Revised Environmental Impact Statement

Atlantic Gold Corporation
Beaver Dam Mine Project

February 2019

PRESENTED TO
THE CANADIAN ENVIRONMENTAL ASSESSMENT AGENCY
and NOVA SCOTIA ENVIRONMENT

ATLANTIC GOLD

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February 28, 2019

Canadian Environmental Assessment Agency
Suite 200, 1801 Hollis Street
Halifax, NS 63J 3N4

Environmental Assessment Branch
Nova Scotia Environment
Suite 2085, 1903 Barrington Street
PO Box 442, Halifax, NS B3J 2P8

To Whom It May Concern,

Atlantic Gold is pleased to continue to move forward the Environmental Assessment of its proposed Beaver Dam Mine Project.

Please find enclosed the **Information Responses (CEAA Round 1: Part 1 and Part 2, and NSE Round 1) and associated revised Environmental Impact Statement (EIS)** as per the *Canadian Environmental Assessment Act, 2012* and the Environmental Assessment Registration Document (EARD) as per Nova Scotia *Environmental Assessment Regulations*.

The undersigned has signing authority and submits the contents of the Information Responses as per the federal and provincial environmental assessment processes.

Any correspondence regarding the Environmental Assessment should be directed to the undersigned, James Millard, at 902-403-1337 or jmillard@atlanticgoldcorporation.com.

Sincerely,
<Original signed by>

James Millard
Manager Environment and Permitting
Atlantic Gold Corporation

cc. Maryse Belanger; Alastair Tiver (AGC)
Meghan Milloy (MEL)

Concordance Table and EIS Readers Guide:

The Revised Beaver Dam Mine Project EIS has been submitted to CEAA in response to Information Requests (IR) from the original Beaver Dam Mine Project EIS submitted in June 2017. IR responses can be found within the concordance table below or/and within the document as referenced within the concordance table. The concordance table also outlines the IR reference number, EIS reference section, and the Proponent's requirements for responding to the IR.

In order to distinguish differences between the original Beaver Dam Mine Project EIS (June 2017) and the Revised Beaver Dam Mine Site EIS, new text has been highlighted in greyscale (example) and text omitted has been struck through (~~example~~). Differences between the documents are a result of in-document responses to IRs, micro-siting of Project infrastructure, changes to the boundary of the Beaver Dam Mine Site component of the Project Area, and the inclusion of information pertaining to quantitative modelling efforts and associated technical reports and analysis of effects.

If minor modifications were required within tables, those changes are highlighted in greyscale. If larger scale changes were required to tables, the tables were replaced. This is indicated by tables that have titles highlighted in greyscale. This applies to all Valued Component (VC) mitigation tables and VC residual effects tables, along with subsections and tables for the Preferred Alternative Haul Road.

Information pertaining to monitoring, previously located within each VCs mitigation and monitoring section, has been removed from the Revised Beaver Dam Mine Project EIS and is evaluated within the Preliminary Environmental Effects Monitoring Plan (EEM) found in Appendix O.1.

Due to the substantive changes, the following sections have been completely replaced (with no strikethrough/greyscale in the printed versions, electronic versions have been greyscaled):

- 2.0 Project Description
- 6.2 Air
- 6.6 Groundwater Quality and Quantity
- 6.7 Surface Water Quality and Quantity
- 6.14 Indigenous Peoples
- 8.0 Cumulative Effects Assessment
- 9.0 Environmental Impact Statement Summary and Conclusions
- 10.0 Summary

All figures have been updated to illustrate the new Beaver Dam Mine Site infrastructure layout and PA boundaries. Additional (new) figures and appendices within the Revised Beaver Dam Mine Project EIS have been highlighted in greyscale in the Table of Contents.

Table 1-1 Information Request Concordance Table

Reference IR Number	EIS Reference	The Proponent is Required to:	Revised EIS Reference
CEAA 1-1	Section 2 Project Description, Section 6.11 Indigenous Peoples	Provide a model or virtual representation of the Project area (before construction, during operation, decommissioning and post reclamation) to better understand the visual impact of the Project. Provide topographic mapping to demonstrate that cited topographic ridges block views from nearest residences and close land-users.	Section 6.14.6 Section 6.16.4 Figures 6.16-2, 6.16-3, 6.16-4, 6.16-5
CEAA 1-2	Section 2.1.1 and Section 6.8.6	Provide an estimated existing traffic volume on Highway 224 and project haul roads. Provide the anticipated traffic volume on Highway 224 and haul roads for project related traffic. Provide a worst-case scenario for traffic volumes, in consideration of potential cumulative effects if reasonably foreseeable projects become active. Provide direct and cumulative effects assessment of increased traffic volumes on applicable valued components such as Indigenous current use, Indigenous health and socio-economic conditions. Provide mitigation measures for direct and cumulative effects that will reduce or eliminate impacts from increased traffic volumes. Provide an estimated existing traffic volume on Highway 224 and project haul roads.	Section 2.3.2.2 Section 6.14.6 Section 6.16.3.7 Section 8.5.7.2.3 The worst-case scenario for traffic volumes, in consideration of potential cumulative effects (if the reasonably foreseeable projects in the area become active), would be the increase in the number of haul trucks on the Haul Road during the operational phase of the Fifteen Mile Stream Gold Project (2021 to 2026) and Cochrane Hill Gold Project (2022 to 2027). Those projects indicate that an additional 6 return-trip haul trucks (per project), carrying gold concentrate, would travel from their prospective locations to Sheet Harbour, along Highway 224 to the Haul Road to the Touquoy Mine Site. Although an additional 12 trucks on Highway 224 remains within the variability of the highway counts, it will add an additional load to the Haul Road between Highway 224 and Mooseland Road. Maintenance vehicles may also increase along the corridor to Sheet Harbour but the small counts added to the existing traffic from Sheet Harbour to the prospective mines would be within the variability of traffic counts reviewed.
CEAA 1-3	Throughout	Define the life of the Touquoy mine with respect to the continuation of monitoring.	Section 2.3.3.3 Section 2.5
CEAA 1-4	Section 2.2.1.6 Project Components - Water Management and Section 2.3.2.4 Project Activities - Existing Environmental Mitigation and Monitoring Requirements Associated with Operations	Provide clarity and additional information on the use (including transport, storage and handling) for planned and potential reagents. Including, but not limited to; a. Provide information on the type and volume of reagents, including flocculants, which may be used for the duration of the Beaver Dam Mine Project. If reagent use is unknown at this time, outline the conditions under which they may be required and what will be considered during their selection. For example, state under what conditions the proponent would be required to use reagents for dust suppression and what these potential reagents might be. b. Provide details on the location and storage of all reagents, including flocculants and cyanide.	Section 2.2.1.6 Appendix G.7 Beaver Dam Conceptual Treatment Approach
CEAA 1-5	Section 2.6 Alternative Means of Carrying out the Project	Provide an alternative means analysis for the disposal of Beaver Dam tailings or provide a rationale as to why it was not included. Alternatives considered should include, but not be limited to: • the proposed disposal of tailings in the Touquoy open pit (including why storage of tailings in the Touquoy open pit was the preferred option) • the use or an expansion of the Touquoy tailings management facility; and • creation of a new Beaver Dam tailings management facility/storage areas.	Section 2.6.10.2
CEAA 1-6	Section 5.4.2 Spatial Boundaries, Throughout	Provide a clear and consistent definition of the Project Area that includes the spatial extent of all proposed activities for the Beaver Dam Mine Project. As applicable, update the baseline and effects assessment for each valued component throughout the EIS or, provide the Agency rationale as to why excluding activities at the Touquoy site is appropriate. As per the example provided in the context of this IR for fish and fish habitat, incorporate the baseline information for fish and fish habitat at the Touquoy mine site into the direct effects assessment. Clarify the project area identified as the Touquoy processing and tailings management facility and whether it includes the tailings management facility.	Section 5.4.2 Spatial Boundaries Spatial Boundaries, including Project Area, have been updated with a corresponding figure, and described in Table 5.4-1 as well as their corresponding subsection within Section 6 of this EIS.
CEAA 1-7	Section 5.4.2 Spatial Boundaries, Throughout	Clearly define and rationalize the spatial boundaries for the Local Assessment Area considered for each Valued Component. Provide a Figure that illustrates the Local Assessment Area for each Valued Component.	Section 5.4.2 Spatial Boundaries Spatial Boundaries, including Local Assessment Area, have been updated with a corresponding figure and vary for each VC and are described in Table 5.4-1 as well as their corresponding subsection within Section 6 of this EIS.
CEAA 1-8	Section 5.4.2 Spatial	Clearly define and rationalize the spatial boundaries for the Regional Assessment Area considered for each	Section 5.4.2 Spatial Boundaries

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	Boundaries, Throughout	Valued Component (for both direct and cumulative effects). For example: • Ensure that statements such as “immediately adjacent to the project area” are described. • Ensure that statements such as “wider scale” and areas “directly impacted by the project” are described. Provide a Figure that illustrates the Regional Assessment Area for each Valued Component.	Spatial Boundaries, including Regional Assessment Area, have been updated with a corresponding figure and vary for each VC and are described in Table 5.4-1 as well as their corresponding subsection within Section 6 of this EIS
CEAA 1-9	throughout	Review the proposed mitigation measures in relation to all valued components and provide updated lists of mitigation measures that are specific, achievable, measurable and verifiable, and described in a manner that avoids ambiguity in intent, interpretation and implementation. For example in the EIS: a. Section 6.1.7.1 Atmospheric Environment; clarify when mitigation measures will be applied, and what would be the triggers for dust suppression (e.g. complaints from public and/or First Nations, results from dust monitoring, number of days without rain, etc.). b. Section 6.1.7.3 Noise Emissions, states that “mitigation will be implemented as necessary where sound levels are of concern.” Describe the mitigation options and what would be the specific triggers for action. c. Section 6.3.7.1 Surface Water Quality, states that “mitigation measures will be employed at Touquoy as per existing approvals.” Given that tailings are now being disposed of at the Touquoy pit, describe what additional mitigations are necessary, e.g. for the treatment facility, pump back wells, grouting or lining of possible faults, berms, and emergency procedures in the evident of accidents. d. Section 6.6.7 Fish and Fish Habitat, include such items as: o The size of riparian buffers to protect fish habitat; o Measures to maintain existing vegetation cover, e.g. designated travel routes, buffers around infrastructure; and o How fish habitat will be avoided where possible, e.g. o setbacks/buffers. e. For fish and wildlife, provide further information on standard construction methods and mitigation techniques that reduce impacts to these populations and their habitats, particularly for haul road upgrades and the new 4km section. f. From an indigenous perspective, the MEKS considers the impact of the potential loss of habitat around wetlands and lakes to be significant, yet there is little information as to what the plans for compensation of these habitats are. Provide summary information on planned compensation projects for loss of wetlands and fish habitats. g. Section 6.11.7 Indigenous People, includes no specific measures identified to reduce impacts on recreation or subsistence activities by indigenous people in the area surrounding the project sites and haul road in relation air quality, noise, lighting, or drinking water sources. For example, give consideration to timing and location of project activities, buffer zones around known drinking water locations, and measures to avoid visual impacts. Update analysis and determinations of significance, as required, based on revised mitigation measures.	See updated effects assessment and mitigation sections for each VC in Section 6 (Sections 6.1 to 6.16). Appendix H.3 Preliminary Wetland Compensation Plan
CEAA 1-10	Throughout Section 9 Summary of Compliance and Effects Monitoring Programs	Provide an updated follow-up program for the Project and update corresponding sections throughout the EIS accordingly. For example in the EIS: a. Specifically, for section 6.1.7 Atmospheric Environment, Mitigation and Monitoring, identify the objectives of the follow-up programs and what the triggers will be for further mitigations and corrective action (e.g. complaints from public/Indigenous groups, effects are elevated beyond impact predictions, etc.) Specify what additional mitigation options would be available	Appendix O.1 Preliminary Environmental Effects Monitoring Plan See updated mitigation sections for each VC in Section 6 (Sections 6.1 to 6.16)

