08/02		100	%	75 - 125
	Method Blank	Organic Carbon (TOC)	2005/08/02	ND, DL=0.2		g/kg	
	RPD [H22546-01]	Organic Carbon (TOC)	2005/08/02	7.2		%	35
790964 CAC	QC STANDARD	Total Carbon-combustion IR	2005/08/02		106	%	75 - 125
	Method Blank	Total Carbon-combustion IR	2005/08/02	ND, DL=0.2		g/kg	
	RPD	Total Carbon-combustion IR	2005/08/02	13.4		%	35
791750 SSI	MATRIX SPIKE	Mercury (Hg)	2005/08/03		102	%	75 - 125
	QC STANDARD	Mercury (Hg)	2005/08/03		93	%	75 - 125
	Spiked Blank	Mercury (Hg)	2005/08/03		102	%	75 - 125
	Method Blank	Mercury (Hg)	2005/08/03	ND, DL=0.01		mg/kg	
	RPD	Mercury (Hg)	2005/08/03	19.7		%	35

ND = Not detected
N/A = Not Applicable
TBA = Result to follow
NC = Non-calculable
RPD = Relative Percent Difference
QC Standard = Quality Control Standard
SPIKE = Fortified sample
(1) Please note that the recovery of some compounds are outside control limits however the overall quality control for this analysis meets our acceptability criteria.

9.1.4 Surface Water

INDEX OF COMMENTS

9.0 Environments and Impact Analysis

9.1 Physical Environment and Impact Analysis

9.1.4 Surface Water

C0635-096

9.1.4 Surface Water

WP 1452 – Joint Review Panel
Access Road
If the current access road remains public property, the Proponent proposes to fence it off, enclosing it within a 30m environmental preservation zone. After ten years of quarrying activities, the road will exist on an isolated ridge that traverses the site, almost 90m above the quarry floor on either side.

Provide contingency plans of the effects of such a ridge on facility locations, quarry operations, surface drainage, and site reclamation. Consider the stability of this ridge and safety issues arising for the workforce and the public.

RESPONSE
Please refer to Bilcon's Revised Project Description in Section 7.0, pages 42 – 50.

9.1.6 Surface Water
Describe the flocculent that will be used in the water recycling process. How much of this material will be released into the sediment retention ponds in average and extreme conditions?

RESPONSE
Please refer to the MSD Sheet in Appendix 1 of this section. This is the same polymer currently being used in waste water treatment plants and quarries in the United States and Canada. The flocculent (polymer) is a dry powder delivered in 25 Kg sacks. The flocculent is mixed with water and added to a thickener (settling vessel) so fines particles can be separated from water. The amount of flocculent used in each application varies but the dosage will probably be around 120g of flocculent for every short ton of solids released into the sediment retention pond. This dosage will remain the same in average and extreme conditions. The "clean" water obtained from the thickener (which will be re-used in the plant) will contain trace amounts of flocculent.

Section 9.1.4.2 discusses a "high rate thickener". Is this the same compound as the flocculent? Provide information on the toxicity and the environmental behaviour of these compounds.

RESPONSE
The high rate thickener is a vessel (or piece of equipment) that allows the separation of solids from water with the aid of flocculent. The flocculent will be stored near the thickener and mixed with water in a separate "mixing and dosing" system. Once mixed, the flocculent is added to the plant effluent stream as it enters the high rate thickener. The flocculent helps to separate the solids from the water. Again, this is the same equipment and flocculent that is

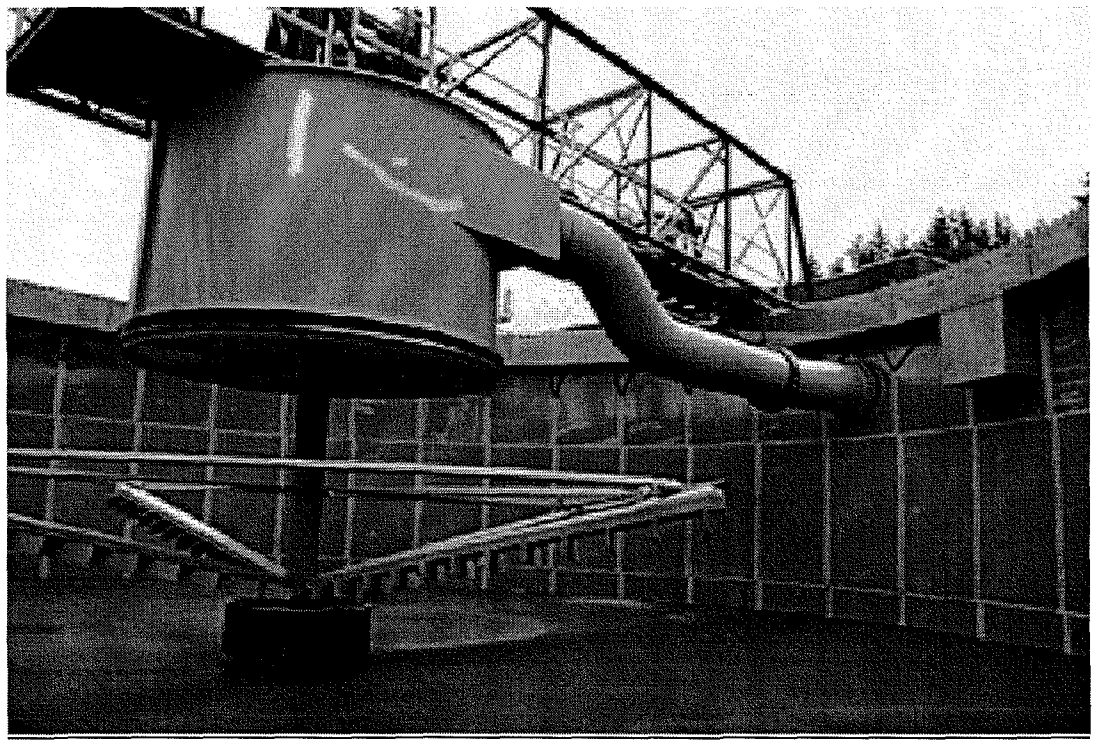
C0635-097

used in waste water treatment plants. Please see MSD Sheets in Appendix 1 of this section for environmental information.

The flocculent compound is a polymer that is added to the waste water stream to settle the solids out of the water at an accelerated rate. The compound breaks down in the presence of sunlight and air and is therefore unable to maintain a lasting presence in the wash water. This system is a closed loop water system and will require continual small amounts of make-up product. The "mud" that settles out of the water is then dried for reuse which neutralizes any flocculent that is in the soil

The "high rate thickener" that is intended for the system is a mechanical device much like that used in solid waste treatment plants world wide. It is nothing more than a large basin with a paddle blade and a water flow system that allows the flocculent to settle the "mud" to the bottom of the tank where it is then pumped in this concentrated state to a sediment disposal area to dry. It is not an additive of any kind.

High Rate Thickener



C0635-098

9.1.4 Surface Water

WP 1498 - Nova Scotia Department of Environment and Labour

Comments from the Environmental and Natural Areas Management Division
Water and Wastewater Branch
Darrell Taylor - Environmental Analyst

I have reviewed the above referenced Environmental Impact Statement (EIS) documents as has been requested by the Joint Review Panel. My comments are provided below for consideration and are from a surface water management perspective, focusing on freshwater.

1. *A considerable amount of information has been provided to aid assessment of impacts from this proposed undertaking on watercourses and surface water resources found on site.*

RESPONSE
Comment noted.

2. *Addressing erosion and sedimentation issues and associated impacts to both fresh and marine waters, is appropriate and one key area of potential impact from this type of activity and land use.*

RESPONSE
Comment noted.

3. *The EIS guidelines appear to have been generally followed, but more clarity in certain areas might be beneficial to aid the overall assessment related to fresh surface water resources.*

RESPONSE
Comment noted. Please refer to Bilcon's Revised Project Description in Section 7.0.

4. *Surface water resources are generally regarded as Valued Ecosystem Components (VECs) in most Environmental Assessments. Although the rationale may be implicitly provided in this case, it probably would be beneficial to clarify the rationale for screening this resource out as a VEC for this project.*

RESPONSE
Two surface water resources indicated as "streams" were identified within the proposed quarry site from the provincial 1: 10 000 topographic mapping.

C0635-099

9.1.4 Surface Water

The stream to the south originates off-site and enters the quarry property as it empties into the Bay of Fundy. This stream was investigated for aquatic resources (Brylinsky 2002). This stream is about 0.2 – 0.5 metres wide and with a water depth of 5 – 10 centimeters. The portion of the stream on the quarry property flows over a very steep gradient with a number of small waterfalls. Due to its steepness and small size, it was determined to not be significant salminoid habitat. The portion of the stream on the quarry property will be protected by a minimum 30m separation distance from the active area of the quarry.

The stream identified on the provincial 1:10 000 topographic mapping flowing through the middle of the quarry site into the Bay of Fundy was also investigated for aquatic resources (Brylinsky 2002). Only the lower portion of this stream was investigated where it flows into the intertidal zone of the Bay. At this point, a small (< 3 meter diameter), shallow (<0.2 meter) pool existed at the time of survey (June 2002). At this time, this pool was covered with a green filamentous algae and most of the bottom was covered with a bacterial mat (probably sulfur bacteria). This pool had a strong odor indicative of anaerobic conditions. Due to this condition of the stream, it was determined not to be suitable fish habitat and was not investigated further.

Further investigation of this stream by the Department of Fisheries and Oceans, Habitat Management Division concentrated on the portion of the stream above the coastal bog. In their September 18, 2002 letter, DFO concluded that "this watercourse cannot be categorized as "Fish Habitat", therefore the *Fisheries Act* does not apply", - see Appendix 18 of the EIS.

Further investigation of the watershed above the coastal bog (Brylinsky and Kern 2005) found no stream flowing into the bog as indicated on the provincial 1:10 000 topographic mapping. Two small watercourses, cut into the basalt rock, and unconfined surface water drainage were the source of surface water runoff for the bog. Based on further investigations of the property east of the quarry site (Berry 2006), the aforementioned stream originating from an off-site pond/wetland actually flows into the Bay off the quarry site to the northwest. This stream was investigated for aquatic resources (Brylinsky 2002) and is described in his report. Since the "north" stream is located off-site, the minimum 30m separation distance from the active area of the quarry has not been applied.

Two identifiable streams (north and south) are located off-site. Except for the lower portion of the south stream, which is mitigated by the required separation distance, it was not determined that the quarry activities would have any effect on these water resources. Therefore, these surface water resources were not considered as Valued Environmental Components during EIS preparation.

It should be noted that the following environmental components of concern have been determined to be a VEC:

C0635-100

9.1.4 Surface Water

- Little River Watershed
- On-site Surface Water Drainage/Wetlands
- On-site Surface Water Quality

7. *If avoidance of all watercourses are not possible, and planned diversions of watercourses (as mentioned in section 9.1.6.3) are necessary for a viable project, then approvals for watercourse alterations or diversions would likely be required.*

RESPONSE

Comment noted. A representative from NSDEL inspected a proposed watercourse diversion in the watershed of the coastal bog in 2002. More specific plans are now available in relationship to the proposed quarry site development. Appropriate approvals for any watercourse alterations or diversions will be requested from NSDEL by Bilcon.

9. *It is stated in the EIS that water supply to meet process water needs will be provided from surface water runoff taken from the sedimentation ponds. It is also mentioned that this water supply would be in deficit during August and September in quantities of 8,000 m3 to 12,000m3, from years 5 through 40 of operation (Chapter 7, section 7.8, page 47, paragraph 2). Additional water supply needed to cover this deficit for process requirements should be identified.*

RESPONSE

Please refer to Bilcon's 7.0 Revised Project Description, page 78 and Appendix 1 – Conestoga Rover's Report dated November 17th, 2006.

10. *Mitigation measures proposed for reducing the migration of silt off site could include a number of measures proposed in the Erosion and Sedimentation Control Handbook for Construction Sites. This should be used as a guide and referenced.*

RESPONSE

Comment noted. Please refer to EIS Volume VII - Bibliography.

11. *Proposed water quality and quantity monitoring programs relate to effluent discharge from the sedimentation ponds only. It would be beneficial additionally for all watercourses on site to be part of the effects monitoring program to confirm impact prediction and to assess whether mitigation is effective. The baseline water quality and quantity monitoring program at upstream and downstream locations of areas of influence from the quarry would serve well as follow up effects monitoring post-development. This would be in the proponent's interest particularly where the southern watercourse originates outside the project area, and as recognized in the*

9.1.4 Surface Water

report, is "subject to the prevailing activities" in the watershed upstream of the proponent's property.

RESPONSE

It is agreed that the baseline water quality and quantity monitoring program at upstream and downstream locations of areas of influence from the quarry would serve well as follow-up effects monitoring, post development.

Baseline water quality data was collected at the outfall into the Bay of Fundy (W.W.P. 2) and off-site (W.W.P. 8) above the influence of the permitted 3.9 hectare quarry on the Whites Point site. This data is presented in paragraph 9.1.6.2 of the EIS and indicates sediment control measures were effective in controlling total suspended solids (TSS) in accordance with the 3.9 hectare quarry permit.

Baseline water quality data was also gathered at water sample station W.W.P. 6 at the outflow of the coastal bog. In addition to the required water quality monitoring from the sediment ponds outfall shown on **Plan IR – 7,** Bilcon proposes the following:

Prior to construction in the area of the coastal bog, water flow at the outfall of the bog into the Bay will be measured. This will be conducted on a seasonal basis. Subsequently, after construction and through reclamation, this sampling station would be monitored seasonally for water quality and quantity. Moreover, off-site runoff to be fed to the coastal bog will be monitored at inflow and outflow points during temporary disruption of the bog watershed. The objective of this monitoring is to provide a comparison of flow quality and quantity in order to confirm the effect prediction and whether mitigation measures are effective.

12. *Characterization of water quality in freshwater monitoring programs typically involves analyzing nutrients such as phosphorus and nitrogen to the lowest detection limits available. This allows better characterization, comparisons over time and space, and avoids water quality reporting of non-detectable concentrations as seen in Volume IV, Appendix 45. Although nutrients are unlikely to be an issue with this project, it would be beneficial to include low level nutrient analysis to any subsequent freshwater monitoring programs for receiving waters.*

RESPONSE

It is agreed that it would be beneficial to include low level nutrient analysis to any subsequent freshwater monitoring programs for receiving waters.

13. *The Little River has been identified as a larger more significant watercourse outside of the project area. Proposed mitigation measures related to drainage from a small*

9.1.4 Surface Water

piece of it's watershed lying in the project area should ensure protection of that resource.

RESPONSE
Comment noted.

Pollution Prevention Branch
Melanie Haggart – Planner

The areas of responsibility and interest of the Pollution Prevention Branch include the following:

- contaminated sites
- hazardous substances
- environmental emergencies
- pesticides
- pollution prevention.

5. *The proponent should provide more information on what flocculents and/or other additives will be used for water treatment, how they will be stored, and on potential impacts and mitigative measures (if potential impacts are identified) for spills of flocculents or additives. Also more information is needed on whether there will be any contaminants (e.g. from specific flocculents) present in the flocculated sediment to be used for site reclamation which could leach out or inhibit vegetation growth and if so, how will this issue be addressed.*

RESPONSE
Please refer to Bilcon's response to the Panel WP 1452 – 9.1.4 in this document.

6. *More information is needed on the dykes mentioned on page 47 of Chapter 7, which are proposed to contain sediment stockpile areas. The proponent should identify whether these areas are expected to contain water. If so, mitigative measures should be identified to ensure they do not fail or overflow during periods of unusually heavy precipitation.*

RESPONSE
Please refer to the Revised Project Description in Section 7.0, page 92.

7. *There is no information provided on ship refueling or storage of fuel for ships at the site. It should be made a condition of the release from the EA that no ship fuel will be stored or dispensed on the site.*

9.1.4 Surface Water

RESPONSE
Ships will not be refueled at the Whites Point Terminal and there will be no storage of fuel for ships at the site.

WP 1524 - Transport Canada

(18) Vol VI – Section 9.2.2.1 – Page – 45 Reference is made to a north water course and south water course. The Proponent is requested to contact TC – Navigable waters Protection Program (Mr. Jon Prentiss) to determine the navigability of these waterways.

RESPONSE
With respect to the navigability of the north and south water course, Bilcon refers to Reference Document Volume II, Table 10, 4.4 – Brooks. The author, Dr. Michael Brylinsky characterizes the water courses as follows:

"The lower portion of the north brook (Figure 4.4.1) is about 0.7 – 1.0 metre in width and, at the time of the survey, had a moderate flow of water. Water depths averaged about 0.2 metres, but in some places there were small pools, generally less than one metre in diameter and 0.5 m in depth. The bottom of the stream was mainly bedrock with a few small areas that contained cobbles. There was little evidence of any sandy or gravelly areas that would serve as suitable spawning habitat for salmonids. Two surber samples taken in an area containing a cobble substrate, contained only a few caddis fly larvae, and visual examination of the undersides of submersed rocks failed to reveal the presence of any other types of aquatic invertebrates. It is unlikely that this stream serves as a significant habitat for salmonids.

The south brook is only about 0.2 – 0.5 metres in width at its lower end and flows over a very steep gradient containing a number of small waterfalls. Water depths were only 5-10 centimetres at the time of the survey. Its steepness and small size make it unlikely to be a significant habitat for salmonids."

WP 1541 - Fisheries and Oceans Canada

Volume I – Plain Language Summary
Page 27 – The document states, "New sediment ponds comprising 20 acres of surface water will create aquatic/wetland habitat," What species would be expected to use this habitat? Would there be any treatment (chemical, biological or physical) of the settling pond that could have an impact on this created habitat or the species that would use it?

C0635-104

9.1.4 Surface Water

RESPONSE

The construction of sediment ponds and a constructed wetland is expected to create aquatic/wetland habitat not usual in this area. Species most likely to use these habitats may be different than those already found on the Whites Point site. Specific species to use these created habitats during progressive successional stages are identified in response to Environment Canada's Item #15 Habitat Value of Constructed Wetlands and Sediment Retention Ponds contained in Section 9.2.1 - Terrestrial Ecology in this submission.

No chemical treatment of the sediment ponds, such as flocculents, are proposed. Biological treatments such as planting the sediment pond berms is proposed as well as planting the constructed wetland. Physical cleanout of accumulated sediments in the ponds will be required. To reduce the disturbance of clean-out activities, a "sediment forebay" in pond 5 is proposed to facilitate maintenance of sediments. The forebay would trap sediments in a portion of pond 5 where runoff enters pond 5. The forebay would require more frequent clean-out, however, the remainder of the ponds would remain relatively undisturbed and allowed to mature.

Volume III - Maps

Map 15 – Digby Neck – Important Freshwater Wetlands - There is no indication as the meaning of the score in the legend

RESPONSE

The source of this information presented on this Map is the Nova Scotia Department of Natural Resources – Wetland Atlas. The score was developed by NSDNR.

Volume V – Reference Document 30

The report indicates that the project will require additional water for August and September. The proponent should indicate where they will obtain the water shortfall.

RESPONSE

Please refer to Bilcon's 7.0 Revised Project Description, page 78 and Appendix 1 Revised Project Description – Conestoga Rover's Report dated November 17th, 2006 and Conestoga Rover's Report on the Domestic Well Surveys in Section 12 – Reference Documents in this submission.

WP 1630 - Environment Canada

Surface Water Quantity

References: EIS Sec. 9.1

Reference Volume V, Tab 30 – Hydrologic Budget Analysis

The flow regimes of the two watercourses entering the coastal bog are not adequately represented by the description "barely a trickle" (Sec. 9.1.6.1).

9.1.4 Surface Water

Tables of summary model output in Appendix A of the Hydrologic Budget Analysis are virtual repetitions of each other (WBNRMSD.025 to WBNRNMSD.250) except for the water holding capacity values. Further interpretation and explanation is required.

RESPONSE

Please refer to the Revised Project Description in Section 7.0, Appendix #1 – Revised Project Description – Conestoga Rovers Report dated November 17th, 2006 and Conestoga Rover's Report on the Domestic Well Surveys in Section 12 – Reference Documents in this submission.

Surface Water Quality
Reference: Volume IV, Appendix 45

Information on the quality assurance/quality control program used by the laboratory analyzing water quality samples should be included. It is noted that the results for most sampling stations are for a single sample.

RESPONSE

Please refer to Appendix 1 – Laboratory Certificates of Analysis in section 4.1 Proper Scientific Standards.

WP 1625 – Partnership for Sustainable Development
EIS Guidelines – Section 9.0 – Description of Existing Environments
Deficiency Statement 49
EIS Guidelines

9.0 - Description of Existing Environment - 'Baseline data, developed primarily from recent and/or immediate data, must not be a static or steady-state description of the environment but rather should reflect its true state of continuous change."
9.1.2.3 - Water Quality – 'Describe and quantify the water column characteristics and their spatial and temporal variability for the Project site, and adjacent area, in terms of temperature, salinity, suspended sediments, nutrients concentrations and optical transmissivity."
9.1.3 - Terrestrial Water Quality and Quantity - 'Describe terrestrial water quality and quantity...."

EIS

Section 9.1.6.2 - Analysis – Some water quality parameters, e.g. Total Suspended Solids (TSS), are highly episodic in nature and responsive to rainfall events. Collection of samples on a fixed pattern (weekly or monthly) may fail to detect TSS pulses through system.
The number of water samples for TSS appears to have been inadequate to detect effects (once a month is shown in the table although it is stated that the samples were taken once a week - neither is frequent enough). TSS typically pulses through the system after heavy rains, so an

C0635-106

9.1.4 Surface Water

event driven sampling schedule should have been used. As it is we have no way of knowing whether there were any important TSS pulses or not.
Monitoring TSS in the intertidal area needs to be more frequent than monthly and should be timed with rain events or spills to maximize the likelihood of assessing high TSS periods. A monthly sampling will provide lots of data but it is unlikely to be worth much in terms of assessing impacts. The Proponent should collect sufficient water samples to establish a suitable baseline & revise the EIS accordingly.

RESPONSE
Please refer to Bilcon's response to WP-1498 Nova Scotia Department of Environment and Labour.

C0635-107

9.1.4 Surface Water

Appendix 1
MSDS Sheet

C0635-108

MATERIAL SAFETY DATA SHEET

Date-Issued: 10/11/2005
MSDS Ref. No: 11015-005
Date-Revised: 10/11/2005
Revision No: New MSDS

CALLAWAY A-4230

1. PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: CALLAWAY A-4230
CHEMICAL FAMILY: Polyacrylamide Copolymer

MANUFACTURER

Kemira Chemicals, Inc.
Suite 200
245 TownPark Drive
Kennesaw, GA 30144
Product Stewardship: 800-347-1542

24 HR. EMERGENCY TELEPHONE NUMBERS

CHEMTREC (US Transportation) : (800) 424 - 9300
Emergency Phone : (770) 422 - 1250

2. COMPOSITION / INFORMATION ON INGREDIENTS

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

PHYSICAL APPEARANCE: White, granular solid

IMMEDIATE CONCERNS: This material is not a significant, immediate concern for emergency response personnel unless spilled material becomes wet. Wet material will cause surfaces to become extremely slippery. It presents little or no unusual hazard if involved in a fire.

POTENTIAL HEALTH EFFECTS

EYES: Slightly irritating but does not injure eye tissue.

SKIN: Low order of toxicity. Prolonged or repeated contact may irritate and cause dermatitis.

INGESTION: Low order of toxicity. May cause gastrointestinal irritation and nausea.

INHALATION: Dust may be irritating to eyes and respiratory tract.

CANCER STATEMENT: This product (or any component at a concentration of 0.1% or greater) is not listed by the NTP, IARC, OSHA or EPA as a carcinogen.

4. FIRST AID MEASURES

EYES: Flush eyes with large amounts of water until irritation subsides. If irritation persists, get medical attention.

SKIN: Wash with large amounts of water; use soap if available. If irritation persists, seek medical attention.

INGESTION: First aid is normally not required. If symptoms develop, get prompt medical attention.

INHALATION: First aid is normally not required. If symptoms develop, get prompt medical attention.

5. FIRE FIGHTING MEASURES

FLASHPOINT AND METHOD: None

FLAMMABLE LIMITS: Not Applicable

AUTOIGNITION TEMPERATURE: Not Available

EXTINGUISHING MEDIA: Carbon dioxide, dry chemical, foam or water spray.

HAZARDOUS COMBUSTION PRODUCTS: No unusual

OTHER CONSIDERATIONS: Contact with water may form a gel which is extremely slippery and difficult to clean up.

FIRE FIGHTING PROCEDURES: Use water to cool fire-exposed surfaces and to protect personnel. Isolate "fuel" supply from fire. Use foam, dry chemical, or water spray to extinguish fire.

FIRE FIGHTING EQUIPMENT: As in any fire, wear self-contained breathing apparatus pressure-demand, (MSHA/NIOSH approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE M EASURES

ENVIRONMENTAL PRECAUTIONS

WATER SPILL: Prevent additional discharge of material, if possible to do so without hazard. This material is water soluble/dispersable and may not be recoverable. If possible, contain and recover floating material.

LAND SPILL: Prevent additional discharge of material, if possible to do so without hazard. For small spills implement cleanup procedures; for large spills implement cleanup procedures and, if in public area, advise authorities.

GENERAL PROCEDURES: Spilled product should be scooped up as much as possible and the remaining solid material swept up. Washing the area with water should only be attempted after most of the polymer has been removed.

RELEASE NOTES: Recycle or dispose of recovered material in accordance with all federal, state, and local regulations.

COMMENTS: Contact with water may form a gel which is extremely slippery and difficult to clean up.

7. HANDLING AND STORAGE

GENERAL PROCEDURES: Keep container closed. Both open and handle containers with care. Store in a cool, well ventilated place away from incompatible materials.

STORAGE TEMPERATURE: (86°F) maximum

STORAGE PRESSURE: Atmospheric

SHELF LIFE: At least six months in unopened containers.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS: Ventilation should be provided to control worker exposures and prevent health risk; and as necessary to reduce, prevent and control particulate exposure.

PERSONAL PROTECTIVE EQUIPMENT

EYES AND FACE: Safety glasses with side shields.

SKIN: Where contact may occur, wear chemical resistant gloves, and long sleeves.

RESPIRATORY: Where concentrations in air may exceed the limits given in this section or Section 2 and engineering, work practice or other means of exposure reduction are not adequate, NIOSH/MSHA approved respirators may be necessary to prevent overexposure by inhalation.

OTHER USE PRECAUTIONS: An eyewash station is recommended in area of use.

COMMENTS: ACGIH TWA-TLV for "particulates not otherwise classified"/nuisance dust: Inhalable particulate: 10 mg/m3 Respirable particuate: 3 mg/m3 OSHA TWA-PEL for "particulates not otherwise regulated"/inert dust: Total dust: 15 mg/m3 Respirable fraction: 5 mg/m3

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE: Solid
ODOR: Slight mild odor

VAPOR PRESSURE: Not Applicable
VAPOR DENSITY: Not Applicable
BOILING POINT: Not Applicable
FREEZING POINT: Not Applicable
SOLUBILITY IN WATER: Soluble
EVAPORATION RATE: Not Applicable
DENSITY: ~50 lbs/ft3 at (77°F)
VISCOSITY: ~660cP (0.25% in DI water)
MOLECULAR FORMULA: Mixture

10. STABILITY AND REACTIVITY

STABLE: YES

HAZARDOUS POLYMERIZATION: NO

CONDITIONS TO AVOID: Heat over 50 degrees C (122 F) and moisture/water.

HAZARDOUS DECOMPOSITION PRODUCTS: None

INCOMPATIBLE MATERIALS: Strong oxidizing agents.

11. TOXICOLOGICAL INFORMATION

ACUTE
ORAL LD_{50}: >5000 mg/kg (rat)

SENSITIZATION: Testing on guinea pigs (skin): non-sensitizing

12. ECOLOGICAL INFORMATION

ECOTOXICOLOGICAL INFORMATION: Fish: 96-Hour, Danio rerio: LC50 = >100 mg/L (OECD 203) Daphnia: 48-Hour, Daphnia magna: EC50 = >100 mg/l (OECD 201) Freshwater algae: 72-Hour, Scenedesmus subspicatus: IC50 = >100 mg/L (OECD 202)

CHEMICAL FATE INFORMATION: This product in not readily biodegradable. This product does not bioaccumulate.

13. DISPOSAL CONSIDERATIONS

EMPTY CONTAINER: "Empty" containers retain product residue and can be dangerous. Empty containers should be completely emptied, and properly disposed of.

RCRA/EPA WASTE INFORMATION: Discarded product, as sold, would not be considered a RCRA Hazardous Waste.

GENERAL COMMENTS: Ensure compliance with local, state, and Federal regulations in disposing of this container, residual contents, or rinsing.

14. TRANSPORT INFORMATION

15. REGULATORY INFORMATION

UNITED STATES
SARA TITLE III (SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT)

311/312 HAZARD CATEGORIES: This product is not a hazardous chemical under 29 CFR 1910.1200, and therefore is not covered by SARA Section 311/312.

FIRE: NO **PRESSURE GENERATING:** NO **REACTIVITY:** NO **ACUTE:** NO **CHRONIC:** NO

313 REPORTABLE INGREDIENTS: This product does not contain Section 313 Reportable Ingredients.

CERCLA (COMPREHENSIVE RESPONSE, COMPENSATION, AND LIABILITY ACT)

CERCLA REGULATORY: If this product is accidentally spilled, it is not subject to any special reporting under the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). We recommend you contact local authorities to determine if there may be other local reporting requirements.

TSCA (TOXIC SUBSTANCE CONTROL ACT)

TSCA STATUS: All components of this product are listed on the TSCA Inventory or are exempt from TSCA Inventory requirements .

RCRA STATUS: Discarded product, as sold, would not be considered a RCRA Hazardous Waste.

CANADA

CANADA INGREDIENT DISCLOSURE LIST: This product, or its components, are listed on or are exempt from the Canadian Domestic Substance List (DSL).

16. OTHER INFORMATION

PREPARED BY: HS&E GROUP

REVISION SUMMARY New MSDS

HMIS RATING

HEALTH:	1
FLAMMABILITY:	1
PHYSICAL HAZARD:	0
PERSONAL PROTECTION:	

HMIS RATINGS NOTES: This information is for people trained in Key the National Paint & Coatings Association's 4 = Severe (NPCA) Hazardous Materials Identification 3 = Serious System (HMIS). 2 = Moderate 1 = Slight 0 = Minimal

MANUFACTURER DISCLAIMER: NOTICE: We believe that the information contained on this Material Safety Data Sheet is accurate. The suggested procedures are based on experience as of the date of publication. They are not necessarily either all-inclusive or fully adequate in every circumstance. Also, these suggestions should not be confused with or followed in violation of applicable laws, regulation, rules or insurance requirements. NO WARRANTY IS MADE, EXPRESSED OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OTHERWISE.

9.1.5 Marine Environments and Physical Oceanography

EIS Reference: EIS Volume VI, Chapter 9, Section 9.1.7

INDEX OF COMMENTS

9.0 Environments and Impact Analysis

9.1 Physical Environment and Impact Analysis

9.1.5 Marine Environments and Physical Oceanography

C0635-113

9.1.5 Marine Environments and Physical Oceanography

WP 1452 – Joint Review Panel

9.1.7.1.5 Ocean Tides and Currents – This is an instance where the evidence could have been informed by local knowledge

RESPONSE

The Bay of Fundy is a region of continual change. These changes include sea level variations, Bay geometry, and crustal movements in response to post glacial rebound. It is well-known that low sea level stands of -60 m and high stands of +45 m have occurred along the Digby Neck area. These variations in sea level change have resulted in several periods of high tides as well as low tides. This has occurred over a time span of approximately 10 000 years. Thus the present oceanographic conditions are unique and considered in a constant state of flux. Such a complex history of sea level change, crustal movement, and Bay geometry renders aboriginal and traditional knowledge of limited value as observations would have been made under different environmental conditions. However, during marine terminal and transport vessel design an attempt will be made to evaluate any traditional knowledge on oceanographic characteristics that may exist.

9.1.7 Physical Oceanography

Marine Sediments

9.1.7.1.2 (Pg 52, paragraph 2 & 4) – The Proponent says that data indicates "little current movement close to the bottom" and "sediments are sparse and do not appear to be in transport". These two statements appear to be in contradiction. Resolve the inconsistency.

RESPONSE

The question 9.1.7.1.2 suggesting that the two statements regarding currents, sediments and sediment transport appear to be inconsistent is incorrect. Confusion may arise from a lack of sediments across most of the study area and an unclear understanding of why there is such a lack of sediment on the bedrock. The dominance of bedrock at the seabed and the occurrence of only small parches of sand does not arise from modern sediment transport but from processes of erosion and sorting that took place many thousands of years ago during the marine regression and transgression of the area as relative sea level fell and rose from a relative high stand of approximately + 45 m and a low stand of – 60 m. The bedrock presents a relict surface. As stated in Paragraph 2 of page 52, the sidescan sonar investigation of the area, which is the best regional technology to assess seabed materials and features, showed small patches of sand overlying a seabed of exposed bedrock, and the patches of sand were featureless with no ripples, megaripples, sand waves, comet marks and sand ribbons present on their surfaces. It is the featureless sand patches that indicate that there is little current movement at the seabed. Based on flume tank models of sediment transport, a lack of bedforms on the small and sparse coarse sand patches indicates that at the seabed, bottom

C0635-114

currents would be less than 35 cm/s. The small sand patches are likely trapped within slight depressions and crevasses on the bedrock surface.

Ocean Tides and Currents
9.1.7.1.9 Provide specific information on ocean tides and currents for the coastal zone adjacent to the proposed marine terminal.

RESPONSE
As a result of potential tidal power development in the Bay of Fundy during the 1970s and 80s, a large amount of information was collected and interpreted regarding the physical oceanography and this information has been assessed by Bilcon. The dominant force driving the system in the Bay of Fundy is the large tides and associated tidal currents. Greenberg, 1984, first summarized the physical oceanography of the Bay and modeled hydrographic data. The study indicated that the variations in water levels and currents result from predictable variability in the tidal generating forces.

Since that time there has been little new research on the physical oceanography of the Bay of Fundy but Greenberg and Petrie, 1996, concluded that the original description given in 1984 by Greenberg still holds.

The Bay appears to be forced and controlled by the resonant semi-diurnal tide. The tides produce a range at the head of Minas Basin of over 14 m and at times over 16 m with currents as high as 6m/s off Cape Split. Other physical processes can be considered only as variations around the tidally driven picture (Greenberg and Petrie, 1996).

One of the first major reports to incorporate an understanding of regional meteorological and oceanographic phenomena was the publication of a marine climatological atlas for the Canadian East Coast (Mortsch, 1985). It was intended to help structural designers, operational planners, marine scientists and regulatory agencies and in it, wind, waves, air and sea surface temperature, precipitation, humidity, wind-chill, ice accretion, sea level pressure, flying weather and visibility are summarized. It is a synthesis of information collected from ships-of-opportunity, land and ocean weather station data sets, geostrophic wind climatology and a spectral ocean wave model. It covers a time period from the mid 1800s to 1984, and over 1000 vessels provided information for the entrance to the Bay of Fundy region. For example, from this report the strongest winds greater than 17.5 knots occur during the winter months and are from the northwest. They swing to the southwest during the summer months at approximately 10 knots and are parallel to the orientation of North Mountain (coastline of Whites Point).

In the EIS monthly information on the wind and wave climate from the atlas, Volume 1, for the east coast of Canada (MacLaren Plansearch, 1991) is reported.

