Chapter 10 – Freshwater Aquatic Environment

Chapter 10 covers pages 10-1 to 10-43, and illustrates key subject areas with 8 tables as well as 4 figures. It begins by explaining that the Freshwater Aquatic Environment includes watercourses (rivers, lakes, and streams) that provide habitat for fish and other freshwater aquatic species. As such, it was identified as a Valued Environmental Component (VEC), due to its importance in supporting freshwater aquatic life.

Although there is no known Aboriginal fishery or commercial fishery in the Freshwater Aquatic Environment in the Regional Assessment Area (RAA), the Report notes that local residents value the ability to angle recreationally mainly for brook trout and brown trout. During public and stakeholder engagement activities, some local residents expressed concerns about the Project and how it might affect this activity. There is currently no recreational fishing season for Atlantic salmon on the Mispec River, but local residents have identified that conserving the salmon population in this river is important to them.

The Report notes that the Project has the potential to affect the Freshwater Aquatic Environment, due to the unplanned or accidental release of deleterious substances or sediments into watercourses; direct mortality of fish; changes in drainage area, and the deposition of air contaminant emissions. The Report states, however, that with effective Project planning, design, avoidance, and application of known and proven mitigation measures, it has been concluded that the environmental effects of the Project on the Freshwater Aquatic Environment would not be significant.

Section 10.1 and 10.2 cover pages 10-2 to 10-18 and provide detailed information on the Scope of Assessment and Existing Conditions under the following sub-headings:

Scope of Assessment

- Regulatory Setting
- Issues and Concerns Identified During Aboriginal, Public and Stakeholder Engagement
- Selection of Environmental Effect
- Selection of Measurable Parameters
- Temporal Boundaries
- Spatial Boundaries
- Administrative and Technical Boundaries
- Residual Environmental Effects Rating Criteria

Existing Conditions

Potential Project-VEC Interactions

Table 10.4 lists each Project activity and physical work, and ranks each interaction as 0, 1 or 2. These rankings are also defined and indicate the level of interaction each would have with the Freshwater Aquatic Environment.

All Project activities or physical works associated with the Marine Terminal and Other Marine-Based Infrastructure were ranked as 0, since these would not interact with the Freshwater Aquatic Environment in any substantive way.

As such, the potential environmental effects of the Construction, Operation, and

Decommissioning and Abandonment of the Marine Terminal and Other Marine-Based Infrastructure on the Freshwater Aquatic Environment were rated not significant, with a high level of confidence.

Overall, the potential environmental effects of all Project activities and physical works that were ranked as 0, including cumulative environmental effects, on the Freshwater Aquatic Environment, during any phase of the Project, were rated not significant, and were not considered further in the assessment. The Report notes, however, that the Environmental Risk

Assessment (ERA) does include an assessment of the environmental effects of emissions from ships in the Marine Environment on the Freshwater Aquatic Environment.

Potential Interactions of the Petroleum Refinery and Other Land-Based Infrastructure

This section describes the rationale for the ranking of activities as 1 or 2, which are summarized in Table 10.4.

Construction The interaction between the Freshwater Aquatic Environment and Road Transportation during Construction was ranked as 1, as this activity has the potential to affect fish populations primarily through erosion and sedimentation of watercourses.

Activities related to Construction of Linear Facilities and Watercourse Crossings were also ranked as 1. The potential crossing locations included Hazen Creek, a tributary to Hazen Creek and Brandy Brook, as well as field-identified watercourses. Hazen Creek and the Tributary to Hazen Creek each have one potential crossing, while Brandy Brook might be crossed up to four times by the preferred linear facilities corridor.

Two unmapped watercourses also lie within the preferred linear facilities corridor, each having one potential crossing. Despite this, there would be no anticipated direct interaction between these construction activities and the Freshwater Aquatic Environment, due to the avoidance of all work activity in fish-bearing portions of watercourses, through application of technologies such as horizontal directional drilling (HDD) and bridging for linear facility watercourse crossings.

Work activity within 30 m of watercourses (particularly those that are fish-bearing) would also be minimized. Further, preliminary geotechnical investigations indicated that bedrock in the Project Development Area (PDA) is not net acid producing. As such, there is very little risk for acid rock drainage during construction. A Project specific environmental protection plan (EPP) for Construction would also be developed, including the following:

- Implementation of well established and proven erosion and sedimentation control measures for protection of watercourses during near-stream work, as per the standard protocols from the NB Departments of Transportation and Environment, as well as other procedures designed specifically for the control of run-off.
- Proper storage, use, and containment of potentially deleterious substances, as per the standard NBDOT protocols and provincial hazardous material storage and containment regulations.
- Monitoring of water quality parameters (*e.g.,* total suspended solids) during work.
- Compliance with all provincial and federal legislation, permits, approvals and guidelines.