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		b. For section 6.3.7 Surface Water Quality, Mitigation and Follow-up /state the proposed locations of sites to monitor environmental effects of the project at the Beaver Dam site. Also, include whether there are any changes to monitoring locations and programs required at the Touquoy Mine site, given that tailings will now be disposed of at this site. Describe the triggers for corrective action should monitoring reveal effects different to those predicted and what options would be available, e.g. in-situ treatment water, treatment plants, etc. c. For section 6.11.7 Indigenous People, include follow-up related to the effects of the project on recreational and subsistence use (e.g. noise, dust, light, wildlife disturbance). Describe the triggers/thresholds for corrective action and any adaptive management options. Include any planned involvement of Indigenous groups in the follow-up program. d. For sections 6.10.7 Species of Conservation Interest, state the objectives and how they will be achieved of the Moose Management and Monitoring Program that is proposed to be implemented during preconstruction, and throughout operation of the Project. Include any planned involvement of Indigenous groups in the Moose Management and Monitoring Program. Provide summary details of this follow-up and management program for moose. e. For section 6.2.7 Geology, Soils and Sediment, state the objectives of the proposed monitoring program "that will conduct annual sampling at select baseline sediment locations for metals suite done for baseline and regular testing of rock for acid generating potential at a rate to be determined by NSE, anticipated to be no less than 1 sample per 100,000 tonnes of rock generated." Include a description of how the information will be used, and what the thresholds are for segregation of rock with different acid rock drainage and metal leaching potential. Describe what contingency plans and mitigation options are available should predictions regarding acid generating and metal leaching potential of rock proves inaccurate, i.e. management and storage of waste rock, and prevention of acid rock drainage and metal leaching.	
CEAA 1-11	Section 5.10 Residual Effects and Determination of Significance and throughout	Expand upon the criteria definitions provided in table 5.10-1 to include, where possible, quantitative and qualitative definitions. For example, provide definitions of terms such as "natural variability" and "population viability". Update the assessment of each valued component as appropriate. Explain how the existing definitions of criteria are appropriate for effects to valued components such as current use and health and socio-economic or provide rationale why the criteria defined in table 5.10-1 is applicable for all valued components.	Section 5.10 and throughout Section 6 within Residual Effects of each VC (Sections 6.1 to 6.16)
CEAA 1-12	Section 5.10 Residual Effects and Determination of Significance and throughout	Include a consideration of timing as a criterion for the determination of significance of residual effects of all valued components or provide a rationale as to why it was not included. Ensure that the criterion is fully defined and rationalized. Update the effects assessment for each valued component as appropriate.	Section 5.10 and throughout Section 6 within Residual Effects of each VC (Sections 6.1 to 6.16)
CEAA 1-13	Section 5.10 Residual Effects and Determination of Significance and throughout	Provide an explanation of how the ecological context was taken into account in the assessment of significance for each Valued Component. Update the effects assessment for each valued component as appropriate.	Section 5.10 and throughout Section 6 within Residual Effects of each VC (Sections 6.1 to 6.16)
CEAA 1-14	Throughout	Provide an analysis to support each significance determination within the EIS so that the reviewer understands how the conclusions were made.	Throughout Section 6 within Thresholds for Determination of Significance and Residual Effects of each VC (Sections 6.1 to 6.16) Section 6.1.5.2 Section 6.2.4.4 Section 6.3.5.2 Section 6.4.5.2 Section 6.5.5.2

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Reference IR Number	EIS Reference	The Proponent is Required to:	Revised EIS Reference
			Section 6.6.5.4 Section 6.7.5.5 Section 6.8.5.3 Section 6.9.5.2 Section 6.10.5.2 Section 6.11.5.2 Section 6.13.5.2 Section 6.14.5.2 Section 6.15.5.2 Section 6.16.6.2
CEAA 1-15	Section 8.2.4 Identification, selection and Description of projects in the Area Past, Present and Future Physical Activities, Section 4.4 Presentation and organization of the EIS	Confirm that the 35 km radius extends from the complete Beaver Dam Mine Project area (including the Beaver Dam mine site, the haul road and the Touquoy mine site) and not just the Beaver Dam mine site. Provide a rationale for why a 35 km radius was deemed sufficient for the cumulative effects analysis. If it is determined that the 35 km radius needs to be modified, update the list of projects in the area as required. Provide further detail on other projects considered for the cumulative effects analysis to allow potential environmental effects to be characterized. For example, provide a figure, for clarity, showing all of the projects in the area that were considered in the cumulative effects analysis.	Section 8.3.1 Section 8.4.3 Figure 8.4-1
CEAA 1-16	Section 8 Cumulative Effects Assessment	Provide a rationale for why Cochrane Hill and Fifteen Mile Stream Project are excluded from the cumulative effects assessment if they may be using Touquoy facilities. As applicable, include project information on Cochrane Hill and Fifteen Mile Stream Projects and update the cumulative effects assessment. If there is a potential for these foreseeable projects to use the Touquoy site, provide anticipated project activities at the Touquoy site associated with these projects, e.g. traffic routing and traffic volumes, as well as plans for tailings management.	Cochrane Hill and Fifteen Mile Stream projects have been added to the cumulative effects assessment Section 8.4.3.3
CEAA 1-17		Provide the criteria definitions for characterizing residual effects in the cumulative effects analysis or provide rationale as to why the criteria outlined in Table 5.10-1 for direct effects are applicable to cumulative effects. Provide the analysis of how significance was determined for each valued component considered in the cumulative effects assessment and what rationale supports the conclusions reached.	Section 8.3.2.4 Section 5, Table 5.10-1 Given that the direct effects of the Project and the cumulative effects with other projects can be expected to be of a similar type, we consider it preferable to use the same characterization criteria (those outlined in Table 5.10-1) for both the direct and cumulative assessments. In addition, using the same criteria makes it easier to communicate the relative contribution of the Project to the cumulative effects.
CEAA 1-18	Section 8.5.5.1 Cumulative Impacts to Fish Habitat, and Section 8.5.9.1.4 Cumulative Effects to Species of Conservation Concern	Clearly identify the sources of uncertainty (where they exist) with respect to potential cumulative effects resulting from the Project (e.g. on fish and fish habitat and species of conservation concern). Provide, where possible, mechanisms to address areas of uncertainty, i.e. mitigation and/or follow-up. Include information on how the proponent proposes that follow-up programs will be designed to address the uncertainty in identifying potential cumulative effects and what adaptive management options are proposed.	Section 8.5.1.5 Section 8.5.2.5 Section 8.5.3.5 Section 8.5.4.5 Section 8.5.5.5 Section 8.5.6.5 Section 8.5.7.5
CEAA 1-19	Appendix E	Provide a 3D groundwater numerical model for the Beaver Dam open pit to provide information on issues such as groundwater dynamics, recharge areas, seepage, drawdown, transport, etc. Ensure all referenced figures are provided. Provide a 3D groundwater numerical model for the Touquoy Mine site to provide information on issues such as groundwater dynamics, recharge areas, seepage, drawdown, transport, etc. Update the environmental effects analysis provided in the EIS based on the 3D model results, where appropriate.	Section 6.6 Appendix F.5 Beaver Dam Hydrogeological Model Development and Application Appendix F.6 Groundwater Flow and Solute Transport Modelling to Evaluate Disposal of Beaver Dam Tailings in Touquoy Open Pit – Beaver Dam Gold Project
CEAA 1-20	Appendix E	Present the lateral and vertical extent of the Mud Lake Fault Zone in the hydrogeological study and assess its	Section 6.6.6.1

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Reference IR Number	EIS Reference	The Proponent is Required to:	Revised EIS Reference
		impacts using the 3D groundwater numerical model at the Beaver Dam Mine site.	Appendix F.5 Beaver Dam Hydrogeological Model Development and Application
CEAA 1-21	Section 6.2 Geology, Soil and Sediment Quality	Demonstrate how the information requirements outlined in sections 3.2.2, 6.1.2 and 6.2.2 of the EIS Guidelines has been included in the EIS or provide a rationale as to why the information has not been included. The rationale should be clearly substantiated by geochemical and mineralogical information and analysis. Reference the manual produced by the MEND Program, entitled, MEND Report 1.20.1, "Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials", Version 0 - December 2009 for use in acid rock drainage and metal leaching prediction.	Characterization and management of ore, waste rock, low grade ore, overburden, and tailings are described in Section 2 (Project Description) and Section 6.5. Section 6.6.6 and Section 6.7.6 Appendix E.2 Beaver Dam Project - ML/ARD Assessment Report Appendix E.3 Beaver Dam Project - Geochemical Source Term Predictions for Waste Rock, Low-Grade Ore, Tailings and Overburden Appendix F.5 Beaver Dam Hydrogeological Model Development and Application Appendix F.6 Groundwater Flow and Solute Transport Modelling to Evaluate Disposal of Beaver Dam Tailings in Touquoy Open Pit – Beaver Dam Gold Project Appendix G.2 Touquoy Integrated Water and Tailings Management Plan Appendix G.3 Predictive Water Quality Assessment Appendix G.4 Evaluation of Potential for Aquatic Effects as a Result of Effluent Releases Related to Beaver Dam Mine Appendix G.5 Beaver Dam Mine Site – Water Balance Analysis Appendix G.6 Assimilative Capacity Study of Moose River. Touquoy Open Pit Discharge
CEAA 1-22	Section 2.3.3.2 Conceptual Reclamation Plan	Provide additional description or explanation of the proposed remediation of ore stockpiles.	Section 2.3.3.2
CEAA 1-23	Section 5.7 Anticipated Project-Environmental Interaction	Clarify whether groundwater quality and quantity will interact with project activities related to general waste management (during both operation and maintenance and decommissioning and reclamation phases of the project), or provide a valid rationale for their exclusion.	Groundwater quality and quantity interactions with General Waste Management during operation and maintenance (referred to as Operation in the revised EIS) and decommissioning and reclamation (referred to as Closure in the revised EIS) are not anticipated. General Waste Management refers to the generation, management, storage and disposal of domestic types wastes and materials past service life generated through equipment use. All of these materials will be managed in accordance with provincial regulation including the handling, storage and disposal off-site as licensed facilities. There are therefore no anticipated interactions. Related "waste" interactions have been discussed relative to groundwater for waste rock in the Groundwater Section and in the Accidents and Malfunctions Section for specific scenarios but these differ greatly with general waste management for the reasons noted previously.
CEAA 1-24	Section 6.2.3.2.1 Soils and Sediment (under baseline conditions)	Provide a justification with any available chemical data to support the statement that existing topsoil and overburden are considered suitable for use in the rehabilitation of disturbed areas.	Section 6.5.3.2 In general: • If plant material/vegetation grew on the overburden and topsoil before, it is assumed that it will grow on the area post reclamation, as it is the same material. • Soil will be amended with the overburden when required to encourage revegetation. • Review of other quarry projects reclamation stage indicates that broad general statements are given regarding the use of overburden/topsoil and revegetation of the area. Many projects stabilized the stockpiles via seeding, and used incremental replacement of overburden/topsoil and revegetation to facilitate the reclamation/rehabilitation process. Soils mapping completed by Agriculture Canada (AgCan) (Report No. 13, Nova Scotia Soil Survey) by J.I MacDougall and D.B Cann. 1963 was reviewed to determine the existing soils suitability for use in rehabilitation activities for final cover. Soils with agricultural capabilities are important to promote revegetation of areas disturbed by the mine development. Within the areas slated for disturbance for mine development at the Beaver Dam Mine Site there are there are five mapped soil types according to the aforementioned report. The Proponent has committed to salvage of the vegetation (organics, root mat, leaf debris, and decaying tree matter) overlying the soils noted as well, which, based on site observations, averages 30 centimetres depth. NS Energy and Mines promotes rehabilitation plans that create surfaces that are heterogeneous creating opportunities for a variety of plant and animal species to occupy reclaimed lands. This is important to note as it reinforces the idea that materials including rocks of various sizes are useful on the reclaimed surfaces as well as