C0635-115

9.1.5 Marine Environments and Physical Oceanography

Sea Level and Tides

In an early attempt to understand the large tides in the Bay of Fundy, they were first considered to be caused by the near resonance between the M2 tide with a period of 12.42 hours and the natural period of the Bay resulting from its geometry. Defant (1961) thought that the resonant condition was almost completely fulfilled, while Rao (1968) assessed the period of the Bay as 9 hours and considered that it was not completely in resonance. Garrett (1972 and 1974) showed that both the Bay of Fundy and the Gulf of Maine were part of an integrated resonant system with a period close to 13 hours. The tidal range increases from the continental shelf edge at the mouth of the Gulf of Maine by a factor of 6 at Saint John, to a maximum of 12 in Minas Basin. The M2 component of the tide accounts for 90% of the tidal energy in the system.

Tidal Currents

Greenberg (1984) considered that the tidal currents are closely related to tidal elevations, but can vary with geometry of the basin. Most of the Gulf of Maine has tidal currents of about 0.5 m/s. Those at the mouth of the Bay of Fundy are between 0.75 and 1 m/s and increase to the northeast to as high as 4 m/s in the Minas Channel area of the inner Bay.

An atlas of tidal currents for the Gulf of Maine and Bay of Fundy was prepared by the Canadian Hydrographic Service (1981), (Appendix 40 in the EIS). This report presents 36 comprehensive maps of hourly rate and direction of the major tidal currents of the region. It is based on a hydro-dynamic mathematical model developed by D. Greenberg.

Greenberg (1983) has modeled mean currents and determined that the barotropic residual circulation at the head of the Bay is largely driven by the tides. Gyres have been identified only at the head of the Bay near Cape Split. In the main body of the Bay some of the mean currents are tidally generated while others seem to be driven by fresh water input from the Saint John River. Greenberg (1983) interpreted that wind stress does not seem to play a major role in determining the mean circulation pattern.

An extensive and comprehensive suite of maps and data on the physical oceanographic setting is readily available in published form and on the www through the Marine Environmental Data Service (MEDS)
http://www.meds-sdmm.dfo-mpo.gc.ca/meds/Home_e.htm. It is a branch of Canada's federal Department of Fisheries and Oceans (DFO).

MEDS' mandate is to manage and archive ocean data collected by DFO, or acquired through national and international programmes conducted in ocean areas adjacent to Canada, and to disseminate data, data products, and services to the marine community in accordance with the policies of the Department. MEDS is a member of the International Oceanographic Data and Information Exchange whose mission is to enhance marine research, exploitation and

C0635-116

development by facilitating the exchange of oceanographic data and information between participating Member States and by meeting the needs of users for data and information products.

Conclusions

From the above publications and web sources the physical oceanography of the Bay and the meteorological setting is well-known and much information has been published and is readily available and regularly updated. Based on an assessment of the various atlas maps on currents, tides and winds that cover observations and measurements of over 100 years from 1000 vessels, it is clear that at the mouth of the Bay of Fundy where the proposed quarry is to be located that there are no unique anomalies in the current regime or the presence of local gyres. The region occurs along a straight coastal segment where geological, bathymetric and geomorphic conditions are uniform.

The interpretation of Greenberg (1983) that wind stress does not seem to play a major role in determining the mean circulation pattern and the conclusion of Greenberg and Petrie (1996), that other physical processes such as wind can be considered only as minor variations around the tidally driven picture, have lead us to the conclusion that the winds do not play a major role in affecting oceanographic currents in the Bay of Fundy.

Many large vessels including bulk carriers regularly transit the waters of the entrance to the Bay of Fundy and both dock and anchor within and near the major ports. No unique problems are experienced during these activities. The development of a marine terminal at Whites Point and the design of transport vessels will consult and use the widely available detailed meteorological and oceanographic data that includes winds, waves, currents, etc. for site specific design criteria. It is Bilcon's opinion that it is not necessary to undertake these studies until project approval.

References

Canadian Hydrographic Service, 1981. Atlas of Tidal Currents Bay of Fundy and Gulf of Maine. Department of Fisheries and Oceans, Ottawa. 36 p.

Defant, A. 1961. Physical Oceanography. Volume 2. Pergamon Press, London, 598p.

Garrett, C.J.R. 1972. Tidal resonance in the Bay of Fundy and the Gulf of Maine. Nature 238: pp441 – 443.

Garrett, C.J.R. 1974. Normal modes of the Bay of Fundy and the Gulf of Maine. Canadian Journal of Earth Sciences, No 11; pp549 – 556.

C0635-117

9.1.5 Marine Environments and Physical Oceanography

Greenberg, D.A. 1983. Modeling of the mean barotropic circulation in the Bay of Fundy and Gulf of Maine. Journal of Physical Oceanography. 13(5): pp. 886 – 904.

Greenberg, D.A., 1984. A review of the physical oceanography of the Bay of Fundy; *in* Update on the marine environmental consequences of tidal power development in the upper reaches of the By of Fundy, edited by D.C Gordon and M. J. Dadswell. Fisheries and Oceans Canada Technical Report of the Fisheries and Aquatic Sciences, No. 1256, pp 9 – 43.

Greenberg, D.A. and Petrie, B.D, 1996. The physical environment of the Bay of Fundy, Chapter 2, in Fundy Marine Ecosystem Science Project Workshop, Wolfville, Nova Scotia, January 29 – February 1, 1996.

Mortsch, L.D., Agnew, T., Saulesleja, A. and Swail, V.R. 1985. Marine Climatological Atlas – Canadian East Coast. Canadian Climate Centre, Atmospheric Environment Service, Report No. 85 – 11, 343 p.

Rao, D.B. 1968. Natural oscillations of the Bay of Fundy. Journal Fisheries Research Board of Canada, 25: pp 1097 – 1114.

Consider normal as well as extreme meteorological conditions and use traditional knowledge to supplement existing data.

RESPONSE
Please refer to Section 9.1.1 – Climate in this document.

Sea Level Change
9.1.7.1.9 Clarify the apparent inconsistency in statements concerning rising sea levels (generally) and falling sea level (locally) on page 58.

RESPONSE
Bilcon does not see any inconsistencies in this paragraph and provides the following clarification.

This paragraph is intended to inform the reader of the complex and dramatic changes that have occurred in the sea level of the Bay of Fundy during geologic time as compared to the present. Some of these changes were quite dramatic. At the end of the last glaciation, indications are the Bay of Fundy sea level at the Whites Point site was at the 45 metre land elevation. If that were the case today, the sea would cover half the elevation of the site. The sea level then regressed to a "shallow" 60 metre water depth in the Bay of Fundy. After global melting of glaciers, the sea level again rose to the present shoreline elevation. In more

C0635-118

9.1.5 Marine Environments and Physical Oceanography

recent history, the dramatic changes experienced during glaciation have stabilized and rates of sea level change are in the order of between 20 and 30cm/century.

For further information on this subject, please refer to EIS Reference Volume III – Tab 17 "Glacial, Post Glacial, Present, and Projected Sea Levels, Bay of Fundy". Prepared by Gordon Fader.

More recent information supplied by Natural Resources Canada "Review of the Whites Point Quarry and Marine Terminal Project Environmental Impact Statement by Natural Resources Canada" – August 3, 2006 indicates that there will be an increase in the historical trend of sea-level rise due to global climate change. According to the Intergovernmental Panel on Climate Change "middle of the road" scenario IS92A, relative sea level will increase globally by 0.49 m by 2100 AD. Other researchers in Atlantic Canada including Shaw et al claim that the sea level will increase by 0.76 m over the period 2000 – 2100 AD. In NRCan's opinion, the projected rise for the study site would be similar to the above estimate and much higher, therefore, than the rate of 30 cm/century.

Further information supplied by Fisheries and Oceans Canada "Comments on the Whites Point Quarry and Marine Terminal Project to the Joint Review Panel" August 2006 indicates that historic sea level rise of 30cm/century is made up of 20 cm per century of regional subsidence and 10 cm/century of the ocean rising (Petrie and Loucks, unpublished). In addition, the amplitude of the M2 tide is increasing by about 10 cm/century at Saint John (Godin 1992). Thus it can be expected that mean sea level at Saint John, and along Digby Neck will increase by about 40 cm over the next 50 years (30+50/2) and that the high water level will increase by about 45 cm over the next 50 years (30+50+10/2). The increase in each case could be as much as 60 or 70 cm.

Respecting this information provided by Natural Resources Canada and Fisheries and Oceans Canada, Bilcon will adhere to the precautionary approach. The most current, conservative projections for sea level rise will be used during the engineering and design of coastal infrastructure. These projections will reflect the 50-year life of the project, historic sea level trends and projected sea level rise as a result of global warming.

As stated in the EIS, the coast of the Digby Neck area of the southern Bay of Fundy is subject to rising sea level of approximately 20 – 30 cm/century. In an assessment of the stability of coastal areas using a concept termed "coastal vulnerability index" Shaw et al, 1998 used seven variables for assessment. Those with a high sensitivity index would have low relief, unconsolidated sediments, barrier islands, high tidal range, high wave energy levels and rapidly rising sea level. Coasts with a low sensitivity index would in contrast have high relief, rocky shores with resistant non-eroding bedrock, falling sea level, low tidal range and low wave energy. When the classification is applied to the Bay of Fundy region, the area

C0635-119

of Digby Neck extending to Morden along the south Fundy shoreline falls into the low sensitivity category. For this coastal segment of the Bay of Fundy, most of the low sensitivity index parameters apply. It is not critical that all of the parameters are met. The only other low sensitivity area in the Bay of Fundy is a small section of New Brunswick shoreline centered at Martin Head. The remainder of the Bay of Fundy shoreline is classified as moderate to high sensitivity.

In a personal communication with one of the coauthors of the coastal vulnerability index Bulletin 505, Robert Taylor (August 2, 2006) of the Geological Survey of Canada stated that the index is to be used regionally as a guide – please see Appendix 1 in this section. For the Digby Neck Coast consisting of resistant basalt and high relief, these factors would outweigh the other factors of a slowly rising sea level and higher tidal range. For classification, each factor in the study was broken down into different categories and the factors were summed to give a rating which was then grouped into the three classes of high, moderate and low sensitivity. For the outer Bay of Fundy south shore, the tidal range, wave energy and rising sea level would tend to bump up the numbers. However, the overall assessment of the Digby Neck area has been classified with a low sensitivity index because of the dominance of high relief and hardness of the exposed bedrock. Most importantly, the coast is not subject to significant retreat under current conditions and would remain stable with rising sea level at predicted rates.

References

Natural Resources Canada. "Review of the Whites Point Quarry and Marine Terminal Project Environmental Impact Statement by Natural Resources Canada". August 3, 2006.

Fisheries and Oceans Canada. "Comments on the Whites Point Quarry and Marine Terminal Project to the Joint Review Panel". August 2006.

9.1.7.2 Provide evidence that all other possible locations for a marine terminal in the Bay of Fundy have been investigated to support the conclusion that "Digby Neck is the most optimum location", as stated on Page 61

RESPONSE

As part of the EIS, a regional assessment of the marine geology that included bedrock geology complexity, faulting, lithology, exposure and distribution (EIS Reference Volume III, Tab 16); seismic risk (EIS Reference Volume III, Tab 18); surficial sediment character, thickness, distribution and dynamics (EIS Reference Volume III, Tab 16); sediment transport pathways and bedforms (EIS Reference Volume III, Tab 19); coastal stability, and bathymetry (EIS Reference Volume III, Tab 15), was undertaken for the entire Bay of Fundy as well as site specific to the location of the proposed development. The following is an assessment of each of these components to provide the marine evidence that the Digby Neck

location is the most optimum for a marine terminal when other areas of the Bay of Fundy are considered.

Bedrock Geology
The bedrock geology (Figure 1, EIS Reference Volume III, Tab 16) of the Bay of Fundy shows that the south coast and nearshore coastal zone consists of Jurassic Basalt that is continuous with the on land bedrock geology. The basalt is overlain by Jurassic sedimentary bedrock offshore at a distance of approximately 7 km that represents an erosional edge of the sedimentary bedrock. This relationship and simple distribution continues along most of the south coast of the bay extending from Long Island to Minas Passage.

The surficial sediments are thin or absent in the nearshore in most areas along this region as evidenced by the multibeam bathymetry collected off the Sandy Cove area (Figure 3, EIS Reference Volume III, Tab 14) and the sidescan sonograms collected directly off Whites Point for this study (EIS Appendix Volume III, Map 23A). In contrast, the north shore of the Bay of Fundy is much more complex with large areas of structurally disturbed sedimentary bedrock, thick sediments overlying the bedrock close to shore, muddy sediments at the seabed in a state of erosion and net transport to the west, and the presence of a major regional fault termed the Glooscap or Chedabucto Cobequid fault that trends along the entire north side of the Bay.

The western part of the Bay of Fundy, to the east and northeast of Grand Manan Island, has many faults within the bedrock. In fact the bedrock is broken into a very large number of blocks that could not be individually mapped on GSC Map 812H. The region is referred to as a structurally disturbed area. Small local bedrock outcrops occur near adjacent headlands along the New Brunswick coast, but also located in these areas are many current gyres and large sand deposits with sand waves that are moving with each tidal cycle (John Hughes Clark, University of New Brunswick, http://www.omg.unb.ca/Projects/Musquash/Musquash_ADCP.html).

From the perspective of the bedrock geology and based on assessment of lithology, structural integrity, and seabed exposure, the nearshore coastal zone of the southern Bay of Fundy, to a depth of approximately 40 m, extending from Long Island to Minas Channel is the optimum location for the siting of a marine terminal offering high quality hard, uniform and stable foundation conditions.

Bathymetry
The deepest water closest to land in the Bay of Fundy that provides an unobstructed, direct, safe and deep water route to the adjacent Gulf of Maine occurs along Digby Neck and specifically at the Whites Cove area (Figure 4, EIS Reference Volume III, Tab 15). This section of Canadian Hydrographic Service Chart #4011 shows this relationship through the

C0635-121

location of the 50 fathom (92 m) contour (**Figure 2.2RI,** this document). This contour makes its closest approach (2 nautical miles or 3.7 km) to Digby Neck immediately west of the Whites Point area. The only other area in the Bay of Fundy where this deep water depth nears land is at the northern tip of Grand Manan Island at the northern end of the Grand Manan Channel.

The bathymetry in the nearshore of the Digby Neck region of North Mountain shows no isolated bathymetric highs or other seabed protrusions that could provide an obstruction to navigation and the contours on CHS map 4011 are parallel to sub parallel with the coastline. The exception occurs to the west of Sandy Cove where a shallow high is indicated on Chart 4011 and where the multibeam bathymetry shows a ridge protruding from the shoreline that extends to the west (EIS Reference Volume III, Tab 14).

Large vessels navigating into the Bay of Fundy from the Gulf of Maine must pass to the north of the linear and treacherous shoals northwest of Brier Island that are part of the Northwest Ledge and Moores Ledge region (Figure 4, EIS Reference Volume III, Tab 15). This route follows the traffic lanes for vessel navigation into the Bay of Fundy. Once the shoal area is passed, a direct deep water, unobstructed route to Whites Cove is approximately 10 nautical miles (18.5 km) long. This direct, deep water route and short distance into the outer Bay of Fundy from the adjacent Gulf of Maine represents a minimal intrusion into the Bay and is a desired aspect of marine terminal siting and overall project location.

Surficial Sediments

Geological Survey of Canada Surficial Geology Map # 4011 G is the published map of the seabed geology of the Bay of Fundy and shows the distribution and characteristics of unconsolidated sediments. The seabed at the entrance to the Bay of Fundy and offshore Digby Neck in an area extending from Sandy Cove to the west consists dominantly of glacial till (Figure 2, EIS Reference Volume III, Tab 16). The till is armoured with gravel and the seabed is composed of pebbles, cobbles and boulders. Multibeam bathymetry and sidescan sonograms also show that this surface is covered with ancient iceberg furrows that are large linear bermed troughs formed approximately 14000 years ago as the glaciers receded from the Bay of Fundy. The iceberg furrows present a rough topography to the till seabed with local relief up to 7 m from troughs to the top of the bouldery berms. A few isolated deposits of muddy sediment occur within the region farther offshore. This gravel armoured till seabed is very stable and not generally subject to erosion by currents.

Directly north of the Sandy Cove region off Digby Neck, the seabed character changes. This bottom type, termed the Sambro Sand Formation continues to the northeast throughout the inner Bay of Fundy (Figure 5, EIS Reference Volume III, Tab 19). Within this surficial formation the seabed consists of a modified glacial till that has been and still is eroding by strong currents and consists of a wide variety of sand bedforms such as sand ribbons, large

C0635-122

sand waves, and megaripples. Scour features around large sand waves are also found on this seabed. The dynamic Sambro Sand formation continues to the northeast from the Sandy Cove area all the way to the Ile Haut area and continues westerly along the New Brunswick offshore to Cape Spencer. It overlies both till and buried LaHave Clay muddy sediments, and bedforms, indicative of sediment transport, are widespread across its surface. In essence the Sambro Sand Formation occupies the inner Bay of Fundy region. The sandy mud LaHave Clay formation occurs to the west of Cape Spenser and continues to the area east of Grand Manan in the northwestern area of the Bay of Fundy. It is very thick in places and occurs close to shore.

Recent surveys of the north coastal zone of the Bay of Fundy by the University of New Brunswick using multibeam bathymetry (http://www.omg.unb.ca/Projects/Musquash/Musquash_ADCP.html) show that the seabed is very dynamic with headland controlled large sand bodies and active sand bedforms. A few small exposures of local bedrock occur offshore and in the nearshore. Studies of the dump site in the Bay of Fundy off St John, NB, by Environment Canada and the Geological Survey of Canada under the leadership of Russell Parrott, Geological Survey of Canada, using the same technology, also show thick sediments overlying bedrock and many areas of bedforms such as erosional comet marks around seabed obstacles that indicate net sediment transport to the west (EIS Reference Volume III, Tab 19).

Based on a regional assessment of the distribution, character and dynamics of surficial sediments throughout the entire Bay of Fundy, the most stable and coarse-grained surficial sediments occur only in the adjacent offshore of the area extending from Brier Island to the Sandy Cove area off Digby Neck. The seabed is covered largely with relict sediments from glacial times and these sediments are not presently eroding. Areas to the northwest of Sandy Cove, covering the inner Bay of Fundy, are underlain by the Sambro Sand formation that exhibits a wide variety of erosional and constructional bedforms developed on its surface. These bedforms appear active today. The areas of the Sambro Sand Formation are less suitable as foundations for structures as characteristics of thick sediments, areas of extensive erosion and sediment transport occur.

Coastal Classification

The coasts of Canada have been assessed and mapped in terms of an index of sensitivity (EIS Volume VII, Bibliography) which is derived by relating a numbed of variables such as relief, lithology, landform and wave energy. The index assesses the relative sensitivity of Canadian coasts and identifies the coastal areas that are the most vulnerable to changes in sea level. In an assessment of the Bay of Fundy region, the areas with a low vulnerability index are a small area in New Brunswick centered near Martin Head, and the south coast of the Bay extending from Digby Neck to Morden near the head of the Bay. The other remaining areas are classified as medium to high sensitivity.

C0635-123

9.1.5 Marine Environments and Physical Oceanography

A low sensitivity coast is one that will experience the least physical change under rising sea level. The Whites Point area falls within the coastal classification system with low sensitivity.

Summary
An assessment of the distribution and character of the bedrock throughout the Bay of Fundy for siting of a marine terminal indicates that the south coast of the Bay is the best location representing a hard, uniform and stable substrate in the nearshore. Based on an assessment of faulting within the Bay the south coast has the least number of faults. The only ones that occur are offsets within the North Mountain Basalt presently occupied by water passages. The northern Bay of Fundy region is structurally disturbed with large zones of bedrock faults in close proximity to the Glooscap Fault zone and the location of recent seismic activity in the Passamaquoddy Bay region.

From a bathymetric perspective the Digby Neck area presents a direct, deep water route, without the presence of shallow shoals from the adjacent Gulf of Maine. Other than the northern tip of Grand Manan Island and overdeepened scoured areas of seabed in Minas Passage with high velocity currents, Whites Point has the closest deep water near land for the entire Bay of Fundy.

The surficial sediments directly offshore Digby Neck in the Bay of Fundy are hard armoured gravel seabeds of glacial origin that have experienced little modification since deposition. Fine-grained sediments are sparse across this seabed. Extending from Sandy Cove to the northwest in the inner Bay of Fundy, the seabed is a sandy bottom overlying mud in places and is presently eroding with sand in transport in a wide variety of complex bedforms. The north coast of the Bay of Fundy also consists of sand and muddy sand in transport with scoured features to the east of Cape Spencer and muddy sediments to the west that continue along the eastern flank of Grand Manan. The most stable seabed of the Bay of Fundy lies directly off Digby Neck.

A coastal classification of the Bay of Fundy indicates that the area extending from Digby Neck to Morden is the most stable coastal segment of the Bay. It will experience the least physical change under rising sea level and as such is classified as having low sensitivity.

When all of the above marine geoscience attributes and aspects of the entire Bay of Fundy are considered, evaluated, compared and contrasted, a conclusion can be reached that Digby Neck and indeed the Whites Point area represent the optimum location for siting of a marine terminal. The seabed in the coastal zone of the area offers a stable, hard, largely sediment free and uniform foundation, and the location offers a deep water direct route to the adjacent Gulf of Maine with a minimal intrusion into the Bay of Fundy.

C0635-124

9.1.5 Marine Environments and Physical Oceanography

WP 1498 – Nova Scotia Department of Environment and Labour

Comments from the Environmental and Natural Areas Management Division
Water and Wastewater Branch
Darrell Taylor - Environmental Analyst

2. Addressing erosion and sedimentation issues and associated impacts to both fresh and marine waters, is appropriate and one key area of potential impact from this type of activity and land use.

RESPONSE
Comment noted.

WP 1525 – Natural Resources Canada
Comment from Reviewer 3
The proponent provides a broad view of marine geology and geological issues in the Bay of Fundy but the information in the documents was not particularly well organized and as a result, some significant pieces of information may have been missed related to the comments listed below. For example, it was difficult to compare the location of the samples collected offshore that contained sediment with the location of the proposed terminal (Fig 2.2 Vol. 2 section 9 and Vol. III fig 2).

RESPONSE
Figure 2.2 Volume II, Reference Document 9 has been revised to show the proposed location of the marine terminal in relation to the nearshore sediment sample locations. This revised figure follows as **Figure 2.2 - R1.**

Figure 2 Volume III, Maps, has been revised to show the proposed location of the marine terminal in relation to the nearshore grab sample locations. This revised figure follows as **Figure 2 - R1.** Since revised Figure 2 - R1 only shows the grab sample locations in the immediate area of the marine terminal, **Map 19B - R1** is also included to show the full extent of the grab samples in relation to the marine terminal.

It should be noted that further bottom investigations will be conducted during detailed engineering and design, once the exact location of the pipe piles is established.

There is a description of the shallow marine area using sidescan sonar (Vol. III-20, Vol. I – may 12). The shoreline is generally described in Vol. VI as exposed basalt rock which extends into the subtidal and is visible on the air photo Figure 9, 10 (Volume III maps). The description of the shoreline in Whites Cove is a very mobile cobble substrate (Vol. II section

C0635-125

9.1.5 Marine Environments and Physical Oceanography

10). The footprint of the marine terminal structure on the shoreline appears to be small. The proponent should comment on the anticipated coastal impacts to the shoreline especially in Whites Cove and its immediate backshore as this may have relevance to impacts on macroalgal communities in the area.

RESPONSE

Given the small footprint of the marine terminal structure and the low sensitivity the anticipated coastal impacts to the shoreline and its immediate backshore are expected to be very small and have no impact on macroalgal communities in the area.

Coastal processes and sea level rise - the proponent discusses past and present sea level conditions and on page 10 Vol. III – 17 indicates "facilities will be designed for a sea level rise of 30 cm/century with associated change in tidal heights and storm waves". This does not take into account over a life span (50 years) of the project, the anticipated rise in sea level predicted as a consequence of climate change.

RESPONSE

Please refer to 7.0 Revised Project Description, Pages 149 to 153.

Since the Revised Project Description was submitted, the UN Intergovernmental Panel on Climate Change has lowered predictions of how much sea levels will rise in comparison with its last report in 2001. The predictions for sea level rise by 2100 have now been reduced by one half.

Wave climate statistics were provided in Appendix 46 (Vol. IV) but it did not provide any information on extreme conditions – i.e., the anticipated sea levels generated by storm surges during extreme storms such as hurricanes or Nor'easters and anticipated extreme wave energy impacting the structure. Also there was no detailed description about the extent of wave run up and flood levels along this coast and the vulnerability of the infrastructure to storm surges and waves during storm events and the need for shore protection structures.

RESPONSE

Please refer to Section 7.0 Revised Project Description, Pages 149 to 153.

Scouring of the seabed and the marine terminal infrastructure is mentioned in Vol. III – 20 page 4. Vol VI (9.1.7) describes a scarcity of sediment with little transport; however, the currents are also reported to be strong which prevents deposition. The introduction of piles for terminal would cause changes in the immediate sea floor. The proponent should comment on the anticipated impact of the introduction of the marine terminal (track and beam piles and berthing Dolphins) on current flow and sedimentation patterns adjacent the structures.

C0635-126

9.1.5 Marine Environments and Physical Oceanography

RESPONSE

The seabed consists of exposed basalt bedrock where the marine terminal that includes the berthing dolphins and piles to support the conveyor and quadrant ship loader will be founded. An assessment of the bedrock exposure at the seabed was made on the basis of shoreline surveys, aerial photographs, sidescan sonograms, seismic reflection profiles, underwater video and seabed samples. Multibeam bathymetry collected by the Geological Survey of Canada to the northwest of the marine terminal, but contained within the local study block, also showed the presence of bedrock exposed at the seabed as a rough and undulating surface. Figure 2.2-R1 shows the interpretation of the sidescan sonograms, seabed sample locations, superimposed bathymetry and the location of the marine terminal and quadrant ship loader.

The berthing dolphins will be located off Whites Point along the 16 m water depth contour as indicated in Figure 2, Vol. III, Pg 46, of the EIS. Samples collected from the seabed of the broad regional area, Vol. II, Tab 9, Figure 2.2 of the EIS and Map 7, Vol. V, Tab 26 indicate that with the exception of sample no 21, Figure 2.2, that was collected in 29 m water depth, all other attempted sample locations in depths shallower than 30 m could not retrieve sediments. This ground truth evidence supports the sidescan sonar high backscatter and rough and undulating surface signatures for an interpretation of exposed bedrock over the region extending from the shoreline to depths of 30 m.

The following is a comment on the anticipated impact of the marine terminal piles on current flow and sedimentation patterns. As stated in Volume III, reference document #20, an analysis of the video, sidescan sonograms and sediment samples shows a lack of bedforms on any of the few sand patches in the region. Based on sediment transport models and a study of the currents required to produce a variety of bedforms, this indicates that the currents at the seabed would be less than 40 cm/sec. That is the current speed required to produce ripples in the coarse sand. Megaripples require current velocities of 40 to 60 cm/sec to form and there are no megaripples at the seabed.

Given that there are no sediments other than very small pockets of coarse sand on the undulating bedrock surface and the sidescan sonograms showed no sand ribbons on the seabed, sand sized material is not in transport across the bedrock surface. Sediments that were previously present across the area were removed by marine regression and transgression that occurred thousands of years ago, giving the present seabed a relict character.

The construction of the pilings directly on bedrock is not expected to result in an accumulation of sediments around the base of the pilings. If any did occur it would take the form of a thin and small patch of sand at the base of the pilings and would be more likely to develop on the eastern or inner Bay of Fundy side. However, given that there is no sand at

C0635-127

the seabed of the region in the water depths where the structures will be founded, deposition of sand in the lee of the pilings in not expected to occur.

Additionally, scouring will not occur around the base of the pilings as they are founded on exposed hard bedrock. Large boulders in the region overlying thin sand did not appear on sidescan sonograms to have scour features associated with them. As the boulders occur in the local area their relationship with the sand provides additional information regarding the strength of bottom currents and the ability to scour around seabed obstacles.

The introduction of socketed pilings into the water column is expected to have little effect on the currents. Local gyres may develop around individual pilings but the turbulence will only extend a few pile diameters away from them. The pilings will have no effect on the regional current pattern.

See also reply to Comment 3, Reviewer # 4, NRCan on sediment and habitat disturbance, for information on local effects of pilings.

Ship traffic in the area will increase considerably and there is little shelter for ships against storms in the immediate area. Given that a marine oil spill can occur as a consequence of a marine accident, NRCan did not see any detailed preparation plans for shoreline cleanup or containment of marine oil spills other than the short section in Chapter 11 pg 21 which states spill response teams are available. The rough nature of the coastline and marine conditions will likely make this a very difficult area to conduct an oil spill clean-up or contain it to a small area. An adequate knowledge of these shoreline and marine conditions is relevant to determining how long it would take for response teams to reach the site and the adequacy of spill response. This knowledge should be brought to bear during spill response planning.

RESPONSE
Please refer to Section 11.0 Environmental Management in this document.

Comment from Reviewer 4
Comment 1: Title of Vol. VI, Section 9.1.7
As this section deals with not only physical oceanography, but also bathymetry, marine sediments, contaminants, and sea level rise, the title should be changed to Marine Environments and Physical Oceanography to reflect the contents.

RESPONSE
Bilcon agrees with the reviewer that the title of Vol. VI, section 9.1.7 should be changed to Marine Environments and Physical Oceanography to better reflect the content.

C0635-128

9.1.5 Marine Environments and Physical Oceanography

Comment 2: Discharge of sediment

The Summary (p. 29) and Vol. VI section 9.1.7 both mentioned that the discharge of sediment into the Bay of Fundy from this project will not exceed the limits set out by the Nova Scotia Department of Environment and Labour; however, the volume, contents and potential effects on local and regional habitats are not provided. The proponent should provide this information and demonstrate that the seabed erosion by the strong Bay of Fundy tidal currents and river discharges provide significant input of silt and clay and that the discharge volume from this project will be insignificant and likely be dispersed into the Bay of Fundy proper by the moderately strong currents off Whites Cove.

RESPONSE

EIS Reference Vol. III, tab 19 indicates that the total amount of material released from the discharged waters to the Bay of Fundy would not exceed 2.45 cubic metres per year and would consist dominantly of silt sized material produced from the quarry operations. Appendix VIII, Tab 4 provides a breakdown of the metals found in the bedrock that would be expected to occur in the fines contained in the retention ponds. Further testing of the basalt rock for metals has been carried out and is found in Section 9.3.6 – Human Health, Wellness and Socio-cultural Environment. EIS Volume III Reference Document #19 provides an assessment of the overall natural and anthropogenic processes that introduce fine-grained sediments to the Bay of Fundy waters. These fine-grained muddy sediments (silt and clay) are the result of: natural erosion of the seabed from strong currents on a fragile bottom of the inner Bay, river input particularly from the inner part, seabed erosion from bottom fishing activities, and the disposal of dredge spoils. Fluid mud with extreme concentrations of suspended sediments is found in the inner Bay particularly in Chignecto Bay. The volume of sediments introduced by these processes is very large compared to the amount that could be released from the quarry operation. The reviewer correctly concluded that the amount from the quarry would be considered insignificant in relation to all of the other sources of fine-grained sediments and that the material would be dispersed into the Bay by the moderately strong currents off Whites Cove. This scenario is described in EIS Reference Vol. III, tab 19.

It is the intention of the quarry development plan to have 0 discharges to the Bay of Fundy as the water is required for the operation of the quarry and will be recycled and filtered through the settling ponds. The only release would be associated with settling pond failure or an excessive rain event.

If the material were released to the water column of the Bay as suspended sediment off Digby Neck, it is envisioned that silt would only settle to the seabed during slack water over a short time interval if released at exactly slack water. As the tidal cycle generated stronger currents, the silt would be remobilized and transported as suspended sediment in the water column, being diluted as it moved further from source. A short period of deposition of a very small quantity of silt on the bedrock is considered to have little or no effect on the benthic

C0635-129

community. It could be described as a dusting of the bedrock surface as the quantity is so small that a measurable accumulation could not be undertaken. Under conditions where waves are over a metre in height, the silt would not settle to the seabed in depths less than 10 m water depth but remain in suspension. The author has observed similar thin coatings of silt and organic matter across gravels on Browns Bank and boulders and bedrock in Halifax Harbour during summer. These fine-grained sediments were eroded and transported during other seasons of the year when waves and currents were higher and stronger.

For most of the tidal cycle the seabed off Whites Point is swept clean of fine-grained sediments by the tidally generated currents that are approximately 40 cm per sec. Net sediment transport for the Bay of Fundy south coast is up Bay toward the northeast and these sediments would be transported to the northeast and their concentrations would be diluted from the source. The quantities released from the quarry would be virtually undetectable from the background suspended sediment of approximately 4 mg/l that have been measured offshore Digby Neck.

Comment 3: Sediment and habitat disturbance, Vol. VI, 9.1.7
The proponent suggested that marine sediment redistribution during construction is extremely unlikely since pilings for the marine terminal are located on exposed bedrock and that the design of the marine terminal infrastructure on pipe piles allows for practically unobstructed current and tidal flows (pages 60, 61). Firstly, after reading Map 19B, Ref. Vol. II Tab 9, and Appendix 23 (Vol. III), NRCan concludes that the proponent did not provide maps that clearly show the seabed texture type and bottom sediment grain size at the locations of the pipe piles supporting the terminal and the conveyor. Thus the statement that pilings for the marine terminal are located on exposed bedrock cannot be substantiated. Second, the pipe piles will have a thirty-six inch diameter. With the estimated maximum current speed of 45 cm/s, flow and pipe interaction can cause enhanced currents, turbulence and erosion/suspension of sand sediment if some of the pipe piles are located on sandy seabed. However, these effects will be local and as the bottom sediments contain little clay and silt, their suspension and advection will probably be minimal.

RESPONSE
In response to reviewer #4, NRCan, comment #3, please refer to Geospacial Data, Vol. 5, Tab 26, Map 6, which shows the bathymetry of the seabed, the geology of the seabed interpreted from the sidescan sonar data, bottom samples and video, and the adjacent multibeam bathymetry. The marine terminal will be positioned off Whites Point with the seaward face of the docking dolphins in 16 m water depth. This places the dock in approximately the middle of the broad regional area of exposed bedrock at the seabed and the conveyor and quadrant ship loader entirely over the region of basalt bedrock exposed at the seabed.

C0635-130

9.1.5 Marine Environments and Physical Oceanography

Figure 2.2 R1 has been prepared for clarification on this matter to assist the reviewer and shows all of the physical elements to address the location of the marine terminal relative to bathymetry, seabed samples and seabed geology. This map shows that there is no sediment at the seabed beneath or near any of the proposed foundations for the offshore structures. The nearest thin sand patch that overlies bedrock is over 125 m to the northwest of the marine terminal.

With respect to the comment on flow and pipe interaction, Bilcon agrees that the pipe piles will affect local currents but because of the minimal number of pipe piles, the increased water flow and potential turbulence with the generation of vortices will only be local and confined to a few pile diameters distance from each individual pile. Research conducted in Nantucket Sound on water movement around seabed pilings constructed for wind energy structures has shown that interaction among piles ceases when the piles are spaced greater than 5 pile diameters from each other (ESS Group, 2006). The construction technique of socketed piles within bedrock is the optimum design for producing a minimal effect on local currents. This is in contrast to other standard dock construction techniques such as sheet pilings or ballasted concrete caissons. Most importantly, and as stated above, the piles will be fixed to exposed bedrock and not in areas of sand. Thus, seabed erosion, piling scour, and local lee side sand deposition is not expected to occur around the pilings.