Due to the implementation of effective erosion and sedimentation control measures and the avoidance of all work activity in fish-bearing portions of watercourses, the environmental effects of the interactions ranked as 1, with the Freshwater Aquatic Environment during Construction,

were rated not significant.

The interactions between the Freshwater Aquatic Environment and the following Construction activities and physical works were ranked as 2 in Table 10.4:

- Site and Right-of-Way Preparation; and
- Physical Construction and Equipment Installation.

The Report notes that construction activities have potential to affect fish populations through changes in surface water available for stream flows, due to an increase in impermeable surfaces and diversion of surface water run-off. Change in fish populations are a particular concern in the Mispec River watershed, and sub-watersheds supplying tributaries to the Mispec River, due to the presence of Atlantic salmon in the system. The potential interaction between the Freshwater Aquatic Environment and these construction activities is complex and required further analysis.

This potential environmental effect would continue through Operation. The potential for changes in surface water availability was also raised by stakeholders, members of the public, and regulators, during consultation, further emphasizing the importance of this interaction, and its ranking as 2.

Operation The following interactions between the Freshwater Aquatic Environment and the following Operation activities were ranked as 1:

- Emissions Control and Management of Effluents and Wastes
- Water Supply and Use
- Linear Facilities Presence and Operation
- Right-of-Way and Infrastructure Maintenance
- Road and Rail Transportation.

Emissions Control and Management of Effluents and Wastes was ranked as 1, due to the interaction of air emissions, wastes and effluents with the Freshwater Aquatic Environment. The ranking of 1 reflected the existence of well established and proven mitigation measures, including air pollution control technologies, for this anticipated interaction. It is also supported by the Ecological Risk Assessment (ERA), which showed that predicted environmental concentrations of contaminant of potential concern (COPC) resulting from atmospheric Project emissions did not result in any unacceptable risk to any aquatic ecological receptor.

As noted earlier, no wastewater discharge to the Freshwater Aquatic Environment would be planned as part of the Project. Additionally, all provincial and federal legislation, permits, approvals and guidelines would be followed.

Water Supply and Use was ranked as 1 because, although surface water is proposed as a potential source of process water for the Project, it would be obtained through the licensed City of Saint John municipal water supply system, and not from watercourses within the Regional Assessment Area (RAA).

The Mispec River watershed has been separated from the Loch Lomond watershed by a dam at the south end of Robertson Lake. While water use from the municipal watersheds by a variety of users, including the Project, could result in lower than normal water levels, it would be expected that the City of Saint John, as the owner and operator of the municipal system, would manage the water supply in a manner that did not adversely affect the Freshwater Aquatic Environment.

The Report notes that Interactions between the Linear Facilities Presence and Operation, Right-of-Way and Infrastructure Maintenance, and Road and Rail Transportation and the Freshwater Aquatic Environment have potential to cause a Change in Fish Populations through the potential release of deleterious substances and contaminated surface run-off from roads and rail beds.

A ranking of 1 was assigned, due to the existence of well established and proven mitigation methods and techniques, including the standard erosion and sedimentation measures described above for these anticipated interactions. For those activities ranked as 1 in Table 10.4, in consideration of the planned implementation of known and proven mitigation, the environmental effects of the Project on the Freshwater Aquatic Environment during Operation were rated not significant. Operation and Maintenance of Refinery Processes and equipment were ranked as 2, due to their interaction with the Freshwater Aquatic Environment. The presence, operation and maintenance of Project processes and equipment would sustain the loss of drainage area which would take place during Construction and, thus, was carried through the assessment.

Decommissioning and Abandonment The interaction between the Freshwater Aquatic Environment and the Removal of Facilities and Site Reclamation was ranked as 2. Potential interactions involved in Decommissioning and Abandonment would be anticipated to be very similar to those occurring during Construction.

Such interactions would also have potential to cause a Change in Fish Populations due to erosion and sedimentation of watercourses, and the release of deleterious substances. Well established and proven mitigation methods and techniques, including standard erosion and sedimentation measures, as described above, would be employed during this phase of the Project. These interactions are nonetheless carried forward in the EIA.