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			salvaged vegetation noted above and larger organic items such as full trees and tree stumps that may be available from within the disturbed footprint. Stated objectives of the reclamation of areas disturbed at the Beaver Dam Mine include returning the areas to pre-existing uses such as forest (in varying stages of regrowth) along with recreational opportunities. Based on the inventory of available materials and their characteristics, AGC is confident that reclamation of the site can occur through the use of materials currently on-site.
CEAA 1-25	Section 6.2.3.4 Bedrock Geology	Update the frequency of ARD/ML analysis and provide a rationale for the number of tonnes of rock and the analysis. Provide a description, of the information provided in Table 6.2-3.	Section 6.5.3.4
CEAA 1-26	Section 6.3.1 Rationale for Valued Component Selection	Provide existing evidence, with rationale, to support the statement that the potential disconnection between bedrock groundwater aquifers and surface water in the area limits the potential for contaminant transport from surface to groundwater.	Section 6.7.1 This reference has been removed. Predictive modelling has been completed to evaluate potential connection between surface and groundwater
CEAA 1-27	Section 6.3.2.3 Surface Water Quantity	Provide clarification of which impermeable surfaces are being referred to in the statement of "a water balance for the Beaver Dam mine site was calculated to determine the amount of surface water runoff currently created given minimal impermeable surfaces in order to compare it against the amount of water surplus generated from an increase in impermeable surfaces as a result of the Project."	Impermeable surfaces expected on the Beaver Dam mine site include the haul road and crusher pad. All other mine features will have significant infiltration as discussed in Appendix G.4 Beaver Dam Mine Site – Water Balance Analysis Infiltration rates for the Beaver Dam stockpiles are based on measured values from the Touquoy mine site stockpiles.
CEAA 1-28	Section 6.3.3.2 Surface Water Quality	Provide an explanation for the large difference between the field pH measurements and the laboratory pH measurements for surface water results.	Field pH values will generally be higher or lower than laboratory pH values by as much as +/- 1 pH unit or more. Temperature may be a factor, with lower pH associated with higher temperatures and vice versa than when pH values are measured in the field. However, field values are commonly lower than laboratory values because collection, transport, and or storage causes a release of dissolved carbon dioxide from the water into the head space of the sample and a release to the atmosphere when the sample is opened (Pyne 1994) Latysh and Gordon's (2002) study investigating pH difference in precipitation water measured in the field and lab show s that in post 1994 data, the laboratory pH values were higher for 67% of all samples. Other literature indicates that laboratory pH is, ideally, slightly lower than field measurements of pH (McKean & Huggins, 1989). But his predates the 1994 change in laboratory procedures to eliminate differences in the pH measurement through improved sample collection and testing methods. Factors including temperature and exposure to atmospheric CO2 influence pH after sampling. Where the pH data in the EIS generally shows field pH to be lower than laboratory pH, a reassessment of the data may not be necessary.
CEAA 1-29	Section 6.3.2.1 Project Watershed Locations, Section 6.3.2.2. Surface Water Quality	Provide monitoring data for the two unnamed lakes (which appear in figures 6.3-1 and 6.3-2), Crusher Lake, Tent Lake and Kent Lake.Or Provide a rationale as to why surface water quality data from the surface water resources are not required to understand the proposed projects and its potential effects.	Section 6.7.3.2.1 Kent Lake especially is upstream of the water flow direction in an adjacent watershed. Kent may be hydraulically connected up stream by the wetlands in the headwaters. Both lakes drain to the West River Sheet Harbour. Kent Lake would provide no useful data relating to baseline conditions for the Project.
CEAA 1-30	General	Provide information on the dam at Crusher Lake, whether it still exists and its location. If present, provide an assessment of the ability of migratory fish species to pass this structure in either direction. If the dam is still present, provide an assessment of the ability of migratory fish species to pass this structure in either direction.	The dam at Crusher Lake is still present on the north side of the eastern end of the lake, but it is has been fully naturalized over time and would not be identifiable if not for the elevation change when approaching from the north. It is a solid earth barrier holding water above its original elevation, but it does not impede fish passage. There is direct connection between WC 5 and Crusher Lake where the water over time has made its way around or eroded the earth barrier to create that connection. Some fish passage may be impeded by the slope of this connection, but fish are still entering the lake as evidenced by fish captured in Crusher Lake. Brook Trout were not caught in Crusher Lake, but are expected to be able to pass from WC 5, where they were identified, into Crusher Lake via the connection.
CEAA 1-31	Section 6.6.2 Fish Habitat Assessment	Determine the potential for other commercial, recreational and Aboriginal fisheries species to be present in areas where project effects may occur.	Section 6.9.3.1

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Reference IR Number	EIS Reference	The Proponent is Required to:	Revised EIS Reference
		Provide an updated assessment for fish and fish habitat that considers potential environmental effects on commercial, recreational and Aboriginal fisheries species other than salmonids. Provide information on any downstream barriers in the project area that may obstruct migratory species, such as Sea-run trout, from reaching potential habitat.	
CEAA 1-32	Section 2.1 Project Location and History Section 2.3.2.2 Haul Road Section 6.1.2 Baseline Methodology Program Section 6.1.5.1 Boundaries Section 6.1.6.3.1 Beaver Dam Mine Site and Haul Road Figure 6.1-1	Evaluate the potential for elevated noise levels at the nearest human receptor location(s), which would include seasonal cabins/cottages as well as any areas used by Indigenous people that are closer to the site than Beaver Lake IR 17. Where values are predicted to approach or exceed provincial noise standards, additional mitigation measures should be considered (such as those presented in Appendix HI of Health Canada (2016)).	Section 6.1 Appendix B.1 Noise Impact Study Beaver Dam Mine Project
CEAA 1-33	Section 6.1 Atmospheric Environment	Provide baseline data on SOx, NOx, VOCs for local background air quality. Include a map of any Environment Canada air quality stations being proposed as surrogates for many of these baseline parameters for regional background air quality.	Section 6.2.2.4 Figure 6.2-2 Nearest Monitoring Stations to Beaver Dam Mine Project Site
CEAA 1-34	Section 6.1.6.1.2 Touquoy Processing Facility	Provide additional information to validate/justify the conclusion that there will be no adverse health impacts to Indigenous people who may use the area surrounding Beaver Dam Mine, the haul road and Touquoy Mine with respect to air quality as a result of project activities, taking into consideration all emission sources, including fugitive emissions from the open pit, unpaved haul roads, and storage pile erosion. If justification cannot be provided, update the air quality modelling to include all air emissions sources associated with the proposed Beaver Dam Gold Project.	Section 6.2 Appendix C.1 Air Dispersion Modelling and Air Emission Estimate Technical Memorandum Appendix C.2 Evaluation of Exposure Potential Related to Dust Deposition from Haul Road Traffic onto Soils, Berries, and Vegetation
CEAA 1-35	Section 6.1.6.1.2 Greenhouse Gas Emissions	Provide additional information to validate the conclusion that there will be no adverse health impacts to Indigenous people who may use the area surrounding Beaver Dam Mine, the haul road and Touquoy Mine with respect to air quality as a result of project activities, taking into consideration all emission sources, including fugitive emissions from the open pit, unpaved haul roads, and storage pile erosion.Provide justification for using the Touquoy Mine Focus Report to describe fugitive air emissions for the Beaver Dam Mine Project and potential associated health effects from activities at the Beaver Dam Mine, haul roads and Touquoy Mine; or conduct air modelling which includes all project activity sources.	Section 6.2 Appendix C.1 Air Dispersion Modelling and Air Emission Estimate Technical Memorandum Appendix C.2 Evaluation of Exposure Potential Related to Dust Deposition from Haul Road Traffic onto Soils, Berries, and Vegetation
CEAA 1-36	Section 6.1.6.1.2 - Touquoy Processing Facility (which cites the Touquoy Focus Report – Appendix L – Emission Summary and Dispersion Modelling Report) 6.1.7.1 Dust and Particulate Emissions 6.11.6 Project Activities and Indigenous Peoples Interactions and Effects	Evaluate the potential for dust deposition and subsequent consumption of vegetation (including consumption of metals in dusts) if plants are being harvested and consumed for traditional purposes by Indigenous peoples in areas where fugitive dust emissions may be a concern (e.g. near haul roads)	Section 6.2 Appendix C.1 Air Dispersion Modelling and Air Emission Estimate Technical Memorandum Appendix C.2 Evaluation of Exposure Potential Related to Dust Deposition from Haul Road Traffic onto Soils, Berries, and Vegetation
CEAA 1-37	Section 6.10 Species of Conservation Interest and Species at Risk; Section 8.5	Provide further detail on any potential adverse effects, e.g. loss of habitat, related to Project activities on each identified species at risk as well as cumulative effects. This analysis should also include effects resulting from accidental events and response.	Section 6.13 Tables 6.13-17, 6.13-18, 6.13-19, 6.13-20 Section 8.5.6

Table 1-1 Information Request Concordance Table

Reference IR Number	EIS Reference	The Proponent is Required to:	Revised EIS Reference
	Species of Conservation Interest and Species at Risk Cumulative Effects Assessment; Section 9.2 Environmental Monitoring Plan	Identify proposed mitigation measures that avoid/minimize potential adverse effects on these species, and plans to monitor the effectiveness of these mitigation measures. Describe how the proposed mitigation measures relate to Species at Risk Act-listed wildlife species and explain how these measures are consistent with any applicable recovery strategy and action plan.	
CEAA 1-38	Section 6.9 Birds	Provide: • mapping that identifies mature and interior forest habitat in relation to proposed project infrastructure, and a rationale for any patch of habitat that cannot be avoided; • an analysis of project impacts on mature and interior forest habitat for migratory birds and the species of migratory birds that use these habitats, taking into account cumulative losses; and • a plan that sets out appropriate mitigation measures for the predictable loss of mature and interior forest habitat for migratory birds in instances where the habitat cannot be avoided.	Section 6.10.2.5 Section 6.10.3.5 Section 6.12.7 Section 6.12.9 Figure 6.10-4 Interior Forest and Mature Forest Habitat Figure 6.10-5 Interior Forest and Mature Forest Habitat-Preferred Alternative Haul Road
CEAA 1-39	Section 6.10.3.7.10 Bird SAR and SOCI Summary; Section 9.2 Environmental Monitoring Plan	Clarify whether all observation locations for Greater Yellowlegs identified in Figures 6.10-2 to 6.10-2L consisted of birds observed/detected during the breeding season; and if not, identify which would consist of birds detected during the breeding season. Identify any instances where impact to habitat for breeding Greater Yellowlegs cannot be avoided, and why avoidance is not possible. Identify any other proposed mitigation to avoid this impact. In instances where breeding habitat would not be directly affected by the project but occurs near the project footprint, clarify whether a buffer would be established if Greater Yellowlegs nest near the project footprint.	Section 6.13.3.7.10 Section 6.13.6.4 Section 6.13.8.4
CEAA 1-40	Section 6.15.4 Accidents	Provide an analysis of the effects of potential fuel or other spill events on current use of land and resources by Indigenous people, including the potential for a worst-case scenario event. Provide mitigation and contingency planning, with priority given to areas of high importance by Indigenous people and how these would be protected in the event of a spill.	Section 6.18.4.2
CEAA 1-41	Section 6.11.2 Baseline Program Methodology, Appendix N Mi'kmaq Ecological Knowledge Study	a) Provide the 2005 Mi'kmaq Ecological Knowledge Study (MEKS) that was completed for the Touquoy Mine site, ensuring that all figures are included. Describe any changes to Mi'kmaq land and resource use since the Touquoy MEKS was written in 2005. b) Provide an updated figure showing current use by Indigenous people in the project area, including a clear legend. c) Clarify, based on the information provided in the MEKS, whether Indigenous people use the local and regional assessment areas of the Project, including along the existing and new sections of haul road.	Section 6.14 The 2005 MEKS for Touquoy is publicly available online in Appendix M of the Touquoy Environmental Assessment found here: https://www.novascotia.ca/nse/ea/MooseRiver/AppendixA.pdf Updated figures of current use are not included based on confidentiality agreement between Atlantic Gold Corporation and Millbrook First Nation. Evaluation of updated current use is included in Section 6.14
CEAA 1-42	Section 6.11.3.2 Current Mi'kmaq Land and Resource Use	Provide, in relation to Mi'kmaq use, further information on the location, type and timing of current use activities (including the consideration of natural resources used and the availability of these resources), within the project, local and regional assessment areas.	Section 6.14.3.2
CEAA 1-43	Sections 6.1.2 Baseline Program Methodology and Section 6.1.3.7 Ambient Light	Provide a predicted light assessment or light modelling for night-time conditions (including dusk and dawn) for the Beaver Dam Mine Project site and haul road to delineate the predicted change from pristine (or nearly pristine) conditions. Determine and provide a figure showing the extent of light effects from the Project. Or Provide a rationale for not conducting a light assessment for the Beaver Dam Mine Project that justifies how relying on the 2007 Touquoy light assessment is appropriate. At a minimum, the rationale should include: • A description of topographical similarities and differences between the Touquoy Mine site and the Beaver Mine site/haul road, • How effects of lighting from traffic activities are captured within the 2007 Focus Report, and • How the equipment used for the 2007 Focus Report is appropriate.	Section 6.3 Appendix D.1 Light Impact Assessment