As Reviewer #4 notes, there is no silt and clay sediments at the seabed in the area of the marine terminal as well as sand sized sediments that could be eroded and transported by local effects associated with the pilings. Regarding sediment transport and erosion Bilcon reiterates that the location of the marine terminal and associated infrastructure is founded on a hard and stable seabed and that no sediments will be affected by the presence of the structures through erosion, transport and deposition. Additionally, the pilings will have only a local effect on currents producing turbulence during maximum tidal flow. The turbulence will be confined to a few pile diameters distance.

References

2006, ESS Group. Revised scour report. Prepared for Cape Wind Associates, LLC, Boston, MA. Prepared by ESS Group, Inc., Wellesley, MA. Project No. E159-501.16, 13 February, 2006.

Comment 4: Storm surge protection of the infrastructure and re-claimed land

The physical plant and several sediment ponds will be located behind a preservation zone (Figure 1 of Volume V, Chapter 7). The reclamation diagram indicates that the finished grade quarry will be lower than the preservation zone in elevation (Vol. V, 7.10). Storm surges during extreme storms under the scenario of long-term sea level rise could pose erosion and flooding risks. The report did not provide the information on the elevation of the preservation zone above the datum mean sea level. The document mentioned "Necessary

C0635-131

studies including wave height and duration, wind speed, and potential sea level rise of 30 cm/century will be conducted during detailed engineering design to ensure adequate infrastructure over the 50 year life of the project". Wind and wave statistics are given in Appendix 48 and 46 (Vol. IV) but the maximum water level that can be reached due to the combination of storm surge, extreme wind and waves, and long-term sea level rise is not given. Thus it is not clear whether the construction and the height of the preservation zone offer enough protection against the storm surge under extreme wind and wave conditions (a) for the infrastructure during the life span of the project, and (b) for the low reclaimed land after decommissioning. If this will be dealt with in the detailed engineering design, for the purposes of the environmental assessment, please indicate what is the predicted maximum water level of storm surges, and that detailed engineering design will ensure the elevation of the preservation zone will be safe against the maximum storm surge.

RESPONSE

Please refer to 7.0 Revised Project Description, Pages 149 to 153 and Bilcon's response to the Panel's Information Request 22 (IR-22) in Section 7.0 in this submission.

Comment 5: Decommissioning, Vol. V, 7.10

The report states that portions of the marine infrastructure, such as the conveyor support system, gallery trusses and floor, mooring dolphins and buoys will remain. It is likely that the mooring dolphins and buoys can be used by the local community after the project; however, it is doubtful that the conveyor support system (pipe piles) and the gallery trusses and floor can be used for other purposes. Other federal authorities may have concerns that leaving marine infrastructure in place may affect navigation and/or tourism in the region, so clarification is needed.

RESPONSE

Bilcon has stated that the marine terminal will remain after decommissioning. It is entirely possible that 50 years hence, there will be a demand for a recreational facility and Bilcon is willing to work with a future group to create a recreational facility at Whites Point. This would be particularly true if the reclaimed quarry site were to be developed into a tourism venture.

If there is no demand for future use of the terminal, Bilcon will dismantle the terminal in consultation with the appropriate regulatory agencies.

Comment from Reviewer 5

Review of Reference Volume III, Tab 17, Glacial, Post Glacial, Present and Project Sea Levels, Bay of Fundy

The document referenced above is a fair assessment of the past, present and projected sea levels in the area, except for one deficiency. The author (correctly) reminds us that future

C0635-132

9.1.5 Marine Environments and Physical Oceanography

sea-level changes must be taken into account: "Of utmost importance to the design of the marine terminal is to take into consideration the continued projected rise in sea level." (p.10).

However, the author goes on to say: "Based on the knowledge of sea level change over the past 50 years, all facilities will be designed and constructed to anticipate a sea level rise of 30 cm/century with associated potential change in tidal heights and storm waves".
There are some problems with this statement. It suggests that we can simply extrapolate the existing trend of sea level. However, most researchers agree that there will be an increase in the rate of sea-level rise, due to global climate change. The exact amount is debatable. According to the Intergovernmental Panel on Climate Change "middle of the road" scenario IS92A, relative sea level will increase globally by 0.49 m by 2100 AD. The actual rate may be more or less, and even if the global mean increase is 49 cm, the amount of local change will vary.
It is generally assumed that in Atlantic Canada a major component of sea-level rise is ongoing glacio-isostatic crustal subsidence, so a reasonable approach is to add only the glacio-isostatic component to the predicted 0.49m. Carrera and Vanicek (1988) argued that the mean water level increases recorded by the Halifax (NS), Yarmouth (NS) and Charlottetown (PEI) tide gauges exceeded the long-term "radiocarbon" trends by an average of 0.1 m/century. Hence, by subtracting 0.1 m from the modern rate of sea-level rise to derive the subsidence rate, and by adding the 0.49 m we can predict sea-level rise in the coming century. A report in preparation by Shaw et al. for the Bras d'Or Lakes, Nova Scotia, claims that sea level will increase by 0.76 m over the period 2000-2100 AD. GSC Open File Report 2061 argued for a 0.70 m increase by 2100 AD at Charlottetown (McCulloch et al., 2002). In NRCan's opinion, the projected rise for the study site would be similar to these estimates, and much higher, therefore, than the rate of 30cm/century mentioned in the report.

RESPONSE
Please refer to response to Panel in 9.1.7.1.9 – Sea Level Change, in this document.

Comments from Reviewer 6
The following points should be corrected / clarified:

1. *Vol. III – 14 page 10.*
   - *Correct "nautical km" to "km"*
   - *Distance scales are missing on Figures 1 to 4*

RESPONSE
Errata -"nautical km changed to "km".
Please refer to revised Figures in Appendix 1 of this section.

C0635-133

9.1.5 Marine Environments and Physical Oceanography

- *Distance scales are missing on Figures 1 to 4*

RESPONSE
Please refer to revised Figures in Appendix 1 of this section.

2. *Vol. III – 16 page 7.*
   - *Iceberg furrow berms 7 m high in the Bay of Fundy? Please clarify.*

RESPONSE
Iceberg Furrows
The reviewer has asked for clarification on the statement regarding the iceberg furrow berms that are 7 m high in the Bay of Fundy, Vol. III – 16, page 7. The discussion in question is associated with a description of the bottom of the Bay of Fundy in deeper water adjacent to the Whites Point area and continuing to the north. The seabed is mapped as till, which is a mixture of gravel, sand, silt and clay deposited directly by glaciers during the last glaciation approximately 22 – 14 thousand years ago. As the glaciers receded from the region and retreated up the Bay of Fundy, large icebergs were generated at the calving margin of the ice stream that occupied the Bay. These icebergs floated to the open ocean in the outer part of the Bay and moved with currents and winds to the Gulf of Maine. Many of them had draughts deep enough to remain in contact with the seabed of the Bay as they moved.

This movement produced features termed iceberg furrows on the seabed. An iceberg furrow is a linear trough with parallel flanking berms. The berms generally are bouldery till piles and the trough floor is often smooth. Many generations of grounded and moving icebergs have scoured the till of the outer Bay of Fundy. Multibeam bathymetry of these surfaces shows a crisscrossing pattern of bermed troughs. The height of the berms as measured from the adjacent troughs can reach as high as 30 m in other regions. The height of the berms in the nearby area of the Bay of Fundy as measured from existing multibeam bathymetry reaches a maximum of 7 m. It is anticipated that as more multibeam bathymetry is collected, larger iceberg furrows with higher berms will be discovered, particularly in deeper water where larger icebergs existed.

The iceberg furrows of the outer Bay of Fundy are relict, that is, preserved features from an earlier time without subsequent modification. Icebergs do not of course presently occur in the Bay of Fundy.

- *Change "sand in not" to "sand is not"*

RESPONSE
Errata -"sand in not" changed to "sand is not".

C0635-134

9.1.5 Marine Environments and Physical Oceanography

- *Change "medium to coarse and" to "medium to coarse sand and".*

RESPONSE
Errata -"medium to coarse and" changed to "medium to coarse sand and".

- *Change "Local current increases" to "Local current speed increases".*

RESPONSE
Errata - "Local current increases" changed to "Local current speed increases".

- *"Gravel clasts that could be lost to the seabed in the event of a delivery system failure from the quarry would not change the character of the seabed". The statement should be deleted from this section of the EIS unless some justification and/or clarification are included as to why it is warranted: this is a topic for engineers to evaluate. If "lost to the seabed" implies "a large amount of gravel", then the newly added material would change the character of the seabed. Stating that such a loss would not change the character of the seabed was not unequivocally supported by the information provided by the proponent.*

RESPONSE
Most aggregate transshipment facilities for various mined or quarried products (aggregates and minerals) that load the materials on vessels at tidewater, generally obtain materials from distant sources or different environments. As such, the lithology of the material transported generally differs from the lithology of the material at the marine terminal location. Most marine terminals occur in inshore areas where the underlying seabed is composed of sediments such as silt, clay and sand and rarely does bedrock crop out beneath the terminal.

In the case of the terminal area off Whites Point, the seabed contains no sediments and the bedrock is exposed basalt at the seabed with a minor component of gravel that includes boulders. Although it is the intention of the marine terminal at Whites Point to be designed using modern covered loading ramps and to be operated with great care not to lose or discharge material to the seabed at the terminal location, Bilcon wishes to clarify and point out that in the event that any material was lost to the seabed, that the crushed rock exhibits the same lithological characteristics as the exposed bedrock at the terminal location. If material were lost to the seabed it would only represent a small volume. Thus the lithology of the seabed and the character of exposed bedrock with minor gravel would remain the same. This would not be the case if the seabed were composed of silt, clay and sand sediments.

C0635-135

9.1.5 Marine Environments and Physical Oceanography

3. *Vol. III – 16 page 8*
   - *Change "height and over" to "height, and over"*
   - *Change "falling sea" to "falling sea level".*
   - *Change "mud (silt and clay) free sands and gravels" to "sands and gravels and no mud (silt and clay) free".*

RESPONSE
Errata - "height and over" changed to "height, and over".
"falling sea" changed to "falling sea level".
"mud (silt and clay) free sands and gravels" changed to "sands and gravels and no mud (silt and clay) free".

4. *Vol. III – 16 page 9*
   - *Delete "where such ground truth exists".*

RESPONSE
Errata - "where such ground truth exists" has been deleted.

5. *Vol. III – 16 figures*
   - *No distance scales on Figures 1 to 4, 6 to 8.*
   - *Figure 4 particularly lacking in distance scales in two directions.*
   - *Reference to Figure 3 is out of sequence in the text.*

RESPONSE
Please refer to revised Figures in Appendix 1 in this section.

WP 1541 - Fisheries and Oceans Canada

VOLUME III – Reference Document 19 - Erosion, Suspended Sediment and Sediment Transport.
This is a well written description of the general sediment regime for the Bay of Fundy. However, as a document to support the EIS for the Whites Point Quarry and Marine Terminal it has much less merit. While it is interesting to know that sediment concentrations are high in the upper Bay of Fundy and that there are mega ripples and dunes, the information provided does not have direct relevance to the transport of sediment derived from quarry operations. What is happening in the Petitcodiac is irrelevant for sediment transport off of the quarry site. The question that needed to be answered is what would the fate of the 2.5 m3 of sediment released from the quarry be. It is correct to state that in

C0635-136

9.1.5 Marine Environments and Physical Oceanography

comparison to the total sediment in the Bay this amount of irrelevant, but if this material was deposited in an area of macrophytes sensitive to TSS, there could be a negative impact. There is a need for data on the background levels of suspended sediment off of the quarry site and some estimate of the dispersion based on tidal current velocities, wave climate and tidal range for the area of interest. While it may be unlikely that sediment will accumulate in the area, the report fails to make a case for this assumption. Similar to the Brylinsky report (Reference Document 12), the overall conclusion that sediment from the quarry will be dispersed is likely correct but the report provided does not support that conclusion.

RESPONSE

The reviewer questions the value of the regional assessment of sediments, erosion, suspended sediment and sediment transport in the EIS. Bilcon considers that the mandate of the EIS was to evaluate the impacts of the quarry both locally and regionally. Numerous concerns were expressed during the public meetings about the fate of particulates from the quarry operation and anecdotal comments were frequently made that suggested that these particles would settle locally on the seabed and have a major impact on the fishery. Based on these previous comments and concerns, it was clear that a Bay of Fundy wide assessment of the stability of the seabed, other sources of fine grained sediment, sediment transport processes, depositional areas, and a regional Bay of Fundy sediment budget were required to place the potential role of suspended sediment from the quarry into context and for comparison purposes. Such a Bay of Fundy wide assessment contained in the EIS clearly shows that the potential amount that could be released from the quarry is extremely small relative to all the other inputs and the reviewer correctly notes that the amount is really irrelevant to the overall sediment budget.

Results from a Bay of Fundy wide assessment of sediment sources and transport pathways indicate that the fine-grained sediments have a net transport direction to the northeast toward the inner Bay of Fundy and that the inner Bay and north shore are the eventual locations where fine grained materials will settle. In their review of the EIS, Reference # 1628, the Sierra Club has provided a model of expected particle trajectories at 25 m depth for a 2 week period in July 2007 based on the M2, K1, N2, S2, O1 and residual tidal constituents. This shows that particles would have a net transport direction to the northeast if released off Whites Point.

The early research of Miller, 1966, summarized in the EIS, presents a regional assessment of suspended sediment and transport and represents the only Bay wide comprehensive assessment. The seabed of the southern area of the Bay of Fundy adjacent to the proposed quarry was characterized as a winnowed Quaternary bottom of coarse materials. Amos, 1984, reported on suspended sediments in the outer Bay of Fundy and its residual transport based on unpublished research conducted by Kate Kranck. These results indicate that sediments are transported counter clockwise to the northwestern area of the Bay. Kranck observed a net

C0635-137

inward transport of suspended sediments and interpreted that they were sourced from the outer Bay. The analysis presented in the EIS of the seabed sediments and features off Margaretsville in the central area of the Bay, using multibeam bathymetric and backscatter technology, shows net transport of sand in sand ribbons at the seabed in a northeastern direction and a failure of the large sand dunes on their eastern flanks with spill over fan deposits. Scour depressions in the form of large flutes around these large and numerous bedforms, liberates mud to the water column of the Bay that is advected toward the inner Bay. The shape of the flutes that are oriented southwest – northeast clearly shows the relationship between the bottom currents and seabed of this region and that the strongest currents are from the southwest. All of these studies appear to agree on a regional northwestern transport of suspended and seabed sediments for the southern area of the Bay.

The second part of the question regards the effects of sediment deposited in an area of macrophytes. Firstly it is the intention of the quarry development plan to have 0 discharges to the Bay of Fundy as the water is required for the operation of the quarry and will be recycled and filtered through the settling ponds. The only release would be associated with settling pond failure or an excessive rain event. The dominantly silt sized material that will be deposited in the settling ponds is to be conserved and used as part of the reclamation plan, mixed with organic material and supplied as a soil.

If the material were released to the water column of the Bay as suspended sediment off Digby Neck, it is envisioned that the silt sized particles would only temporarily settle to the seabed during slack water over a short time interval if released at exactly slack water. As the tidal cycle generated stronger currents, the silt would be remobilized and transported as suspended sediment in the water column, being diluted as it moved further from source. A short period of deposition at slack water of a very small quantity of silt on the bedrock is considered to have little or no effect on the benthic community. It could best be described as a dusting of the bedrock surface as the quantity is so small that a measurable accumulation could not be undertaken.

The author has observed similar thin coatings of silt and organic matter across gravels on Browns Bank and boulders and bedrock in Halifax Harbour. Such fine-grained sediments were deposited only for short periods of time during fair weather periods and were eroded and transported to deeper water depths during other seasons of the year when waves and currents were higher and stronger.

For most of the tidal cycle the seabed off Whites Point is swept clean of fine-grained sediments by the tidally generated currents of 2.5 knots (Canadian Hydrographic Chart # 4118). Silt sized sediments released from the quarry operations would not accumulate at the seabed and would be eventually transported to the northeast toward the inner bay and diluted as the material moved further from the source. The quantities released from the quarry would

C0635-138

be virtually undetectable from the background suspended sediment of approximately 4 mg/l as reported along the Digby Neck coastal zone.

Reference

Amos, C.L., 1984. An overview of sedimentological research in the Bay of Fundy, in: Gordon, D.C. and Dadswell, M.J., eds. Canadian Technical Report of Fisheries and Aquatic Sciences No. 1256, Fisheries and Oceans Canada

Volume IV – Appendix 40 – Tidal Currents in the Bay of Fundy

The tidal information presented in "Ocean Tides and Currents seems appropriate for the purpose. The proponent's analysis indicates that the large tidal heights and the tidal currents are not a problem for their operations. For example, they have designed the marine terminal so that the water flows through the structure and this reduces the impact of the currents on the structure and the structure on the currents.

There are lots of references to tidal currents in relation to the sediment, which are not reviewed here. However, there is an inconsistency on pages 51 and 52, the tidal currents are not having any impact on the movement of sediment; "No sediment bedforms were visible on the sidescan sonar and photographic data indicating little current movement close to the bottom. Does this mean that all of the fine sediment has already been removed by the currents?

The document mentions sea level rise and considers the potential effect of future sea level rise on operations and the potential environmental impact of the quarry. The following is provided for additional information for the Panel on the latest scientific understanding of sea level rise in the Bay of Fundy.
The proponent quotes a sea level rise expectation of 30m/century. This number is based on historical records. Best estimates for Saint John are that the 30 cm per century is made up of 20 cm per century of regional subsidence and 10 cm per century of the ocean rising (Petrie and Loucks, unpublished). However, the expectation is that the ocean rising component will increase to about 50 cm per century for the next century (IPCC 2001; the range is approximately 10 – 90 cm per century). In addition the amplitude of the M2 tide is increasing by about 10 cm per century at Saint John (Godin 1992). Thus one can expect that mean sea level at Saint John, and along Digby Neck, will increase by about 45 cm over the next 50 years((30+50+10)/2). The increase in each case could be as much as 60 or 70 cm.

RESPONSE

The reviewer in paragraph 2 asks the question has the fine grained sediment already been removed by the currents. The seabed off Whites Point is a hard bedrock exposed seabed with little or no sediment and the marine terminal will be constructed on the exposed bedrock

area. There is sometimes confusion regarding the absence of sediments at the seabed. Not all areas are covered with sediment and their absence is not necessarily associated with removal by currents. The region was once covered with thick glacial sediments but major relative sea level changes in post glacial time have largely removed these materials during transgressions and regressions. The surface is considered relict.

These are the processes that eroded sediment at the seabed off Whites Point. The few residual sand patches are composed of very coarse sand and gravel and they exhibit no bedforms on their surfaces. Such a lack of bedforms places an upper limit on the velocity of currents that flow across these materials as stated in the EIS. The currents prevent the deposition of silt and clay sized particles. Thus the fine sediment has been removed not by currents, but by erosion in a transgressing and regressing beach zone that occurred thousands of years ago.

Bilcon appreciates the information provided and refers the reviewer to information contained in previous responses in this section.

9.1.5 Marine Environments and Physical Oceanography

Appendix 1
Coastal Vulnerability Index

Appendix 2
Figure 2.2-R1

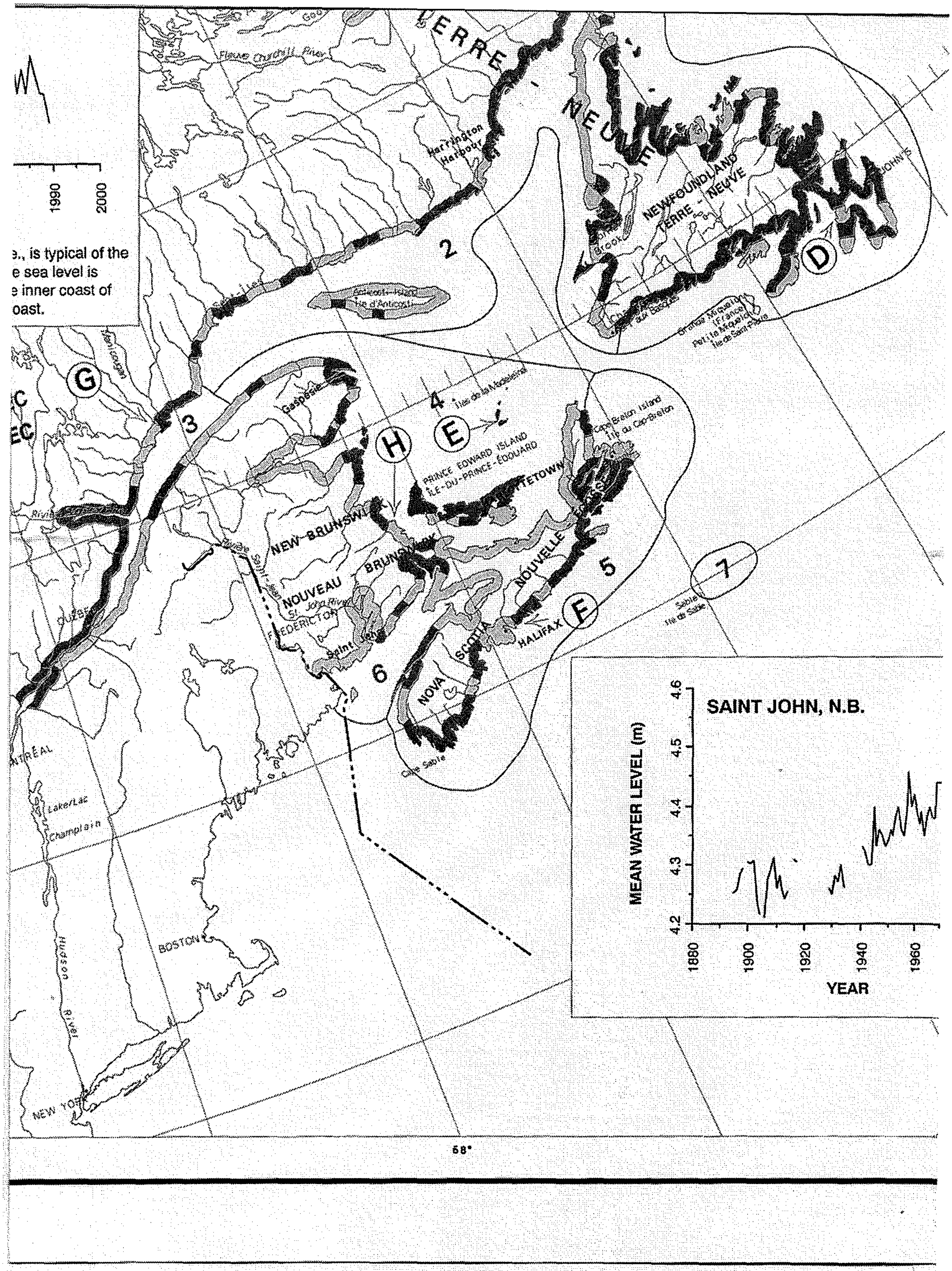
Appendix 3 - Revised Figures from EIS Reference Volume III

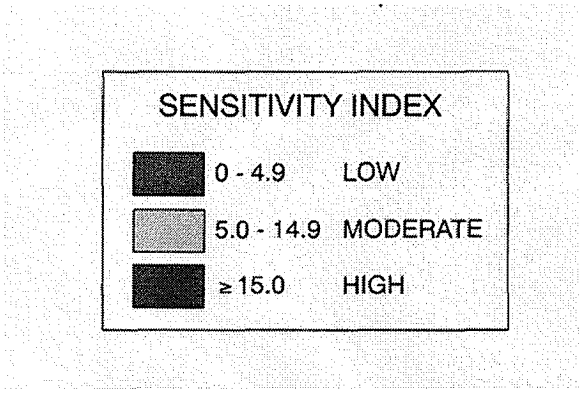
Tab 14
Figure 1R1
Figure 2R1
Figure 3R1
Figure 4R1

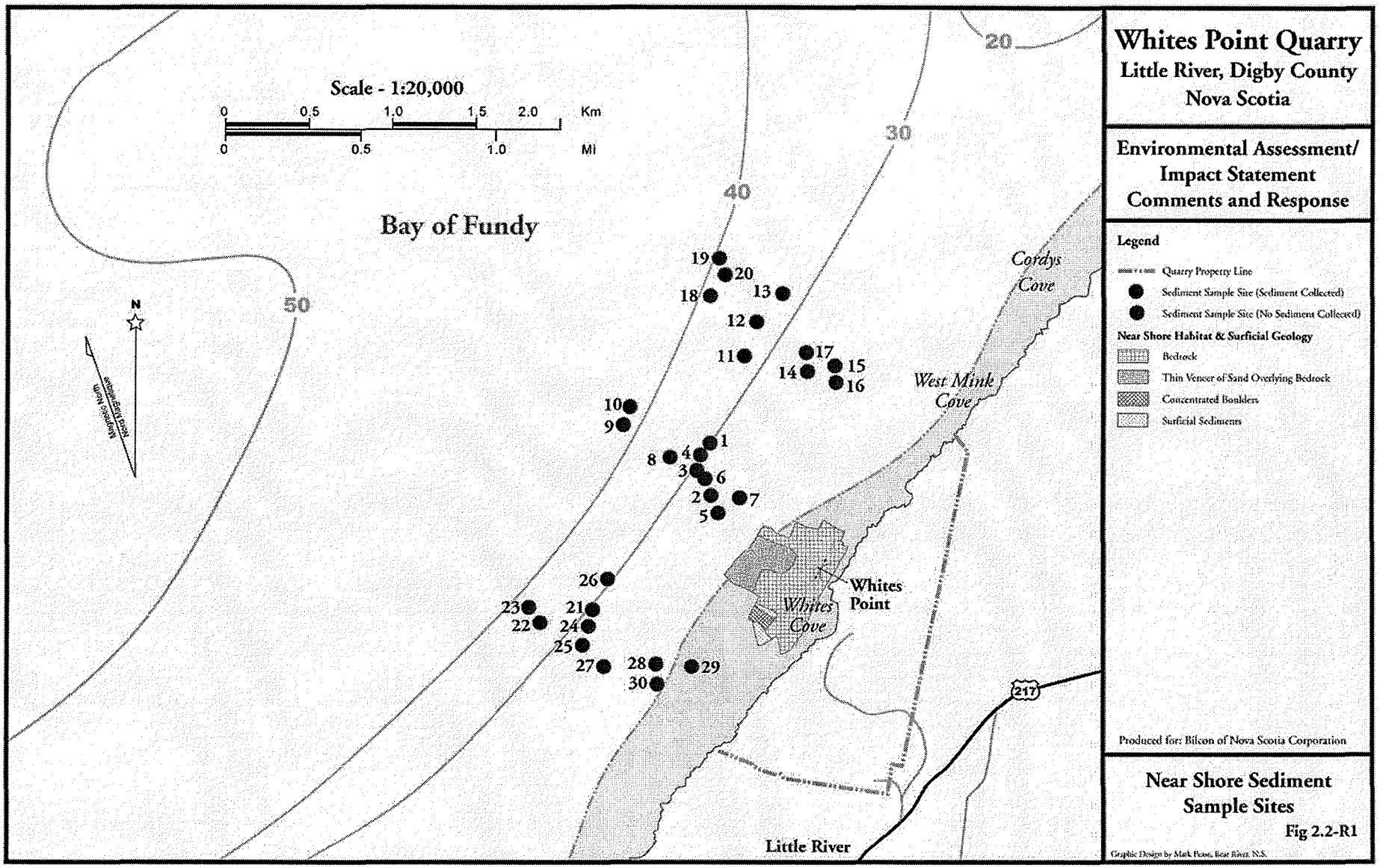
Tab 15
Figure 4-R1

Tab 16
Figure 1-R1
Figure 3-R1
Figure 4-R1

C0635-141


1990
2000
e., is typical of the
e sea level is
e inner coast of
oast.
TERRE-NEUVE
Fleuve Churchill River
Harrington Harbour
2
Anticosti Island
Île d'Anticosti
G
3
Gaspésie
4
Îles de la Madeleine
H
E
PRINCE EDWARD ISLAND
ÎLE-DU-PRINCE-ÉDOUARD
CHARLOTTETOWN
Cape Breton Island
Île du Cap-Breton
NEWFOUNDLAND
TERRE - NEUVE
D
Grande Miquelon
(France)
Petite Miquelon
Île de Saint-Pierre
ST. JOHN'S
NEW BRUNSWICK
NOUVEAU BRUNSWICK
St. John River
FREDERICTON
Saint John
NOUVELLE
5
F
HALIFAX
7
Sable Island
Île de Sable
6
NOVA SCOTIA
Cape Sable
Lake/Lac Champlain
BOSTON
Hudson River
NEW YORK
68°
SAINT JOHN, N.B.
MEAN WATER LEVEL (m)
4.2
4.3
4.4
4.5
4.6
1880
1900
1920
1940
1960
YEAR


SENSITIVITY INDEX
0 - 4.9 LOW
5.0 - 14.9 MODERATE
≥ 15.0 HIGH



Whites Point Quarry

Little River, Digby County
Nova Scotia

Environmental Assessment/ Impact Statement Comments and Response

Legend

- Quarry Property Line
- Sediment Sample Site (Sediment Collected)
- Sediment Sample Site (No Sediment Collected)

Near Shore Habitat & Surficial Geology

- Bedrock
- Thin Veneer of Sand Overlying Bedrock
- Concentrated Boulders
- Surficial Sediments

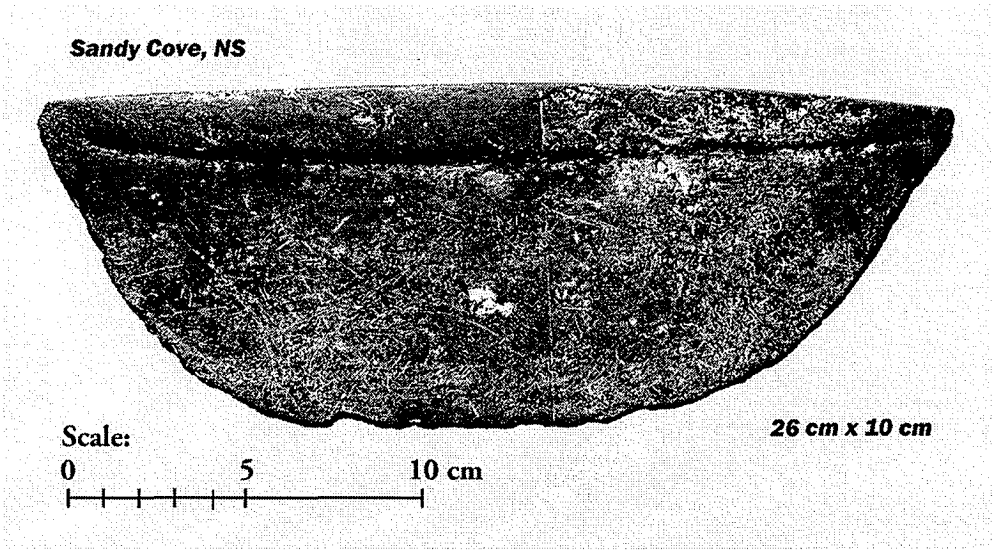
Produced for: Bilcon of Nova Scotia Corporation

Near Shore Sediment Sample Sites

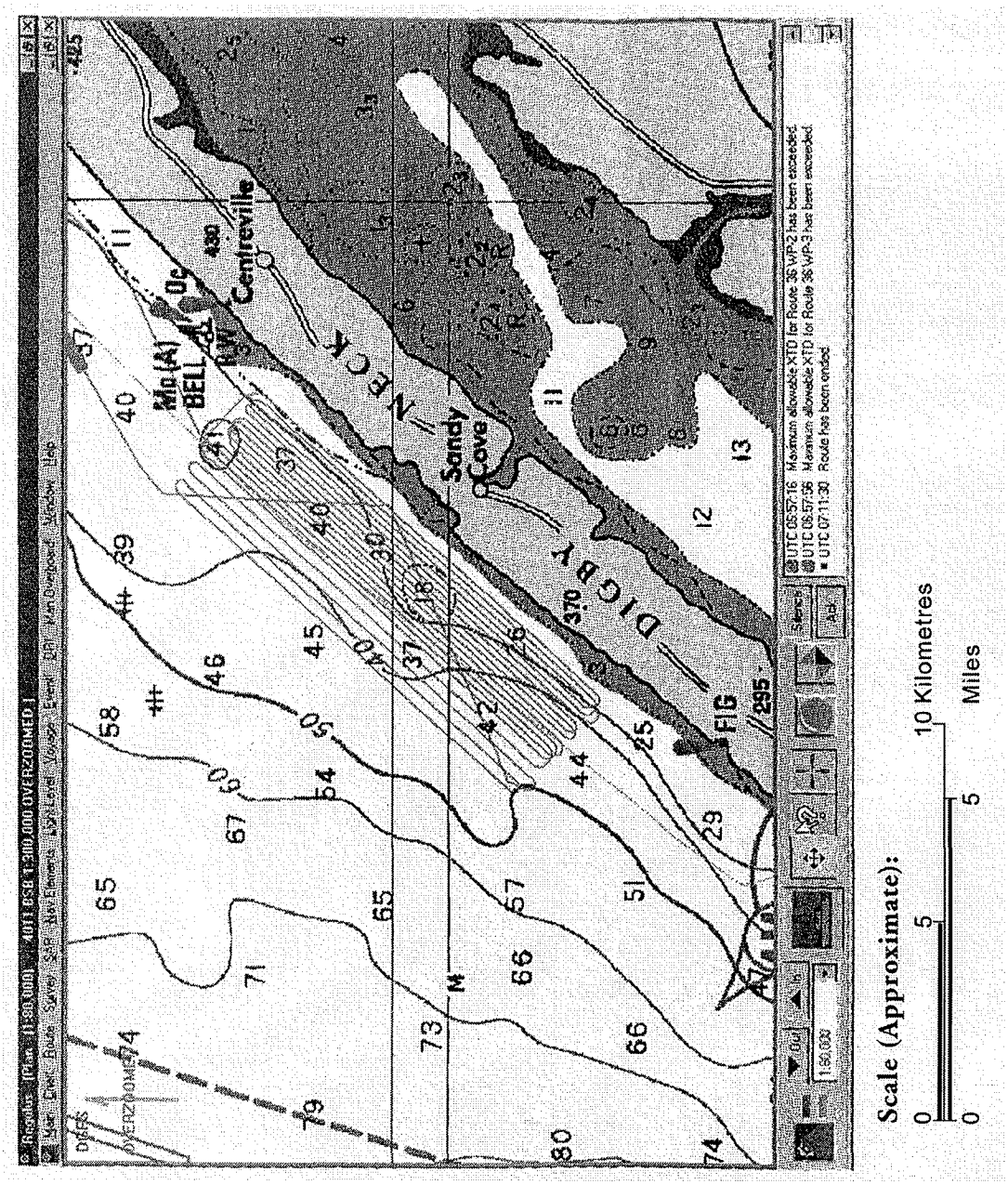
Fig 2.2-R1

Graphic Design by Mark Pease, Bear River, N.S.