To summarize, all Project activities ranked as 0 or 1 in Table 10.4 would result in no residual environmental effects on fish populations, due to the application of well established and proven mitigation measures, and were considered to be not significant.

The post refinery ecological hazard quotient (EHQ) was less than 1, and no freshwater fish mortality would be expected to result from any of the Project phases. It is anticipated that the measurable parameters presented in Table 10.1 would be maintained to support existing fish populations in the RAA during these Project activities. Therefore, no residual environmental effects on fish populations would be anticipated from these activities, and they were rated not significant.

Petroleum Refinery and Other Land-Based Infrastructure Environmental Effects Assessment

A summary of the environmental effects assessment and prediction of residual environmental effects resulting from interactions ranked as 2 on the Freshwater Aquatic Environment, is provided in Table 10.5. They include the following interactions, which were ranked as 2, due to the potential change in drainage area of watersheds containing fish-bearing watercourses.

Construction

- Site and Right-of-Way Preparation
- Physical Construction and Equipment Installation.

Operation

- Operation of Refinery Processes and Equipment.

Decommissioning and Abandonment

- Removal of Facilities and Site Reclamation.

Assessment of Project-Related Environmental Effects

As discussed earlier, a Change in Fish Populations through interactions ranked as 1 in Table 10.4 were rated not significant, and would be effectively mitigated through well established and proven mitigation measures.

Harmful alteration, disruption or destruction (HADD) of freshwater fish habitat would also be avoided, through the use of horizontal directional drilling (HDD) technology at underground pipeline crossings, and bridging of watercourses for road, and above ground, pipeline crossings. The potential change in drainage area ranked as 2 in Table 10.4 required further investigation.

The measurable parameters used to assess the potential Change in Fish Populations from a change in drainage area were the drainage area itself, dissolved oxygen (DO) and water temperature. Drainage area for fish-bearing watersheds in the Regional Assessment Area (RAA) was considerably reduced with the construction of the Robertson Lake dam in 1906. Since then, drainage area loss has occurred on a much smaller scale for other watersheds in the Local Assessment Area (LAA), primarily due to residential and industrial development and road construction.

DO levels were observed in the surveyed watercourses at levels sufficient to support populations of fish. Several instances of low DO levels were observed in Calvert and Balls Lake, and in watercourses where barriers such as beaver dams had reduced flow.

Water temperatures in the majority of watercourses showed cool clear water, also supportive of brook trout and Atlantic salmon populations, with the exception of areas impounded by beaver dams or tree falls.

Potential Project-Valued Environmental Components (VEC) Interactions

During Construction, environmental effect mechanisms resulting in a loss of drainage area would primarily include near-stream and watershed-level works for linear facility and land-based Project component construction. A loss in drainage area has the potential to affect fish populations through lower stream flow, particularly during base/low flow conditions (summer months).

Lower stream flows can also affect DO levels and water temperatures. Of particular interest are the watersheds supplying the Mispec River, and its tributaries, Brandy Brook (Unnamed Tributary 1 to Mispec River), Anthonys Brook, and Bean Brook, due to their proximity to the PDA (Figure 10.4). Watershed area within each of the watersheds supplying these watercourses would be reduced due to Construction and Operation of the refinery and associated land-based facilities (*e.g.,* tank facilities).

Components of Construction contributing to these mechanisms would include Site and Right-of-Way Preparation, Physical Construction and Equipment Installation.

These components would contribute to drainage loss through the creation of interception ditches and the subsequent diversion of flows. Operation components to this mechanism could have similar effects. During Decommissioning and Abandonment, environmental effects mechanisms could also be very similar, with the exception that the potential Removal of Facilities and Site Reclamation might result in restoration of drainage area.

Mitigation of Environmental Effects for Change in Fish Populations

The following mitigation measures, through careful design and planning, would be employed to avoid or reduce the environmental effects of the Project on the Freshwater Aquatic Environment, potentially resulting from the loss of drainage area described above:

- Avoidance of work activity in fish-bearing portions of watercourses;
- Minimization of work activity within 30 m of watercourses (particularly those that are fish-bearing);
- Minimization of disturbance of drainage area for fish-bearing watercourse watersheds;
- Hydrological analysis of fish-bearing watersheds in the LAA to support design and confirm environmental effects predictions;
- If required, development of an effective storm water management system with the capability to return surface water to select drainage areas to maintain stream flows for fish-bearing watercourses;
- Compliance with all provincial and federal legislation, permits, approvals and guidelines.