Table 1-1 Information Request Concordance Table

Reference IR Number	EIS Reference	The Proponent is Required to:	Revised EIS Reference
CEAA 1-44	Section 6.3.3.3.1 Beaver Dam Mine Site	Provide the water balance calculations for the project area (i.e. Beaver Dam Mine, haul road and Touquoy Mine). Provide a Figure to indicate directional water flow before and after the Project. Update, if applicable, the assessment of direct and cumulative effects and provide any additional mitigation and follow-up for direct and cumulative effects based on the analysis required above.	Section 6.7.6 Section 8.5.2 Figure 6.7-15, 6.7-16 Appendix G.2 Touquoy Integrated Water and Tailings Management Plan Appendix G.5 Beaver Dam Mine Site – Water Balance Analysis
CEAA 1-45	Section 6.12 Physical and Cultural Heritage, Appendix O Archaeological Reconnaissance Reports and Nova Scotia Communities, Culture & Heritage Communications	Provide the 2017 archaeological assessment conducted by Cultural Resource Management Group for the new four kilometer section of haul route.	Section 6.15 Appendix N.4 Archaeological Assessment- Haul Road Option 2
CEAA 1-46	Section 6.11 Indigenous Peoples	Provide a list of non-confidential commitments from the benefits agreements for use in the environmental assessment.	Benefits discussions are on-going but at the time of submission of the revised EIS, not finalized.
CEAA 1-47	Section 6.11.6 Project Activities and Indigenous Peoples Interactions and Effects	Identify how the information presented during the proponent's Mi'kmaq Consultation efforts was used during the development of the effects assessment of the EIS; specifically in the development of mitigation measures, monitoring and follow-up. Provide information on mitigation measures that will address potential impacts from noise relative to Mi'kmaq use of the project area. Details should include, but not be limited to, information stating how the Mi'kmaq were/will be involved in developing these noise mitigation measures; as well as details of monitoring and adaptive management mechanisms relative to the effectiveness of the measures. Indicate whether the proponent will involve the Mi'kmaq in the implementation of mitigations, monitoring and adaptive management for other valued components for the proposed project.	Section 6.14.4 Section 6.14.6 Section 6.14.8
CEAA 1-48	6.11.5.2 Thresholds for Determination of Significance	Update the significance threshold for the determination of significance for Indigenous people. Or Provide a rationale for how the proponent concluded that potential effects to Indigenous people are not significant based on the threshold identified by the proponent in section 6.11.5.2 of the EIS.	Section 6.14.5.2
CEAA 1-49	Section 8.4 Identification of Projects in the Area	Include the Atlantic Salmon Conservation Centre's liming programs in the cumulative effects assessment or provide rationale for why the Atlantic Salmon Conservation Centre liming programs are excluded from the cumulative effects assessment. Include, as applicable, project information in the cumulative effects assessment; assess cumulative effects as a result of the Project to such things as fish and fish habitat, water quality and water quantity in relation to the liming programs. Include any mitigation measures proposed to mitigate adverse effects; and include any related follow-up and monitoring. Provide clear information on the location of lime dosers for example, provide locations in the figure suggested in information requirement number CEAA 1-15.	Section 8.4.3.2.15 Figure 6.7-1 Figure 6.7-3 Figure 6.7-3B
CEAA 1-50	Section 6.11.6 Project Activities and Indigenous Peoples Interactions and Effects	Update the direct and cumulative effects assessment of current use of land and resources by Indigenous people, including at a minimum: The direct and indirect effects of air quality, noise, light and landscape changes on Indigenous people to include the area surrounding the Project. Consideration should be given to potential receptors in close proximity to the project area or that could be	Section 6.14.6 Section 6.14.8 Section 8.5.7

Table 1-1 Information Request Concordance Table

Reference IR Number	EIS Reference	The Proponent is Required to:	Revised EIS Reference
		using the area intermittently for current land and resource use purposes. The consideration of resource use for subsistence, food, social and ceremonial purposes, and moderate livelihood purposes within the local and regional assessment areas. The consideration of hauling activities (e.g. truck traffic and forestry activities, including the risk of accidents), road construction and maintenance, and tailings management. Whether improving access to relatively undisturbed areas has the potential to affect natural resources, and by extension, the availability of resources for current use activities. Provide any additional mitigation and follow-up for direct and cumulative effects based on the analysis required above. Include mitigation that would address: the combined truck traffic on the haul road, critical periods of the year for wildlife movement, and timing of traditional activities by Indigenous people. Provide, if necessary, an updated significance determination based on the effects assessment above and in consideration of the potentially revised threshold in CEAA 1-48.	
CEAA 1-51	Section 6.11 Indigenous Peoples	Provide further analysis, to enable the EIS reviewers to understand the conclusions reached concerning potential impacts of the Project, including the haul road, on areas of high importance/use for Indigenous people.	Section 6.14.6
NSE 1-1	Section 6.3.2	Identify any other surface water uses that exist in the project vicinity including water withdrawals.	There are no known or registered surface water users within the PA. NSE issues the water withdrawal approvals so they should know that FYI. No one at Beaver Lake IR are known to draw water from the lake for any domestic purpose and the camps at Tangier River are known to be on groundwater supplies.
NSE 1-2		Identify and describe the water supply for the Beaver Lake Community.	There are 28 civic addresses with 38 buildings at the Beaver Lake Community, of which 11 addresses fall within Beaver Lake IR 17. Of the 28 civic addresses and are presumed to be all residential (either permanent or seasonal) dwellings (14 dwellings on lakeside, 14 dwellings along highway), while the other buildings are outbuildings, a few of which appear to be out of use. There are few well records available from the provincial database. Only one record is available for an identified residential dwelling along Highway 224, which indicates it is a dug well 20 ft. depth and the substrate consists of an organic layer followed by sand and gravel. Other well records are available for the limited number of wells in the surrounding community (i.e. Marinette and Pleasant Valley). These records indicate that the wells are predominantly drilled wells, with a depth below surface ranging from 85 ft. to 307 ft., most falling between 160 – 200 ft. The substrate of the wells varies, but clay, gravel/stone and quartzite are commonly identified. By observance the permanent residences at the Beaver Lake Community use wells for water supply and are a combination of dug and drilled wells. There is the possibility for seasonal dwellings to be drawing water from the lakes; however, there is no record of this. Treatment methods are not documented.
NSE 1-3		Provide information regarding application of CCME FWAL guidelines to assess the level of protection and significance of impacts to surface water and in all receiving water related monitoring. Include all three aspects of the project (i.e. Beaver Dam Mine, haul road and Touquoy Mine site). Parameters included would relate to all potential substances of concern from activities at this mine.	Section 6.7 CCME FWAL guidelines have been utilized, along with relevant NSE Tier I EQS criteria Appendix G.3 Predictive Water Quality Assessment- Beaver Dam Gold Mine Appendix G.6 Assimilative Capacity Study of Moose River. Touquoy Open Pit Discharge
NSE 1-4		See request NSE 1- 5 a, b and NSE 2-1 and 2-2.	Note: NSE 2-1 and 2-2 do not exist.
NSE 1-5	Section 6.3.2	a) Provide a plan to protect down-stream or down-gradient water resources (and expected water uses) from disposal of tailings from the Beaver Dam Mine at Touquoy.	Section 6.7.6 Appendix G.4 Evaluation of Potential for Aquatic Effects as a Result of Effluent Releases Related to Beaver Dam Mine

Table 1-1 Information Request Concordance Table

Reference IR Number	EIS Reference	The Proponent is Required to:	Revised EIS Reference
			Appendix G.6 Assimilative Capacity Study of Moose River. Touquoy Open Pit Discharge
		b) Provide information regarding migration of groundwater, or runoff from in the pit that would impact surface waters.	Section 6.6.6
NSE 1-6		Conduct 3D groundwater flow computer modelling for the Beaver Dam site. Groundwater modelling should follow industry standards including proper model calibration and sensitivity analysis. As the interaction between groundwater and surface water is key, an appropriate model that incorporates this interaction should be chosen.	Section 6.6 Appendix F.5 Hydrogeologic Model Development and Application
NSE 1-7		Provide information on minimum base flow requirements for Cameron Flowage to maintain ecological and human use. Provide flow maintenance measures.	Section 6.6.6 and 6.7.6 Appendix G.5 Beaver Dam Mine Site – Water Balance Analysis
NSE 1-8		a) Provide potential leachability of both the site mine tailings and rock in the exposed ore pit.	Section 6.7 Appendices E.2 Beaver Dam Project – ML/ARD Assessment Report Appendix E.3 Beaver Dam Project – Geochemical Source Term Predictions for Waste Rock, Low-Grade Ore, Tailings, and Overburden
		b) Undertake Bench scale tests of mine tailings/ore from the site with pH appropriate leaching procedures such as The Synthetic Precipitation Leaching Procedure (SPLP).	Appendix E.3 Beaver Dam Project – Geochemical Source Term Predictions for Waste Rock, Low-grade Ore, Tailings and Overburden Touquoy ore/tailings were used as a conservative proxy and that confirmatory BD-specific testing will be undertaken when additional metallurgical testing is conducted.
		c) Describe the life-cycle process of cyanide addition, recovery and environmental management.	Section 2.3.1.3
		d) Provide contingency planning for potential failures related to cyanide recovery and proposed open pit disposal in water.	Section 2.3.1.3
NSE 1-9	Section 2.2.3.1	a) How the conclusion was reached that water quality in the final pit will be similar?	Section 6.7.6
		b) Why is it expected that water quality will be similar after Beaver Dam tailings disposal into the Touquoy open pit?	Section 6.7.6
		c) What science-based methodology was used to predict that the water quality in final pit containing tailings and water from Beaver Dam processing with associated parameters that were not introduced to the mini-pit, such as the by-products of the reagents used during ore processing (cyanide, copper sulphate), and crushed rock with associated arsenic-bearing minerals with a much higher surface area than in their natural state in the rock, will be similar to the water quality in the mini pit? (It is understood that the mini-pit is a bedrock excavation from which loose rock was removed and which filled only with groundwater / rainwater / snowmelt runoff. (See also questions on Section 6.4.6.2 and Section 8.5.3.1.2).	Section 6.7.6
		d) What science-based methodology was used to determine whether or not it may be necessary to manage the water in the final, tailings-containing Touquoy pit to prevent an adverse effect on the environment?	Section 6.7.6
NSE 1-10	Section 2.6	a) What alternatives to disposal of Beaver Dam tailings in the Touquoy open pit have been considered?	Section 2.6.10.2
		b) What are the factors considered in selecting disposal in the open pit versus other potential alternatives, e.g., expansion of the Touquoy tailings management facility (TMF) or creation of a new TMF for Beaver Dam tailings?	Section 2.6.10.2
		c) Why is disposal in the Touquoy open pit the preferred alternative to other potential alternatives?	Section 2.6.10.2
		d) How do the environmental effects in the short term and long term (after closure) differ between the alternatives?	Section 2.6.10.2
		e) How are potential long term environmental management costs factored into the evaluation of economic feasibility?	Section 2.6.10.2
NSE 1-11	Section 6.3.6.3	a) During the transition from use of reclaimed water from the Touquoy TMF to use of reclaimed water	Section 6.7.6.3.1

Table 1-1 Information Request Concordance Table

Reference IR Number	EIS Reference	The Proponent is Required to:	Revised EIS Reference
		from seepage from the proposed tailings disposal in the Touquoy open pit, will there be a period of time where there is insufficient reclaimable water from either the Touquoy TMF or the proposed open pit tailings disposal to supply the 'normal' quantity of reclaimed water to the mill?	Appendix G.2 Touquoy Integrated Water and Tailings Management Plan
		b) If so, how long will it last and what is the expected increase in fresh water demand during this period?	Section 6.7.6.3.1 Appendix G.2 Touquoy Integrated Water and Tailings Management Plan
		c) Where will this water come from – Square Lake? Scraggy Lake?	Section 6.7.6.3.1 Appendix G.2 Touquoy Integrated Water and Tailings Management Plan
		d) There seem to be inconsistencies between sections of the document. (see comments below on Section 8.5.2.1.3). Section 6.3.6.3 states that the amounts for this surface water use and time period have been previously identified in this document, however I can't locate it. In what section is this information provided?	Section 6.7.6.3.1 Appendix G.2 Touquoy Integrated Water and Tailings Management Plan
		e) Has a revised water balance for the Touquoy site arising from the Beaver Dam development, at each stage of the project, been developed and what does it show?	Section 6.7.6.3 Appendix G.2 Touquoy Integrated Water and Tailings Management Plan
NSE 1-12	Section 6.4.6.2	a) What is the basis of the prediction that 'potential impacts would be minor in nature and within a short radius of the flooded pit?'	Section 6.6.6.3 Appendix F.6 Groundwater Flow and Solute Transport Modelling to Evaluate Disposal of Beaver Dam Tailings in Touquoy Open Pit – Beaver Dam Gold Project
		b) What is the radius involved and how does it relate to the expected final distance of the pit wall to the Moose River and/or other watercourses and drainage channels?	Section 6.6.6.3 Appendix F.6 Groundwater Flow and Solute Transport Modelling to Evaluate Disposal of Beaver Dam Tailings in Touquoy Open Pit – Beaver Dam Gold Project
		c) What is the expected hydraulic gradient around the flooded pit during various times of year and why would discharge to surface watercourses of impacted groundwater not be expected?	Section 6.6.6.3 Appendix F.6 Groundwater Flow and Solute Transport Modelling to Evaluate Disposal of Beaver Dam Tailings in Touquoy Open Pit – Beaver Dam Gold Project
		d) Provide the details of studies and/or modelling upon which this is based (as referenced in Ausenco 2015 as cited elsewhere in the EIS).	Section 6.6.6.3 Appendix F.6 Groundwater Flow and Solute Transport Modelling to Evaluate Disposal of Beaver Dam Tailings in Touquoy Open Pit – Beaver Dam Gold Project
		e) Are mitigative measures required to ensure this prediction is true, and if so what measures?	Section 6.6.6.3 Section 6.6.8 Appendix F.6 Groundwater Flow and Solute Transport Modelling to Evaluate Disposal of Beaver Dam Tailings in Touquoy Open Pit – Beaver Dam Gold Project
		f) How will those measures be maintained in the long term (including indefinitely, after mine closure)?	Section 6.6.6.3 Section 6.6.9 Appendix F.6 Groundwater Flow and Solute Transport Modelling to Evaluate Disposal of Beaver Dam Tailings in Touquoy Open Pit – Beaver Dam Gold Project
NSE 1-13	Section 8.5.3.1.2	a) What is the basis of the prediction that residual reagent (i.e. cyanide) introduced to the tailings during ore processing will be degraded and hydrolyzed… similarly in the Beaver Dam tailings stored in the Touquoy open pit (as to what is expected in the Touquoy TMF)?	Based on available operational testing data, the cyanide destruction circuit in the existing Touquoy Plant as described in Section 1.3.1.3 is very effective and WAD/total cyanide typically treats to effluent levels that are, for the most part below federal MDMER criteria. Also, it should be noted that during the processing of Beaver Dam ore and discharge to the Touquoy Pit, that there will be no release of effluent from the pit and the residence time of effluent in the pit will be a number of years, post operation while the pit fills. Due to the long residence time in the pit, there would be ample time for natural degradation of cyanide to occur. Appendix H.4 Touquoy Integrated Water and Tailings Management Plan
		b) Has this been modelled?	Refer to response to IR NSE 1-13, above. Based on available operational testing data, no discharge scenario, and lengthy residence time in the pit before discharge, there is no practical requirement for modelling.
		c) What is the effect of the difference in the surface area of the TMF from the surface area in the open pit at the elevation at which tailings disposal would occur?	Refer to response to IR NSE 1-13, above. Based on those considerations, the effect of the difference in surface areas is not anticipated to be of importance.