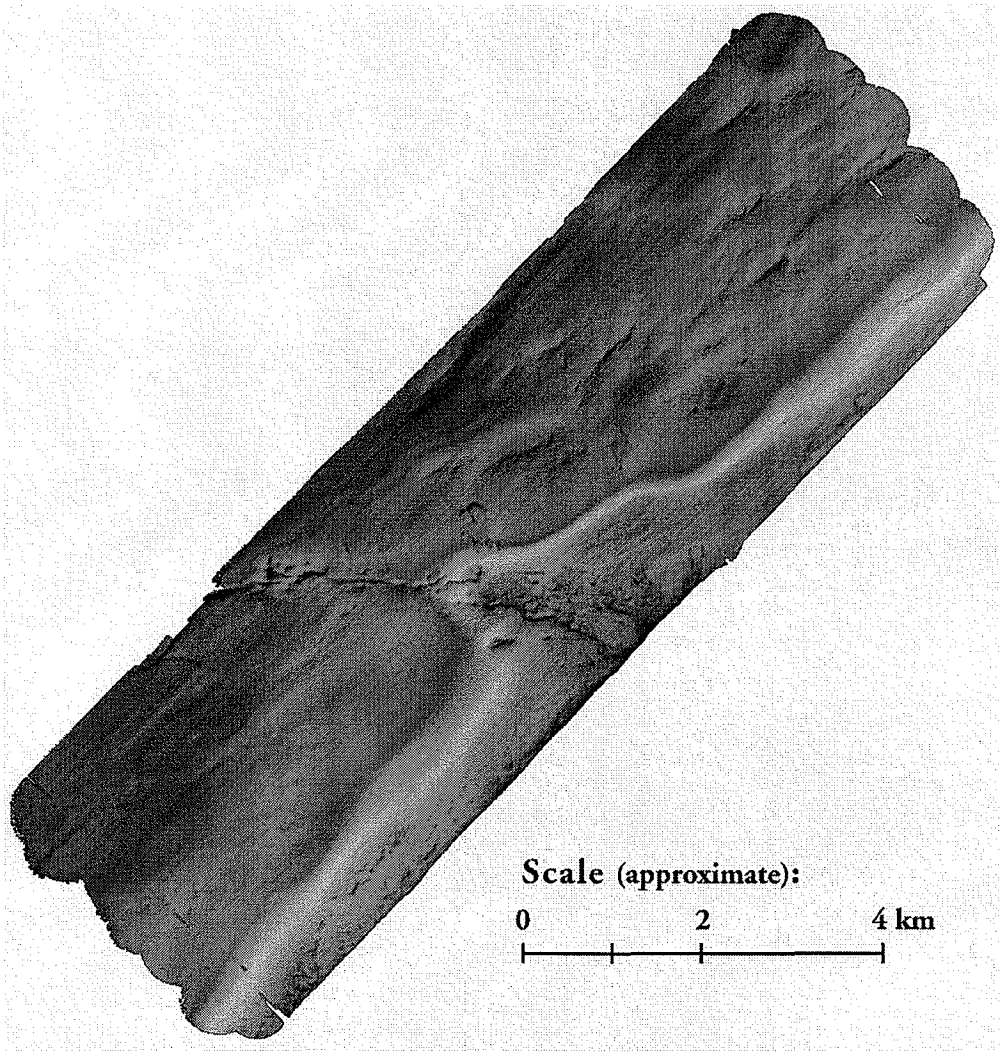
Tab 14 - Figure 1-R1



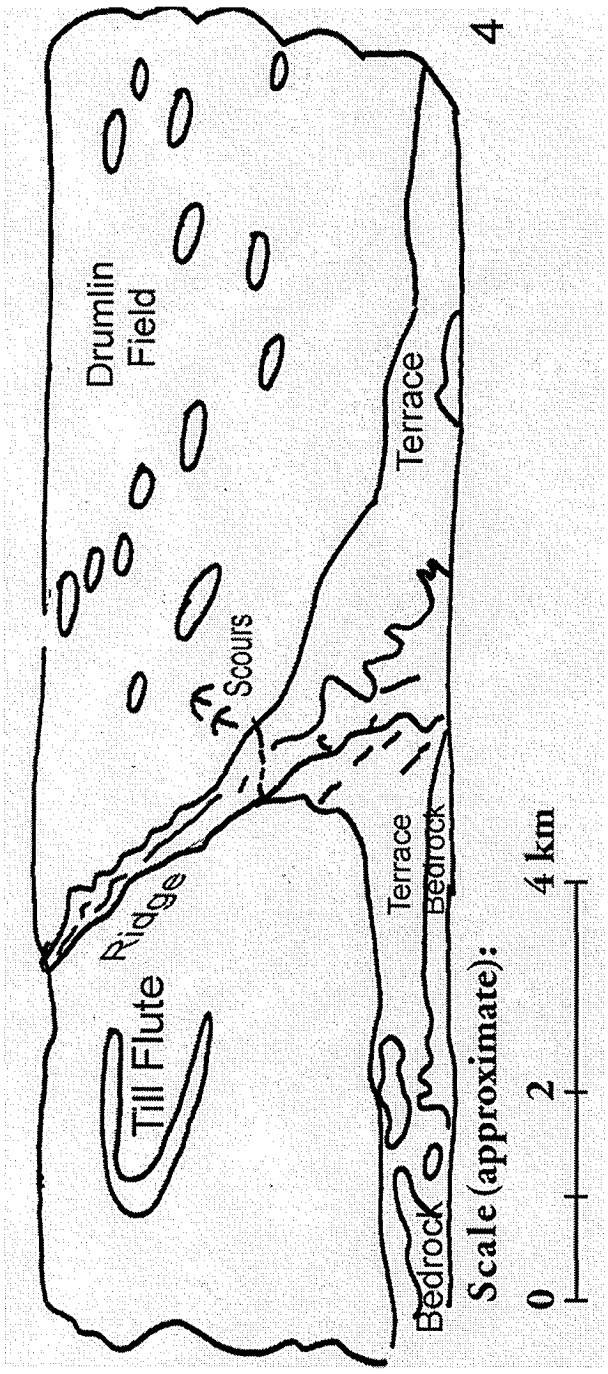
Tab 14 -Figure 2-R1



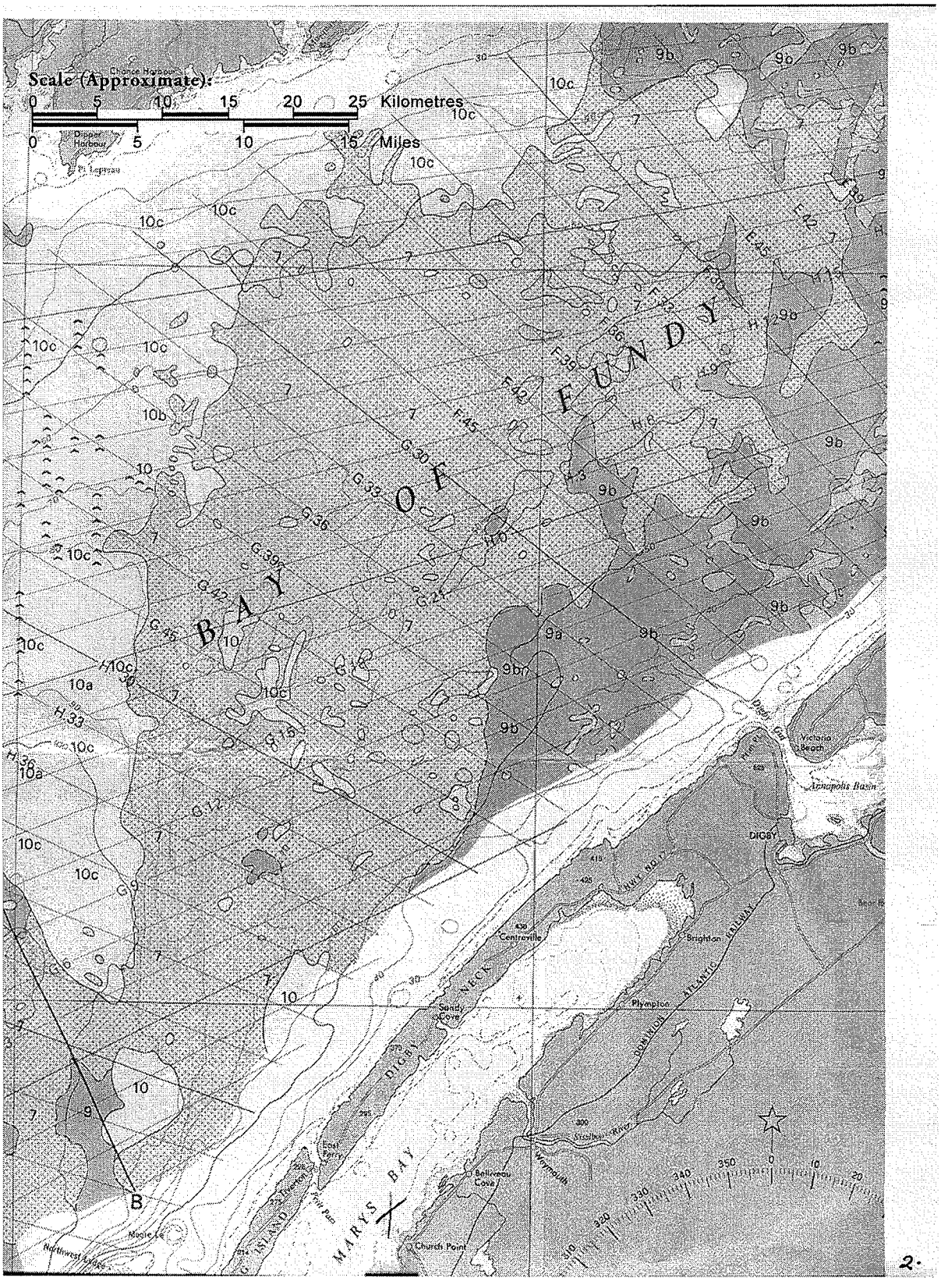
Tab 14 -Figure 3-R1

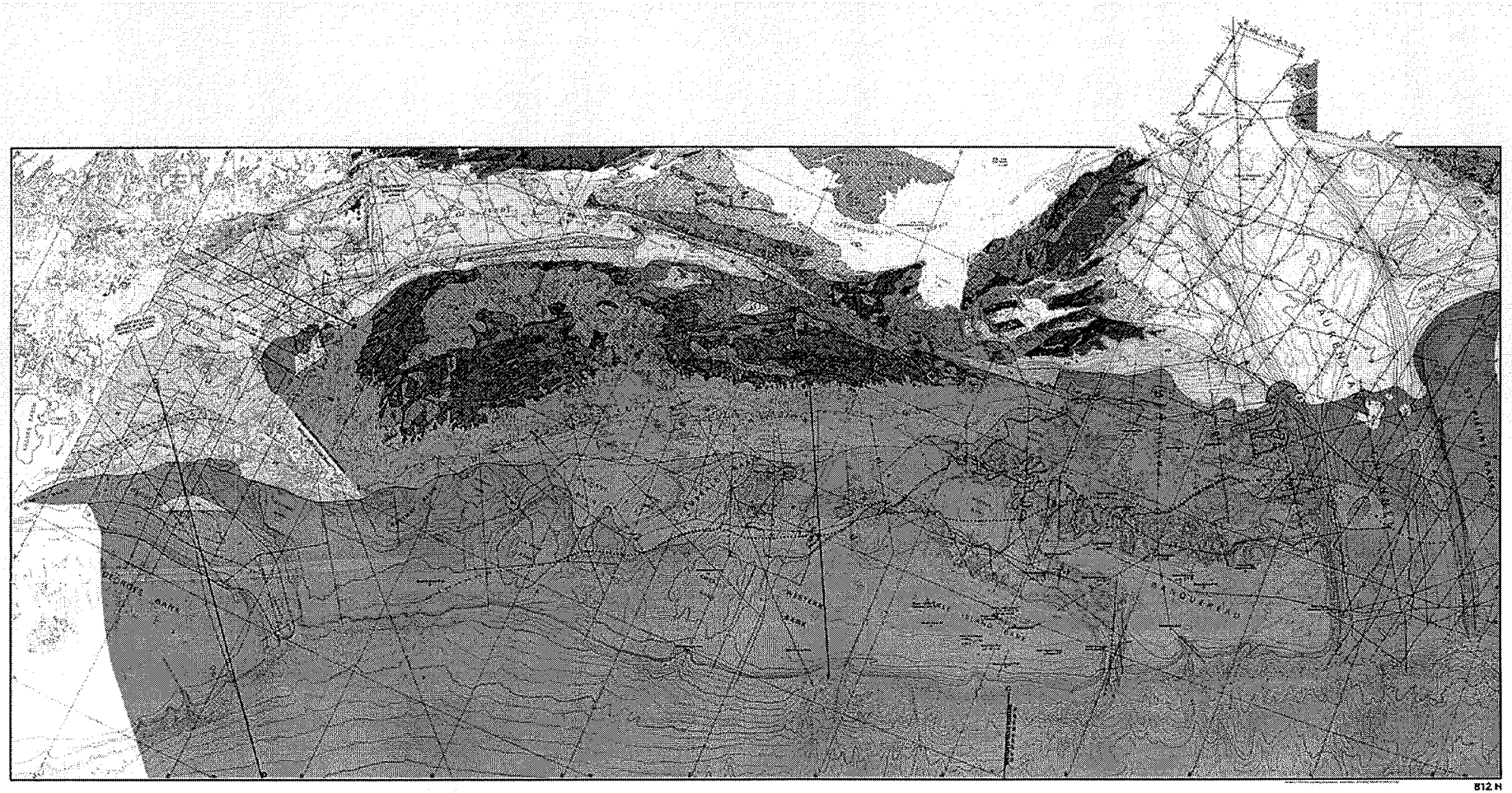


Tab 14 -Figure 4-R1



Tab 15 -Figure 4-R1



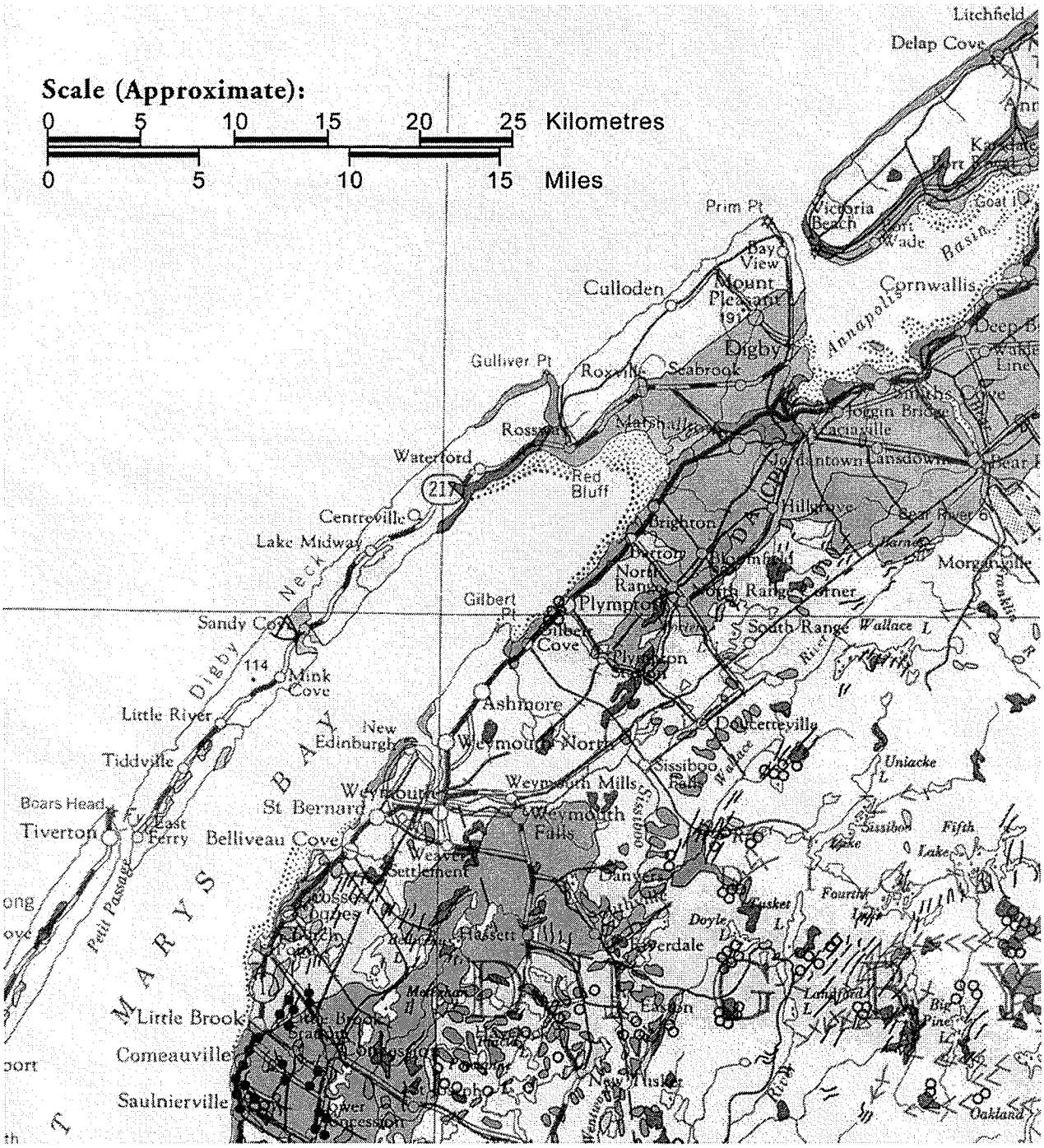


Scale (approximate):
0 50 100 km

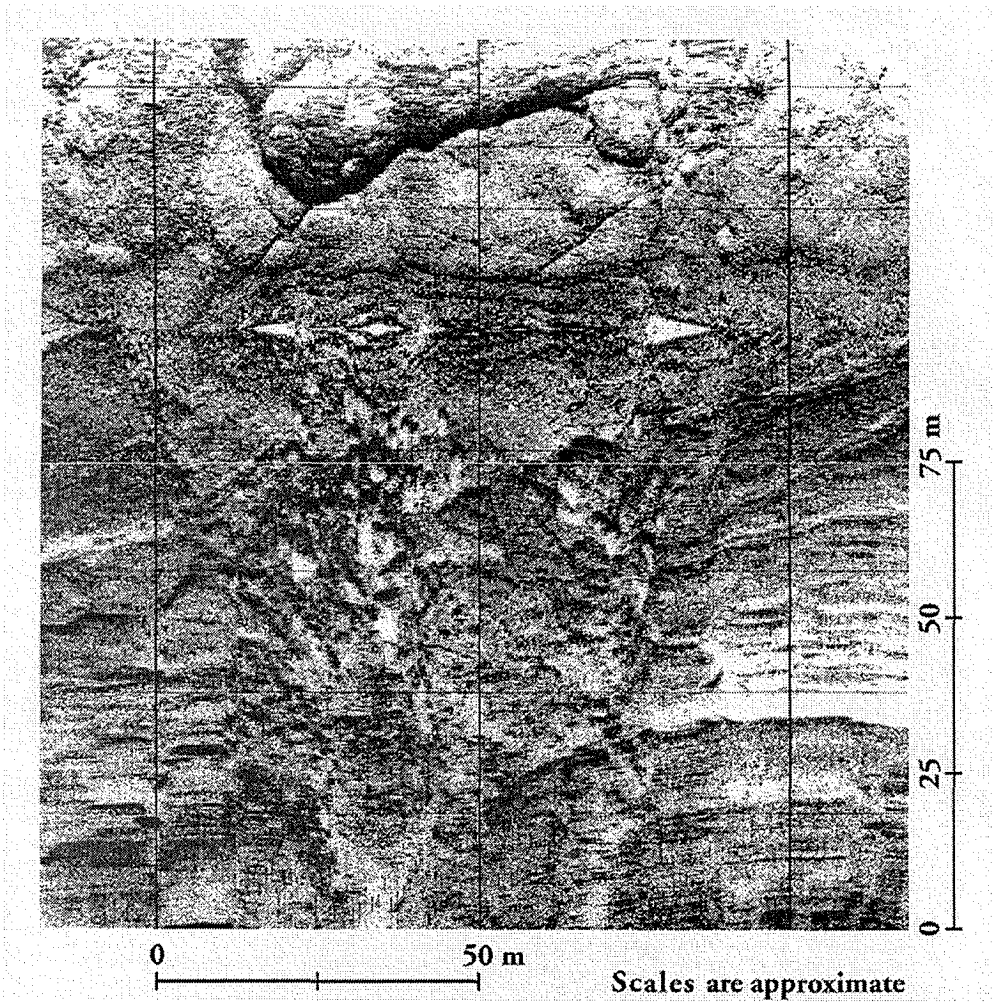
Tab 16 - Figure 1-R1

C0635-150

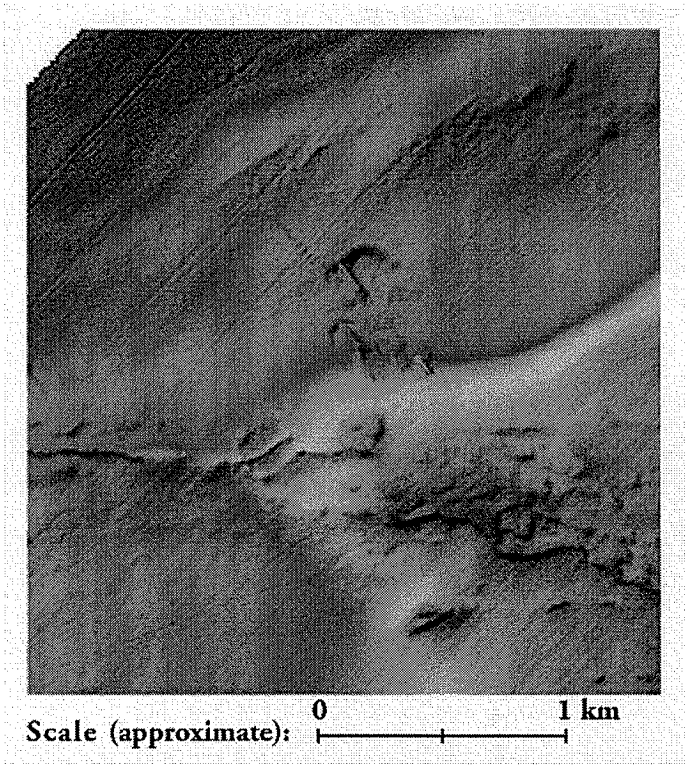
Tab 16 -Figure 3-R1

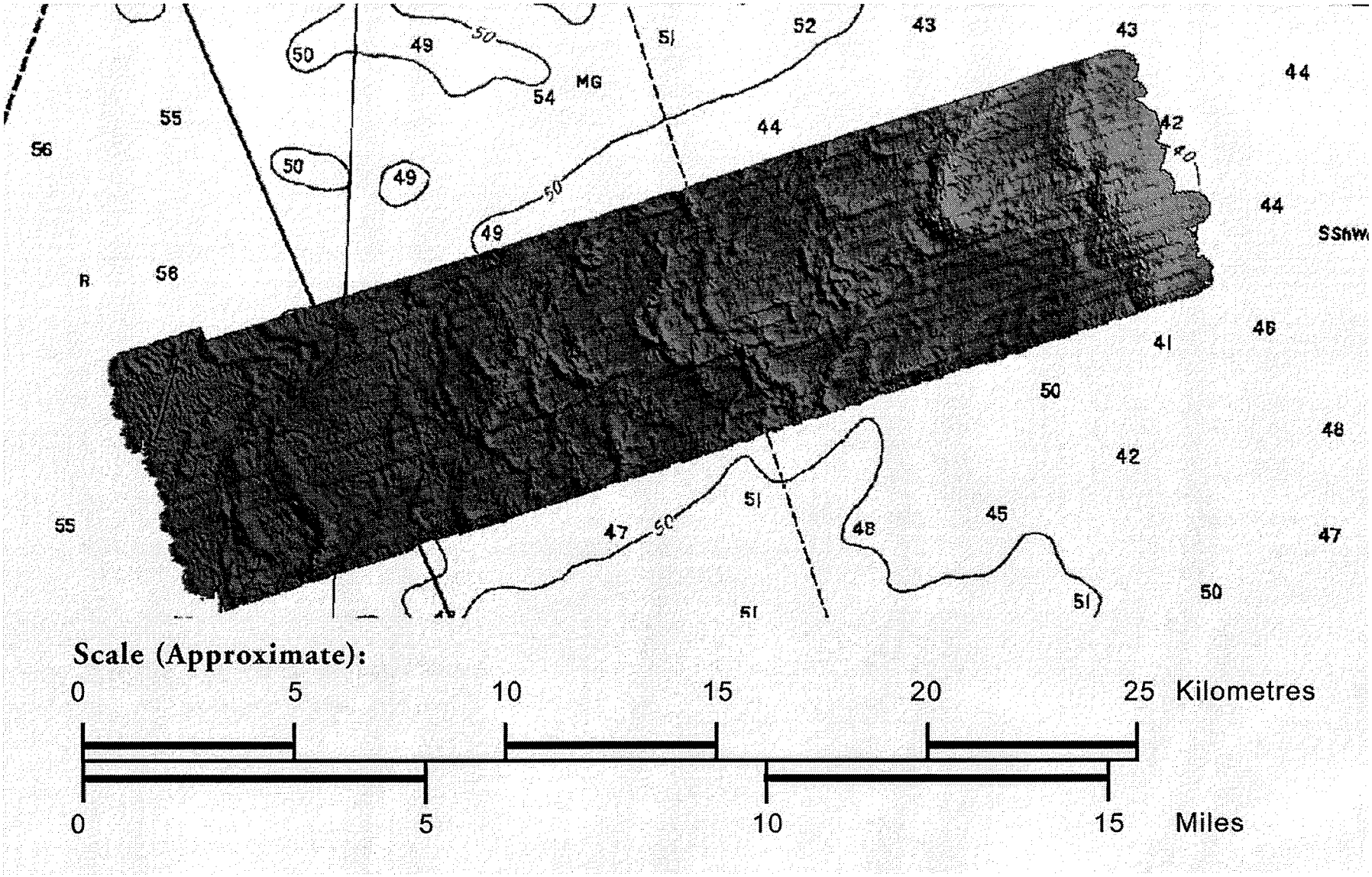


Tab 16 -Figure 4-R1



Tab 16 -Figure 7-R1





Tab 16 - Figure 8-R1

9.1.6 Air Quality

EIS Reference: EIS Volume VI, Chapter 9, Section 9.1.8

INDEX OF COMMENTS

9.0 Environments and Impact Analysis

9.1 Physical Environment and Impact Analysis

9.1.6 Air Quality

C0635-155

9.1.6 Air Quality

WP 1431 – Joint Review Panel
Information Request - IR-9

Explain how dust will be controlled in the planned sediment disposal areas.

RESPONSE
The sediment pumped from the high rate thickener will be distributed in layers in the sediment disposal areas. This material will drain naturally and within two to three weeks will be stable to the extent that it can be driven on. The surface of this material will dry quickly on hot, windy days and there will be a requirement for dust suppression by water spray.

WP 1452 – Joint Review Panel
9.1.8 Air Quality

The EIS proposes the use of air quality criteria for particulate matter that are found in the 1999 provincial Pit and Quarry Guidelines. While accepting the relevance of these criteria to the project, the Panel wishes to know if Bilcon has considered the use of parameters more directly related to particulate matter and human health, e.g. PM10 and/or PM 2.5. If other criteria were considered and rejected, the Panel would like to receive the rationale behind the decision.

RESPONSE
Please refer to Bilcon's response to Health Canada – Crushing Operations in 9.1.6 Air Quality in this document.

Bulk carriers are identified in the EIS as a source of air pollutants yet no mitigation is identified. The EIS does indicate emissions from the carries will be "brief". Provide a more detailed analysis of effects on air emissions from this source and identify mitigation measures if appropriate.

RESPONSE
Bulk carriers are anticipated to arrive, berth and depart the Whites Point Marine Terminal approximately once per week. Berthing procedures, loading and departure procedures are anticipated to last for approximately twelve hours. During this period, the vessel's main engines will be shut down, but a diesel auxiliary engine will be used for ship's services and in particular, lighting. There will therefore, be diesel emissions for an approximate twelve hour period once per week.

Since the nearest residence is in excess of 1000 metres from the ship's berth, with an intervening ridge at an elevation of approximately 95 metres, air quality at residences along

C0635-156

9.1.6 Air Quality

Highway #217 is not expected to be impacted. Mitigation is to reduce the amount of time the carrier is at the berth to a minimum.

Mitigation

9.1.8.3 In the Air Quality Study (Reference Documents V5 Tab 31) the consultant, Jacques Whitford, reports that the Proponent has made commitments that the Panel does not see carried through to the EIS.

These include:

- *the Proponent will take measures to minimize visible plumes;*
- *crushing will be conducted in an enclosed space which is ventilated through filters to the outdoors (by contrast, elsewhere the EIS limits the scope to "whenever practical"); and*
- *a complaint resolution program will be put into place.*

Confirm whether these commitments apply to the EIS or otherwise resolve the discrepancies in the documents. Describe any measures to be taken on these items.

Jacques Whitford Air Quality Study (section 3.6 and 3.8) recommends steps that can be taken to reduce or eliminate particulate emissions. Provide information on which of these measures will be adopted and provide reasons for rejecting or omitting the others

Provide a clear indication as to the components of the Project that will be covered to control dust so that the residual effects can be evaluated.

RESPONSE

Bilcon has committed to the following mitigation measures to reduce or eliminate particulate emissions:

- Quarry products will be transported by water, thereby eliminating heavy trucks travelling and raising dust on rural/residential roads
- A paved access road from Highway #217 to the quarry site will be constructed thereby practically eliminating dust generated by employee and delivery vehicles commonly associated with gravel access roads
- Water sprays will be used to control dust on quarry roads and work areas caused by quarry mobile equipment and on stockpiles and/or sediment disposal areas.
- The processing plant will be located 1000m from the nearest residence with processing equipment enclosed to control fugitive dust
- Vertical separation and vegetative buffer zones will further separate the processing plant from adjacent residences
- Quarry products will be washed during processing with state of the art mist systems

9.1.6 Air Quality

- Load out tunnels will be used to reduce product handling and associated dust generation; conveyors will be hooded to reduce fugitive dust
- All heavy mobile equipment will have approved emission controls and be well maintained
- Use of electric power for stationary land operations
- Brush will be chipped and composted instead of burned

With respect to measures to minimize visible plumes, please refer to Bilcon's response to Health Canada's Specific Air Quality Comments – Blasting Operations.

The components of the project that will be covered to control dust are the crusher, screens and conveyor belts.

A complaint resolution program will be established through the Community Liaison Committee.

WP 1498 - NSDEL – Air Quality Branch
Angela Birch –Program Admin Officer

"The Air Quality Branch has reviewed the EIS for the Whites Point Quarry and Marine Terminal project in Digby County. We are satisfied that the mitigation measures proposed in the EIS for air quality issues are adequate".

RESPONSE
Comment noted.

WP 1542 - Health Canada

Air Quality (Table ECM-2, Section 9.1.8, Reference Document #31, Noise and Air Quality Study at Whites Point Quarry)

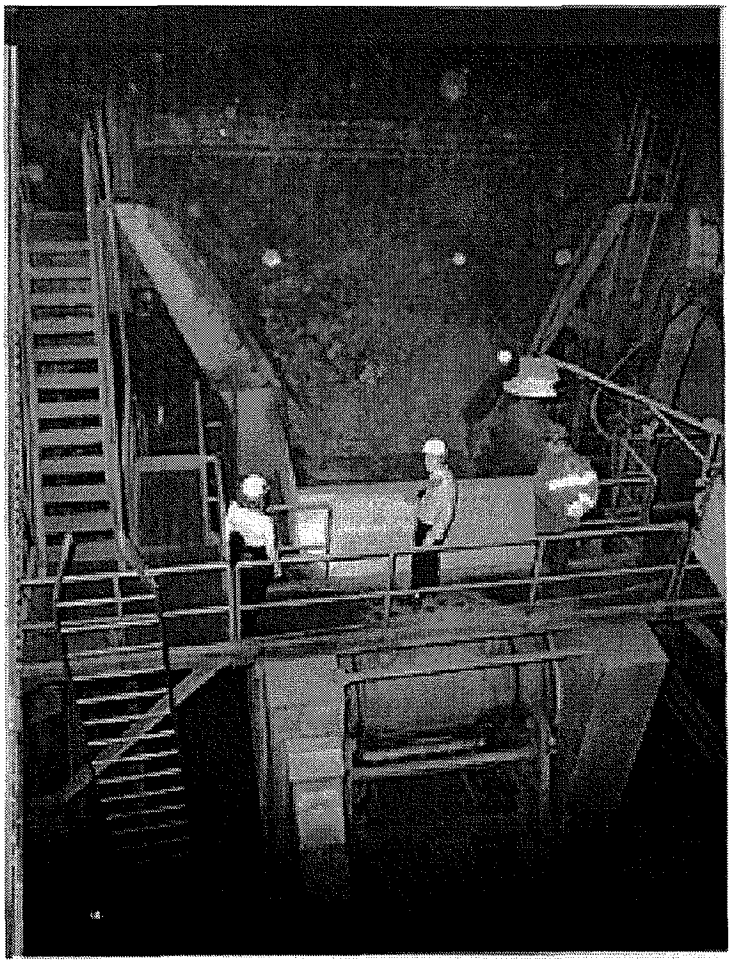
The project EIS report includes many pictures and maps; unfortunately, many processes that will be used have not been described schematically. It would be useful to obtain more visual information regarding project processes and equipment, such as the crusher/screening operations.

RESPONSE
Please see following pages for photographs of plant processes.