Characterization of Residual Project Environmental Effects for Change in Fish Populations

The Project activities ranked as 2 in Table 10.4 required further assessment, in addition to the mitigation measures presented above, due to the complexity of their potential to affect fish populations.

As described earlier, the mechanism for this environmental effect would entail a change in surface water hydrology, where run-off would be captured from Project facilities and directed outside of the drainage area. This is particularly important at the refinery site, where site run-off would be collected, directed to wastewater treatment, and discharged to the marine environment. This environmental effect would be restricted to watercourses downstream of the area, within which run-off water would be diverted. The duration of the Project-related Change in Fish Populations would be expected to slightly exceed the expected lifespan of the Project.

Drainage Area Assessment An assessment was carried out for permanent fish-bearing watercourses that might be affected by a reduction in drainage area, to determine the potential drainage area affected. This assessment used existing information, combined with ground verification in select areas, to define the watershed boundaries. Additional field hydrological survey data was collected during the spring and summer of 2008, including water level and stream flow information from select watercourses in the LAA. Table 10.6 shows that, while drainage area would be lost, the amount would be relatively small, in comparison to the total drainage area present for each watershed. The Report states that this would not be anticipated to affect the fish populations presently inhabiting each stream.

Fish Habitat Requirements The Report also points out that any observed or measurable reduction in stream flows, due to loss of drainage area, would likely occur during periods of the year when low flow conditions were present (*e.g.,* summer/winter). The report notes that critical lifecycle stages (*e.g.,* spawning) for species such as Atlantic salmon, or other fish species, most commonly occur during periods of high flow. As a result, it is not anticipated that the small potential reduction in stream flows, due to small losses in drainage area, would affect the ability of fish populations to survive in watercourses near the PDA and in the LAA.

The Report notes that Atlantic salmon are clearly the most sensitive species in the Mispec River system. Atlantic salmon carry out the critical stages of their lifecycle (migration, spawning, hatching) under higher flow conditions, but are tolerant under a broad range of habitat

conditions. Supporting information contained in the Surface and Groundwater Resources Technical Study indicated that groundwater discharge sustains most small stream flows in the PDA during the dry portions of the year. Brook trout are found in watercourses in the LAA, and also spawn in the fall months during higher flow conditions. Other non-salmonid fish species present in surveyed watercourses are also resilient and hardy under low flow conditions.

Further to the description of habitat requirements above, the Report states that a loss in drainage from the Project would only be experienced in the lower reaches of the Mispec River. These lower reaches are fed by the entire drainage area upstream of the PDA, which would not be affected by the Project. Flows in the middle and upper reaches of the Mispec River, where salmonid spawning is more likely to occur (particularly Atlantic salmon), would therefore not be anticipated to be reduced to any measurable degree by the Project.

During field surveys of the lower reaches of the Mispec River near the PDA, there was little potential salmonid spawning habitat observed, likely due to the steep gradient in this area. Potential spawning habitat was observed further upstream near the crossing of Old Black River Road in the Mispec River and Brandy Brook. Juvenile salmon were also observed in this upstream area, well above the PDA, which would not be affected by the Project.

Atlantic salmon were not observed in any of the unnamed tributaries draining to the Mispec River during field surveys. Brandy Brook, as with Mispec River, would experience a small loss in drainage area (approximately 9.5%) at its lower reaches. Juvenile salmon were observed in this watercourse as well, although at much lower numbers than the upstream reaches of the Mispec River.

Areas of spawning and rearing habitat were observed in Brandy Brook during stream surveys. In-stream flows in these areas would not likely be affected by the Project, due to the vast majority of upstream drainage area that would remain intact to provide adequate stream flows. Atlantic salmon were not observed in any of the other smaller watercourses (*e.g.,* Bean Brook, Anthonys Brook) near the PDA and in the LAA, nor would they be expected to be observed, given the small nature and habitat characteristics of these watercourses. The predominant species observed in these smaller watercourses were brook trout and blacknose dace.

The Bean Brook watershed would experience the highest predicted drainage area loss on a percent basis (approximately 18.3%). Although this could potentially represent a substantial loss in drainage area, it is anticipated that Calvert Lake would serve to provide Bean Brook with adequate stream flows during low flow conditions.