Table 1-1 Information Request Concordance Table

Reference IR Number	EIS Reference	The Proponent is Required to:	Revised EIS Reference
		d) What would be the effect of ongoing disposal during winter ice cover over this reduced surface area?	Appendix H.4 (Section 3.2) Touquoy Integrated Water and Tailings Management Plan Discussion of options for tailings discharge operation during frozen winter conditions is discussed.
		e) Would the expected accumulation of residual reagents in tailings pore water occur at higher concentrations within tailings deposited over a reduced surface area compared to when spread laterally within a TMF with a larger surface area?	Refer to response IR NSE 1-13, above. Based on long residence time and initial no discharge conditions, it is thought there is much time for natural degradation to occur for cyanide and other minor reagents.
		f) How long will seepage out of these tailings take and what is the expected timeline for this pore water seepage to infiltrate to groundwater surrounding the pit?	Section 6.6.6.3 Appendix F.6 Groundwater Flow and Solute Transport Modelling to Evaluate Disposal of Beaver Dam Tailings in Touquoy Open Pit – Beaver Dam Gold Project
		g) At what concentrations would seepage be expected to arrive in groundwater and are the concentrations of these reagent and their byproducts higher than around the TMF?	Section 6.6.6.3 Appendix F.6 Groundwater Flow and Solute Transport Modelling to Evaluate Disposal of Beaver Dam Tailings in Touquoy Open Pit – Beaver Dam Gold Project
NSE 1-14		Is a similar facility anticipated for water in the open pit after Beaver Dam tailings disposal and if not, why?	Section 6.7.6.1
NSE 1-15		a) Will dissolved copper be correspondingly higher in water discharged to the open pit with Beaver Dam tailings than in water discharged to the Touquoy TMF?	Section 6.7.6 Appendix G.2 Touquoy Integrated Water and Tailings Management Plan
		b) Ammonia was also predicted to be somewhat elevated at the discharge of the polishing pond for Touquoy ore in more recent modelling. Has the potential water quality in the open pit and in the pore water in the open pit been predicted by modelling, including for arsenic, metal-cyanide complexes, copper, and ammonia or any other parameters?	Section 6.6.6, and Section 6.7.6 Appendix G.2 Touquoy Integrated Water and Tailings Management Plan
		c) Has the potential for Beaver Dam tailings to be acid-generating been sufficiently evaluated to determine whether or not acid generation is a concern? What are the details of this evaluation?	Section 6.5.3.4 Appendix E.2 Beaver Dam Project- ML/ARD Assessment Report
		d) What is the expected water quality (for the specific parameters identified above) in the open pit including both surface water and tailings pore water resulting from Beaver Dam tailings deposition?	Section 6.7.6.3
		e) What is the potential effect of these parameters on receiving water including seepage to groundwater directly from tailings pore waters?	Section 6.6.6, Section 6.7.6
		f) Is it likely that management of the water quality in the pit to prevent an adverse effect on the environment could be necessary?	Yes. See Section 6.6.6.3 Appendix F.6 Groundwater Flow and Solute Transport Modelling to Evaluate Disposal of Beaver Dam Tailings in Touquoy Open Pit – Beaver Dam Gold Project
NSE 1-16		Could this evaluation of minimal interconnection between the pit and surface water and groundwater have changed since 2007 in consideration of the most up to date understanding of the geology and hydrogeology of the pit area and the pit design, including current design expectations of distance between the pit wall and the river?	Section 6.6.6 and 6.7.6
NSE 1-17		a) Provide the details of the assumptions, methods, and results of this more recent modelling. Are mitigative measures required based on the predictions of this modelling?	Section 6.6.6, Section 6.6.8, Section 6.7.6, and Section 6.7.8 Appendix F.6 Groundwater Flow and Solute Transport Modelling to Evaluate Disposal of Beaver Dam Tailings in Touquoy Open Pit – Beaver Dam Gold Project
		b) If so, what measures and what is their effect on the surrounding environment including Moose River, groundwater, and any discharge points of open pit water?	Section 6.7.6.3, and Section 6.7.8 Appendix F.6 Groundwater Flow and Solute Transport Modelling to Evaluate Disposal of Beaver Dam Tailings in Touquoy Open Pit – Beaver Dam Gold Project Appendix G.2 Touquoy Integrated Water and Tailings Management Plan Appendix G.6 Assimilative Capacity Study of Moose River. Touquoy Open Pit Discharge. Appendix G.4 Evaluation for Potential for Aquatic Effects as a Result of Effluent Releases Related to Beaver Dam Mine
		c) How will those measures be maintained in the long term (including indefinitely, after mine closure)?	Section 6.7.8 Appendix G.6 Assimilative Capacity Study of Moose River. Touquoy Open Pit Discharge.

Table 1-1 Information Request Concordance Table

Reference IR Number	EIS Reference	The Proponent is Required to:	Revised EIS Reference
			Appendix G.4 Evaluation for Potential for Aquatic Effects as a Result of Effluent Releases Related to Beaver Dam Mine
		d) Is there a need for collection of additional hydrogeological data around the open pit to update the groundwater flow model to support deposition of tailings in the open pit for the Beaver dam operations (as per Ausenco 2015 recommended additional work?)	Section 6.6.5.3 Appendix F.6 Groundwater Flow and Solute Transport Modelling to Evaluate Disposal of Beaver Dam Tailings in Touquoy Open Pit – Beaver Dam Gold Project
		e) Does modelling upon which predictions of groundwater / surface water interactions (quality and / or quantity) and a conclusion made in the EIS of 'no significant adverse effects' at the open pit (with Beaver Dam tailings disposal) take into account the fault that runs across the open pit from southwest to northeast and separates ore bearing rock from non-ore bearing rock that was used as borrow for Touquoy TMF construction?	Section 6.6.6 Appendix F.6 Groundwater Flow and Solute Transport Modelling to Evaluate Disposal of Beaver Dam Tailings in Touquoy Open Pit – Beaver Dam Gold Project
		f) Does modelling need to take into account localized zones of highly fractured slates with higher hydraulic conductivity that are intercalated with quartzites in the area of the Touquoy development, as found during construction of the Touquoy TMF, leading to TMF design changes, and modelled by Stantec in 2016 as part of seepage predictions for the revised TMF design?	Section 6.6.6 Appendix F.6 Groundwater Flow and Solute Transport Modelling to Evaluate Disposal of Beaver Dam Tailings in Touquoy Open Pit – Beaver Dam Gold Project
		g) What are the possible fault-related and/or localized hydrostratigraphic differences in predicted groundwater / surface water quantity and quality interaction in the vicinity of the open pit when used for tailings disposal, compared to the assumptions used during modelling in 2007 and compared to the assumptions used in more recent models (as described in Ausenco 2015), and what are the uncertainties that those differences may introduce to the predictions in the EIS?	Section 6.6.6 Appendix F.6 Groundwater Flow and Solute Transport Modelling to Evaluate Disposal of Beaver Dam Tailings in Touquoy Open Pit – Beaver Dam Gold Project
NSE 1-18	Section 6.4.7	a) Has the existing groundwater monitoring program including well network design (well placement, screen intervals, etc), parameters being monitored, and monitoring frequency around the Touquoy open pit, been reviewed to evaluate if it is adequate to monitor the potential effects of Beaver Dam tailings disposal into the open pit?	Section 6.6.5.3 Appendix F.6 Groundwater Flow and Solute Transport Modelling to Evaluate Disposal of Beaver Dam Tailings in Touquoy Open Pit – Beaver Dam Gold Project
		b) What additional wells should be placed, in what locations, with what design and what additional parameters should be added to monitoring to reflect the modified plans for the open pit?	Section 6.6.5.3 Appendix F.6 Groundwater Flow and Solute Transport Modelling to Evaluate Disposal of Beaver Dam Tailings in Touquoy Open Pit – Beaver Dam Gold Project
		c) How far in advance should any changes in the monitoring program be made, prior to the start of disposal of Beaver Dam tailings, to ensure adequate baseline data are available to monitor and detect whether or not the prediction of 'no significant adverse effect' to groundwater or surface water from the proposed disposal is correct for all parameters, including those that would not be expected to be of concern without tailings disposal into the open pit?	Section 6.6.10, and Section 6.7.10 Appendix O.1 Preliminary Environmental Effects Monitoring Plan
NSE 1-19	Section 8.5.2.1.3	a) Is water withdrawal from Square Lake actually part of the Touquoy project and/or is it anticipated?	No. Square Lake is neither part of or anticipated to be part of the Touquoy project.
		b) Is water withdrawal from Square Lake part of the Beaver Dam project?	No. Square Lake is neither part of or anticipated to be part of the Beaver Dam project
		c) What are the potential cumulative effects on water quantity on the proposed project water source(s) due to the combination of the Beaver Dam project and the Touquoy projects?	The Touquoy mine under the Beaver Dam scenario is an extension in the timeline of the processing facility. This will require an extension to the use of Scraggy Lake as one of the sources of fresh water to process ore. Water will also be recycled from the Beaver Dam tailings (Touquoy Pit) when sufficient supply is available, and sourced from the Touquoy TMF Polishing Pond and a large site Settling Pond where meteoric water and surface runoff has accumulated. The cumulative effect of the combined projects could mean a reduction in the streamflow from Scraggy Lake to the Fish River system; however, assuming that the rate of withdrawal is consistent with current needs of the project, then it has been shown that the withdrawal from Scraggy Lake is sustainable given the current level of inputs to the watershed. Provincial permitting will be applied for to consider this additional use. Section 8.5.2.1.3 with reference to Square Lake removed – Replaced with Scraggy Lake
NSE 1-20	Section 8.5.3.1.3	a) Does this section take into account changes in TMF design made during 2016/17?	TMF design changes were reviewed by NSE at the time and approved for construction and operation. Not relevant to the