C0635-158

9.1.6 Air Quality

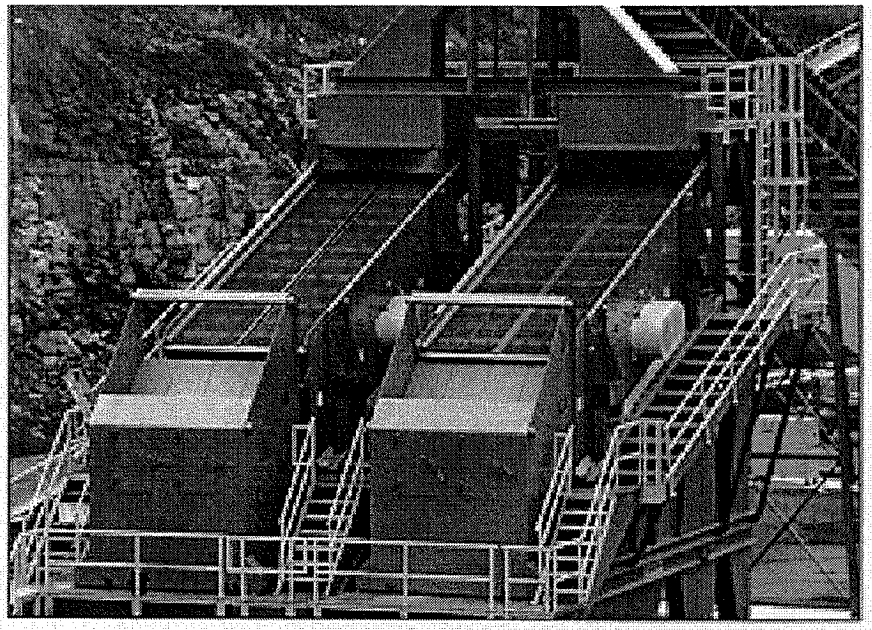
Enclosed Jaw Crusher

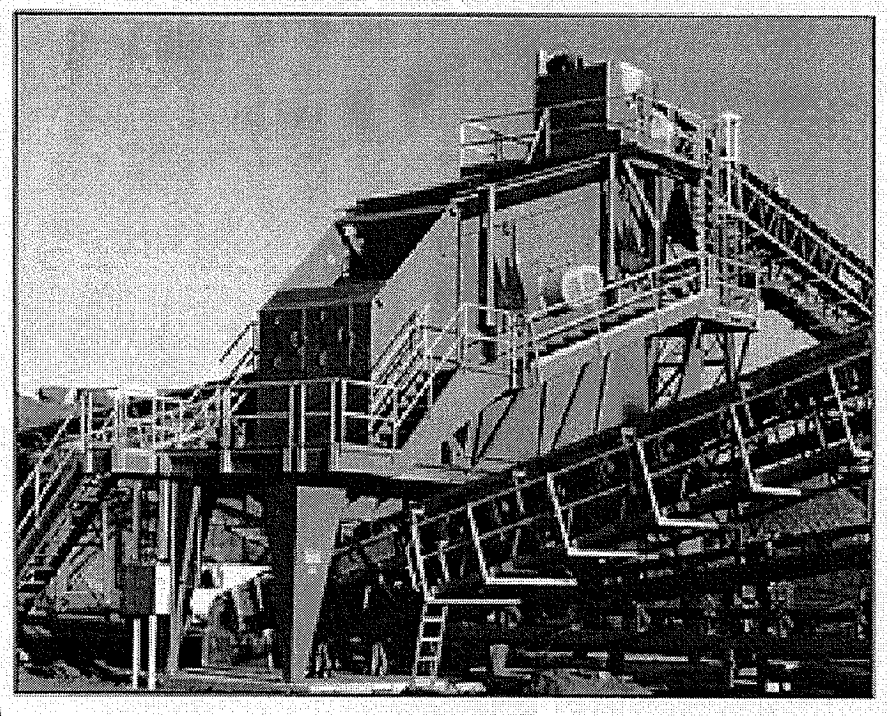


C0635-159

9.1.6 Air Quality

Screens

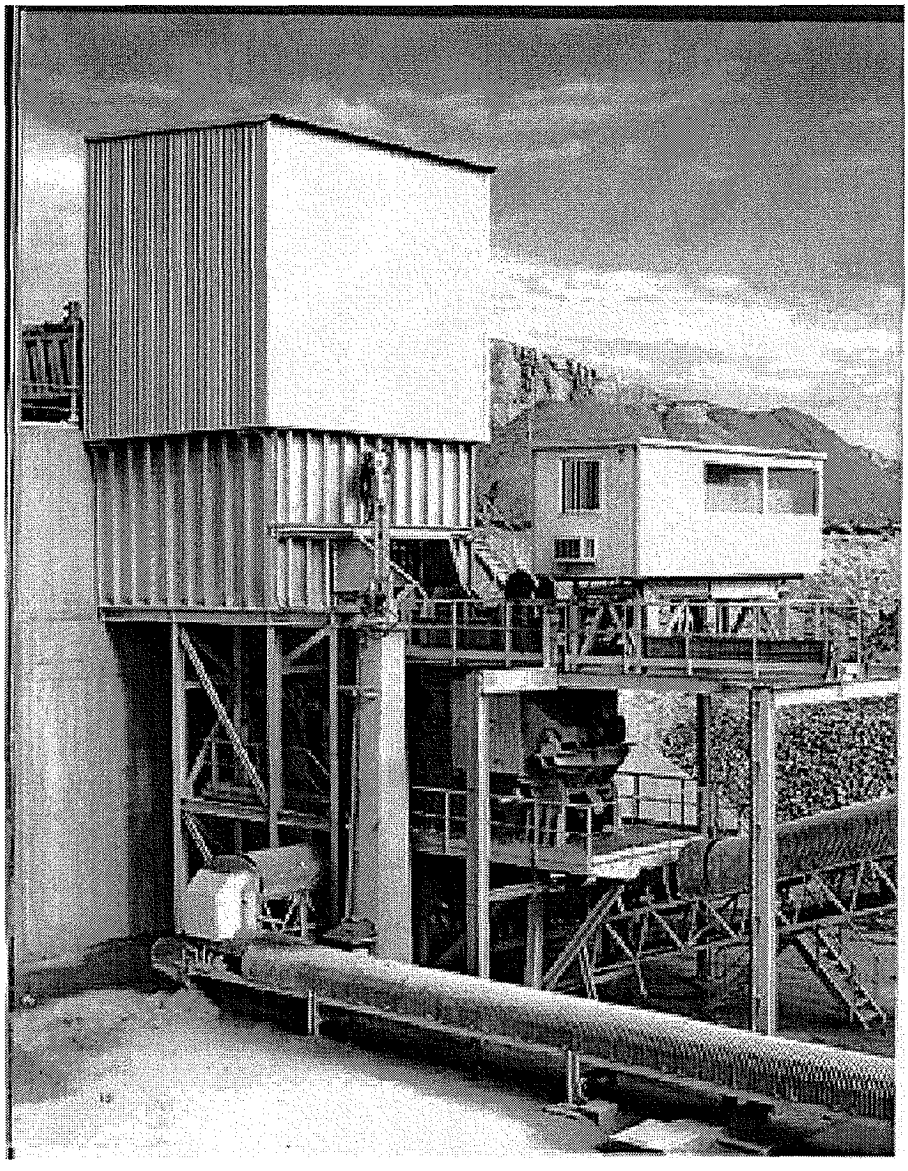




C0635-160

9.1.6 Air Quality

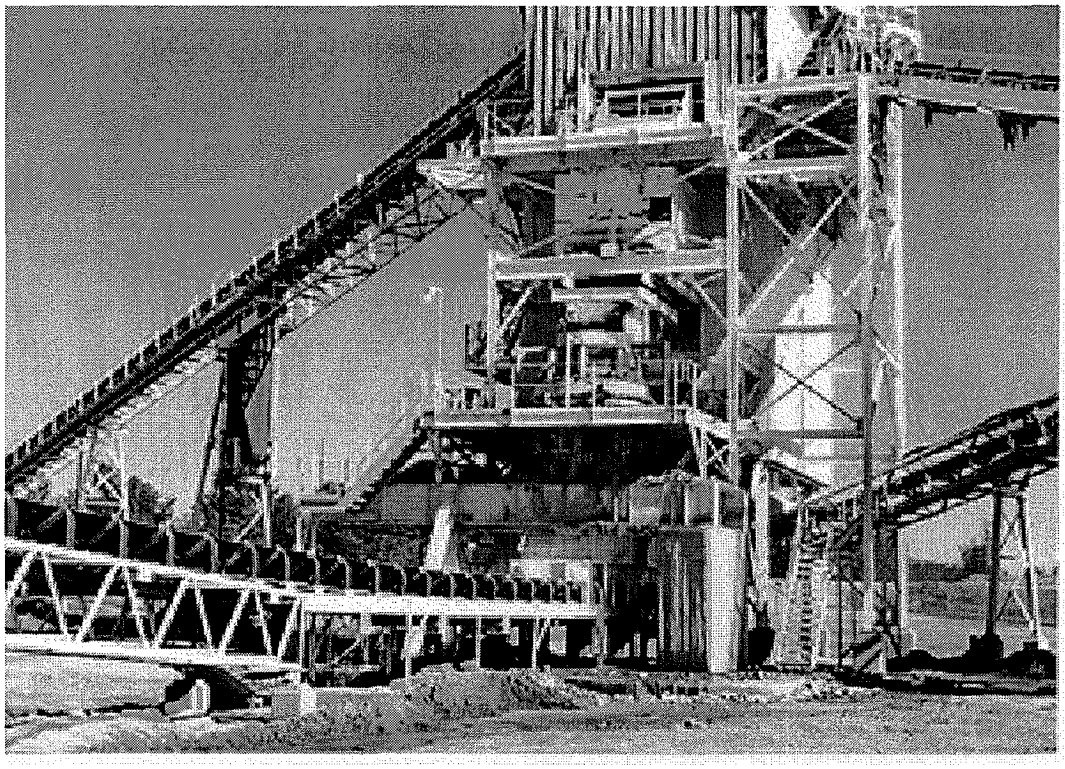
Enclosed Jaw Crusher and Covered Conveyors



C0635-161

9.1.6 Air Quality

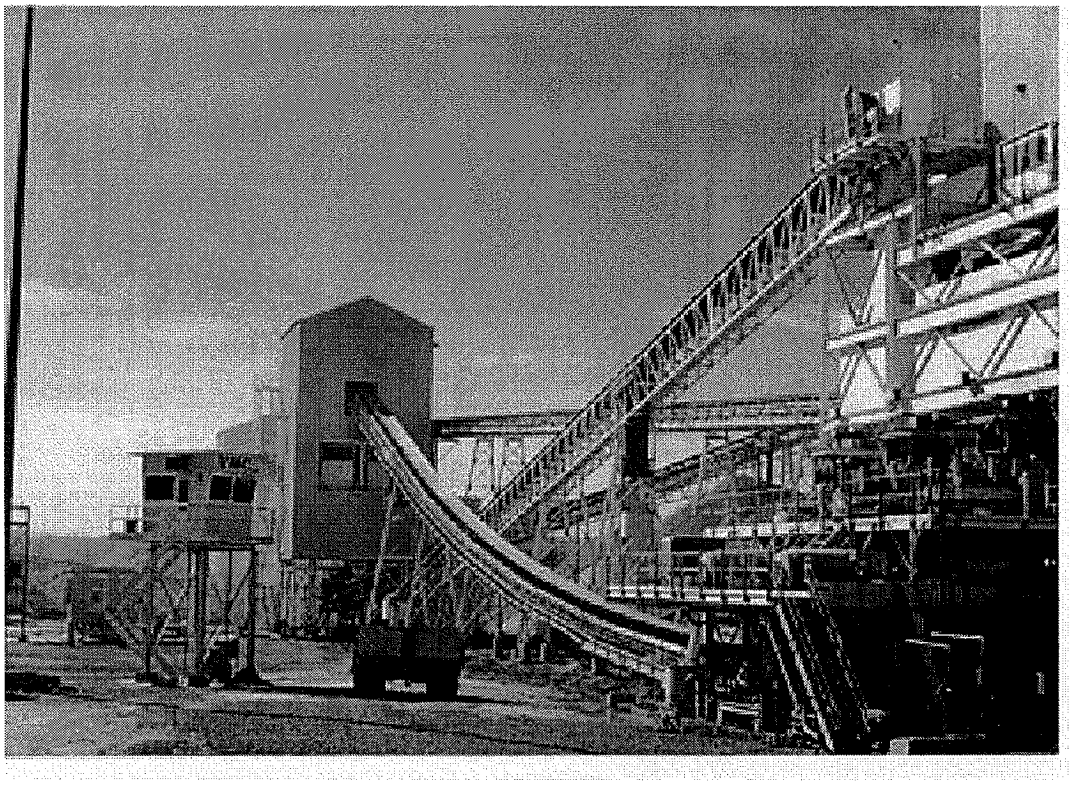
Enclosed Screen House



C0635-162

9.1.6 Air Quality

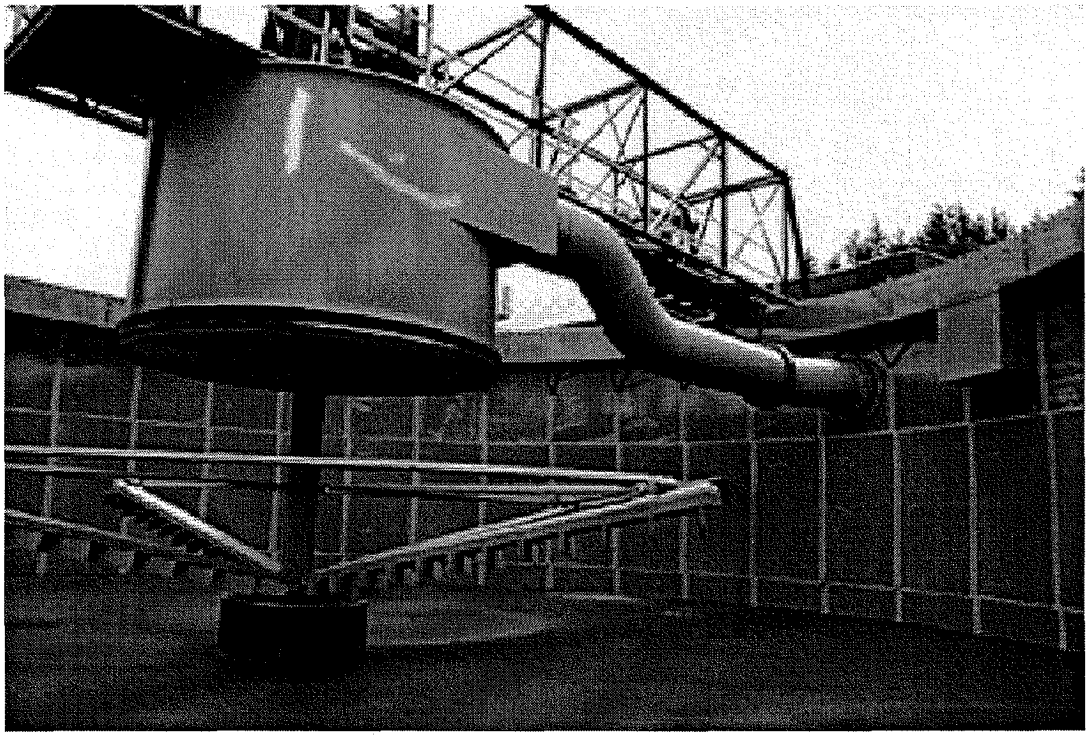
Enclosed Screen House



C0635-163

9.1.6 Air Quality

Flocculent Tank with High Rate Thickener



C0635-164

9.1.6 Air Quality

General Air Quality Comments

1) Is there a wind rose for the site? (A wind rose is a graphical representation used to show the information about the distributions of wind speeds, and the frequency of the varying wind directions, based on meteorological observations of wind speeds and wind directions).

RESPONSE

Monthly and annual wind speed statistics, including wind rose diagrams for the site, are provided in the Whites Point Quarry EIS. Please refer to Appendix 48 - Wind Statistics.

2) Health Canada is looking for clarification as to the location of the closest residences, including how many are within two kilometres of the site. Several references provide different distances; 1000 metres (ref: EIS Plain language summary, Section 7.3); and 500 metres (ref: Noise and Air Quality Study, Jacques Whitford (2005), Section 2.11, page 12).

RESPONSE

The number of residences within 2 km of the site is approximately 92 – please see EIS Volume VI, Chapter 9.3.6.1 for the number of residences in zones of 500 m from the quarry property. Also please refer to EIS Volume III – Maps, specifically Maps 3A to 3E. These maps were generated in response to the EIS Guidelines requesting buildings by type within 4 kilometres of the quarry site. Please refer to the legend on each map for detailed information.

Specific Air Quality Comments

Blasting operations

Study report descriptions of blasting activities impacts on air quality are very general. The Noise and Air Quality Study at Whites Point Quarry by Jacques Whitford (2005), Section 3.5, page 27, states "Blasting can result in a concentrated plume of particulate matter, but the volume and time duration of such plumes are constrained. Even when blasts result in a visible plume, the contribution to 24-hour averages, as in the Air Quality Regulations, will be negligible." Such activity requires more in depth analysis and should answer the following questions:

- *What are the characteristics of the emissions associated with blasting?*
- *What is the dispersion pattern of the plume, e.g. where does it go?*
- *How long would it stay in the air and what is the exposure that is anticipated for the population located close to the site?*
- *Who are the most exposed people?*
- *Has there been modeling of those plumes? If not, how can the proponent conclude that contribution to ambient air deterioration will be negligible (see citation above)?*
- *Blasting has been associated with carbon monoxide poisoning in houses located close to a blasting area. Is there any risk of such an effect?*

C0635-165

9.1.6 Air Quality

RESPONSE

Quarries must drill and blast to reduce aggregate material to sizes that can be transferred in an efficient way to the crusher, if necessary. Similar to crushing, blasting operations consist of particulate matter generated during physical attrition of the aggregate and are conducted by professional blasters, who design custom blast plans to increase efficiency while reducing dust emissions and vibration.

Blasting technology has undergone significant improvements in order to minimize vibration and dust problems. With precision detonation techniques that have been adopted, explosive charges located in drilling holes are detonated with precisely timed millisecond delays. The result is a number of small detonations as opposed to one large blast, which reduces dust. In addition, the blast control plugs and/or stemming materials used when blasting serve to further reduce dust generation and flyrock. Therefore, blasting produces aggregate and particulate of relatively larger sizes that do not remain suspended in the atmosphere for an extended period of time. The plume created when blasting would likely only remain visible for a matter of minutes whereby a large fraction of the particulate would settle close to the blast site. A small fraction of dust could become entrained according to wind direction; however its effects on air quality at the residential receptors located closest to the quarry is negligible. The people most exposed to blasting emissions would be employees present on the blast site; however strict precautions are taken to ensure the health and safety of workers, minimizing exposure as much as possible.

Carbon monoxide (CO) has been associated with the detonation of explosives for the purposes of blasting; however by employing a few preventive measures, CO migration can be curtailed. The measures found to be safe and reduce CO production were to excavate the overburden before drilling, place blast mats, excavate the broken rock after each blast, and change the sequence of blasting (Martel, R. *et al.*, 2004).

A blast emission is more accurately characterized as a puff, than as a plume. The event is relatively short lived, generally passing a downwind observer in a time frame of seconds to a minute or two. Bilcon will use the services of a professional blasting firm to conduct these activities, ensuring that the appropriate amount of design is used to use the blast energy in the fracturing of rock, rather than in suspending particulate matter in the air. Given an estimate of a worst-case visible puff, of dimensions of, say, 100m, and with concentrations of particulate at the visible range of 1000 $\mu g/m^3$, and an ambient level of about 40 $\mu g/m^3$, the resulting 24 hour suspended particulate matter would be elevated from 40 to 41 by the passage of the puff at a slow wind speed of 1 m/s. Therefore, the contribution to the 24 hour average is negligible. It is the intended policy of Bilcon that there will be no visible puffs affecting any offsite receptors.

C0635-166

9.1.6 Air Quality

Crushing operations

Based on the project description as presented in the EIS, crushing and screening would be more regular activities than blasting, and may also result in particulate matter emissions. The Noise and Air Quality Study at Whites Point Quarry by Jacques Whitford (2005), Section 3.5, page 27 states "In this project, the crushing is to be conducted in an enclosed space, which is to be ventilated through filters to the outdoors. The material is collected after crushing, and the finer particles are transported in a moist state to be used as fill on the property." In Section 9.1.10.3 of the EIS (Mitigation), the document states that "processing equipment will be enclosed whenever practical to reduce noise levels at the source".

- *Will the equipment be in an enclosed space (as opposed to being enclosed whenever practical)?*
- *What are the chemical characteristics of the particles associated with crushing?*
- *Is there any toxicity associated with such particles (for example leachable toxic metal)?*
- *What size are the particles that will go in the air after filtration (what is the filter mesh size)?*
- *What is the pattern of the plume, e.g. where does it go?*
- *How long will particles emitted from crusher and passed through filters stay in the air?*
- *Has there be any modeling of those emissions?*
- *Will the deposit site for particles (see Noise and Air Quality study, paragraph above) be maintained in a moist state on a permanent basis?*

RESPONSE

The only pollutant emission of concern from stone crushing operations is particulate matter; which is generated due to the physical attrition the aggregate undergoes. Particles formed by crushing operations have chemical compositions identical to the parent material undergoing size reduction. The main constituents of mineral particulate are typically natural crustal elements. These emissions are similar to particulate emitted by agricultural and construction operations.

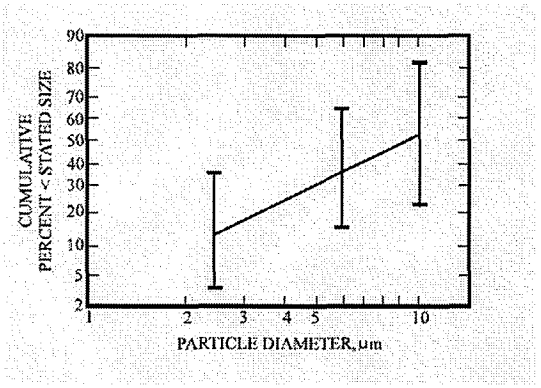
Physical attrition processes, such as crushing, typically yield particles which have aerodynamic diameters that are predominantly larger than 10 μm. Only a minute fraction of the mineral particulate would be in the PM_{10} range. Due to the significant amount of energy required to further subdivide the particles, even less of the mineral particulate are in the $PM_{2.5}$ size range.

The particle size distribution characteristic of mechanically generated particulate from processing aggregate and unprocessed ore is provided in the US EPA AP-42 (Fifth Edition, Volume 1, Appendix B.2) reference document (Figure 1).

C0635-167

9.1.6 Air Quality

Figure 1



$PM_{2.5}$ emissions, of greater concern with respect to health-related impacts, are produced primarily from combustion processes (e.g., internal combustion engines) as opposed to mechanical processes. In fact, the cumulative percent of mechanically generated $PM_{2.5}$ from the production of aggregate and/or unprocessed ores is less than or equal to 15% (US EPA, AP-42).

Due to the nature of the size distribution of the particles generated by crushing, the particles would settle within a relatively close distance from the source.

In this particular case, the crusher will be completely enclosed in a building. It is intended that the building be completely contained to maintain a safe working temperature through the year, and to enable the use of water as a medium to completely control the dust production from the crusher; therefore no emissions and/or plume will be emitted from crushing operations. Ventilation of the building will be strictly for the purpose of providing an appropriate working environment for staff, and there will not be visible emissions from the source.

<u>*Storage of material*</u>
This is also an on-going activity, since the project implies both removal of organic soil on the area where extraction will be carried out and the subsequent storage of blasted rock material. The Noise and Air Quality Study at Whites Point Quarry by Jacques Whitford (2005), Section 3.5, page 27 states "Storage piles and exposed areas are often left uncovered due to the need for frequent material transfer, which can lead to considerable dust generation. Dust emissions can take place during several points in the storage cycle, including material loading onto the pile, disturbances by strong wind currents, and removing loads from the pile. The potential drift distance of particles caused by wind is determined by the initial injection height of the particle, the terminal settling velocity of the particle, and the degree of atmospheric turbulence."

C0635-168

9.1.6 Air Quality

- *What would be the characteristics of the stored particles?*
- *What would be their size?*
- *Is there any mitigation procedure to prevent particle dispersion?*

RESPONSE

The characteristics and size distribution of the particulate matter in storage piles would be similar to that of the material produced by crushing; therefore primarily consisting of particles great than 10 microns in diameter with the additional washing step to completely rid the stockpiles of fine material. There is only the potential for fugitive dust emissions to occur from topsoil storage piles, or from the storage are of the washed fines by wind action and/or by human activities.

There are several different mitigation options to minimize particle dispersion from storage piles, if needed. These types of mitigation measures are outlined in the table shown below.

	Control Techniques																			
Fugitive Emission Source	*Chemical Stabilizers*	*Vegetative Cover*	*Watering*	*Windscreens*	*Wind Barriers/Berms*	*Plantings*	*Pile Shaping and Orientation*	*Paving and Gravel*	*Sweeping and Cleaning*	*Reduced Speed*	*Curbing and Stabilizing Shoulders*	*Operations Change*	*Reduced Drop Distance*	*Water Sprays and Foggers*	*Electrostatic Curtains*	*Partial or Complete Enclosure*	*Hooding and Ducting*	*Covers*	*Wheel Washes*	*Foams*
Paved roads			X	X	X	X			X	X	X									
Unpaved roads	X		X	X	X	X		X		X	X									
Unpaved parking lots	X		X	X	X	X		X		X	X									
Active storage piles			X	X	X	X	X					X				X		X		
Inactive storage piles	X	X	X	X	X	X	X					X				X		X		
Exposed areas	X	X	X	X	X	X		X												
Construction sites			X	X	X			X				X				X				
Conveyor transfer				X		X						X	X	X	X	X	X			X
Drop points				X								X	X	X	X	X	X			X
Loading and unloading				X	X							X	X	X	X	X	X			X
Vehicle carryout								X	X										X	
Truck and rail spills								X	X	X								X		
Crushing and screening			X	X	X							X	X	X	X	X	X	X		
Waste sites	X	X		X		X		X				X								
Tilling operations			X									X								
Feed lots	X	X	X									X								

(Reference: Environmental Engineers' Handbook, Second Edition)

In the case of Whites Point quarry, topsoil storage piles will remain relatively inactive with no frequent transfer of particulate matter. The organic disposal area will be seeded as a temporary erosion control measure. In addition, with the treed buffer zone surrounding the quarry site and the strict watering regime, suppression of fugitive dust emissions will be sufficient. The storage piles will also ultimately contribute to quarry reclamation as well, where they will be covered with vegetation. The washed fines will be maintained in a moist

9.1.6 Air Quality

state, by water sprays in the sediment storage area or in the settling ponds potentially fully covered by a water surface, and will not be susceptible to wind erosion.

Power supply and heating source

From available information, it appears that the project will mainly be electrical powered, using the provincial electricity network. Is there any possibility that the quarry project execution could reduce any Nova Scotia community air quality because of the additional electric energy requirement?

RESPONSE
Discussions with Nova Scotia Power Inc. (NSPI) indicate the following:

1. The electrical distribution system from Digby to Whites Point will need to be upgraded. This will be carried out by NSPI at Bilcon's expense.

2. NSPI has sufficient capacity in its current system to supply the demands of the quarry operation.

Since no additional production capacity is required, it is not anticipated that there will be a reduction of the air quality in any Nova Scotia community.

The report also mentions another on-site source of air pollutant emission:

Heating systems for the office

"Heating systems for the office and shop will be fueled by recycling waste oil from the mobile equipment. A double walled fuel storage tank with an alarm system and surrounding spill containment will be located in the compound area." (Source: EIS Report Volume V, section 7.8, p. 43). More details on the nature of this heating and storage system are required in order to determine the potential for adverse human health effects. Details would include:

- *What are the chemical characteristics of the fuel to be used?*
- *Could those fuels be considered as dangerous waste?*
- *Does this use of recycling waste oil require a permit and, if affirmative, does the proponent own such permit?*
- *What type of equipment will be used to heat the office and shop?*
- *What is the dispersion model for the plume?*
- *Who are the most exposed people?*

9.1.6 Air Quality

RESPONSE

Bilcon has revisited this element of the conceptual design and at the present time does not anticipate fuelling the heating systems for the office and shop with recycled waste oil from the mobile equipment. Heating will be by conventional oil-fired equipment.

Cumulative Effects

No mention is made about the cumulative effects associated with dust related to multiple quarry operations (i.e. blasting, crushing, screening, stockpiling, etc.) and also with respect to this quarry and the other existing quarries on Digby neck, and how an additional quarry will contribute to increased dust generation in the area.

RESPONSE

Please refer to Section 10.0 – Cumulative Effects in this document.

Health Canada Conclusions Re: Air Quality Assessment

The report on Whites Point quarry reveals some significant uncertainties regarding air quality issues. As a result, at this point, it is not possible to give an evaluation of the potential health risk for the project related to air quality.

RESPONSE

As stated in the EIS, the primary air quality issue involved with Whites Point Quarry, and other similar quarry and aggregate processing operations, is PM emissions. This is illustrated in Table 1:

Table 1 - Whites Point Quarry Construction and Operation Activities and Associated Emissions

	Non-Engine Emissions					**Engine Emissions**
Process	**Total Suspended Particulate (TSP)**	**Carbon Monoxide (CO)**	**Sulfur Dioxide (SO_2)**	**Nitrogen Oxides (NO_x)**	**Volatile Organic Compounds (VOC)**	**NO_x, CO, CO_2, VOC, TSP, HC**
Construction Activity						
Site Infrastructure (*e.g.*, roads)	X					X
Site Clearance (*e.g.*, grading, scraping)	X					X
Earthmoving	X					X
Operations Activity						
Drilling	X					
Blasting	X					
Crushing	X					
Screening	X					

C0635-171

9.1.6 Air Quality

Conveying	X					
Material Handling	X					X
Material Transport	X					X
Ship Loading/Unloading	X					X
Fugitive Sources (*e.g.*, storage piles, power generation)	X					X

As stated in the EIS, applicable regulatory requirements considered included those prescribed by the Nova Scotia Air Quality Regulations and the Nova Scotia Pit and Quarry Guidelines. Table 2 shows the Nova Scotia Air Quality Regulations.

Table 2 - Nova Scotia Air Quality Regulations

Contaminant	Averaging Period	Maximum Permissible Ground Level Concentration ($\mu g/m^3$)
Nitrogen Oxides (as NO_2)	1 hour 24 hour Annual	400 - 100
Sulfur Dioxide (SO_2)	1 hour 24 hour Annual	900 300 60
Particulate Matter (PM)	24 hour Annual	120 70
Carbon Monoxide (CO)	1 hour 8 hour	34,600 12,700

The Nova Scotia Pit and Quarry Guidelines echo the Nova Scotia Air Quality Regulations for PM at the site property boundaries:

- Annual Geometric Mean 70 $\mu g/m^3$
- Daily Average (24 hours) 120 $\mu g/m^3$

From Table 2, it is evident that PM is the air contaminant of concern in terms of quarry construction and operations; however, as stated in the EIS, mitigative measures will greatly reduce the quantity of PM emissions. Mitigative measures such as enclosing equipment (*i.e.*, crushers, screens and conveyors) and the use of water as a dust suppressant are highly effective ways in which to reduce PM dispersion.

In addition, a dust monitoring plan will be developed in consultation with Nova Scotia Department of Environment and Labour (NSDEL). Through periodic ambient air quality monitoring at specified monitoring locations the effectiveness of implemented mitigative measures can be verified and further action can be taken, if required.

C0635-172

9.1.6 Air Quality

The impact of the White's Point Quarry is estimated to be significantly less than the many comparable operations in the province, because of the lack of truck traffic out of the site, the strict washing and consequent dust control, the enclosure of the crusher, and the topography and site isolation. Bilcon is of the opinion that Health Canada can conclude with some confidence that the Whites Point Quarry will be constructed and operated in compliance with all applicable air quality regulations and guidelines.

WP 1630 - Environment Canada
Item #11 Characterizing Existing Ambient Air Quality
Information Request
Identify and use data from recording stations that are more indicative of air quality in the area likely to be affected by the Project.

Delineate and explain the airshed boundaries to be used in describing air quality and in assessing impacts while recognizing that particulates emitted by the Project have been identified in the EIS as the contaminant of most concern.

RESPONSE
In addition to ambient air quality monitoring stations operated by The Nova Scotia Department of Environment and Labour, stations are also operated by the National Air Pollution Surveillance (NAPS) network. Stations operated by NAPS that would be closest to the quarry site, and therefore representative of air quality in the area, would include those located at Kejimkujik National Park, Aylesford Mountain, Dayton (Yarmouth), and St. Andrews, New Brunswick. Air quality data collected by NAPS have been used to demonstrate the links between air pollution and human health, and also to evaluate air pollution control strategies, identify urban air quality trends, and forewarn of emerging air pollution issues. With reference to Whites Point quarry, the primary air quality issue is related to particulate matter generated from aggregate processing operations on-site.

The St. Andrews monitoring station is located on the grounds of the Huntsman Marine Science Centre and conducts monitoring for ozone (O_3), particulate matter < 2.5 μm (PM2.5), and mercury (Hg). With respect to measured PM2.5 concentrations, in 2003 and 2004 hourly values were consistently low. Hourly values seldom exceeded 30 $\mu g/m^3$, with the majority below 15-20 $\mu g/m^3$. The 98th percentile value for 2003 and 2004 (based on 24-hour averages) were 13.1 $\mu g/m^3$ and 9.5 $\mu g/m^3$, respectively.

The station located at Kejimkujik National Park showed low concentrations of PM10 between 1993-1996 and 1999-2001 of between 6 and 11$\mu g/m^3$. Similarly, low concentrations below 6 $\mu g/m^3$ were found at the Kejimkujik between 1999 and 2001.

C0635-173

9.1.6 Air Quality

Ground-level ozone is also measured at the Kejimkujik monitoring station, in addition to the Aylesford Mountain and Dayton (Yarmouth) sites. From 1986 – 2001, the Kejimkujik and Aylesford Mountain stations have shown an increase in ground-level ozone. Ground-level ozone concentrations measured at Aylesford Mountain are typically higher due to the elevation of the site. Given the relatively remote locations of both monitoring sites, their data are a good indicator of the impact of transboundary air contaminants from the United States and central Canada.

While ground-level ozone and other air contaminants are integral to the region's overall air quality, it is particulate matter that is of concern when dealing with quarry operations. When assessing the impacts of operations at Whites Point Quarry, while the Nova Scotia Air Quality Regulations are essential, the current state of air quality in the region with respect to particulate matter will be considered.

Item #12 Predicting the Quantity and Fate of Emissions
Information Request
Provide more detailed emission estimates in terms of pertinent parameters (e.g. total particulate matter and its fractions including PM10 and PM2.5) and sources (e.g. construction equipment, bulk carriers). Discuss these estimates in the context of applicable regulatory requirements, standards, goals, objectives and targets as applicable.

Provide more detailed discussion on dispersion of Project-related emissions, and their potential influence on ambient air quality in an appropriately defined airshed(s) taking into account the influence of wind conditions.

RESPONSE
Please refer to Bilcon's response to Health Canada Conclusions re: Air Quality Assessment in this section.

The presence of a ship at the dock will add the emissions of the "hotelling" systems to the project emissions; however, the spatial separation of 1 km, or more, from public receptors is adequate to provide safe dispersion of these emissions, and is much greater – perhaps an order of magnitude – than the separation of similar vessels from the public in harbours such as Halifax, Dartmouth, Digby, and elsewhere. The use of electrical power from the provincial grid eliminates the need for on-site generation, and the utility providing this power is approved to do so by the Department of Environment and Labour. Vehicles operated within the site will be well maintained, and are well separated from the public. The design of the facility to use ship transport of the product eliminates the need for trucking the material on the public roads.

C0635-174

9.1.6 Air Quality

Item #13 Mitigating and Monitoring Effects on Air Quality
Information Request
Provide a more detailed description of how ambient air quality requirements will be met and the role of a monitoring program in this regard.

Present a proposed monitoring program for air quality consistent with the direction provided in Section 12.4 of the guidelines. Such a program should include regulatory requirements, standards, goals, objectives and targets; provisions for submitting monitoring results for review by the public and regulatory agencies; and, a discussion of how monitoring results will be used for making necessary adjustments to Project design and operation.

RESPONSE
An air quality monitoring plan for Whites Point Quarry will be developed in consultation with NSDEL. Bilcon notes the following preliminary observations with regard to such a plan.

Whites Point Quarry – Air Quality Plan
Particulate matter emitted into the atmosphere consists of material in a broad range of aerodynamic diameters. Matter greater than about 44 μm in diameter will fall to the ground within a few metres, or tens of metres, of the source. Material of smaller diameter will remain suspended in the atmosphere, and is referred to as Total Suspended Particulate Matter (TSP), but is often referred to by the public as "dust". The "dust" monitoring plan technically refers to Suspended Particulate Matter. The standard method for determining Suspended Particulate Matter is the use of high-volume air samplers that draw about 2 m^3/minute of air through a filter paper that has been weighed prior to exposure. Following exposure, the filter is desiccated for 24 hours and then the weight difference is determined gravimetrically.

Dust emissions are inevitable when conducting quarry operations; however by applying the appropriate dust mitigation measures (as outlined in the EIS) their effects will be kept to acceptable levels. To confirm the success of the mitigative measures or to signal the need to apply more aggressive mitigation, dust monitoring will be conducted.

According to the conditions of Nova Scotia Pit and Quarry Guidelines, the dust emissions will not exceed the following limits at the site property boundaries:
- Annual Geometric Mean 70 μg/m^3
- Daily Average (24 hours) 120 μg/m^3

Therefore, when conducting dust monitoring, these will be the guidelines by which the success of the dust mitigation measures will be gauged.

C0635-175

9.1.6 Air Quality

Monitoring parameters and locations will be selected in consultation with NSDEL. The potential monitoring site locations would represent the areas of potentially sensitive receptors. Selection will be based on agreement from parties (*i.e.*, landowners) involved, power, access, and other relevant issues. In response to public consideration and concern the monitoring plan will comprise routine monitoring and attention to allegations of chronic problems or isolated events.

Visual inspections in conjunction with real-time monitoring will be performed to measure dust levels and to ensure that quarrying, materials handling, and consolidation operations do not result in excessive on-site dust emissions. Visual inspection will be the primary method for evaluating the effectiveness of dust control during this project. Real-time monitoring using a combination of hi-volt samplers and gravimetric weighing will be used to quantify total dust levels and/or to determine if corrective action is needed.