Further, it is highly likely that populations of other fish species in these smaller streams and the Mispec River are naturally adapted to low flow conditions and able to seek areas of deeper water refuge during dry months of the year. It is not anticipated that the small drainage area lost due to Project development would affect fish populations, when these natural conditions occur.

History of Mispec River and Atlantic Salmon As discussed in Section 10.2, the lower Mispec River system was historically the site of multiple industrial operations and infrastructure (*i.e.,* sawmill, cotton mill, barrier dam) that would likely have had a significant environmental effect on the ability of the system to support populations of migratory fish species such as Atlantic salmon. This system has since recovered considerably and now contains freshwater habitat conducive to supporting Atlantic salmon populations.

The following primary factors have been identified as relating to the collapse of the inner Bay of Fundy Atlantic salmon stock:

- Alteration of habitat by forestry and agriculture practices;
- Damming of rivers and estuaries;
- By-catch in shad and herring fisheries;
- Potential salmon farm threats such as disease or competition; and
- Illegal fishing of wild salmon.

As the Project would not involve any of the activities listed above, the Project would also not contribute to any further decline of inner Bay of Fundy Atlantic salmon populations in the Mispec River system. Although the inner Bay of Fundy native salmon of the Mispec River would appear

to be extirpated. The Report notes that the Project would not affect the River's capacity to support Atlantic salmon populations, at present or in the future.

Potential Mitigation At this juncture, the Report states that, if further field hydrological data collection and analysis, currently being undertaken, suggests that the loss of drainage area has potential to result in a change in sensitive fish populations due to decreased stream flows, or if follow-up identifies any issues, additional mitigation measures would be available and could be implemented.

The diversion of surface water flow from the land based facilities back to select watersheds through a modified storm water management system would be one example. To summarize, for the majority of watersheds within the LAA, the loss of drainage area would be low in magnitude. While it would occur during Construction and remain for the life of the Project, it would not be anticipated to affect fish populations.

Assessment of Cumulative Environmental Effects

An assessment of the potential cumulative environmental effects was conducted for other projects and activities that could have potential to interact with the Project.

Table 10.7 identifies potential cumulative environmental effects and ranks each interaction with other projects as 0, 1 or 2 with respect to the nature and degree to which important Project-related environmental effects might overlap with those of other projects and activities. Projects and activities potentially interacting with the Petroleum Refinery, and other Land-Based Infrastructure, with potential for cumulative environmental effects ranked as 1, include Infrastructure Land Use and Planned Infrastructure Projects. Well established and proven mitigation measures and techniques would exist for these potential interactions.

Projects and activities that would potentially overlap with the environmental effects of the Petroleum Refinery, and other Land-based Infrastructure ranked as 2, include Industrial Land Use, Forestry and Agricultural Land Use, Recreational Land Use, Planned Future Industrial/Energy Projects, Planned Residential Development and Planned Marine Use (including aquaculture).

To address these potential interactions, an environmental effects assessment was conducted, and the resulting cumulative environmental effect mechanisms, mitigation measures and characterization of residual cumulative environmental effects are presented in Table 10.8.

Project Cumulative Environmental Effect Mechanisms for Change in Fish Populations

The Project cumulative environmental effect mechanisms for a Change in Fish Populations are described below for the Base Case, Project Case and Future Case scenarios:

Base Case The Base Case includes past projects, as well as current projects that have received some level of environmental approval and/or are in some form of planning, construction and/or commissioning. Past projects, activities and actions contributing to this Base Case are the:

- Mispec River barrier dams (1821 to 1894 and 1898 to the 1960s)
- Mispec River sawmill
- Mispec River pulp mill
- Mispec River cotton and wool mills
- Past forestry and agriculture activities
- Past recreational and commercial fishing activities.

Freshwater Aquatic Environment habitat conditions on the Mispec River have improved considerably in more recent decades. This is evidenced by the good habitat quality and the presence of healthy fish stocks of native and non-indigenous species (*e.g.,* brown trout). Commercial fishing for Atlantic salmon in the Bay of Fundy has been prohibited for some time, and it is unknown if Atlantic salmon were ever fished commercially on the Mispec River itself. Recreational fishing for Atlantic salmon is currently prohibited, but was formerly allowed on the Mispec River, prior to the collapse of the inner Bay of Fundy Atlantic salmon stock. Recreational fishing still takes place for resident and sea-run trout species. Current projects, activities and actions contributing substantively to the Base Case are:

- Municipal water supply dam at Robertson Lake
- Canaport LNG emergency access road
- Brunswick Pipeline
- Aquaculture
- Operation of existing road network
- Fishing activities
- ATV and snowmobile use.