Table 1-1 Information Request Concordance Table

Reference IR Number	EIS Reference	The Proponent is Required to:	Revised EIS Reference
			EIS for Beaver Dam- TMF at Touquoy is not a component of the Beaver Dam EIS project description.
		b) If not, what changes in the conclusions are expected based on the updated design which eliminated the grout curtain in fractured bedrock, and revised predictions of seepage to groundwater through fractured bedrock?	TMF design changes were reviewed by NSE at the time and approved for construction and operation. Not relevant to the EIS for Beaver Dam- TMF at Touquoy is not a component of the Beaver Dam EIS project description.
		c) How does this affect the assessment of cumulative effects upon groundwater of the combination of the Beaver Dam project and the Touquoy project?	TMF design changes were reviewed by NSE at the time and approved for construction and operation. Not relevant to the EIS for Beaver Dam- TMF at Touquoy is not a component of the Beaver Dam EIS project description.
NSE 1-21	Page 35	Provide a technical justification for this prediction based on the changes in water quality that might be expected with tailings deposition.	Section 6.6.6 and Section 6.7.6 provide updated gw and sw effects assessment predictions
NSE 1-22		What contingency plans could be employed to prevent this situation?	Blasting will be completed at the Touquoy Mine Site prior to deposition of Beaver Dam tailings into the exhausted pit at Touquoy.
NSE 1-23	Page 207	a) If the flooded Touquoy pit is considered “physically disconnected” from Moose River, where will this natural lake (tailings filled pit) discharge upon final reclamation?	Section 6.6.6, and Section 6.7.6
		b) If there is a physical disconnection of the pit, will this result in all pit water migrating into the groundwater regime to potentially impact groundwater quality?	Section 6.6.6
		c) If the pit overtops surface water, as occurred with the mini-pit, how and where will water be conveyed, what is the expected impact on the receiving stream and will the stream be capable of accommodating hydraulic changes?	Section 6.7.6
NSE 1-24	Page 52	a) Provide the water balance and technical information to demonstrate the expected storage volume of tailings, runoff and groundwater in the pit over the life of the project.	Section 6.6.6, and Section 6.7.6 Appendix G.2 Touquoy Integrated Water and Tailings Management Plan
		b) What is the capacity of the Touquoy pit for the volume of tailings anticipated to be generated?	Section 6.6.6 and 6.7.6
		c) What are the contingency plans if the pit is filled with tailings and/or water prior to end of project life?	Section 6.6.6 and 6.7.6
NSE 1-25		a) Will the filling of the pit compromise or effect the natural treatment of wastewater in the pit, particularly natural cyanide destruction which is a component of the current treatment process in the tailings management facility of the Touquoy mine site?	Section 6.6.6, and Section 6.7.6
		b) What are the expected cyanide concentrations anticipated in the pit wastewater and groundwater during operation?	Section 6.6.6
		c) What operation, maintenance and surveillance tools will be used to manage the potential environmental impacts resulting from the handling of Beaver Dam tailings?	Section 6.7.6 Appendix O.1 Preliminary Environmental Effects Monitoring Plan
NSE 1-26	Page 154	a) Provide details on the “areas” that require specific handling and disposal, and what these handling and disposal plans might be?	Section 6.5.3.4
		b) What specific acid rock drainage plans will be employed to manage areas of the deposit and mine wastes generated from potentially acid generating rock?	Section 6.5.3.4
NSE 1-27	Page 164	Provide kinetic test results for the acid generating potential.	Appendix E.2 ML/ARD Assessment Report
NSE 1-28		Justify this evaluation frequency both for controlled conditions of disposal within the mine footprint and reuse for haul road construction outside the mine footprint.	Section 6.5.3.4 Section 6.2.6.5 Appendix C.2 Evaluation of Exposure Potential Related to Dust Deposition from Haul Road Traffic onto Soils, Berries, and Vegetation
NSE 1-29		Please provide the technical justification or test results which indicate that acid generation and/or metal dissolution will not be an environmental issue. Should testing be completed provide testing locations.	Section 6.5.3.4 Appendix E.2 ML/ARD Assessment Report
NSE 1-30		a) How will this be achieved based on the low hydraulic conductivity of pit bedrock?	Section 6.6.6 and 6.7.6
		b) If the pit does overflow, what is the ultimate plan and discharge location for the overflow from the Beaver Dam mine pit and what are the expected impacts?	Section 6.6.6 and 6.7.6 Appendix G.3 Predictive Water Quality Assessment – Beaver Dam Gold Mine

Table 1-1 Information Request Concordance Table

Reference IR Number	EIS Reference	The Proponent is Required to:	Revised EIS Reference
			Appendix G.4 Evaluation of Potential for Aquatic Effects as a Result of Effluent Releases Related to Beaver Dam Mine
NSE 1-31		What changes are expected in the reclamation plans at the Touquoy mine site as a result of the Beaver Dam Mine project?	Section 2.3.3
NSE 1-32		a) Please provide the justification for constructing what appears to be settling pond(s) and drainage structure within wetlands.	Section 6.8.6 Infrastructure has been micro-sighting wherever possible to reduce impact to wetlands.
		b) How will these structures be constructed within wetlands	Section 6.8.6 Additional micro-sighting efforts will take place to work to reduce/eliminate placement in wetland habitat. Pond will be excavated and lined with clay followed by rip rap to protect the clay liner.
NSE 1-33	Section 6.3.5.2	Consider CCME FWAL to determine thresholds of significance.	Section 6.7.5.5
NSE 1-34	Section 6.4.5.2	Provide a threshold for determining significance of loss of surface water to Cameron Flowage.	Section 6.7.5.5
NSE 1-35		a) Is the Beaver Dam mine project expected to be subject to the Metal Mining Effluent Regulations?	Yes.
		b) If so, at what stage in project development is this expected to occur? (I.e. exceeding 50 m3 per day discharge)?	Section 2.2.1 The Beaver Dam Project is expected to trigger MDMER from discharge from the north settling pond during operations
NSE 1-36	Table 3.4-1	Elaborate on this statement in light of the disposal of tailings in the mined out Touquoy pit.	Section 6.6.6
NSE 1-37	Page 207	a) What impacts are expected and how can they be mitigated?	Section 6.7.6
		b) What is the potential for seepage of contaminants from the open pit to the groundwater systems?	Section 6.6.6
		c) A model predicting the anticipated impacts to groundwater and surface water systems (such as Moose River) should be provided.	Section 6.6.6, and Section 6.7.6 Appendix F.6 Groundwater Flow and Solute Transport Modelling to Evaluate Disposal of Beaver Dam Tailings in Touquoy Open Pit – Beaver Dam Gold Project Appendix G.2 Touquoy Integrated Water and Tailings Management Plan Appendix G. 4 Evaluation of Potential for Aquatic Effects as a Result of Effluent Releases Related to Beaver Dam Mine
NSE 1-38	Page 229	a) The MMER levels, generally exceed freshwater and drinking water standards, could these levels within pit water still negatively impact groundwater and surface water receiving environments?	Section 6.6.6, and Section 6.7.6
		b) Provide the design concept of the wastewater recycle system from the Touquoy pit including tailings discharge system to the Touquoy pit and the seepage water recycle from the Touquoy pit to the mill. What leak or spill contingencies are proposed?	Section 2.3.1.3 Section 6.18
NSE 1-39		a) How much aggregate will be required to construct the haul roads?	Based on preliminary engineering estimates, a total of approximately 500,000 m3 of aggregate will be required to construct and upgrade the mine haul roads.
		b) How much is available from the Beaver Dam mine and how much will need to be accessed elsewhere?	It is anticipated that approximately 150,000 m3 of aggregate will be sourced from the Beaver Dam Open Pit. This does not include an additional 200,000 to 250,000 m3 required for the Beaver Dam Site preparation, which most of it will likely be sourced from the Beaver Dam Open Pit.
		c) If another quarry source is required, where will the aggregate be obtained?	The remaining aggregate will be sourced wherever possible from cut and fill operations along the Mine Haul Road. In the event additional aggregate material is required, small road side quarries will be developed. The exact location of these quarries has not yet been determined; geotechnical studies are required for siting and assessment of suitability of material. The use of offsite material sourced from established quarries is at this time unlikely and would be the least desirable option.
		d) Are authorizations required from the regulatory agencies to transport aggregate, possibly large tonnage transport, over provincial roadways?	A large tonnage transport over provincial highways is not likely based on the response above. Based on our current understanding, transport of aggregate from established quarries over provincial roadways does not require any specific regulatory authorizations.
		e) If so, what authorizations are required and what are the plans to obtain these authorizations?	No authorizations are anticipated to be required.
		f) What is the anticipated location of historic tailings that were generated from the past mine site activities?	There are no mapped historic tailings in any DNR or GSC reports, no air photo evidence, no geochemical anomalies to suggest any, no evidence seen during EBS work since 2014

Table 1-1 Information Request Concordance Table

Reference IR Number	EIS Reference	The Proponent is Required to:	Revised EIS Reference
			and no evidence through historical research completed for the EIS.
		g) Do these areas need to be investigated and will the project have an impact on these areas?	There are no mapped historic tailings in any DNR or GSC reports, no air photo evidence, no geochemical anomalies to suggest any, no evidence seen during EBS work since 2014 and no evidence through historical research completed for the EIS.
NSE 1-40		Provide an updated Accidents and Malfunction Plan to address new activities at the Touquoy site.	Section 6.18
NSE 1-41	Page 161	a) What assessment was completed to come to this determination that historical tailings are not a factor at BD?	There are no mapped historic tailings in any DNR or GSC reports, no air photo evidence, no geochemical anomalies to suggest any, no evidence seen during EBS work since 2014 and no evidence through historical research completed for the EIS.
		b) What is the long-term management strategy to ensure the groundwater and surface water is protected from potential migration of beaver dam tailings?	Section 6.6.6, and Section 6.7.6
		c) Will the tailings fill the Touquoy pit to surface or will there be open water at surface? Please demonstrate how this was determined.	Section 6.6.6, and Section 6.7.6
		d) If there is open water at surface in the Touquoy pit, how will that water be managed to ensure it doesn't overtop?	Section 6.6.6, and Section 6.7.6
		e) If the tailings in the Touquoy TMF require treatment before entering Scraggy Lake, how was it determined that treatment will not be required for the BD tailings? Perhaps there is treatment planned but, further clarification is required.	Section 6.6.6, and Section 6.7.6
		f) If there is treatment planned for the BD tailings in the Touquoy pit, where will the final discharge point be and which watercourse will it enter?	Section 6.6.6, and Section 6.7.6
NSE 1-42		Provide a dust suppression plan for the Beaver Dam Mine site, haul road and addition mitigation measures for the Touquoy site.	Appendix C.3 Dust Control Plan
NSE 1-43		a) Will the tailings fill the Touquoy pit to surface or will there be open water at surface? Please demonstrate how this was determined.	Section 6.6.6, and Section 6.7.6
		b) If there is open water at surface in the Touquoy pit, how will that water be managed to ensure it doesn't overtop?	Section 6.6.6, and Section 6.7.6
		c) If the tailings in the Touquoy TMF require treatment before entering Scraggy Lake, how was it determined that treatment will not be required for the BD tailings? Perhaps there is treatment planned but, further clarification is required.	Section 6.6.6, and Section 6.7.6
		d) If there is treatment planned for the BD tailings in the Touquoy pit, where will the final discharge point be and which watercourse will it enter?	Section 6.7.6
		e) There is no mention of whether TIR is in acceptance of the proposed plan to use highway as a haul road between the two sites. Has this plan been approved?	Section 2.3.1.2
		Provide information regarding all wastes and waste management at the workshop.	Section 2.2
NSE 1-44		Was sufficient baseline data collected (away from the former mine operations) to establish that elevated occurrences are not attributed to former mine operations?	Section 6.5.3.2.1
NSE 1-45	Section 6.2.2	Compare baseline soil/sediment and surface water analytical results to Tier 1 EQS.	Section 6.5.2, Section 6.5.3.2, Section 6.7.3.2
NSE 1-46	Section 6.4.5.2	Identify Tier 1 EQS soil/sediment exceedances as trigger for adverse effect should a release occur (as with surface water – Section 6.3.5.2).	Section 6.5.2, 6.7.5.5
NSE 1-47	Section 6.4.7	Compare groundwater quality results to Tier 1 EQS.	Section 6.6.6
NSFA 1-1	Table 7-1 Page 87	a) Why were speckled trout (brook trout), NS Provincial Fish, the most important sport fish in the province, not included as a priority species?	As per conversations with Mark Elderkin during the early spring of 2015, it has been requested that all priority species lists be built using status ranks (SRanks, S1, S2, S3) rather than the previously used general status ranks (GS Ranks Red and Yellow). The Priority species list was created using up to date ACCDC data in March 2015 when the brook trout was ranked S4 and no longer identified as a priority species as they had previously been under the general status rank system (GS Rank Yellow). In August 2015, the SRank of brook trout was updated to S3, after our ranking list was obtained from ACCDC. Brook trout will be brought forward as a priority species for all further effects evaluation, monitoring, and mitigation.