Regarding the frequency of dust monitoring, inspections for visible airborne dust will be conducted routinely several times during each working day. A schedule will be developed for real-time air sampling that includes meteorological fluctuations that occur on a daily basis and throughout the year. One option is that real-time monitoring is performed once a month and readings are collected at 0600, 1200 and 2300 hours, which characterizes the morning, afternoon, and nighttime conditions. By doing this on a monthly basis, seasonal results will also be characterized. Monitoring is not appropriate during rain snow, or heavy fog conditions due to limitations of the method applicability. These weather conditions, however, substantially reduce the potential for heavy dust emissions.

If the dust emission limits of the Nova Scotia Pit and Quarry Guidelines are exceeded, then further mitigative action will be initiated. Furthermore, visible airborne dust will be used as the site action item. If dust is visible, dust suppression methods will be implemented. If visible dust is present at the site boundary, work will be stopped until engineering controls or alternate methods are initiated to reduce the levels of visible airborne dust. Appropriate engineering controls and personal protective equipment will be used where appropriate. In the event of a public complaint, additional monitoring will be used to aid in addressing the complaint so appropriate action can be taken, if needed. Whites Point quarry will establish a complaint resolution program to deal with residents' or other (*e.g.*, NSDEL) potential queries and/or complaints as they arise.

C0635-176

9.1.7 Noise and Vibration

EIS Reference: EIS Volume VI, Chapter 9, Section 9.1.9 and 9.1.10, and 9.1.11

INDEX OF COMMENTS

9.0 Environments and Impact Analysis

9.1 Physical Environment and Impact Analysis

9.1.7 Noise and Vibration

C0635-177

9.1.7 Noise and Vibration

WP 1452 – Joint Review Panel

9.1.9 Noise and Vibration – Blasting

The text on pg 67 and pg 68 cites an example of blasting effects under specific parameters using a considerable amount of jargon. Clarify the meaning of this paragraph and explain the relevance of this example to the blasting proposed for the operation.

The EIS states that no blasting will be permitted if there is a thermal atmospheric inversion or low cloud cover or fog conditions. These criteria are highly subjective. Provide numerical criteria and describe the manner in which they will be implemented.

RESPONSE

This paragraph presents an example of blast monitoring results from a comparable quarry and a predictive model for a specific blast proposed at the Whites Point Quarry.

The monitoring results for a production blast at the comparable quarry indicate the NSDEL thresholds for concussion (128 dBA) and ground vibration (12.5 mm/sec) were met at the given distances for the given blast design. It should be noted that the weight of explosives in this case was 214 kg per delay.

Also, a predictive model was used to illustrate ground vibration for an initial blast proposed at the Whites Point site. The nearest structure from the location of this initial blast is approximately 1120 m. Using a 45 kg weight of explosive per delay, a ground vibration of 1 mm/sec is predicted at the nearest structure. This is well within the threshold contained in the NSDEL "Pit and Quarry Guidelines" of 12.5 mm/sec.

The cooling of the air by the Bay of Fundy waters can create a thermal inversion. Since the water temperature in the Fundy area ranges from 1 – 6 degrees Celsius in the winter and up to 12 – 15 degrees Celsius in summer, and the predominate air flow is from the southwest to south-southwest, where air temperatures are generally above these levels in the respective seasons, there is a likelihood of thermal inversion over the Fundy coast of Nova Scotia in winter, spring, and early summer. The general occurrence of significant marine inversions is probably in the range of 15 – 25% of the time for the period January through June and less than 5% for the remainder of the year (*pers. com.* Mac MacLeod, Scotia Weather Services Inc. 2006). Marine thermal inversions are easily forecast with relative reliability as the atmospheric models handle the ground thermal structure quite well and the water temperature changes slowly so the cooling of the air near the water surface is easy to calculate and the general low level wind flow will determine if the thermal inversion will occur over the coastal area under forecast.

C0635-178

9.1.7 Noise and Vibration

Research concerning blasting/thermal inversions did not reveal any published thresholds or numeric criteria to indicate when blasting should or should not be undertaken. Communications with the NSDEL, the regulatory agency for blasting activities in Nova Scotia, indicated "there are no numerical criteria existing with respect to thermal inversions" (*pers. com.* D. Bruce Arthur, P. Eng. NSDEL).

Further, according to representatives of the blasting industry and NSDEL, it is standard industry practice for blasters to communicate with the Weather Service before initiating a blast (*pers. com.* D. Morehouse, Dyno Nobel North America and D. Bruce Arthur, P. Eng. NSDEL). Regarding inversions, Bilcon intends to follow existing industry and regulatory procedures during its blasting activities. Also, Bilcon is committed to conducting blasting activities (construction and production) within the thresholds established by the NSDEL's "Pit and Quarry Guidelines" and DFO's "Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters".

In summary, Bilcon will conduct blasting in accordance with NSDEL's "Pit and Quarry Guidelines" paragraph VIII Blasting (6). Blasting will not be conducted if a thermal inversion is forecast. The presence of a thermal inversion will be determined in consultation with the Environment Canada Weather service (1-900-565-5555). Cloud cover (ceiling) and visibility information, as applicable, will also be obtained from the Weather Service. This information will be verified on-site by a Certified Blaster before a blast is initiated. Blasting will generally be conducted between the hours of 1100 and 1600 hours. Information on weather conditions including ceiling, temperature, and wind speed and direction will be recorded for each blast on the Blast Report.

9.1.9 Noise and Vibration - Plant

9.1.10.5 - Assess the effects of noise and vibration for the construction and decommissioning phases of the project.

RESPONSE

Construction

The construction phase is expected to take 12 to 18 months. Noise levels at nearby residential receptors were assessed using the CadnaA model. For the purpose of modeling, it was assumed that 12 major pieces of construction equipment (i.e. loader, bulldozer, air compressor, generator, pile driver, scraper, grader, crane, excavator and trucks) could be operating at any given time within the primary project construction area (i.e. processing plant and marine terminal). The predicted noise levels at the nearest receptors are anticipated to be well below the noise limits as prescribed by the NSDEL Pit and Quarry Guidelines. The predicted construction noise levels (dBA) range from 39.5 dBA to 43.9 dBA at the nearest

C0635-179

9.1.7 Noise and Vibration

receptors. The NSDEL Pit and Quarry Guidelines limits range from 55 dBA to 65 dBA depending upon time of day, evening, or night.

Vibration levels, as a result of blasting during site preparation, at the nearest structure will be within the limits (12.5 mm/s peak particle velocity) prescribed by the NSDEL Pit and Quarry Guidelines. All blasts will be designed to be within the Guidelines. Modeling and data from comparable quarries, based on the amount of explosives and distance from detonation to the nearest structure, indicate these guidelines can be met.

Decommissioning
The decommissioning phase is expected to take 12 months. Noise levels during decommissioning at the nearby receptors will be similar to those experienced during construction. Similar pieces of equipment will be used to dismantle the processing plant and certain components of the marine terminal.

Vibration during decommissioning is expected to be minimal compared to that experienced during construction and operation. Vibration is expected to be minimal since limited blasting activities are necessary during decommissioning. Vibration will be monitored and be within the NSDEL Pit and Quarry Guidelines of 12.5 mm/s peak particle velocity at the nearest structure not located on the property.

Bilcon intends to monitor noise and vibration levels during construction, operation, and decommissioning phases of the project and intends to operate within the limits prescribed by NSDEL.

9.2.9 Blasting
The Panel requires better information on the potential effects of blasting on marine species at this site.

***9.2.11.2 Harbour Porpoise (and Seals)** – Harbour Porpoise, commonly sighted off Whites Point are a species of concern. Provide evidence to substantiate the claim that a distance of 170 m from a blast is acceptable for these animals without physiological or behavioural effects.*

DFO has suggested monitoring seal colonies near the site before, during and after blasts occur to gauge effects on behaviour. Describe how that suggestion has been incorporated into the monitoring plan.

RESPONSE

C0635-180

9.1.7 Noise and Vibration

The CONWEP model was used to determine possible effects from blasting on cetaceans (whales, porpoises, and dolphins) and pinnipeds (seals) – see EIS Ref. Vol. V, Tab. 27 (Hannay and Thomson 2003).

Data on behavioural responses of marine mammals to explosions are limited for pinnipeds. Some response may be evident, however, pinnipeds seem quite tolerant of noise pulses from explosives. Also, harbour seals living near a major airport have apparently become habituated to repeated aircraft over flights (Richardson et al 1995). Further, DFO indicates "seals are considered to be more behaviourally tolerant to loud sounds and to have less sensitive underwater hearing relative to many cetacean species (DFO 2006).

Modeling was conducted using the variables outlined for an initial (test) blast at the quarry site. The results of this modeling for the initial blast indicate a safety range for pinnipeds (seals) is approximately 170m if inverse distance (1r) acoustic spreading transmission loss is assumed. The 170m is based using the variables indicated for the initial blast. Bilcon intends to curtail blasting if pinnipeds are observed within 170m of the detonation.

Modeling for cetaceans (whales, porpoise, and dolphins) using the variables outlined for an initial (test) blast at the quarry site indicates a 500m safety range appears appropriate for cetaceans. Further, Fisheries and Oceans Canada's review of Bilcon's Blasting Protocol indicates "it is considered unlikely that blasting would result in physical effects on marine mammals, endangered or otherwise, beyond 500m". It was not intended to imply that the safety range of 170m for pinnipeds was to be applied for the harbour porpoise. Bilcon intends to curtail blasting if cetaceans are observed within 500m of the detonation.

Monitoring of the seal colony at Crowells Cove as proposed in Bilcon's Blasting Protocol will be conducted in coordination with DFO. Visual monitoring of the behaviour of the seal colony is proposed prior to, during, and after the initial blast. The approach will be to monitor and document any behavioural reaction to the initial blast event. As recommended by DFO, observations will be conducted during the breeding season and by an experienced biologist. Video documentation is proposed and the details of monitoring will be coordinated with DFO prior to the initial blast.

How does the proponent intend to verify the results of the blasting model in the absence of a test blast?

RESPONSE

The initial blast at the quarry site will be conducted as a test blast using monitoring protocols agreed to in discussions with Fisheries and Oceans Canada. The monitoring results from the initial blast will be carefully examined against the predictions from the blasting model and

C0635-181

9.1.7 Noise and Vibration

formulas presented in the "Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters". Adjustments will be made to the blasting protocol and design if required.

WP 1524 – Transport Canada

19) Vol. VI – Section 9.2.10.2 Page – 116 – Reference is made to blasting explosion lasting less than 0.5 seconds whereas Vol. VI – Section 9.2.9.3 – Page 114 reference is made to blasting lasting less than 1 second. Please clarify duration for consistency.

RESPONSE
Depending upon the design for each particular blast, the time frame of the blast will vary; however, all blasts will be less than 1 second.

WP 1541 Fisheries and Oceans Canada

Volume 1 – Plain Language Summary
Page 23 – Although generally accepted that socket drilling is less noisy than pile driving, the impact and duration of the installation of the piles should be described.

RESPONSE
Introduction
The reviewers of the EIS for Fisheries and Oceans Canada have requested a description of the impact and duration of pile installation by drilling.

Noting that pile design has yet to be completed and construction equipment specified, at this time only a general commentary on pile drilling can be provided.

Requirement for Drilling
The seabed is basalt bedrock with no significant sediment overburden. Steel pipe pilings installed on this type of formation require drilling and socketing to attain resistance to imposed loads. In the case of White's Point Quarry, a combined system comprising drilled and socketed piles with internal anchors is proposed. With this system, the pile tip is drilled and socketed one to two metres into the bedrock to attain shear resistance. Subsequently, drilled and grouted internal tension anchors are installed in the piles to attain uplift resistance. This combined system works together to obtain fixity of pile tips and resistance to shear and uplift loads.

Drilled Tubular Piles
The essential feature of the drilled tubular pile is the use of a tube, typically a steel pipe, which is capable of being rotated into the ground to the desired level and is left permanently

C0635-182

9.1.7 Noise and Vibration

in place. The tube is advanced by means of rotation with a hydraulically powered rotary table or through semi-rotary motion attained by means of a casing oscillator. Loose rock and soil is removed from within the tube by various means including grabbing, augering, chiselling and reverse circulation. The pile is socketed to the bedrock by injecting grout into the end of the tube.

It is noted that the operation of internal soil and rock removal and grout injection is shielded from the marine environment by the pipe wall. Drilling the basalt bedrock will generate mostly coarse cuttings. The cuttings will be disposed of on site.

Summary
The sonic impact of pile drilling and socketing can be compared qualitatively to pile driving:

- pile drilling and socketing is significantly less noisy than pile driving. Pile drilling noise sources include the drilling equipment motors that operate on the deck of the marine construction platform or derrick, noise associated with equipment used to remove soil and the friction of the casing against the bedrock formation. Pile drilling does not produce sharp, high intensity noise associated with the impacting of steel pipe into the ground. The noise from drilling and socketing operations would have the same magnitude as typical marine construction operations that exclude pile driving. Occasional and transient noise sources including small tools and equipment, winches, boat motors, chain dragging across deck etc. can be expected to occur noting that the amplitude of these noise sources are low and diminish quickly at the inverse square of the distance from the source. It is common for these lower amplitude noise sources to be undetectable at the shore against the noise generated by wind or surf.

- Pile drilling is generally a slower method of pile installation than pile driving. There are many variables that may influence installation rates, however, for comparative purposes it is proposed that the installation of a steel pipe pile would take twice as long as the installation of the same pipe in soil in which it can be installed by driving. This means that during the course of the project pile installation by drilling will go on for a longer period than a comparable installation by driving. Drilling and socketing will yield construction noise for a longer duration but at amplitudes many times lower than would be the case for pile driving.

Page 29 – Paragraph 3 – The wording here regarding "a safety factor three for separation distance" should be clarified to reflect the statements in the Blasting Protocol.

RESPONSE

C0635-183

9.1.7 Noise and Vibration

With respect to the statement in the Plain Language Summary, page 29, paragraph 3, regarding the inner Bay of Fundy Atlantic salmon, the following is added:

"As a further precautionary measure, and based on recommendations by the Department of Fisheries and Oceans – Habitat Management Division in their November 12, 2004 letter re: Whites Point Quarry and Marine Terminal – Blasting Activity, "a horizontal distance from shoreline to the blast location be at least triple that determined by application of the equations" in the "Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters". Also, the size of individual charges will be minimized and decked as required to further reduce effects. Decking would follow the procedure described in Department of Fisheries and Oceans – Newfoundland Region, Factsheet: "Blasting – Fish and Fish Habitat Protection", 1999." This would apply during May until October when the inner Bay of Fundy salmon may be present in nearshore waters.

Volume III - Maps
Map 31 – Blast Monitoring – Should this map be titled, "Initial Blast Monitoring and Observation Monitoring Area" or will this monitoring area remain in place for all blasts? Blast locations are not clearly indicated on this map. If this is not intended to depict the initial blast monitoring where is this information presented? It should include underwater sound level monitoring out to the margin of the North Atlantic Right Whale Conservation Area as stated in Blasting Protocol.

RESPONSE
This Map may be more appropriately titled "Initial Blast Monitoring and Marine Mammal Observation Area". The proposed blast monitoring locations shown in the water would only be used for monitoring the initial blast. More specific monitoring distances in nearshore waters from the initial detonation site are presented in EIS Volume VI, Chapter 9.2.9.4 and Chapter 9.2.11.4

As stated in Bilcon's Blasting Protocol, a monitoring location of the initial blast is proposed in the North Atlantic right whale Conservation Area. **Map 41** indicates this proposed monitoring location.

Volume IV – Chapter 1
Table ECM – 1
Summary Table – Page 8 – The proponent should also indicate the duration of construction in addition to the frequency of blasting during construction which is described as once per week elsewhere in the document. They should also indicate the relative size of the blasts during construction as compared to those described in the initial blasting plan. Will the construction blasts be monitored?

C0635-184

9.1.7 Noise and Vibration

RESPONSE
Please refer to Revised Table ECM –1 in Bilcon's Revised Executive Summary in this document. As noted elsewhere in these responses the duration of construction is somewhat difficult to predict. This is because the timing of the issuance of a permit is unknown and the construction of the marine terminal can only take place during the summer months. However, if the permitting process allows construction of the marine terminal in the summer of 2008, the construction of the facility is estimated to be 18 months. Frequency of blasting during the construction period is estimated to be once per week.

In general terms the size of the blasts during construction will be as described in the initial blasting plan. However, Bilcon has noted that as the location of the blasts move away from the aquatic environment, blasts may be increased in size provided that they meet all the thresholds set out in the blasting plan. All construction blasts as well as production blasts will be monitored.

Summary Table - Page 14 The document states "An additional mitigative measure will be adopted of three times the designated setback indicated in the "Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters" from the blast to fish habitat during times of the year when inner Bay of Fundy Atlantic salmon could be present in these coastal waters" More details are required for this mitigation measure. What are the times of the year when in Bay of Fundy Atlantic salmon could be present in these coastal waters? What are the separation distances during other times of the year?

RESPONSE
Please refer to Revised Table ECM –1 in Bilcon's Executive Summary.

Regarding the proposed mitigation measure of inner Bay of Fundy Atlantic salmon and the times of year when iBoF Atlantic salmon may be present in these coastal waters, reference is made to Peter Amiro, Diadromous Biologist with Fisheries and Oceans Science who indicated that there may be migrating iBoF Atlantic salmon in the Whites Point, Digby Neck area from May until October (Meeting Bilcon/DFO-HMD December 10, 2004). Thus during May until October, it is Bilcon's understanding that the "three times" the designated setback indicated in the Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters would be applicable. During other times of the year (October through April) the separation distances based on the Guidelines would be applicable.

Volume V – Chapter 7
Page 10 For the section on Alternative Means was any consideration given by the proponent to scheduling certain production activities (e.g. blasting) outside of ecologically sensitive times of the year?

C0635-185

9.1.7 Noise and Vibration

RESPONSE

Production blasting "outside of ecologically sensitive time of the year" was considered during assessment of alternative means. It is conceivable that production blasting could be carried out in the winter during the time of year birds are not breeding, nesting, or raising their young, or when migrating mammals or fish are not present in marine waters or when plants are dormant. However, this alternate means is not economically feasible for Bilcon for the following reasons:

- Cost of production would increase significantly due to loss of efficiency in handling materials
- Constraints of the site, primarily the size of usable area for stockpiling, would increase the cost of production
- Incremental reclamation would not be feasible since once an area was quarried out, it would have to be used for stockpile area
- The designed sediment retention/wash water retention ponds would not be of sufficient size to function under worst case scenarios

Page 15 – The document states, "Blasting will not be conducted during periods of fog or atmospheric inversions and will be delayed until clear weather prevails." What does the proponent consider as fog conditions (e.g. level of visibility) given that there could be "fog conditions in the area for days or longer. How would blasting be coordinated around these weather conditions? How long can the blast holes be left filled before they create a safety and/or environmental issue? Would these limitations force the proponent to blast in fog conditions?

RESPONSE

Please refer to Bilcon's response in Section 9.1.1 Climate in this document.

9.2.4 Aquatic Ecology – Coastal Nearshore Marine

Page 95 – paragraph 3 – It is presumed that the reference to "noise from land-based activities" does not include noise from blasting. If this is correct then last sentence in paragraph can remain.

RESPONSE

"Noise from land-based activities" in the context of this paragraph was intended to refer to noise originating from the processing plant, not from blasting activities. Regarding the last sentence, it is not a foregone conclusion that animals do not acclimate to some level of acoustic and visual disturbances once they learn that it does not constitute a direct threat (Richardson et al 1995, page 304 "Thus pinnipeds seem quite tolerant of noise pulses from explosions").

C0635-186

9.1.7 Noise and Vibration

9.2.6 Fish-Threatened and Special Concern

Page 104 – 9.2.6.3/.4 Mitigation/Monitoring – The focus should have been on Blasting Controls that will be implemented to protect these threatened species.

RESPONSE

The following blasting controls will be implemented by Bilcon regarding threatened and special concern fish species. All on land blasting will be done in accordance with the "Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters". As noted elsewhere in this document the precautionary approach will take when IBOF salmon could be migrating. This precautionary approach will of course also apply to all fish, threatened or of special concern, during this time period.

9.2.8 Marine Reptiles – Endangered (leatherback turtle)

Page 110 – The proponent should still include mitigation such as no blasting if any endangered species is sighted in the monitoring zone, however unlikely. Noise has unknown effects on marine turtles and precautionary measures should be taken.

RESPONSE

Since blasting effects on marine turtles are unknown, Bilcon would not conduct blasts if endangered leatherback turtles were observed within the 2,500m safety radius proposed for endangered marine mammals.

9.2.9 Fish Habitat - Blasting

Most assertions in this section are based on the acoustic model study by D. Hannay. JASCO Research and D. Thomson, LGL Ltd. Titled "Peak Pressure and Ground Vibration Study of White's Cove Quarry Blasting Plan". Comments on this study have been provided previously by DFO (See Appendix 9 of EIS)

Several issues were earlier identified in regard to this study, the most important pertaining to apparent quantitative inaccuracies in assessing how P (compressional) to S (shear) wave conversions at the water sediment interface would enhance the amplitude of P waves transmitted into the water. The conclusion was that the Hannay & Thomson study probably overestimated the compressional wave amplitudes transmitted into the water column. This would tend to strengthen the statement that the model presented represents "worst case situation" (last paragraph on page 112)

RESPONSE

Bilcon agrees with the conclusion that the CONWEP model study conducted by JASCO Research probably overestimated the compressional wave amplitudes transmitted into the water column and that this aspect of the model represents a "worst case situation".

C0635-187

9.1.7 Noise and Vibration

Sub-section 9.2.9.2 – This section states, "this is within the l00.5 m (330 ft) at the point of producing 13 mm/s in the guideline/threshold criteria." This statement, as presented, is confusing. Direct reference to the Thomson & Hannay study clarifies the statement: The DFO Guidelines for Explosives in Canadian Waters (Wright and Hopky, 1998) predicts a 45kg charge should produce a ground velocity of 13 mm/s at l00.5 m range. It is encouraging that the CONWEP model as applied by Thomson & Hannay and the DFO Guidelines model yield reasonably similar distances (118 m vs. l00.5m respectively) for the 13 mm/s ground velocity criteria.

RESPONSE

Bilcon agrees that the statement in the EIS may be confusing and directs reference to the Thomsen and Hannay study. The statement should read – The DFO Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters (Wright and Hopky 1998) predicts a 45kg charge should produce a ground velocity of 13mm/sec at 100.5m range. Bilcon confirms that it is encouraging that the CONWEP model as applied by Thomson and Hannay, using site specific conditions, and the DFO model yield reasonably similar distances (118m vs 100.5 respectively for the 13mm/sec ground velocity criteria.

After verification of the above model results with a proposed initial blast, Bilcon proposes to use the Fisheries and Oceans formulas in the Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters to determine setback distances from the marine environment during subsequent construction and production blasting at the Whites Point site.

Sub-section 9.2.9.3 – This section states, "the explosive ANFO will be used whenever possible." Does this imply that the quarry operator reserves the right to use more powerful explosives for some blasts? The Hannay & Thomson study considered only ANFO explosives. It is also asserted that 'ANFO" has a lower yield per equivalent weight than TNT, which was used to derive the DFO Guidelines. Without the benefit of data on comparative yields, TNT does have a significantly higher detonation velocity (about 22,800 fps) than ANFO (variable with charge geometry and fuel type but typically 13,000 – 15,000 fps).

RESPONSE

Bilcon proposes to use an ANFO based explosive for the initial blast, construction (site preparation) and production blasting.

9.2.9.3 The proponent should have made reference to the Blasting Protocol document in Appendix 9 that indicates further mitigation such as triple the horizontal distance and decking of charges.

C0635-188

9.1.7 Noise and Vibration

RESPONSE

Bilcon agrees that the Blasting Protocol (EIS Appendix Volume III, Appendix 9) should have been referenced indicating further mitigation in certain instances which would include increased setbacks and decking of charges.

Sub-section 9.2.9.4 This section states, "Monitoring for peak pressure and ground vibration will be conducted at locations in one metre of water depth in the tidal zone and at approximately 170m (560 ft.) and 500 m (1640 ft.) from the detonation site." Are both ground vibration and pressure to be measured at these sites? Will the ground vibration be measured underwater or at an equivalent distance on land? If the blast is conducted within 3 hours of low tide there will only be a 0 – 1.5 water depth at 170m range so measuring at 1m depth (if the water is indeed this deep) may be reasonable. At 500m range, the water depth could be in the vicinity of 10m. At 500m range, blast pressure measurements should be made near-bottom rather than at 1m depth where the direct wave and surface reflection will be expected to nearly cancel. Near-bottom, the pressure levels will maximize. These monitoring considerations need to be clarified.

RESPONSE

Bilcon would like to clarify the intention of this paragraph regarding technical blast monitoring in the marine waters. This monitoring is proposed for the initial blast.

1. Four monitoring locations from the detonation site are proposed
   - In the tidal zone at the water's edge (high tide)
   - In the nearshore water at 118m from the detonation site
   - In nearshore water at 164m from the detonation site
   - In offshore water at the edge of the North Atlantic Right Whale Conservation Area

2. For monitoring the initial blast, the blast would be conducted at or near the time of high tide with subsequent blasts at or near the time of low tide to provide a further precautionary measure.

3. Blast pressure measurements will be made at all locations near the bottom where the pressure levels will maximize except at the edge of the right whale conservation area where monitoring is proposed in the upper water column.

4. The initial blast and the monitoring of the initial blast will be conducted from December to June when right whales are not present in the Bay of Fundy.

In regard to the models employed, it should be kept in mind that the geometries assumed constitute only an idealized 2-dimensional approximation to a 3-dimensional reality. This is particularly true in modelling the propagation of the pressure wave across the bottom

C0635-189

9.1.7 Noise and Vibration

interface at very low grazing angles and where surface reflection multi-path is also very important. Clearly, the real bottom interface) and often the surface interface) is rough and of variable slope on sufficiently small spatial scales. A factor of 2 uncertainty in the resulting pressure field is probably not unreasonable. Since the model parameters were selected fairly conservatively, and in light of the fact that the Hannay & Thomson model would appear to overestimate the theoretical pressure, there seems to be minimal cause for concern in terms of direct harm to fish. Predicted peak ground velocities could be expected to have smaller associated uncertainties that water column pressures since the geometry essential to their calculation is simpler. Nevertheless, because of inherent uncertainties in any physical model, monitoring is recommended if the project proceeds. It should be noted that the 100kPa criteria pertains to lethal or obvious sub-lethal injury to fish and not to more subtle behavioural effect, which if they do exist, are likely to be transitory considering frequency of quarry blasting.

RESPONSE

Realizing the limitation of any modeling, Bilcon's intent was to use a conservative approach. Bilcon believes in this instance, the Thomson and Hannay modelling appears to have over estimated the theoretical pressure and there seems to be minimal cause for concern in terms of direct harm to fish. Also, Bilcon realizes the 100 kPa criteria pertains to lethal or obvious sub-lethal injury to fish and not to more subtle behavioural effects, which if they do exist, are likely to be transitory considering the frequency of quarry blasting. However, due to the potential uncertainties of modelling, monitoring of the initial blast is proposed by Bilcon. Bilcon intends to coordinate the details of monitoring the initial blast with Fisheries and Oceans Canada to ensure a successful monitoring effort is achieved.

9.2.9 Blasting – American Lobster

Page 115 – Section 9.2.10 – Blasting, American Lobster – See DFO comments on the proponent's proposed initial blast in Reference Document 24 of the EIS (page 29 of this document

EIS Ref. Vol. V – Tab 24, Whites Cove Quarry Blasting: Potential Impacts on the American Lobster

The frequency of blasting and, if predictions of sound intensity are accurate, the intensity of noise generated will be lower than for seismic exploration. Research conducted by DFO on the impacts of seismic noise on snow crab indicated no acute or mid-term mortality of adult crab, changes to feeding activity in the laboratory, impacts to survival of embryos carried by the female, or impacts to locomotion of larvae after hatch (DFO 2004). Uncertainties related to potential impacts on snow crab hepatopancreas, ovaries and embryo hatch are to be reviewed by DFO in the fall 2006. Effects of seismic noise on lobsters, while not fully

C0635-190

9.1.7 Noise and Vibration

understood are expected to be on a similar scale as effects of seismic noise on snow crab. Nonetheless, a comparison of predicted sound levels during blasting to background noise levels during storms would be useful. This information would better circumscribe what is local and what level of sound is unusual.

Page 3 states, "in a 1998 DFO assessment, less than 10% of lobster landings...were from the waters around Digby Neck." Given the size of the LFA 34 fishery (~17000 mt in 2004-05), 10 % is still a large quantity of lobster landings (say 1700 mt) with an estimated value of $26 million.

Page 4 the conclusion that, "...the quarry would likely have negligible physical effects on the lobsters in the White Cove area," is not fully supported. On page 4, uncertainties are provided regarding the sensitivities of lobster to intense sounds. On pages 4-5, some evidence is presented for effects of seismic noise on snow crab egg viability. No documentation of the likely size of the area affected is provided.

No monitoring or mitigation measures are recommended within the EIS to address aforementioned uncertainties. The proponent should identify a proposed monitoring program for lobsters which would address uncertainties with the potential impacts from blasting. If this project proceeds and impacts are determined through monitoring, one potential mitigation measure would be to work with local lobster fishermen to limit blasting when lobsters are nearshore and when there is fishing activity in the area. In LFA 34, fishing occurs from late Nov through until May 31 but is diminished in the nearshore areas in winter and early spring.

RESPONSE

Regarding DFO comments on Reference Document 24 of the EIS, background sound levels in marine waters, including pre and post blast near bottom conditions will be part of monitoring the initial blast. Additionally, background sound levels will be measured during quarry/shipping operations and during storm conditions for comparison of local background conditions and anthropogenic noise levels (shipping and blasting). Please also refer to Bilcon's response to DFO under "Effects of Noise on Lobster" in this section and Bilcon's response to DFO in Section 9.3.5 – Economy in this submission.

9.2.11 Blasting – Marine Mammals

Page 118 – Section 9.2.11 – Blasting Marine Mammals – See DFO advice (dated February 10, 2006) on the blasting Plan by Bilcon of Nova Scotia Corporation, May 2005 (in Appendix 9 of EIS).

RESPONSE

C0635-191

9.1.7 Noise and Vibration

Bilcon intends to follow the advice provided by Fisheries and Oceans Canada dated February 10, 2006 on Bilcon's Blasting Protocol. Continued coordination during preparation of monitoring parameters and details for a one year (4 season) verification period during quarry site preparation and construction will be held with Fisheries and Oceans Canada. A summary of Bilcon's research and monitoring commitment for the one year verification period for near and far field is presented below.

1) If the results from the initial blast monitoring validate the predicted results, Bilcon proposes calibrated blast sound measures in near and far field locations during the first year of construction.

- Measure the underwater blast sound levels at the edge of the tidal zone, and at 170m, 500m, 1000m, 2500m and at the margin of the right whale conservation area. This monitoring would be conducted during the first year of construction over 4 seasons.

- Schedule the first blasting shot prior to or after right whales are expected to be present.

- Marine mammal monitoring by trained observers should occur prior to and during any blasting, as proposed, but the observer should use at least 7x50 binocular on a pedestal to ensure the ability to better detect marine mammals at greater distances.

2) Visual observation of seal behaviour before, during, and after construction blasting – especially of known seal aggregations, i.e. during seal pupping.

3) Testing of the effectiveness of visual observation methods at 2500m from the blast site is also recommended, including determination of the average site visibility conditions.

4) Opportunities to link up with other research initiatives e.g. university research, should be considered.

Page 122 – DFO has not formally "accepted" 180dB and 190 dB as acceptable thresholds for sound exposure of toothed whales and pinnipeds.

RESPONSE

Bilcon recognizes that DFO has not formally accepted 180 and 190dB as acceptable thresholds for sound exposure of toothed whales and pinnipeds.

Page 122 – With respect to duration, it is suggested that seismic persists "for hours on end" whereas a blasting event will be over in less than a second. This is a valid comparison for

C0635-192

9.1.7 Noise and Vibration

duration, but it ignores intensity and waveform. In the case of seismic airguns, there is a very slow rise time that is thought to have less impact on swim bladders and other tissues/organs. With explosives, however, there is a very sharp rise time that introduces peak pressure quite suddenly. Therefore the comparison may not be entirely appropriate for short distances from the source.

RESPONSE

Comment noted. Bilcon recognizes that the comparison between seismic airguns and blasting may not be entirely appropriate for short distances from the source.

Noise monitoring at far-field (i.e.) greater than 500m) locations has not been proposed as was recommended in the DFO advice on blasting dated February 10, 2006. Monitoring of the seal colony in the Blasting Plan (Appendix 9 of the EIS) should have been also noted in this section. As well, the Blasting Protocol indicates that underwater blast sound levels will be monitored at the margin of the North Atlantic Right Whale Conservation Area during the initial blast. This should have been indicated in section 9.2.11.4 on page 124.

RESPONSE

DFO's advice regarding sound monitoring at distances stated below should have been included in Chapter 9.2.11 of the EIS:

- At the edge of the intertidal zone
- In the nearshore water at 170m from the detonation site
- In the nearshore water at 500m from the detonation site
- In the nearshore water at 1000m from the detonation site
- In offshore water 2500m from the detonation site
- In offshore water at the edge of the North Atlantic Right Whale Conservation Area

Page 123 – The proponent should provide clarification on where location of the 500m setback radius is measured from (i.e.., does this 500m from shore or from the blast location on land).

RESPONSE

Bilcon proposes that the 500m setback radius is measured from the blast location on land.

Page 123 – What evidence does the proponent have that indicates an observer can accurately identify a marine mammal at 2500 metres? If there is no evidence, the proponent should confirm with marine mammal researchers on the ability to make identifications and in what conditions would this ability be limited

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RESPONSE

C0635-193

9.1.7 Noise and Vibration

The increased safety zone of 2500m for endangered marine mammals would be adhered to if endangered marine mammals have been sighted within the local area. If endangered marine mammals have been sighted, the 2500m safety radius as shown on **Map 41** would be patrolled by boat with an observer on board.

Map 31 – It would be useful for the proponent to illustrate the 2500m buffer.

RESPONSE
The 2500m safety zone is shown on **Map 41**

Section 9.2.11.5 – The EIS concludes that blasting will result in an "insignificant negative impact" on at-risk marine mammals. For the purposes of SARA Section 79, the fact that these impacts are deemed to be insignificant does not change the requirement that measures be taken to avoid or lessen the effects and that the effects be monitored. SARA requires that all adverse effects on species at risk be avoided or lessened and monitored, regardless of their significance.

RESPONSE
Bilcon intends to comply with SARA Section 79, and take measures to avoid or lessen effects on at-risk marine mammals.

The mitigation measures proposed for blasting impacts on species at risk, if applied rigorously, should help to lessen adverse effects on species at risk given the right conditions. One of the key mitigation measures proposed for blasting impacts on marine mammals is the establishment of "safety zones" around the blast site. Blasts will not be conducted if marine mammals are present in these safety zones. The EIS proposes that the presence of marine mammals will be determined by an onshore observer equipped with binoculars. The document notes that this approach is expected to reduce harmful impacts on marine mammals "under good visibility conditions".

Visibility around Digby Neck is not always good. If the proponent intends to blast during periods of low-visibility (e.g. fog, rain, high waves, low light), the EIS should specify what mitigation measures will be taken. This is consistent with requirements for other activities that result in intense marine noise. For example, the Statement of Canadian Practice on the Mitigation of Seismic Noise in Marine Waters requires that operators use passive acoustic monitoring in addition to visual observations during reduced visibility in areas frequented by marine mammals that vocalize. It should be noted that the effectiveness of passive acoustic monitoring for determining the presence of right whales is still being studied, and that it cannot be used reliably to confirm their absence since right whales may only vocalize occasionally. Nonetheless, it may be more effective than visual surveys during low visibility.