The dam at the south end of Robertson Lake has likely changed fish populations, in particular by reducing the habitat available for migratory species such as Atlantic salmon, that tend to require the habitat provided by larger streams.

The Canaport LNG emergency access road and the Brunswick Pipeline projects are both linear projects that cross fish-bearing watercourses. The Report notes that these projects were required to comply with legislation requiring the proponent to conduct a project specific EIA and provide appropriate mitigation measures. No substantive environmental effects are known to have resulted from these projects.

Aquaculture operations, specifically those for Atlantic salmon, exist currently in the Bay of Fundy, although there are no sites proximal to the Mispec River estuary. Department of Fisheries and Oceans Canada (DFO) has identified the spread of disease and competition from escapees from aquaculture operations as contributing to the collapse of the inner Bay of Fundy Atlantic salmon stock. This may contribute to cumulative environmental effects on remaining salmon stocks, and the ability of the Mispec River to recover from previous cumulative environmental effects related to dams and past habitat degradation.

The operation of the existing road network has the potential to affect the Freshwater Aquatic Environment, primarily through the potential release of deleterious substances into fish-bearing watercourses via contaminated surface water run-off.

Fishing, ATV, and snowmobile use are all recreational activities. Fishing has the potential to affect the Freshwater Aquatic Environment through the direct mortality of recreational fish species (*i.e.,* brook trout). ATV and snowmobile use have the potential to affect the Freshwater Aquatic Environment through the use of inappropriate crossing points over fish-bearing watercourses, which has potential to cause harmful alteration, disruption or destruction (HADD) of fish habitat and direct mortality of fish.

Project Case The Project would involve construction and operation of facilities which have the potential to interact with the Freshwater Aquatic Environment through erosion and sedimentation of watercourses and loss of drainage area. Other projects occurring in the same watersheds, such as the Brunswick Pipeline Project, also have the potential for interaction. Well established and proven erosion and sedimentation mitigation measures would be available to address these interactions. The potential environmental effects from loss of drainage area have been demonstrated to be not significant, when the habitat requirements for fish species present in the area are considered, in combination with proposed mitigation measures.

Existing conditions currently supportive of fish populations would be maintained throughout Project development. The habitat important to Atlantic salmon and other species would continue to remain viable and unaffected.

Future Case Environmental effects from reasonable foreseeable projects (Future Case) include those future projects, activities or actions that will occur with certainty, including projects that are in some form of regulatory approval process or have made a public announcement to seek regulatory approvals. For the purpose of this assessment, the Future Case includes the following projects and activities:

- Irving Oil Projects in the Saint John/Mispec Area
- Potential Wind Energy Projects
- Residential Subdivisions.

Though no projects are currently being considered/planned in the Mispec area, potential future Irving Oil projects in the Mispec Area could interact with the Project's environmental effects on the Freshwater Aquatic Environment, through construction and operation of additional linear facilities across fish-bearing watercourses and, potentially, an additional loss of drainage area in fish-bearing watercourse watersheds.

Potential wind energy projects would also require the construction of linear facilities (*e.g.,* roads, transmission lines). Residential subdivision developments, depending on their location, might also result in removal of drainage area from fish-bearing watercourse watersheds and would also require the construction of linear facilities (*e.g.,* roads, water mains).

The environmental effects mechanisms for the Future Case are similar to those for the Base Case and Project Case for linear facility construction and operation. The removal of drainage area as a result of Future Case projects would also have potential to contribute to a cumulative environmental effect on fish populations.

However, such future projects would be undertaken under appropriate regulatory and planning processes, and unauthorized fish and fish habitat environmental effects would not be permitted. Thus, the cumulative environmental effects in the Future Case were rated not significant.

Mitigation of Cumulative Environmental Effect for Change in Fish Populations

The Report notes that Mitigation measures for the Project Case are provided in Sections 10.3.1,

and 10.4.1. It states that the mitigation measures proposed for the Project-related environmental effects would also be anticipated to be effective in mitigating any cumulative environmental effects.