Table 1-1 Information Request Concordance Table

Reference IR Number	EIS Reference	The Proponent is Required to:	Revised EIS Reference
			Refer to Section 6.13.3.1.2 for additional information on brook trout.
		b) Priority Species: What criteria was used to classify priority species?	A priority species is any species that is either listed as a species at risk (SAR) or as a species of conservation interest (SOCI). Through consultation with NSE and ECCC, the Project Team has developed the following definitions for SAR and SOCI: • A SAR is any species which is designated under the federal Species at Risk Act (Government of Canada, 2015) and any species designated under the provincial Nova Scotia Endangered Species Act (Province of Nova Scotia, 2015). • A SOCI is a species which is listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC, 2015) to be considered for federal protection under SARA, but does not yet have designation under SARA. In addition, a SOCI includes those listed as S1-S3 (provincial rarity rankings) by the Atlantic Canadian Conservation Data Centre (ACCDC).
NSFA 1-2		a) Will this result in larger flow rates in the Killag River?	Section 6.7.6 Appendix G.5 Beaver Dam Mine Site – Water Balance Analysis
		b) Will acid be liberated by the mine operations and could this result in an exacerbation of the acidity issue in the Killag River and downstream areas?	Appendix G.3 Predictive Water Quality Assessment – Beaver Dam Gold Mine Acid is not expected to be produced during operating conditions. It is expected acid will be produced from the waste rock piles during post-closure conditions, however, on-site treatment and mixing with neutral groundwater in the pit prior to discharge will ensure minimal acid contribution to the Killag River. Discharge will likely have a pH higher than the background pH of approximately 5.4.
NSFA 1-3		a) Will this improvement in water quality be short-term?	Section 6.7.6 Appendix G.3 Predictive Water Quality Assessment – Beaver Dam Gold Mine Appendix G. 4 Evaluation of Potential for Aquatic Effects as a Result of Effluent Releases Related to Beaver Dam Mine Mine rock materials are not expected to turn acidic during the mine operational phase. Based on the geochemical and modelling completed to date, which was based on conservative assumptions, there is a potential for some of the mine rock to turn acidic over the long term during the post-closure phase. This effect is mitigated naturally due to the alkaline groundwater inflows into the open pit and, as required, by the adoption of closure measures such as water treatment and/or the installation of a cover on the waste rock pile. All mine contact water released from the site must meet the stringent MDMER limits for pH which ranges from 6.0 to 9.5. If on-site water treatment is required for mine contact water, lime is introduced into the process which will raise pH to around the neutral range and above background pH for the Killag River of 5.4
		b) Will the water that is used in mining operation be treated with limestone?	Section 6.7.6 Calcium and calcium magnesium carbonate are natural constituents of waste rock that help to buffer potential acid generation. The proposed water treatment process, should it be required is presented in Appendix G.7 Beaver Dam Conceptual Treatment Approach
		c) Can an explanation be provided as to how the mining of this site will result in reduced acidity of the water that is used in the mining process?	Section 6.7.6 Treatment of mine contact water prior to discharge to the Killag River will result in a pH higher than the background pH in the Killag River
NSE 1-48	Section 6.1.3.4	Provide proposed monitoring locations identified on a map along with seasonal wind roses. The proposed baseline monitoring locations should be informed, in part, by results of air dispersion modelling (see comments below).	Section 6.2.10 Appendix O.1 Preliminary Environmental Effects Monitoring Plan Appendix C.1 Air Dispersion Modelling and Air Emission Estimate Technical Memorandum
NSE 1-49	Section 6.1.3.4, Section 6.1.7.2	a) Complete an inventory of expected air contaminants from this project which includes both air contaminants regulated under the NS Air Quality Regulations and any others of concern (e.g. metals, volatile organic compounds etc.).	Section 6.2 Appendix C.1 Air Dispersion Modelling and Air Emission Estimate Technical Memorandum

Table 1-1 Information Request Concordance Table

Reference IR Number	EIS Reference	The Proponent is Required to:	Revised EIS Reference
		Conduct air dispersion modelling of these contaminants using a model acceptable to the Department.	
		b) Is the proponent committing to following the practice of using Best Available Technology Economically Achievable (BATEA) as an air emissions mitigation measure?	The Proponent will evaluate options for procurement of vehicles and equipment and consider, where economical and practical, low emission and energy efficient options.
NSE 1-50	Section 6.1.7.2 Table 6.2-8, 8.3-1, Section 6.2.3.2.1	Should the dust suppression requested in Comment XX intend to use water from the settling pond, provide mitigation/monitoring measures to address potential contaminants.	Section 2.2 Water from settling pond(s), if used for dust suppression, will meet applicable Provincial water quality criteria
NSE 1-51		Provide appropriate compensation and mitigation measures to address exposed sediment containing elevated levels of arsenic, mercury and other metals of concern.	Section 6.5.8
NSDNR 1-1		Please provide data and analysis on the cumulative effects incurred through overt loss of wetlands, loss of wetland function, toxics transfer and release in food chains supported with modelling. A twenty-year timeline for this modelling is recommended.	Section 6.8.6.4
NSDNR 1-2		Provide baseline blood analysis for turtles, fishes and aquatic furbearers (otter, mink) as a precursor for monitoring at five-year intervals on a twenty-year time horizon (5 sampling iterations in total).	The Proponent is committed to baseline monitoring. Discussions relation to the determination of the scope of baseline and post-construction monitoring programs is currently being initiated with Mi'kmaq communities.
NSE 1-52	Section 2.1, 8.5.11.1.1, 6.1.3.6, Figure 2.1-2 Table 6.13-5, Section 6.1.2, 6.13.1 6.1.3.6, 6.11.6	a) Identify all receptors as described in comments (attached) submitted by the Environmental Health & Food Safety Branch of NSE.	Section 6.2 Section 6.6 Section 6.7 Appendix C.2 Evaluation of Exposure Potential Related to Dust Deposition from Haul Road Traffic onto Soils, Berries, and Vegetation
		b) Assess and report potential impacts to all receptors. These include but are not limited to, noise, dust, air quality, food, and potable water impacts.	Section 6.1 Section 6.2 Section 6.6 Section 6.7 Appendix C.2 Evaluation of Exposure Potential Related to Dust Deposition from Haul Road Traffic onto Soils, Berries, and Vegetation
NSE 1-53	Section 2.3.2.4, 6.1, 6.12, 6.1.6.3.1	Complete noise modelling to include seasonal receptors located in association with the mine site and the haul road.	Section 6.1 Appendix B1. Noise Impact Study Beaver Dam Mine Project
NSE 1-54	Section 6.4.1,6.43, Tables 6.4-1, 6.4-2	a) Establish the type and characteristics of all receptor's potable water supplies (dug wells, drilled wells and surface water). Provide a mitigation plan for these water supplies.	Refer to NSE 1-2 Section 6.6 demonstrates that there is no potential interaction between the Project and surrounding potable wells. As a result, there is no requirement for a mitigation plan. However, at the request of Millbrook First Nation, a pre-construction well survey will be completed at the Beaver Lake IR.
	Section 2.1.3, 2.3.3.1, 6.3.1	b) Identify recreational water usage in the area that could be adversely affected by the project.	Section 6.16.3
NSE 1-55		Please provide a preliminary wetland compensation plan.	See Appendix H.3 Preliminary Wetland Compensation Plan

Table ES-1 Table of Concordance

CEAA EIS Guidelines		Beaver Dam Mine EIS Report	
Section	Title	Section	Title
1.	Introduction and Overview	1.	Introduction
1,1	The proponent	1.2	Proponent Information
1.2	Project overview	1.1	Project Overview
1.3	Project location	2.1	Project Location
1.4	Regulatory framework	1.3	Regulatory Framework and Role of Government
2.	Project Justification and Alternative Considered	1.4 2.6	Purpose of the Project Alternative Means of Carrying Out the Project
2.1	Purpose of the Project	1.4	Purpose of the Project
2.2	Alternative means of carrying out the Project	2.6	Alternative Means of Carrying Out the Project
3.0	Project Description	2	Project Description
3.1	Project components	2.2	Project Components
3.2	Project activities	2.3	Project Activities
3.2.1	Site preparation and construction	2.3.1	Subsections titled "Site Preparation and Construction"
3.2.2	Operation	2.3.2	Subsections titled "Operation and Maintenance"
3.2.3	Decommissioning and abandonment	2.3.3	Subsections titled "Decommissioning and Reclamation"
4.	Public Consultation and Concerns	3.	Public Consultation and Engagement Program
5.	Aboriginal Engagement and Concerns	4.	Indigenous Peoples Consultation and Engagement Program
5.1	Aboriginal groups to engage and engagement program	4.	Indigenous Peoples Consultation and Engagement Program
6.	Effects Assessment	5. 6.	Environmental Effects Assessment Methodology Environmental Effects Assessment
6.1	Project setting and baseline conditions	6.X.X	Subsections for each VC titled "Baseline Conditions"
6.1.1	Atmospheric Environment	6.1 6.2 6.3 6.4	Noise Air Light Greenhouse Gases
6.1.2	Geology and geochemistry	6.5	Geology, Soil and Sediment Quality
6.1.3	Topography and soil	6.5	Geology, Soil and Sediment Quality
6.1.4	Groundwater and surface water	6.6 6.7	Groundwater Quality and Quantity Surface Water Quality and Quantity
6.1.5	Wetlands	6.8	Wetlands
6.1.6	Fish and fish habitat	6.9	Fish and Fish Habitat
6.1.7	Migratory birds and their habitat	6.12	Birds

Table ES-1 Table of Concordance

CEAA EIS Guidelines		Beaver Dam Mine EIS Report	
Section	Title	Section	Title
6.1.8	Species at risk	6.13	Species of Conservation Interest and Species at Risk
6.1.9	Ecosystems	6.10 6.11	Habitat and Flora Terrestrial Fauna
6.1.10	Aboriginal peoples	6.14	Indigenous Peoples
6.1.11	Other environmental changes arising as a result of a federal decision…	6.17.5	Environmental Effects Incidental of Decisions Made by a Federal Authority
6.2	Predicted changes to the physical environment	6.X.X	Subsections for each VC titled “Project Activities Interactions and Effects”
6.2.1	Changes to the atmospheric environment	6.1.6 6.2.5 6.3.6 6.4.6	Project Activities and Noise Interactions and Effects Project Activities and Air Interactions and Effects Project Activities and Light Interactions and Effects Project Activities and GHG Interactions and Effects
6.2.2	Changes to groundwater and surface water	6.6.6 6.7.6	Project Activities and Groundwater Quality and Quantity Interactions and Effects Project Activities and Surface Water Interactions and Effects
6.2.3	Changes to wetlands	6.8.6	Project Activities and Wetlands Interactions and Effects
6.2.4	Changes to the terrestrial environment	6.10.6 6.11.6	Project Activities and Habitat and Flora Interactions and Effects Project Activities and Terrestrial Fauna Interactions and Effects
6.3	Predicted effects on valued components	6.X.X	Subsections for each VC titled “Project Interactions and Effects”
6.3.1	Fish and fish habitat	6.9.6	Project Activities and Fish and Fish Habitat Interactions and Effects
6.3.2	Migratory birds	6.12.7	Project Activities and Birds Interactions and Effects
6.3.3	Species at Risk	6.13.6	Project Activities and Species at Risk Interactions and Effects
6.3.4	Aboriginal peoples	6.14.6	Project Activities and Indigenous Peoples Interactions and Effects
6.4	Other valued components that may affected as a result of a federal decision….	6.X.X	Subsections for each VC titled “Project Interactions and Effects”
6.4.1	Atmospheric environment	6.1.6	Project Activities and Noise Interactions and Effects

Table ES-1 Table of Concordance

CEAA EIS Guidelines		Beaver Dam Mine EIS Report	
Section	Title	Section	Title
		6.2.5 6.3.6 6.4.6	Project Activities and Air Interactions and Effects Project Activities and Light Interactions and Effects Project Activities and GHG Interactions and Effects
6.4.2	Water quality and quantity	6.6.6 6.7.6	Project Activities and Groundwater Quality and Quantity Interactions and Effects Project Activities and Surface Water Interactions and Effects
6.4.3	Wetlands	6.8.6	Project Activities and Wetlands Interactions and Effects
6.4.4	Plants	6.10.6	Project Activities and Habitat and Flora Interactions and Effects
6.4.5	Wildlife	6.11.6	Project Activities and Terrestrial Fauna Interactions and Effects
6.4.6	Health and socio-economic conditions	6.16.7	Project Activities and Socioeconomic Interactions and Effects
6.4.7	Physical and cultural heritage and structures…	6.15.6	Project Activities and Physical and Cultural Heritage Interactions and Effects
6.5	Mitigation	6.X.X	Subsections for each VC titled “Mitigation”
6.6	Significance of residual effects	6.X.X	Subsections for each VC titled “Residual Effects and Significance”
6.7	Other effects to consider	6.18 7 8	Accidents and Malfunctions Effects of the Environment on the Project Cumulative Effects Assessment
6.7.1	Effects of potential accidents or malfunctions	6.18	Accidents and Malfunctions
6.7.2	Effects of the environment on the Project	7	Effects of the Environment on the Project
6.7.3	Cumulative effects assessment	8	Cumulative Effects Assessment
7.	Summary of Environmental Effects Assessment	10	Environmental Impact Statement Summary and Conclusions
8.	Follow-up and Monitoring Programs	9	Compliance and Effects Monitoring Program
8.1	Follow-up program	9.1	Environmental Management Plans