C0635-194

9.1.7 Noise and Vibration

To be compliant with Section 79 of SARA, monitoring of the effect of blasting on marine mammal species at risk would need to be conducted if the project proceeds. The EIS proposes only to monitor the initial series of blasts to confirm sound propagation models and establish a baseline. While this may be a useful activity, monitoring the initial blasts is not sufficient. Monitoring of pressure/vibration/sound from blasting should be conducted at various times of the year at locations deemed appropriate by DFO and should continue for a sufficient length of time to draw reasonable conclusions. In addition to monitoring pressure and vibration, there is a need to monitor actual effects on species at risk to satisfy SARA requirements. According to the Canadian Wildlife Services Environmental Assessment Best Practice Guide for Wildlife at Risk in Canada, "actual effects on species should be monitored to verify the accuracy of predictions and warn of impending harm to individuals or populations, community degradation or loss of ecosystem function." This could involve, for example, monitoring marine mammal behaviour through visual or acoustic observations prior to and after blasting events to verify conclusions of no adverse behavioural effect.

Also, monitoring should be conducted to confirm the effectiveness of the mitigation measures. In this regard, the CWS best practice guide states that "as a priority, mitigation measures designed to protect wildlife at risk should be monitored to verify their effectiveness" For the Whites Point Quarry, this should include confirming the effectiveness of methods used to determine the presence/absence of marine mammals in the blasting safety zone. Details should be provided as to what course of action will be taken if monitoring determines that the sound propagation models used in the EIS are inaccurate, the mitigation measures prove ineffective, or the effects are greater than expected. For example, what if the underwater sound pressure levels are greater than predicted? It would be useful to see some details on the "future adaptive management practices" that are being considered pending the initial blast monitoring (e.g., will the safety radii be adjusted?)

RESPONSE

Monitoring methods to determine the presence or absence of marine mammals within the safety zone during high wave conditions include:

Observation Criteria

Use of knowledgeable marine mammal observers will enhance the probability of spotting a marine mammal. A knowledgeable observer can:

- Identify a marine mammal more quickly than a casual observer
- Understand how to best divide the field of observation into more easily scrutinized segments to increase the probability of spotting a marine mammal
- Is better able to select and utilize the proper optics for the conditions

C0635-195

9.1.7 Noise and Vibration

Technical Passive Observations
If passive acoustic technology becomes proven, Bilcon will consider establishing an array of strategically placed acoustic monitoring devices and consider acoustic deterrent devices as early warning systems as appropriate.

Third Party Observations
Reports from Coast Guard Fundy Traffic on whale sightings will be monitored. Reports from Bilcon's contracted bulk carries will also be used.

Communications will be maintained by the observer with local whale and seabird cruise operators known to tour the waters adjacent to the marine terminal. Their sightings of marine mammals will be considered and verified in decision making regarding "go/no go" for blasting.

To enhance the likelihood of the observer's success in high wave conditions, Bilcon will ensure that:

- The observer is in place at least one hour before blasting is scheduled to begin
- Buoy markers are used to delineate the limits of the safety zone
- Intermediate buoys are used to allow for determination of the range of visibility
- A raised, stable, covered platform (i.e. shiploader) is used to help overcome some of the obscurity caused by a high sea state and
- The observer is supplied with all sources of observational information and is appropriately equipped for the task

To allow for the efficient communication of an observer's decision, Bilcon will develop an effective communication strategy that:

- Defines the observer's authority in relation to the blast coordinator with respect to calling off a scheduled blast
- Established firm "go/no go" protocols as discussed in EIS Volume VI, Chapter 9.2.11
- Requires that records of observations (location, time, date, visibility, weather, species etc.) are maintained that include decisions reached by the observer
- Establishes protocols for conveying the decision from the observer to the blast coordinator

The success of observation in high wave conditions is enhanced through the use of a combination of observation and supplementary devices and third party information. It is further enhanced with the continued use of effects monitoring to provide cyclical feedback on the effectiveness of these observational methods and to help fine tune procedures and equipment chosen and to help determine its most effective use.

C0635-196

9.1.7 Noise and Vibration

Blasting activities at the Whites Point Quarry will not be conducted during periods of low atmospheric visibility (e.g. rain, snow, fog, low light etc.) or during thermal inversions. If clear weather prevails with high waves hampering visual observations from land within the 500m safety zone, the marine mammal observer will patrol the area by boat. Since blasting will not be conducted during low atmospheric visibility and the reliability of confirming the presence or absence of North Atlantic right whales using passive acoustic monitoring is still being developed, Bilcon believes the proposed visual approach should be reliable. If severe limitation become evident, an adaptive management procedure may be required and the use of passive acoustic monitoring and/or acoustic deterrent devices considered at that time.

Bilcon intends to monitor pressure/vibration/sound from blasting activities for one year on a seasonal basis in addition to monitoring the initial blast. This ongoing blast monitoring would be coordinated with DFO and would continue for a sufficient length of time to draw reasonable conclusions. Behavioural effects on selected marine mammal species e.g. seals will also be monitored prior, during and after blast events to verify conclusions regarding no adverse behavioural effects.

As mentioned above, mitigation measures will be monitored to confirm their effectiveness. Specifically, this would include:

- Confirming the effectiveness of methods used to determine the presence/absence of marine mammals in the blasting safety zones
- Confirming DFO's CONWEP models are accurate by initial blast monitoring
- Developing adaptive management procedures in consultation with DFO if models are inaccurate, mitigation is not effective or if scientific evidence changes

If data gained by monitoring the initial blast proves or disproves the models, adjustments to the proposed safety radius may be warranted. Adaptive management options that would be considered if on-going monitoring indicates that the measures are not as effective as expected are discussed in the response to DFO Comments on Volume IV, Chapter 3, page 6 in Section 3.6 – Adaptive Management.

Page 124 – The EIS states that if local whale watching operators report right whale sightings in the near-shore area, "verification of right whale activity within the 2500m safety zone will be conducted prior to any blasting activity". It is unclear how this "verification" would differ from the regular pattern of visual observation proposed prior to and after all blast events. Clarification of this term would be useful. This raises several questions of methodology which should be considered by the proponent. For example, if whale watching operators report Right Whale activity in nearshore waters, how exactly will the observer verify activity within the 2500m area?

C0635-197

9.1.7 Noise and Vibration

It should also be noted that relying upon reports from researches and whale watching is questionable. These activities may not be conducted year round and they can take place well away from the project area. What will happen when an at-risk species enters the 2500 m radius but there are no reports of nearshore whale activity and thus no trigger for observation out to 2500 m? Under these circumstances will an at-risk species be detected before it enters the normal 500 m observation area? What are the risks of unobserved animals between 500-2500 m being exposed to a blast?

RESPONSE

Visual observation from the elevated shiploader is only considered to be effective within the 500m safety radius from the point of blast. If right whale sightings are reported in the vicinity "verification of right whale activity within the 2500m safety zone will be conducted prior to any blasting activity". Observation within the 2500m zone as shown on Map 41 would be conducted by boat. To ensure a reduced risk factor, Bilcon proposes a routine observation trip during the morning that a blast is scheduled.

Page 124 – The blast monitoring locations on Map 31 do not appear to correspond with the location indicated by the proponent. The proponent should provide a diagram of the proposed initial blast site with the location of the blast monitoring locations. Does the proponent plan to monitor blasts at the limits 500 and 2500 metre marine mammal observation area to determine if these limits are appropriate? The underwater sound level monitoring was proposed at these limits in the Blasting Protocol.

RESPONSE

The "proposed blast monitoring location – water" indicated on **Map 31** of the EIS is correct for monitoring noise and vibration in the marine environment for the initial blast for monitoring locations at the edge of the marine tidal zone, 170m and 500m from the point of detonation.

Further, in commenting on Bilcon's Blasting Protocol Plan, DFO recommended "far-field" (i.e. greater that 500m) noise monitoring for marine mammals. Therefore, in addition to the monitoring shown on **Map 31** of the EIS at the edge of the marine intertidal zone, 170m and 500m from the point of detonation, Bilcon intends to monitor noise at 1000m, 2500m and at the edge of the Right Whale Conservation Area during the first year of site preparation and construction – see **Map 41**.

Page 124 – The proponent needs to provide more information on the proposed blast monitoring program (e.g. what equipment will be used, what time of year, impact of water temperature on the results, any observations of seals during blasts and any proposed action if the blast noise levels exceed those predicted in the EIS)

C0635-198

9.1.7 Noise and Vibration

RESPONSE

Details of the proposed marine blast monitoring program will be developed in coordination with DFO during the industrial permit phase of the project. The type of equipment to be used will depend on the final variables to be measured, water depth and the anticipated frequency.

The following is included here as an example of the type of equipment to be used during the initial blast to verify model results. Three monitoring stations in nearshore waters are proposed to measure peak pressure levels in the water column and ground vibration levels on or near the bottom. The proposed type of equipment would include a combination of microphones, hydrophones and geophones.

Station 1

At the ordinary high tide line, a 4 channel Instantel Mini Mate seismograph could be used to monitor peak pressure in the air through the use of a calibrated linear microphone and triaxial geophone. The final sensor position would be located using differential GPS.

Station 2

In nearshore waters approximately 118m from the detonation point, a 4 channel Instantel Mini Mate seismograph could be used to monitor peak pressures in the water column through the use of a calibrated hydrophone. A single 4 channel unit is proposed to be used with the hydrophone to ensure sampling rates of 65,000 samples/sec to capture the peak pressure signatures. A 4 channel seismography would be located on shore for recording.

Also, an underwater geophone will be installed at this location on or near the bottom. This geophone will be connected to an 8 channel Mini Mate seismograph which will record vibration data for both the 118m and 164m locations with recorder located on shore. Again, the sensor position would be located using differential GPS.

Station 3

In nearshore waters approximately 164m from the detonation point, using similar equipment as indicated for monitoring station 2.

The recording station would be set-up at monitoring station 1 on land for these nearshore stations. At this location, a total of 4 seismographs would record a total of 12 channels from the microphone, hydrophones and geophones located at the 3 monitoring stations. Data from the microphone and hydrophones would be expressed in time (msec) versus pressure (kpa) and geophone data for each of the transverse horizontal and vertical axes as peak particle velocity (mm/sec), peak acceleration (m/sec^2) and peak displacement (mm).

C0635-199

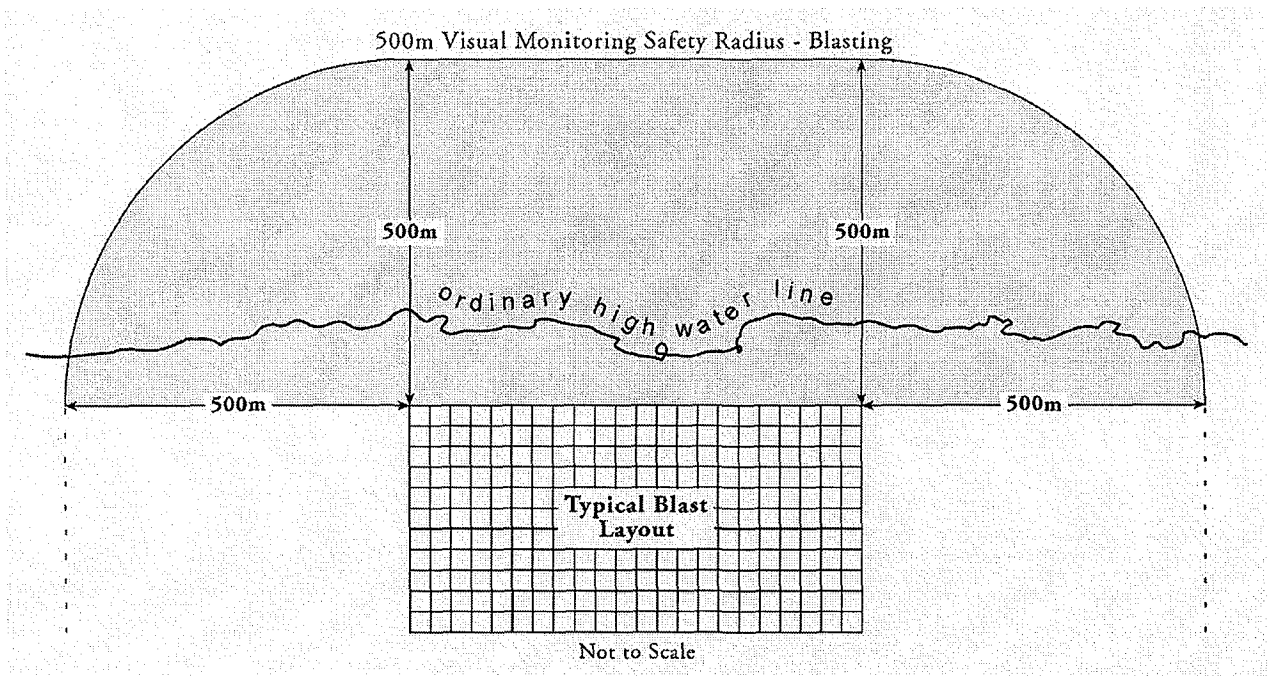
9.1.7 Noise and Vibration

The first step would be to conduct and monitor an initial blast as proposed for verification of the model results. After this data analysis, a more precise analysis may be possible regarding the proposed monitoring program involving near and far-field locations (170m, 500m, 1000m and 2500m from the detonation site and at the edge of the Right Whale Conservation Area) and to comply with the intent of SARA Section 79. If the results of far-field monitoring indicate no concerns, far-field monitoring would be terminated.

Page 124 – If the monitoring zones are calculated from the blast location, the proponent should explain how the marine mammal monitoring zones are determined given that the blast will not be a single point but a series of blasts.

RESPONSE

The proposed visual monitoring zones are calculated from the on-land blast location. The following diagram is presented as an example to illustrate a typical calculation for determining a 500m monitoring zone.



C0635-200

9.1.7 Noise and Vibration

9.2.11- The information contained in the SARA table has or will soon change. A decision on Fin Whale is expected by August 16th, 2006. The Minister of Environment recommended that this species be listed as Special Concern on June 10. Harbour Porpoise has been referred back to COSEWIC for further consideration and a listing decision is therefore not expected in the near future. The COSEWIC status of the Western North Atlantic Humpback Whale is "not at risk" rather than "not assigned".

RESPONSE

Bilcon realizes that SARA designations are an ongoing process and it is their responsibility to comply with SARA over the life of the project. Regarding the SARA Table on Page 118, EIS Volume VI, Chapter 9.2.11.1, recent review of the fin whale, harbour porpoise and Western North Atlantic humpback whale on the SARA Public Registry indicates the following:

Species	Last COSEWIC Designation	SARA Status
Harbour Porpoise	Special Concern	No Status
Humpback Whale	Not at Risk	No Status
Fin Whale	Special Concern	Special Concern

Bilcon appreciates the SARA species update provided.

References

http://www.sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=874
http://www.sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=147
http://www.sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=160

9.2.15 Noise and Vibration Marine – Also in 9.3.4 – Transportation and 9.2.3 Aquatic Ecology - Marine

Page 137 – 9.2.15 concludes that noise from shipping will have a long term, insignificant negative effect on marine organisms. The EIS does not specify which organism will be affected but it can be assumed that this would include locally occurring species at risk, and especially at risk marine mammals, which are considered to be sensitive to noise. Ambient/ship induced noise is identified as a potential limiting factor for right whales in the COSEWIC Status Report

No mitigation for ambient noise is proposed but SARA Section 79 requires that measures be taken to reduce or avoid adverse effects on species at risk. The EIS does note that vessels will reduce their speed after they turn in from the shipping lane, and implies that this will

C0635-201

9.1.7 Noise and Vibration

result in noise reduction. This could be viewed as an effort to reduce the adverse effect of noise, as required by Section 79. If so, the proponent should provide more detail on the expected noise levels at the speed at which the vessels will be travelling.

The proposed monitoring of noise levels is supported, but DFO recommendations (in Appendix 9 of EIS) regarding noise monitoring need to be considered. Also, unless it can be clarified that the negative impact of noise will only affect marine organisms that are not SARA listed, monitoring of the effect of noise on species at risk will be required. This could involve for example, coupling passive acoustic monitoring and/or visual behavioural monitoring with the noise monitoring system to determine whether the movement of ships is affecting marine mammals

DFO supports the proposal for sound and vibration monitoring in the water column near the marine terminal but more detail should be provided by the proponent (e.g., target frequencies, duration, seasonality, reporting, continuance etc). There also seems to be a disconnect between this section and the earlier one on blast monitoring (9.2.11.4). If the proponent is going to install a semi-permanent acoustic monitoring system, it should be designed so that it can be used to monitor blasting noise as well as more general sound from the terminal operation.

RESPONSE

The effect of noise from shipping was primarily directed to marine mammals at risk, which may be sensitive to noise. It is recognized that ambient/ship-induced noise has been identified as a potential limiting factor for right whales (COSEWIC Assessment and Update Status Report 2003). Further clarification is offered for the previous statement.

"It has been suggested that the constant hum of shipping noise in the North Atlantic has habituated right whales to ship sounds, making them less likely to avoid oncoming vessels. It is also possible that the higher levels of ambient noise in the ocean have reduced the ability of right whales to hear mating calls over large distances, perhaps reducing mating opportunities" (COSEWIC Assessment and Update Status Report 2003).

Sound levels and frequency characteristics are generally related to ship size and speed. The primary sources of sounds are propeller cavitation, propeller singing and propulsion equipment. Propeller cavitation is usually the dominant noise source (Ross 1976). Both propeller cavitation and singing originate outside the hull of the vessel while noise from propulsion machinery originates inside and reaches the water via the vessel hull. Large vessels create stronger and lower frequency sounds because of their greater power, large drafts and slower turning engines and propellers. Commercial vessels such as the bulk carriers that will carry aggregate products from the Whites Point quarry produce high sound

C0635-202

9.1.7 Noise and Vibration

levels mainly at low frequencies. Noise also increases with ship speed (Richardson et al 1995). Expected noise levels for a vessel traveling at 10 knots would be 152 dB re 1 μPa2/Hz at 100 Hz near the source (Urick 1975). It should be noted that this data is based on a freighter of that time period and at 1m from the vessel. More modern vessels may produce greater noise levels. Speed between the shipping lanes and the marine terminal, a distance of approximately 13k, would range from 10 to 0 knots. Reduction in speed generally results in a decrease of noise. Thus, continued speed reduction will result in continued noise reduction as the ship approaches the terminal. When the ship departs the terminal, loaded, there may be an increase in noise as compared to the unloaded ship approaching the terminal.

Large commercial ships could be quieted with the application of certain vessel quieting technologies, however, there is apparently no consensus as to whether the need for this is clear, based on current understanding of impacts. Also, the application of these technologies whether in new construction or retrofitting existing vessels is expensive. It therefore appears that any mitigation measures such as quieting technologies to reduce noise from vessels presently lies with the shipping industry in either new construction or retrofitting.

An ecosystem-based approach to conservation management regarding marine pollution, which could include noise, appears to be emerging under IMO as well as other conventions and agreements. However, there are currently no explicit and binding international guidelines or regulations regarding the impacts of anthropogenic noise sources, including vessels, on marine mammals (NOAA 2004. "Shipping Noise and Marine Mammals: A Forum for Science, Management and Technology").

Vessel speeds in the shipping lanes are expected to be approximately 14 to 15 knots. Reduction from these speeds upon approach to the marine terminal at Whites Point would begin approximately 24km from the terminal. Expected speed upon exiting the inbound shipping lane would be less than 10 knots and 2 to 5 knots while beginning maneuvering to the marine terminal, depending on sea conditions. There are presently no speed restrictions for vessels operating in or outside the shipping lanes in the Bay of Fundy. Ship speed is at the discretion of the ship's master in accordance with ship and crew safety considerations.

As stated in the EIS, Bilcon has proposed that the monitoring of noise levels from vessels arriving and departing the marine terminal will be conducted. Also, as stated in Bilcon's Blasting Protocol, background noise monitoring in the Bay at the edge of the Right Whale Conservation Area will be conducted at the time of monitoring the initial blast. Bilcon is not aware of any regulations requiring monitoring of noise from vessels in marine waters. This proposed monitoring would be done on a voluntary basis. Details of the proposed monitoring program will be coordinated with DFO and could involve visual behavioural monitoring of marine mammals in conjunction with the noise monitoring. Bilcon's intention

C0635-203

would be to incorporate appropriate equipment for monitoring noise from vessels, at appropriate frequencies, at the monitoring stations proposed for monitoring blasting noise and vibration in the vicinity of the marine terminal and at the edge of the Right Whale Conservation Area.

Page 137 – Section 9.2.15 – Noise and Vibration, Marine – In Sub-section 9.2.15.2 it is stated that for a one day sonobuoy deployment within the North Atlantic right whale Conservation Area, sound levels were elevated at both 500 and 100 Hz, the measurement period coinciding with verified high levels of shipping in the area. Upon examination of the literature, the measured noise levels reported in Sub-section 9.2.15.1 at 100 Hz appear to be as much as 10 dB higher than normally expected in corresponding heavy shipping areas in the deep ocean and 20 – 25 dB higher than those anticipated in the same deep ocean areas both measured a sea state zero. The sonobuoy levels are somewhat comparable to older historical acoustic levels measured in shallow waters of New York harbour (Urick 1975) however; one day of recording does not provide a representative sample of baseline noise.

It is reasonable to assume that two bulk carrier transits per week through or close to the Conservation Area would not add greatly to average incremental exposures in the Conservation Area itself. However it should be emphasized that for any individual vessel passage the locally observed noise level and any specific animal exposure will be very dependent on the distance to the vessel and also, at increasing ranges, water depth and other physical variables. As an example, for a freighter traveling at 10 knots Urick (1975) quotes a 100 Hz spectral noise level of 152 dB re 1 VPa2/Hz at 1 yd, which is about equivalent (within 1 dB) to a reference viewing distance of 1m. Crudely assuming single vessel noise to fall-off at a 20 log R rate up to a distance comparable to the water depth, say 200m in the Grand Manan Basin, and at a 10 log R rate for distances beyond 200m, vessel acoustic levels comparable to the above reported 93 to 81 dB ambient would be approached at ranges of 4 to 60 km. What this implies is that at observation ranges up to at least a few kilometers the noise levels from a large ship will almost certainly be above the measured (elevated) ambient background. The last sentence in Sub-section 9.2.15.2 stating "background noise levels are therefore expected to be less than noise levels recorded in the North Atlantic right whale Conservation Area study previously mentioned" is difficult to interpret. This is no doubt true providing acoustic levels are highly averaged over time and space. Levels from one or two close bulk carrier passages will no doubt average to something close to the otherwise ambient levels provided the averaging period is long enough (e.g., one week).

The last sentence in Sub-section 9.2.15.2 stating "background noise levels are therefore expected to be less than noise levels recorded in the North Atlantic right whale Conservation Area study previously mentioned" is difficult to interpret. This is no doubt true providing acoustic levels are highly averaged over time and space. Levels from one or two close bulk

C0635-204

9.1.7 Noise and Vibration

carrier passages will no doubt average to something close to the otherwise ambient levels provided the averaging period is long enough...

If this project were to proceed, it would be advisable to make baseline measurements of bulk carrier noise around the terminal and nearby areas of potential environmental sensitivity. It should be noted that it is not entirely certain that modern bulk carrier generated noise levels would closely approximate those of a "freighter at 10 knots" nor if the general ambient noise levels close to Whites Point would be similar to those measured in the Conservation Area during a period of high shipping density.

RESPONSE

In response to the first paragraph of the comment: Bilcon would agree that one day of recording noise levels in the North Atlantic Right Whale Conservation Area does not provide a representative sample of baseline noise. Regarding ambient noise levels in the Bay of Fundy, Bilcon was unable to access contemporary data. If Fisheries and Oceans Canada has reliable contemporary data, Bilcon would appreciate being provided references.

In response to the second paragraph of the comment: It should be noted that the proposed ship route from the inbound/outbound shipping lanes to the marine terminal at Whites Point does not pass through the right whale conservation area. Based on the infrequent shipping schedule of two transits per week, and the reduced ship speeds (below 10 knots entering or exiting the shipping lanes, the predicted effect of quarry induced shipping would constitute an insignificant negative effect (EIS Volume VI, Chapter 9.2.15.5). This predicted effect is for the marine waters between the inbound/outbound shipping lanes and the marine terminal. Bilcon would not disagree with DFO's analysis that the ship would produce noise levels comparable to that recorded in the Right Whale Conservation Area based on the presented assumptions. However, other variables such as vessel speed (less than 10 knots), duration (travel time to and from the shipping lanes to the marine terminal), water depth, season, etc. should be considered.

In response to the third paragraph of the comment: Bilcon would agree that shipping activities at the Whites Point Quarry will add to the ambient noise levels in the Bay of Fundy. Also, there appears to be a lack of quantifiable data existing on ambient noise levels in various areas of the Bay. Since no regulations exist concerning noise level emissions from ships in marine waters, Bilcon has voluntarily proposed monitoring at the marine terminal (EIS Volume VI, Chapter 9.2.15.5). Also, as indicated in Bilcon's Blasting Protocol, monitoring at the edge of the Right Whale Conservation Area will be conducted for the initial blast. Background/ambient noise monitoring would be conducted prior to and after the initial blast. This response should be read in conjunction with the previous response.

C0635-205

9.1.7 Noise and Vibration

It should be realized that sources other than large ships contribute to ambient noise in the area of the Bay. Natural environmental forces such as wind driven waves and surf and other anthropogenic sources such as fishing and whale watching boats. The latter boats in coastal regions contribute significant sound, adding to aggregate noise. Since fishing boats comprise the largest number of vessels operating in the Bay, and have higher-speed engines and propellers than large ships (Richardson et al 1995), their contribution to ambient noise may far exceed the noise generated by two bulk carrier transits per week.

References

Richardson et al. "Marine Mammals and Noise". 1995

Gisiner, Robert C., Ph.D. Marine Mammal Science Program Office of Naval Research. "Proceedings – Workshop on the Effects of Anthropogenic Noise in the Marine Environment". 10-12 February 1998.

Final report of the National Oceanic and Atmospheric Administration (NOAA) International Symposium: "Shipping Noise and Marine Mammals: A Forum for Science, Management, and Technology". 18-19 May 2004. Arlington, Virginia, U.S.A.

In summary, at the present time, Bilcon is not aware of any regulation requiring noise/vibration monitoring in the marine environment. Bilcon intends to operate in accordance with the Fisheries Act and Species at Risk Act and other applicable acts. Bilcon also intends to follow the criteria/thresholds regarding blasting contained in the "Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters". As a precautionary measure, Bilcon will voluntarily monitor an initial blast at the Whites Point site to verify the CONWEP model results and DFO's formulas upon which the "Guideline" criteria are based. Once this initial data has been gathered and analyzed, any effects of concern regarding marine animals would be identified. If the criteria/thresholds contained in the "Guidelines" are achievable based on the results of the initial findings, a reasonable time frame for "significance" monitoring would be established. Bilcon proposes a one year (4 season) time frame to further verify original predictions of change either positive or negative. This monitoring would be conducted during the first year of quarry construction.

Regarding spatial boundaries for monitoring, Bilcon believes it reasonable that the suggested "far-field" monitoring would only be implemented if significant near-field monitoring results are deemed of concern, i.e. if the results of the initial blast conclusively exceed the model and DFO's guideline criteria/thresholds. If there are no significant, measurable effects in the near-field where the greatest effect is most likely, it would appear unreasonable to continue monitoring in the far-field after the one year verification period. This of course would be subject to no new scientific standards or regulatory requirements. If during the 50 year life of the project new standards or regulations come into effect, Bilcon would take an adaptive management approach in coordination with the regulatory authority.

C0635-206

9.1.7 Noise and Vibration

Wharf Construction - the proponent should describe the impact of drilling rock sockets (as compared to pile driving)? Also the impact of the terminal operation, ship loading and the drilling of blast holes should be described.

RESPONSE
Please refer to Bilcon's response to Fisheries and Oceans Canada question regarding Volume 1 – Plain Language Summary, Page 23, earlier in this section.

EIS Vol. VII, Chapter 10- Section 10.0.3.3 and 10.0.3.4 – Marine Mammals, Blasting and Ship Interaction
Cumulative impacts due to blasting and vessel traffic are difficult to evaluate. For ship interactions, see comments on Section 9.2.13. The methods proposed for mitigation of possible deleterious effects due to blasting appear appropriate, if undertaken with rigour and in accordance with the recommendations provided above.

RESPONSE
Comment noted.

However, the ability to detect marine mammals in low visibility conditions should be further examined.

RESPONSE
Periods of low visibility will present challenges for the marine mammal observer from the work boat. During low visibility conditions, observations from the work boat would concentrate in the area of the prescribed route of the vessel.

Ref. Vol. V – Tab 24, Potential Impacts on American Lobster

RESPONSE
Please refer to Bilcon's response to Blasting on American Lobster in this section.

Appendices
Volume III – Appendix 9 – Blasting Plan by Bilcon of Nova Scotia Corporation, May 2005

Page 3 – What does the proponent define as a trained observer for the marine mammal monitoring program?

RESPONSE
Please refer to Section 9.2.3 – Aquatic Ecology – Marine, page 61 in this submission.

C0635-207

9.1.7 Noise and Vibration

A minimum requirement for the "trained" marine mammal observer would be to identify marine mammals to the species level. Bilcon intends to give preference to hiring local people and providing any necessary training. Practical training could include training sessions on a local whale watching boat and/or formal training through consultation with a recognized professional in the field. At this time, Bilcon has not developed specific employment requirements for the marine mammal observer.

Page 3 – The document states that monitoring points are found on Map 001 but Map 1 is a general location map, the document should reference Map 31.

RESPONSE
Comment noted.

Page 3 – The Blasting Protocol states that underwater blast sound levels will be monitored at the margin of the Right Whale Conservation Area during the initial blast. This location should be depicted on the monitoring map.

RESPONSE
Underwater blast sound levels will be monitored at the margin of the right whale conservation area during the initial blast as shown on **Map 41.**

Page 4 – Who would observe behaviour at the seal colony? What aspect of behaviour would the proponent be looking for specifically?

RESPONSE
Behaviour of seals at the colony at Crowells Cove will be observed and documented prior to, at, and post detonation of the initial blast at the Whites Point quarry. Bilcon will be responsible for coordinating this aspect of the initial blast monitoring. A qualified person will be employed by Bilcon. At the present time, the proposed observer will be Dr. George Alliston. Video documentation of the seals prior to, at, and post detonation of the initial blast will be recorded. A specific aspect of the monitoring would be to record any visual behavioural reaction at the time of detonation.

C0635-208

9.1.7 Noise and Vibration

Page 4 – The document states,... "the size of individual charges will be minimized and decked as required to further reduce effects." What does the proponent mean by "decked as required"? Who would require the charges to be decked and how would this mitigate impacts?

RESPONSE

Decking is a means of specifically controlling the explosive weight in multiple charges in a single borehole. This procedure allows the blasting engineer to decrease the amount of explosives detonated in any single minimum 8-millisecond interval.

This method is an often-used method to minimize ground vibration amplitudes, and is most effective when used in situations where the vibration reception is less than 300 metres from the blast location.

Where these distances are greater than 300 metres, the benefits of decking are less significant as perceived by any vibration receptor.

Regarding DFO Guidelines for the use of Explosives Near Fisheries (confined explosives)
Page 4 – If the initial blast is the only blast proposed to be monitored (DFO recommends additional monitoring), does it represent the "worst case" scenario from the perspective of impact on marine life? In the meeting notes of December 10, 2004, Bilcon of Nova Scotia indicated that the size of the charge would increase as they move away from the water. If other blasts would potentially increase the potential impacts in the marine environment, these would also have to be monitored or shown to have no effect based on the results of any proposed initial blast and the results of the modelling (i.e., the proponent would have to show that they can reasonably predict the sound propagation from blasts). This may also include monitoring as the quarry blasting progresses from quarry area 1 to quarry area 4. The progression in quarry development may reflect changes in distance from the marine shoreline.

RESPONSE

Please refer to proposed monitoring programs in Section 9.2.3 – Aquatic Ecology in this submission.

The intent of monitoring the initial blast is to verify the predictive accuracy of the CONWEP model and the application of formulas in the DFO's "Guidelines". If the monitoring results of the initial blast verify the accuracy of the model and formulas, a further year of monitoring at near and far-field is proposed to further verify the application of DFO's formulas. Different size explosive charges and distances from the marine environment would be monitored during this one year, seasonal monitoring effort. If these monitoring results

C0635-209

indicate a reliable accuracy using the DFO formulas, monitoring would be terminated and the formulas would be applied for subsequent construction and operational blasting.

Page 4 – The proposed delay between charges is not clear. It has been reported as both 25 milliseconds and 8 milliseconds in the EIS.

RESPONSE
The Guidelines for Blasting in or Near Canadian Fisheries Waters proposes a delay of 25 milliseconds. Typical blast designs in the industry use a minimum delay of 8 milliseconds. In general terms, the greater the delay the less chance there will be of overlap effects but too great a delay can cause significant technical and safety issues with the blast. Bilcon will engage a blasting engineer to design each blast and each blast will be designed with the greatest delay permissible without creating technical and safety issues.

Comments on the Conclusions of the EIS
Marine Mammals
page 32 DFO Comments on Whites Point Quarry
It is reasonable to assume that a couple of bulk carrier transits per week through or close to the Right Whale Conservation Area would not add greatly to average incremental exposures in the Conservation Area itself. However it should be emphasized that for any individual vessel passage the locally observed noise level and any specific animal exposure will be very dependent on the distance to the vessel and also, at increasing ranges, on the water depth and other physical variables. If applied correctly and with rigour, subject to the recommendations provided above, the proposed mitigation should minimize the risk of direct noise effects to marine mammals.

RESPONSE
Comment noted

Sea Turtles
It is agreed that this proposed activity is likely to have no effect on sea turtles; however, this conclusion can not be supported by the text provided.

RESPONSE
Comment noted

C0635-210

9.1.7 Noise and Vibration

Effects of Noise on Fish

Based on physical modelling, there seems to be minimal cause for concern in terms of lethal effects on fish. It should be kept in mind that the 100 kPa criteria pertains to lethal or obvious sub-lethal injury to fish and not to more subtle behavioural effects. Which if they do exist, are likely to be transitory considering the frequency of quarry blasting.

RESPONSE

Comment noted

Effects of Noise on Lobster

Sound from blasting appears to be substantially less than that from seismic exploration, but enough uncertainty remains that there should be some monitoring and possible mitigation of potential negative effects to lobster.

RESPONSE

Bilcon is prepared to work with DFO to determine the parameters of a monitoring program to determine the possibility of negative effects to lobster. There appears to be little science on this subject at the present time and while there may be some uncertainty as noted, there is no evidence at present of negative effects. Nonetheless, Bilcon is certainly prepared to try to remove the uncertainty.

Comments on Mitigation and Monitoring

Marine Mammals

Blasting will not be carried out if seals are present with 170 metres of the point of detonation or if whales, porpoises or dolphins are within 500 metres of detonations. If endangered marine mammals species such as right whales, blue whales or fin whales are sighted in the near-shore area of Whites Point the safety radius will be increased to 2500 metres.

These commitments will require monitoring of the area before and during blasting and also before and during ship transit. Details on how the proponent will undertake this monitoring, especially during periods of reduced visibility, should be provided.

RESPONSE

Please refer to responses in this section.