No projects are currently being considered/planned within the LAA and, thus, no further loss of drainage area, would be expected. The mitigation measures proposed in Section 10.4.1, if required, would be anticipated to be effective in mitigating any cumulative environmental effects from a loss in drainage area.

No additional mitigation measures would be required to address potential cumulative environmental effects on the Freshwater Aquatic Environment beyond those proposed for the Project.

Future projects will be required by the EIA Regulation and/or CEAA, if triggers are present, to conduct a project specific environmental assessment that will address future potential environmental effects at that time. Existing conditions currently supportive of fish populations would be maintained throughout Project development and the development of future projects.

Characterization of Residual Cumulative Environmental Effects for Change in Fish Populations

Potential residual cumulative environmental effects, resulting from the combination of the Base Case and Project Case on fish populations in the LAA and RAA, would primarily consist of those related to operation of the existing road network, construction and operation of additional linear facilities (*e.g.,* roads, pipelines) and refinery components for the Project, which could result in erosion and sedimentation, as well as loss of drainage area in fish-bearing watercourse watersheds. The interactions of these activities with the Freshwater Aquatic Environment would have potential, if unmitigated, to affect fish populations.

However, given the existence of well established and proven mitigation measures and techniques already presented to address the activities listed above, no residual cumulative environmental effects on fish populations would be anticipated. In particular, the ability of the Mispec River system to support Atlantic salmon would not be affected.

Determination of Significance

The sections below discuss the significance of the residual Project environmental effects, residual cumulative environmental effects, and proposed follow-up and monitoring for these environmental effects.

Residual Project Environmental Effects

The important potential residual environmental effect from the Project on the Freshwater Aquatic Environment would be a Change in Fish Populations, as a result of the loss of drainage area. Well established and proven mitigation measures are available for other activities and interactions described previously. Therefore, no residual environmental effect would be anticipated from these other activities (*e.g.,* linear facility construction, road operation).

Loss of drainage area was also determined to be not significant and would not be expected to change fish populations in the LAA or RAA. With the proposed mitigation and environmental protection measures, the residual environmental effect of a Change in Fish Populations on the Freshwater Aquatic Environment, during all phases of the Project, was rated not significant. This conclusion was determined with a high level of confidence.

Residual Cumulative Environmental Effects

The characterization of the potential cumulative environmental effects and associated mechanisms, combined with the proposed mitigation measures proposed earlier, demonstrated that the residual cumulative environmental effect of a Change in Fish Populations as a result of past, present and reasonably foreseeable projects and activities, in combination with the environmental effect of the Project during all phases, was rated not significant. This determination was made with a high level of confidence.

Additionally, the proposed mitigation measures demonstrate that the Project contribution to a cumulative environmental effect on fish populations in the Freshwater Aquatic Environment would be rated not significant. This determination was made with a high level of confidence.

Follow-up and Monitoring

Follow-up and monitoring programs would be implemented for the Freshwater Aquatic Environment as presented in Table 10.5. Follow-up and monitoring programs would consist of the following, in response to loss of drainage area being identified as the most important environmental effect mechanism.

- Monitoring of stream flow, dissolved oxygen (DO), total suspended solids (TSS) and water temperature in the Mispec River and tributaries where drainage area had been changed, with a focus on wetted perimeters and minimum flows. Bean Brook and Calvert Lake would also be included in this monitoring program. Additional baseline data for these parameters would be collected prior to Construction and sampling sites determined, based on fish-bearing watersheds that would experience Project-related drainage area loss.

Summary

The environmental effect of the Project on the Freshwater Aquatic Environment has been shown to be not significant, as a result of careful Project design and planning, in combination with the existence and application of well established and proven mitigation measures and techniques. The Freshwater Aquatic Environment in the LAA and RAA would continue to support fish populations throughout Project development, including Atlantic salmon in the Mispec River.

The cumulative environmental effect of the Project, in combination with past and future projects and activities in the LAA and RAA, has also been shown to be not significant. Mitigation measures implemented during Project development would be effective at mitigating cumulative environmental effects from the Project.

Future projects would be required to implement similar mitigation measures and perform project specific environmental assessments to investigate potential environmental effects, including cumulative environmental effects, on the Freshwater Aquatic Environment.

Follow-up and monitoring would focus on in-stream flows in watersheds in the LAA that would experience a loss of drainage area from Project development. Stream flow, dissolved oxygen (DO), Total Suspended Solids (TSS), and water temperature would be monitored at select sites prior to Construction, as part of the program.