Blasting/ Noise

At 500m range, blast pressure measurements should be made near-bottom rather than at 1m depth where the direct wave and surface reflection will be expected to nearly cancel. Near bottom. The pressure levels will maximize. These monitoring considerations should be clarified. Far-afield monitoring should also be conducted, as recommended in the initial DFO advice on the blasting plan and as discussed above. Monitoring should be conducted

C0635-211

9.1.7 Noise and Vibration

at various times of the year to take into account seasonal variation and should continue until reasonable conclusions can be drawn about the accuracy of sound modelling and effects predictions.

If this project were to proceed, it would be advisable to make baseline measurements of bulk carrier noise around the terminal and nearby areas of potential environmental sensitivity.

Monitoring for potential effects of blasting on lobster should be conducted when lobsters are nearshore.

According to the Canadian Wildlife Service's Environmental Assessment Best Practice Guide for Wildlife at Risk in Canada, actual effects on species should be monitored to verify the accuracy of predictions and warn of impending harm to individuals or populations, community degradation or loss of ecosystem function>" This could involve, for example, monitoring marine mammal behaviour through visual and/or acoustic observations prior to and after blasting events to verify the conclusion of no adverse behavioural impacts.

RESPONSE
Please refer to responses in this section.

WP 1542 – Health Canada
Noise and Vibration (Table ECM-2, Section 9.1.9, 9.1.11, Reference Document #31, Noise and Air Quality Study at Whites Point Quarry

1. *Table ECM-2 Noise and Vibration – the frequency of monitoring is identified as "weekly". This statement should be clarified to indicate that noise monitoring will be conducted during blasting events, as presented Section 9.1.9.4 – Monitoring.*

RESPONSE
Bilcon agrees. Monitoring of all blast events will be conducted as presented in paragraph 9.1.9.4 of the EIS. Please refer to EIS Vol. VI, Chapters 9.1.9 and 9.1.10 and EIS Reference Vol. V, Tab 31

C0635-212

9.1.7 Noise and Vibration

2. *The report does not look at potential cumulative effects of multiple site activities on total noise levels (including blasting, drilling, plant operations, vehicle traffic and ship loading). Could cumulative effects result in elevated noise levels above provincial standards(55dBA at night 60 dBA in evening, and 65dBA during the day – Nova Scotia Department of Environment Pit and Quarry Guidelines)?*

RESPONSE

In addition to project operations, cumulative effects at Whites Point quarry would include noise emissions from ship loading activities, drilling, and blasting. Material handling and movement is performed on-site. There is little to no vehicular traffic off-site since aggregate is loaded directly on to a ship and is transported from there. Blasting is an event that is short in duration and, as indicated in the EIS, will likely be conducted every two weeks, so it is not appropriate to include blasting in modeling cumulative effects.

The cumulative effects of noise emissions from normal project operations, drilling, and ship loading was modeled using CadnaA. Sound power levels for ship loading and drilling were found to be approximately 105 dBA (European Commission, 2005) and 90 dBA (E.A.R, 2006), respectively. Predicted noise levels at nearby residential receptors with the treed buffer zone were modeled and are shown in Table 1.1 on the following page.

Table 1.1 Predicted Sound Levels for Cumulative Effects at Whites Point Quarry

Residential Receptor	Predicted Cumulative Effects Noise Level (dBA)	Nova Scotia Sound Level Limits (dBA)		
		Day (07:00 – 19:00)	Evening (19:00 – 23:00)	Night (23:00 – 07:00)
R1	48.8	65	60	55
R2	44.2	65	60	55
R3	51.5	65	60	55
R4	37.1	65	60	55
R5	47.3	65	60	55
R6	49.1	65	60	55
R7	48.9	65	60	55
R8	48.6	65	60	55

Table 1.1 shows that the predicted cumulative effects noise levels (resulting from the inclusion of ship loading and drilling) at the nearby residential receptors met provincial noise guidelines.

References

E.A.R., Aearo Company. 2006. Noise NavigatorTM Sound Level Database. Indianapolis, Indiana

C0635-213

9.1.7 Noise and Vibration

European Commission, Directorate General Environment. 2005. Service Contract on Ship Emissions: Assignment, Abatement and Market-based Instruments, Cheshire, England.

3. *In addition to cumulative effect associated with multiple site activities, no mention is made about the cumulative effects associated with noise with respect to this quarry and the other existing quarries on Digby Neck, and how an additional quarry will contribute to increased noise levels in the area.*

RESPONSE

In the whole of Digby County there are numerous pits and quarries, possibly numbering in the range of 80-85. There are two pits (Mink Cove and Sandy Cove) and one quarry (Rossway Quarry) that are located relatively close to Whites Point, neither of which was audible during visits to the area. Many others of various sizes are located at a greater distance.

Due to lack of specific noise data for other pits and quarries it is difficult to accurately model the specific contributions of pits and quarries; however their contributions would be incorporated into the existing baseline data collected prior to construction and operations at Whites Point Quarry.

4. *Plain Language Summary – section 1, second paragraph – This clause indicates there will be two shifts, please clarify if this means operation will occur during the night.*

RESPONSE

There will be 2 shifts – 0600 – 1400 hours and 1400 – 2200 hours. No operations will be conducted at night.

5. *Section 9.1, Existing physical Environment Section 9.1.9.2 – Recognizing that the Nova Scotia Department of Environment Pit and Quarry Guideline (1999) require a concussion (air blast) to not exceed 128 dBA within 7 metres of the nearest structure, Health Canada would like the proponent to provide information on the use of 128 dBA in comparison to the use of 128 dB unweighted (i.e. lin). From discussions with an official of the Ministry of the Environment for Ontario, our understanding is that the concussion criterion should be 128dB unweighted i.e., lin (not A-weighted) to protect property from damage.*

   The EPA (1974) recommended that the peak level of a single daily sonic boom be less than 125 dB in order for there to be little or no public annoyance. As blasts and

C0635-214

9.1.7 Noise and Vibration

sonic booms create similar levels of annoyance (Schomer et al, 1997) for equal peaks and the blasts will not occur more than once every 2 weeks, ***it does*** *not seem likely that the blasts will cause significant annoyance if they meet a 128 dB unweighted criterion when monitored.*

At the 128 dB unweighted criterion level, and with the expected duration of less than l second and frequency spectrum of a blast, there should also be no concerns regarding irreversible hearing damage or other significant adverse physiological effects. However if the same numerical criterion level is used with A-weighting, Health Canada would like to know the C-weighted peak level, the C-weighted SEL, and A-weighted SEL and the overall blast B-duration of the pulse(s) in order to determine the potential for health effects.

Although we cannot comment on the potential for property damage using a 128dBA criterion as this is not our area of expertise, the proponent may wish to further consider this potential concern as a further argument for a commitment to a 128 dB unweighted (i.e., lin) criterion level.

RESPONSE

Bilcon is not aware of the reasoning by which the A weighting scale was used in the Pit and Quarry Guideline, but does recognize that a linear scale is more common. For example, the Halifax Regional Municipality uses 128 dB unweighted. As the reviewer is aware, the objective of blasting in a quarry is to expend the maximum energy in the fracturing of rock, and the minimum of energy in the air as noise. A blast with undue noise can result from either lack of confinement of the explosives (i.e. poor practice), or from unforeseen geologic conditions. Because of the two routes of energy dissipation, there are two safeguards ensuring proper practice. The energy dissipated in the rock is limited through the imposition of maximum vibration criteria, expressed as peak particle velocities. The Nova Scotia criterion is identical to the HRM criterion, and the Ontario one. The protection of structures from damage is accomplished mainly by the vibration limit.

The criterion limiting the noise level is set to limit disturbance and annoyance, and offers a margin of safety for hearing damage or property damage. As a benchmark, the sound pressure levels of the "noon gun" were measured in Halifax on January 5, 2007. The gun is fired at 1200 hours from the Citadel, and has attained the status of a heritage feature in the city. Two Larson Davis 824 Type 1 meters were set up at the corner of Duke and Brunswick Streets, and measurements were made for the noon event. The meters were set on fast response, and the impulse, A, C and linear weighted readings were all within 1 dB of 123 dB. The measurement was approximately 205 m from the cannon, and lower in elevation. These

C0635-215

observations are introduced here to assist in "benchmarking" the sound pressure levels under discussion. An "on-axis" measurement would likely have been significantly higher.

In the case of a blast in a quarry, a greater amount of the energy would be in the lower frequencies, but the A weighted reading would still be relevant for "annoyance" effects. It must be noted that the 128 dBA is a prescribed limit, and that routine, properly controlled blasts would be less than this, and will be protective of annoyance to persons. Although it is intuitively appealing to relate the different weighting schemes, there is a logical problem with this. For a given explosives charge, the sound pressure level may vary greatly, depending on the proper stemming of the charge holes, and the character of the rock. In the extreme, if the charge is in air, the A and linear responses might be essentially the same (as with the noon gun), but if that charge were to be installed perfectly, the bulk of the energy would dissipate in the rock, and the sound pressure level in the atmosphere would be much lower, by either scale. In reality, each case will be between these two extremes. As the A weighted sound goes up, the linear sound becomes closer to the A weighted level because the lower frequency component is reduced. As the A weighted sound goes down, more energy is dissipated in the rock and low frequencies. The relationship between the two scales will not be constant. It varies with the depth of the charge, and this relationship is illustrated in the ISEE Blasters' Handbook (Fig. 38.8, p 631) where a charge in air, average burial, and deep burial would approximately result in 171, 130, and 91 dB, respectively. It is therefore not possible to take a fixed difference, apply it to a 128 dBA blast and derive a linear reading, and it would be misleading to do so.

6. *Section 9.1.9.3 Mitigation – Given the apparent distances between source, 30 metre buffer of trees and receiver, please clarify how much attenuation could be expected from this buffer. A significant attenuation does not seem consistent with the use of ISO 9613-2 (1996). Attenuation of sound during propagation outdoors – Part 2; general method of calculation.*

RESPONSE

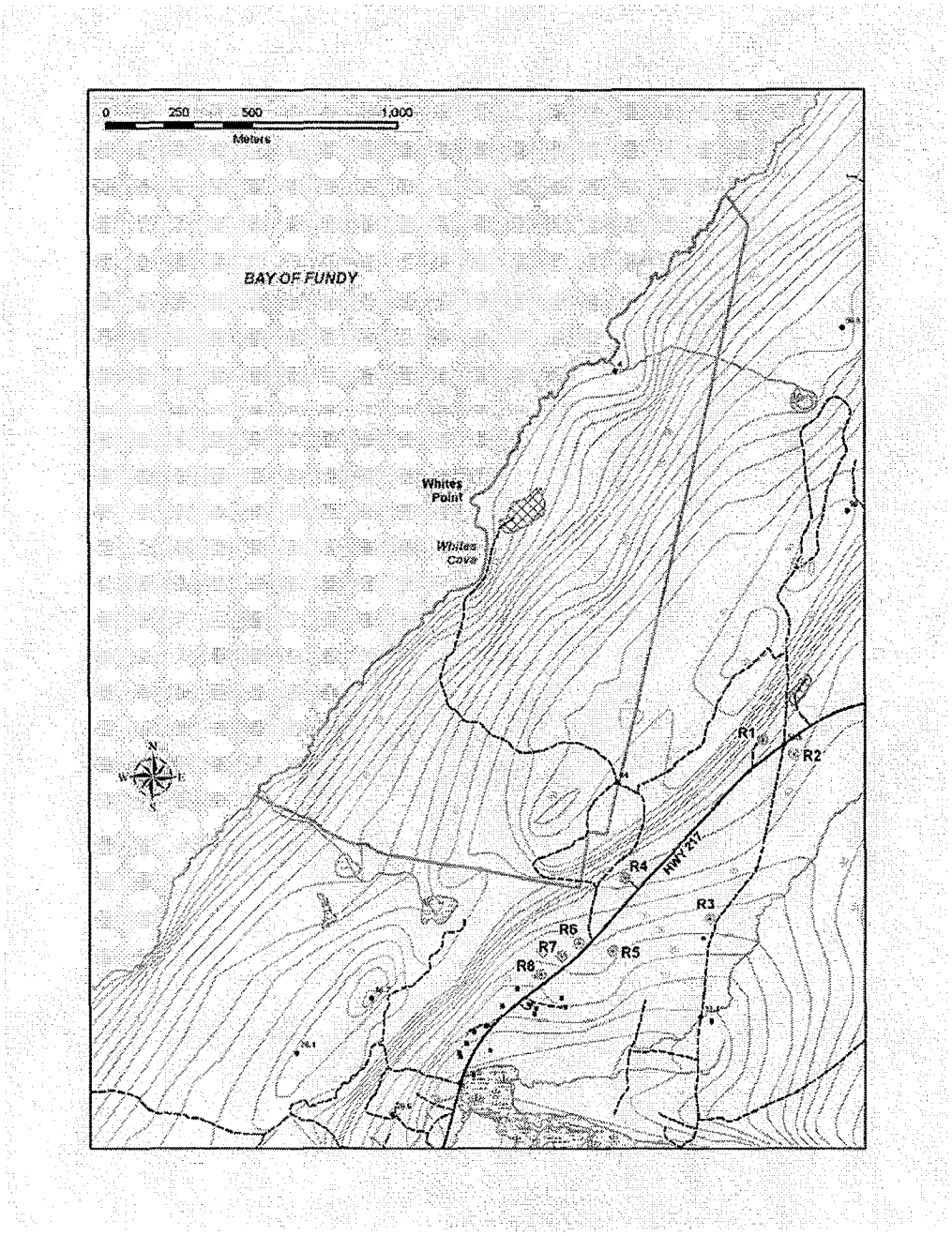
Predicted sound levels at residential receptors closest to the Project study area were measured using CadnaA (Computer Aided Noise Abatement) version 3.5.115, a computer program capable of predicting noise levels at specified receiver positions originating from a variety of noise sources. CadnaA includes the international standards prescribed by the International Organization for Standardization (ISO) Standard 9613 – Attenuation of Sound during Propagation Outdoors (ISO 9613).

The sound attenuation resulting from the 30 m buffer of trees surrounding the quarry site was investigated by predicting the sound levels at receptors without the 30 m treed buffer and then running the model again under the same conditions with the inclusion of the buffer. The map below shows the residential receptors taken into consideration for the model.

C0635-216

9.1.7 Noise and Vibration

Figure 1.1 Locations of Closest Residential Receptors to the Whites Point Quarry Study Area



C0635-217

9.1.7 Noise and Vibration

The predicted sound levels due to Project operations with and without the buffer zone are summarized in Table 1.2.

Table 1.2 Predicted Sound Levels for Operations at Whites Point Quarry with and without the presence of a Buffer Zone

Residential Receptor	Predicted Operations Noise Level (dBA)	Predicted Operations Noise Level with Buffer Zone (dBA)	Nova Scotia Sound Level Limits (dBA)		
			Day (07:00 – 19:00)	Evening (19:00 – 23:00)	Night (23:00 – 07:00)
R1	50.8	48.8	65	60	55
R2	48.9	44.2	65	60	55
R3	51.5	51.5	65	60	55
R4	47.1	37.1	65	60	55
R5	49.6	47.3	65	60	55
R6	49.1	49.1	65	60	55
R7	48.9	48.9	65	60	55
R8	48.6	48.6	65	60	55

As is evident from the modeling results, attenuation due to the buffer zone impacted receptors R1, R2, R4, and R5. R4 and R2 are the most impacted due to the inclusion of the buffer, likely due to their relatively low elevation with reference to the buffer. In addition, R4 is located on property that is owned by Bilcon and is closer to the buffer zone than other receptors, which promotes noise attenuation.

References

International Organization for Standardization (ISO). 1993. International Standard 9613-1, Acoustics – Attenuation of Sound During Propagation Outdoors – Part 1: Calculation of Absorption of Sound by the Atmosphere. Geneva, Switzerland.

7. *Section 9.1.10.1 Noise and vibration research (page 71, first paragraph) – Health Canada recommends that this paragraph be deleted ....based on very old data (1972). Health Canada recommends the use of CAN CSA/ISO9613-21996 or software based on this standard for calculation of sound propagation.*

RESPONSE

Comment noted. The reference cited has not been deleted as suggested as it contains original research on noise, especially in relation to plants and the study work is still applicable to today. However, predicted sound levels at residential receptors closest to the Project study

C0635-218

area were measured using CadnaA (Computer Aided Noise Abatement) version 3.5.115. CadnaA includes the international standards prescribed by the International Organization for Standardization (ISO) Standard 9613 – Attenuation of Sound during Propagation Outdoors (ISO 9613).

8. *Section 9.1.10.2 Noise and Vibration, Analysis (page 72, first paragraph) – Please clarify if operation will occur during the night time*

RESPONSE

No operation will be conducted at night time i.e. between 2200 and 0600 hours.

9. *Can the proponent verify that the noise levels at the nearest receptor will be below the appropriate Health Canada criterion? Guidance on the appropriate criterion to use is given below.*

In quiet rural areas, Health Canada recommends an Ldn at residences below 45 dBA for impulsive noise sources that are neither high energy impulsive noise or highly impulsive noise (these two latter sources are enumerated in CAN/CSA-ISO01996-1:05(2005)(ISO 1996-1:2003). Description, measurement and assessment of environmental noise – Part 1: Basic quantities and assessment procedures).

For representative residences, Health Canada normally requests the Leq from 7 a.m. to 10 p.m., Ld, and the Leq from 10 p.m. to 7 a.m. Ln. Given that these time periods differ from those presented in the Nova Scotia Guidelines for Environmental Noise Measurement and Assessment, if it is not technically or economically feasible for the proponent to provide the numbers as per Health Canada's Leq intervals, Health Canada would be willing to approximate values based on the Nova Scotia guidelines measurement intervals. Health Canada normally requests the Leq values for baseline, construction and for operation. Relevant information was provided in the EA, but not clearly enough for Health Canada to make a comparison to the draft Health Canada criteria.

Higher values are permissible under other conditions as can be determined from the enclosed draft Health Canada Fact Sheet for Noise Issues. Based on the data given in the Environmental Assessment, this level appears to be attainable.

RESPONSE

The Ldn of 45 dBA recommended by Health Canada for impulsive sources, which are neither high energy impulsive noise or highly impulsive noise, is not applicable in this case because impulsive noise will not occur during night time hours. Hours of operation are 0600

C0635-219

9.1.7 Noise and Vibration

– 2200 hours – please refer to 7.8 Operations and Maintenance Phase in Revised Project Description. Blasting, estimated to be conducted on a weekly to bi-weekly time scale, is predicted to add about 2 dB of peak noise to the routine operational noise, although there is likely to be some compensation for this by a shutdown of other activities during the period that blasting occurs.

The residential receptor located closest to the quarry property boundary is R4, for which there is 24 hour baseline noise monitoring data and predicted sound levels due to construction and operational activities, determined using noise modeling software (CadnaA). R4 is located on property owned by Bilcon. The baseline Leq values for R4 calculated from monitoring data were 42.7 dBA and 47.0 dBA, for night and day, respectively. The predicted Leq values at R4 for Project construction and operation are 39.5 dBA and 47.1 dBA, respectively. It should also be noted that construction and operations will be carried out only during day time and evening hours.

Note: When computing the Ldn an additional 10 dB was added to the baseline night time data; however in computing the night time Leq, above, 10 dB was not added.

10. Section 9.1.10.4, Noise and Vibration, Monitoring – Health Canada requests that the proponent verify that the monitoring criteria will also respect the appropriate Health Canada criteria at residences.

RESPONSE

The analysis shows that the facility as planned, will meet the guideline criteria from Health Canada, and be well within the criteria from the Pit & Quarry Guidelines that form the basis for operating permits in the Province of Nova Scotia. Bilcon will undertake to assess the performance of the quarry in conjunction with the monitoring program, and to enact such further mitigation that is consistent with normal business practice.

References

Nova Scotia Department of Environment (NSDEL). 1999. Pit and Quarry Guidelines, Halifax, Nova Scotia.

11. Section 9.1.11.2, Noise and Vibration, Ship Loading – Please clarify if ship loading operations will occur at night.

RESPONSE

Bilcon will attempt to schedule shiploading operations during the 0600 – 2200 hours time period. However, it is possible due to the ship schedule that occasional shiploading will take place at night.

C0635-220

9.1.7 Noise and Vibration

12. *Please indicate why at Sechelt, the decibel levels and distances on page 74 do not seem to be consistent with the value of 45 dBA at 1480 m reported on page 75.*

RESPONSE

Decibel levels recorded at Sechelt during ship loading are presented on pages 74 and 75 of the EIS. These data are taken from reference 69 identified in the EIS bibliography. The dBA data presented appears consistent with diminishing dBA further from the source. At 1480m, shiploading noise diminished to background levels of 45dBA.

Health Canada Comments Related to Reference Document #31 – Jacques Whitford Environment Limited 2005 Noise and Air Quality Study at Whites Point Quarry, Project No. NSD19591

1. *Section 2.1 Introduction to Noise – To call a 3 dB change in sound level barely perceptible may be misleading. If used inappropriately, this generalization can be detrimental to an environmental assessment. Please provide references for this statement. Although the statement may be true in some cases, it can be misleading if the change is due to the addition of two dissimilar sounds. For example, consider masking thresholds for sounds at different frequencies or with different temporal patterns. As another example, a doubling of the number of events may not be noticed by some, but in most cases it is expected that it would be easily perceptible.*

   The use of 90 dBA for noise level from television is not realistic and may cause readers to underestimate the impact of 90 dBA. A better typical comparison may be to the sound level of the background if you have to shout to carry on a conversation with someone only 0.5 metres away. The sound level on the shoulder of a major highway is typically in the range of 80 to 90 dBA.

   It may be illustrative to give an example for a doubling of sound energy level such as two trucks will produce 3 dB more noise than one truck.

RESPONSE

Detecting differences in sound intensity varies according to frequency and sound level. It is noted that when combining two dissimilar sounds, whether differing in frequency and/or temporal pattern, they may not necessarily produce a 3 dB change in sound level, but, in this environment, with the normal variations and composite nature of background as well as project-specific sounds, it is likely that changes of 3 dB would be very difficult to detect.

For the important mid-frequency range and for commonly used levels within the range of human audibility, the minimum detectable change in level that the ear can detect is about 2 or

C0635-221

9.1.7 Noise and Vibration

3 dB (Everest, 2001). While it is agreed that frequency and sound levels are factors that can alter the threshold of detection of differences, it is also noted in the cited reference, and borne out by observations that the detection of such small differences requires a relative absence of interfering sounds, and a relative steady-state of the subject sound.
Televisions are more often found to operate in the 60-70 dBA range, but other audio entertainment systems are operated at levels approaching 90 dBA. Some qualifying text was inadvertently dropped, and it is acknowledged that the 90 dBA should be considered typical of the high end of the range for entertainment devices.

2. *Section 2.8 Potential Issues, Interactions and Concerns – Please indicate the following:*

- *all hospitals, schools, day-cares and seniors' residences for which a significant effect is plausible from either project construction or operation noise – if there are none, state this explicitly and provide a rationale;*

- *any sites within the study area where socially significant First Nations cultural or religious ceremonies take place;*

- *an indication of whether the community is a quiet rural one*

RESPONSE

With regard to hospitals, schools, day-cares and seniors' residences, there is only one school located on Digby neck, located approximately 3 km from the quarry property boundary. However, due to this separation distance it is not expected that the school would undergo significant effects from project construction or operation noise. Attenuation with distance, alone, would likely reduce project-related sound levels by a further 10 dB, or more, at the school.

There are no sites within the study area where socially significant First Nations cultural or religious ceremonies take place.

As indicated in Reference Document #31, Table 2.4, baseline noise monitoring measurements indicate a variety of sound levels within the community. The baseline sound levels in Table 2.4 indicate that the community would lie between the category of quiet suburban and normal suburban community.

C0635-222

9.1.7 Noise and Vibration

3. *Section 2.11, Construction – How many months will the construction last?*

RESPONSE

The construction period will be to some extent contingent upon the date at which permits are issued. This is because the marine terminal will be constructed during the summer months. However, it is reasonable to assume a construction period of 18 months from the end of the permitting process.

4. *Please verify that there will be no night time (i.e. 10 p.m. to 7 a.m.) construction*

RESPONSE

There will be no construction between 2200 – 0600 hours.

5. *It is not clear if the construction noise levels provided of 64 dBA at the nearest receptor will not be likely to cause widespread complaints. This should be verified by the proponent for the following assumption. Health Canada predicts that it is not likely for there to be widespread complaints if construction noise levels are less that 60 or 65 dBA Leq for 12 hours of daytime activity depending on whether the area can be characterized as quiet suburban/rural or normal suburban, respectively. The following assumptions apply:*

   1a) Quiet suburban or rural community (Ldn <52 dBA);
   1b) Normal suburban community (Ldn in range of 53 to 57 dBA);
   2) Construction affecting any one site has a duration of less than 2 months; and
   3) No pure tone or impulsive character.

RESPONSE

The listed assumptions were considered for the Project and Ldn values were calculated based on 24 hours of data taken on June 19, 2005 at the Project boundary and May 3, 2005 at the nearest receptor. The Ldn at the Project boundary was determined to be 44.4 dBA, categorizing that area as quiet suburban or rural community. This categorization was supported by the Ldn value of 49.6 dBA calculated at the nearest receptor. Construction will likely not exceed 2 months in duration in any one area (except for the marine terminal and processing plant) and impulsive noise (*i.e.,* jack hammer) will be kept to a minimum.

Construction noise levels at nearby residential receptors were modeled using CadnaA. The effects of noise due to construction were analyzed by determining the activities that would create noise, and the typical levels of noise produced. Table 1 lists typical construction equipment noise emission levels. Actual equipment used on site may differ from those modeled.

C0635-223

9.1.7 Noise and Vibration

Table 1 Typical Noise Emission Levels of Construction Equipment

Construction Equipment	Typical Sound Level at 15 m (dBA)
Earth Moving	
Loader	85
Bulldozer	85
Backhoe	80
Scraper	89
Grader	85
Excavator	93
Heavy Truck	88
Materials Handling	
Crane (Mobile)	83
Crane (Derrick)	88
Concrete Mixer	85
Screen	100
Vibratory Roller	102
Conveyor Belt	93
Crusher	96
Stationary Equipment	
Air Compressor	81
Generator	81
Impact Equipment	
Jack Hammer	88
Pile Driver (Impact)	101
Source: US Department of Transportation, 2006 European Commission Noise Database 1.0	

For the purposes of modeling, it was assumed that 13 major items (i.e., 2 loaders, 2 bulldozers, air compressor, generator, pile driver, scraper, grader, crane (mobile), excavator, heavy truck) of construction equipment would be operating at any given time within the project development area (*i.e.,* processing plant). When conducting noise modeling, the construction equipment was positioned at the centre of the work area.

Because construction activities will occur between 06:00 and 20:00, construction activity is expected to have little to no effect on night time sound levels. The predicted construction noise levels at each residential receptor location are provided in Table 2, along with provincial noise limits as prescribed by the Nova Scotia Pit and Quarry Guidelines. The level of noise will vary according to the type of construction activity being conducted and the

C0635-224

number of pieces of equipment in operation at any given time; however the predicted values offer an indication of impacts on nearby residential receptors.

Table 2 Predicted Sound Levels for Construction at Whites Point Quarry				
Residential Receptor	**Predicted Construction Noise Level (dBA)**	**Nova Scotia Sound Level Limits (dBA)**		
		Day (07:00 – 19:00)	**Evening (19:00 – 23:00)**	**Night (23:00 – 07:00)**
R1	43.4	65	60	55
R2	41.6	65	60	55
R3	43.9	65	60	55
R4	39.5	65	60	55
R5	42.2	65	60	55
R6	41.7	65	60	55
R7	41.8	65	60	55
R8	41.1	65	60	55

Predicted noise levels at the nearest receptors are well below provincial noise limits for all designated time periods. According to Health Canada, the predicted noise levels due to construction will not likely cause widespread complaints.

6. *Section 2.12, Operation - Please indicate if there will be operation at night*

RESPONSE

No operations will be conducted at night, i.e. 2200 – 0600 hours.

7. *Please clarify the statement that operation levels will be 40 dBA at the nearest receptor due to distance. Health Canada assumed that the nearest receptor was 1 km away and calculated 36 dBA of attenuation due to geometric spreading, yielding a sound level of 49 dBA at the nearest receptor due to distance (i.e., geometric spreading).*

RESPONSE

The answers to the preceding questions have provided much more detailed sound modeling information, including the effects of topography, vegetation buffering, and other factors, such as the site layout, that were not available in the initial analysis but were approximated.

9.1.7 Noise and Vibration

WP 1641 – Nova Scotia Department of Tourism, Culture and Heritage
Noise
There is concern that the noise from the quarry, the construction and operation of the marine terminal and the blasting noise may impact the visitor experience. Blasting will take place every two weeks during regular operation and the shiploading operation will occur once a week. There is also noise created as part of rock processing. Such noise may impact the movement of the whales. If the whales are sensitive to the noise and vibrations, this may negatively impact them. From a tourism perspective, this would place a key experience for the region and province at risk.

RESPONSE
Understandably, the possibility of the creation of excessive noise by the quarry operation is a concern from a tourism perspective.

Bilcon will monitor noise on an ongoing basis so that regulatory thresholds are not exceeded. The Nova Scotia Department of Environment and Labour sets out limits in the Pit and Quarry Guidelines restricting noise levels at the property line. For example, the maximum noise at the quarry property line for night time operation is 55 dBA – the equivalent of quiet conversation. These noise limits are intended to minimize the negative impact of noise created by the quarry, and Bilcon will respect them.

To reduce noise levels and ensure that the Department of Environment and Labour standards are met, Bilcon will carry out a number of measures, including:

- Locating the processing plant 1,000 metres from the nearest residence and 60 metres below the crest of the North Mountain.
- Using rubber-lined truck boxes and screens.
- Enclosing the crushing plant, screens and conveyors.
- Maintaining forested preservation zones to provide greater sound absorption.

Noise monitoring will be conducted at locations selected and approved by the Department of Environment and Labour to ensure that their standards are not exceeded. As well, blast monitoring will be conducted at three monitoring stations for concussion and ground vibration to ensure compliance with government standards.

With regard to concerns expressed about the impact of noise created at the site on whales, it should be noted that Bilcon will generally conduct blasting on the site in accordance with the "Guidelines for Blasting in or Near Canadian Fisheries Waters". Bilcon will not carry out blasting if whales, porpoises or dolphins are within 500 metres of detonations. If endangered marine mammal species like right whales, blue whales or fin whales are sighted in the near-shore area of Whites Point, Bilcon will increase the safety radius to 2,500 metres.

C0635-226

9.1.7 Noise and Vibration

Given this approach, Bilcon does not believe that the experience of visitors to Digby Neck will be negatively impacted. Bilcon also believes it is taking appropriate steps to avoid putting whale watching experiences at risk.

Also, please note the comment from Fisheries and Oceans Canada in their submission to the Panel, Page 33 "if applied correctly and with rigour, subject to the recommendations provided above the proposed mitigation should minimize the risk of direct noise effects to marine mammals".

Potential Growth of the Development
Blasting noises and increased industrial shipping and loading of basalt will impact visitors to the area.

RESPONSE
The total footprint for the proposed quarry and marine terminal project on Digby Neck is defined at 150 hectares. Bilcon propose expanding the quarry by up to four hectares each year, but this is the total amount of land that will be in production at any one time. As land is quarried out it will be reclaimed and restored to a useable state on an ongoing basis for the life of the project. When the full 150 hectares has been quarried out and subsequently reclaimed – an exercise Bilcon estimate will take approximately 50 years – the project will be complete.

This advance knowledge of the proposed total area of the quarry should offer reassurance that this development will not grow in an 'out of control' fashion, impacting the local tourism experience.

WP 1625 – Partnership for Sustainable Development
Deficiency Statement 51
EIS Guidelines
9.1.1 – Terrain, Geology, and Soils – 'For the Project site, provide specific information on the bedrock geology that includes geologic structures (e.g. faults, joint patterns and frequency), bedrock type (lithology), and stratigraphy."
12.5 – 'Indicated which mitigative measures are proven and which are experimental. Provide any analysis that supports any statements regarding the effectiveness of proposed mitigation measures."
EIS
The EIS identifies that 'Concussion and ground vibration from blasting activities will meet the criteria established by the Nova Scotia Department of Environment and Labour...." The EIS does not provide engineering design work to support this conclusion. Without the detail of engineering design, it is difficult to make a judgement on whether or not the Proponent

C0635-227

9.1.7 Noise and Vibration

can achieve the goal and it is also not possible in the future to evaluate the performance of the Proponent whether it has achieved the goal. It is recommended that detailed engineering design and planning work be provided on drilling pattern, use of explosives, blasting sequence, etc, plus any measures to be taken to avoid excessive vibrations and air concussions.

RESPONSE

"Concussion and ground vibration from blasting activities will meet the criteria established by NSDEL" should read "concussion and ground vibration from blasting activities will be designed to meet the criteria established by NSDEL".

C0635-228

9.1.8 Light

EIS Reference: EIS Volume VI, Chapter 9, Section 9.1.12

INDEX OF COMMENTS

9.0 Environments and Impact Analysis

9.1 Physical Environment and Impact Analysis

9.1.8 Light

C0635-229

9.1.8 Light

WP 1542 – Health Canada

Light (Table ECM-2, Section 9.1.12, Reference Document #31, Noise and Air Quality Study at Whites Point Quarry)

The EIS indicates that operational lighting will be kept to a minimum and synchronized with needs to reduce energy consumption at the quarry. Potential effect of light on people is not assessed. JEWEL Report (2005) discusses lightscape management but does not address the potential adverse effects of light/sky glow on people. Sky glow is defined as "the brightening of the night sky due to man made lighting" (IDA, 2002). At this time there is not enough information to determine whether the presence of light/sky glow will have an adverse effect on nearby residents.

Health Canada Light Reference:
International Dark Sky Association (IDA), 2002 Glossary of Basic Terms and Definitions http://www.darksky.org/.

RESPONSE
Please refer to page 100 of the Revised Project Description.

With limited research available on the topic of the effects of artificial light on human health, an assessment cannot be provided at this time. According to the U.K. Environment Agency, the following measures can be employed to reduce the effects of night time light/sky glow.

- Positioning lights properly and directing light downward
- Using only the necessary amount of light
- Switching off unnecessary lighting particularly late at night and in the early morning hours; and
- Designing light fittings that reduce light emitted upwards

These measures will be included in the design of Whites point quarry in order to reduce the potential of exposure of light to nearby residents. The presence of numerous other light sources on the coastline has not resulted in the development of guidelines by government agencies that the proponent has been able to identify, but, should such guidelines be issued, it shall be the policy of Whites Point quarry to make every reasonable effort to comply.

C0635-230

9.1.8 Light

WP 1625 – Partnership for Sustainable Development
Deficiency Statement 13
EIS Guidelines
4.1 – Use of Existing Information - 'The EIS must provide sufficient information to identify, describe and determine the significance of potential impacts on the environment that could arise from the Project."
8.1 – Methods - 'Identify and justify any assumptions made. Indicate the degree of certainty in the impact predictions and determination of significance (identify measures used). Document all models and studies so that, to the extent possible, the analyses are transparent and reproducible, support analyses and conclusions with reference to appropriate literature and provide all relevant references."
EIS
The Proponent is unable to use convincing language to assuage concerns about the quarry lighting. For example, in Chapter 9.1, we are told that "Operational lighting will be kept to a minimum", that "the working face of the quarry will require minimal lighting", and that "minimal light spill is expected into the marine waters and into the night sky". These vague statements are used to support a definitive conclusion that lighting will have "long term, insignificant negative effects, of local scale." Why are these impacts not properly quantified? The Proponent should revise the EIS to quantify impacts and include the degree of certainty associated with lighting impacts.

RESPONSE
Please refer to page 100 of the Revised Project Description and response above in this document

C0635-231