Table ES-1 Table of Concordance

CEAA EIS Guidelines		Beaver Dam Mine EIS Report	
Section	Title	Section	Title
8.2	Monitoring	9.2	Environmental Monitoring Plans
9.	Nova Scotia Environment Requirements		
	- Name of undertaking	1.2	Proponent Information
	- Location of undertaking	2.1	Project Location
	- Proponent information	1.2	Proponent Information and signed letter
	- Nature of undertaking	1.1	Project Overview
	- Purpose and need of undertaking	1.4	Purpose of the Project
	- Proposed schedules	2.5	Project Schedule
	- Description of undertaking	2	Project Description
	- Environmental baseline information	6.X.X	Subsections for each VC titled "Baseline Conditions"
	- Address public and Aboriginal concerns	3 4 6.14	Public Consultation and Engagement Program Indigenous Peoples Consultation and Engagement Program Indigenous Peoples
	- List of approvals required	1.3	Regulatory framework and Role of Government
	- The sources of public funding	1.1	Project Overview

Table ES-2 Commonly Used Acronyms

Acronym	Expanded Use
AMO	Abandoned Mine Opening
ANFO	Ammonium Nitrate and Fuel Oil
APC	Annapolis Properties Corporation
AQHI	Air Quality Health Index
AQI	Air Quality Index
ARD	Acid Rock Drainage
CAAQS	Canadian Ambient Air Quality Standards
CCME	Canadian Council of Ministers of the Environment
CEAA	Canadian Environmental Assessment Agency
CEAA 2012	Canadian Environmental Assessment Act, 2012
CEAR	Canadian Environmental Assessment Registry
CEO	Chief Executive Officer
CEPA	Canadian Environmental Protection Act
CFM	Cubic Feet per Minute

Table ES-2 Commonly Used Acronyms

Acronym	Expanded Use
CIL	Carbon in Leach
CLC	Citizen Liaison Committee
CO	Carbon Monoxide
CO2 eq	Carbon Dioxide Equivalent Units
COO	Chief Operating Officer
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CSM	Conceptual Site Model
DFO	Fisheries and Oceans Canada
DO	Dissolved Oxygen
EA	Environmental Assessment
EARD	Environmental Assessment Registration Document
ECCC	Environment and Climate Change Canada
EIS	Environmental Impact Statement
EMM	Preliminary Environmental Effects Monitoring Plan
EMS	Environmental Management System
EOM	End of Mine
EPP	Environmental Protection Plan
FWAL	Freshwater Aquatic Life
GDP	Gross Domestic Product
GHG	Greenhouse Gas
HRM	Halifax Regional Municipality
IA	Industrial Approval
IR	Indian Reserve
LAA	Local Assessment Area
MBR	Migratory Birds Regulations
MCBA	Migratory Birds Convention Act, 1994
MDMER	Metal and Diamond Mining Effluent Regulations
MEKS	Mi’kmaq Ecological Knowledge Study
NAPS	National Air Pollution Surveillance Network
NGO	Non Governmental Organization
NOx	Oxides of Nitrogen
NPA	Navigation Protection Act, 1985
NPRI	National Pollutant Release Inventory
NRCAN	Natural Resources Canada
NSAQS	Nova Scotia Air Quality Standards
NSCCH	Nova Scotia Department of Communities, Culture, and Heritage
NSDMA	Nova Scotia Department of Municipal Affairs
NSDNR	Nova Scotia Department of Natural Resources
NSE	Nova Scotia Environment

Table ES-2 Commonly Used Acronyms

Acronym	Expanded Use
NSL&F	Lands and Forests
NSSA	Nova Scotia Salmon Association
NSTIR	Nova Scotia Department of Transportation and Infrastructure Renewal
NWPA	Navigable Waters Protection Act, 1985 (repealed)
O3	Ozone
PA	Project Area
PC	Post Closure
PM	Particulate Matter
PM10	Coarse Particulate Matter
PM2.5	Fine Particulate Matter
RAA	Regional Assessment Area
ROM	Run Of Mine
SAR	Species at Risk
SARA	Species at Risk Act, 2002
SO2	Sulphur Dioxide
SOCI	Species of Conservation Interest
TC	Transport Canada
TDS	Total Dissolved Solids
TPM	Total Particulate Matter
TSS	Total Suspended Solids
TSX	Toronto Stock Exchange
USEPA	United States Environmental Protection Agency
VC	Valued Component
VOC	Volotile Organic Compounds
WSS	Wetlands of special significance

Table ES-3 Units of Measurement List

Unit	Expanded Use
cm/year	Centimetres per Year
g/t	Grams per Tonne
ha	Hectares
HZ	Hertz
km	Kilometre
kt	Kilotonne
kW	Kilowatt
m	Metres
masl	Metres Above Sea Level
mm	Millimetres
Mt	Megatonne
pphm	Parts per Hundred Million
t/y	Tonnes per Year
t/m3	Tonnes per Cubic Metre
µg/m3	Micrograms per Cubic Metre
V	Volt

Table ES-4 Useful Links

Resource/Document
Canadian Environmental Assessment Agency https://www.ceaa-acee.gc.ca/default.asp?lang=En
Canadian Environmental Assessment Agency - Environmental Assessment Registry https://www.ceaa-acee.gc.ca/050/index-eng.cfm
Canadian Environmental Assessment Agency - Beaver Dam Mine Project https://www.ceaa-acee.gc.ca/050/details-eng.cfm?evaluation=80111
Nova Scotia Environment Environmental Assessment https://novascotia.ca/nse/ea/
Nova Scotia Environment, Project Documents and Highlights - Surface Gold Mine at Moose River Gold Mines, Halifax County http://novascotia.ca/nse/ea/MooseRiver.asp
Environmental Assessment Document for the Touquoy Gold Project, Moose River Gold Mines, Nova Scotia, dated March 2007 http://novascotia.ca/nse/ea/MooseRiver/MooseRiver_Registration.pdf
Focus Report, Touquoy Gold Project, Moose River Gold Mines, Nova Scotia, dated November 2007 http://novascotia.ca/nse/ea/MooseRiver/FocusReportTouquoyGoldProject.pdf
Environmental Assessment Approval – Touquoy Gold Project, dated February 1, 2008 http://novascotia.ca/nse/ea/MooseRiver/MooseRiver_MinDecisionFinal.pdf

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1 Introduction

1.1 Project Overview

The Beaver Dam Mine Project (the Project) proposed by Atlantic ~~Gold Corporation~~ Mining NS Corp (AMNS), a wholly owned subsidiary of Atlantic Gold Corporation (Atlantic Gold) or the Proponent, will operate as a satellite ~~surface~~ open pit mine with an approximate ore extraction rate of 2 million tonnes per year (t/y). ~~The Beaver Dam Mine Project is part of the Moose River Consolidated (MRC) Project. The MRC Project also includes the existing and fully permitted Touquoy Gold Project in nearby Moose River Gold Mines, Nova Scotia~~. Crushed ore from the Beaver Dam Mine Site will be transported by truck 30 km to the existing and fully permitted Touquoy Mine Site. Processing of ore from the Beaver Dam gold deposit at the existing Touquoy plant will begin upon completion of mining ~~ore from~~ activities from the Touquoy ~~deposit~~ open pit. The Beaver Dam Mine Project (the Project) is anticipated to begin construction in 2021, come into production in 2022, cease operations in 2026 and then be reclaimed.

The Project is subject to both federal and provincial environmental assessment (EA) processes. This document forms both the Environmental Impact Statement (EIS) and EA Registration Document (EARD) under the federal and provincial processes, respectfully.

This EIS/EARD for the Beaver Dam Mine Project has been prepared to facilitate the approval of the Project in accordance with the *Canadian Environmental Assessment Act, 2012* (*CEAA 2012*) and *Environmental Assessment Regulations* made under the *Nova Scotia Environment Act*. The EIS Guidelines (CEAA 2016) prepared by Canadian Environmental Assessment Agency (CEA Agency) have provided a framework for the organization of this EIS. No public money is being sought to undertake the Project.

The Project as presented in this document is comprised of three components:

- Mining and primary crushing of ore to be loaded onto trucks at the Beaver Dam Mine Site;
- Transporting ore from Beaver Dam along a 30.7 kilometers (km) Haul Road to existing facilities in Moose River; and
- Processing of ore and management of tailings in the exhausted pit at existing facilities ~~developed~~ currently operating as part of the fully permitted Touquoy Gold Project.

The location of these Project components on a regional scale is displayed on Figure 1.1-1.

Physical activities specific to the operation of the Beaver Dam Mine Site will include mining of ore, crushing of ore, operation of till and waste rock storage facilities, and treatment of surface water runoff and mine discharge water through collection and settling ponds. No ore processing or tailings management will occur at the Beaver Dam Mine Site. Operational infrastructure will be minimal as those Project activities will use ~~existing~~ infrastructure at the Touquoy Mine Site in Moose River ~~Gold Mines~~. Electrical power demand required for the Beaver Dam Mine Site is not anticipated to be substantial and will be supplied by on site generators. Petroleum products will be stored on-site for use in generators, operational equipment, and haul trucks.

Transporting ore from the Beaver Dam Mine Site to the existing Touquoy facilities is required for processing the ore and managing tailings in the exhausted Touquoy pit. Portions of the Haul Road route (approximately 15.4 km) will require upgrading to a dual lane road to facilitate the safe passage of two-way truck traffic at a maximum speed of 70 km/h. Where possible, the upgrades will follow the course of the existing roadway; however, some adjustments to existing road alignment will be required to fulfill safe design standards. Another portion of the Haul Road route (approximately 4.0 km) will be new construction to allow the Haul Road to avoid traveling along Highway 224 and past the Mi'kmaq community of Beaver Lake. The remainder of the Haul Road (approximately 11.3 km) is along a dual lane provincial road (i.e., Mooseland Road). This portion of the proposed Haul Road does not travel by any existing residences. A Preferred Alternative Haul Road is being evaluated in this EIS. This 5.7 km section of road reduces interaction with residences and private landowners.

The Touquoy Gold Project underwent a review in 2007 to determine if an EA was required under the existing provincial and federal legislation. It was determined by Nova Scotia Environment (NSE) and the CEA Agency that only a provincial EA was required in accordance with the Nova Scotia *Environmental Assessment Regulations*. Under the *Canadian Environmental Assessment Act (1992)* and its pursuant regulations, there were no triggers for a federal EA when the Touquoy Gold Project was reviewed in 2007. The CEAA file number for the review is 10700-40. The Touquoy Gold Project obtained EA approval in 2008 and has since obtained additional approvals through the applicable provincial regulatory processes, including the Industrial Approval (IA); the Touquoy Gold Project is currently (~~2017~~ 2018) ~~under construction~~ in operation as per its approvals.

Changes to the Touquoy Gold Project as a result of the Beaver Dam Mine Project will be assessed through this ~~EA~~EIS. They include: an increase in the duration of ore processing (approximately four additional years); minor adjustments to the ore processing facility; and disposal of Beaver Dam tailings in the exhausted Touquoy ~~surface mine~~ open pit.

Due to the timing of the Beaver Dam ore being processed at the Touquoy site, the Beaver Dam tailings will not be stored in the Touquoy tailings management facility, but instead would be permanently stored in the pit after the Touquoy gold deposit has been mined. This allows the Touquoy Gold Project footprint to be maintained as permitted and no tailings management will be needed at the Beaver Dam Mine Site. All other aspects of the Touquoy Gold Project will remain as assessed and approved through the Nova Scotia EA process in 2008.

Following the production period for the Beaver Dam Mine Project, reclamation would occur at the Beaver Dam Mine Site and at facilities associated with ore processing and tailings management (exhausted pit) at the Moose River site due to processing Beaver Dam ore. Any changes to the current reclamation plan for the Touquoy Gold Project, as a result of the Project, would require approval by the Province of Nova Scotia.

1.2 Proponent Information

1.2.1 Proponent Profile

The Proponent is a well-financed, growth-oriented gold development group with a long-term strategy to build a mid-tier gold production group focused on manageable, executable projects in mining-friendly jurisdictions. Its board and management team, with extensive experience in geology, mining and mine development, process and metallurgy and project financing, is currently focused on growing gold production in Nova Scotia beginning with its Moose River (Touquoy Mine) phase one open pit gold mine which declared commercial production in March 2018, and includes the Moose River and Beaver Dam deposits. The proponent holds two additional deposits, Fifteen Mile Stream Gold deposit; and the Cochrane Hill Gold deposit currently incorporated in its phase two Life of Mine Expansion.

~~The Proponent, Atlantic Gold, is a well-financed, growth-oriented gold development group with a long-term strategy to create a mid-tier gold production group focused on manageable, executable projects in mining-friendly jurisdictions. Its board and management team, with extensive experience in geology, mining and mine development, process and metallurgy and project financing, is currently focused on the development of its project portfolio of advanced gold development properties located in Nova Scotia, Canada.~~

Currently, ~~Atlantic Gold~~ the Proponent holds four gold development projects in Nova Scotia: the Touquoy Mine, the Beaver Dam Mine Project, the Fifteen Mile Stream Gold Project and the Cochrane Hill Gold Project.

Environmental data collection began in September 2014 and diamond drilling began in October 2014 at the Beaver Dam Mine Site. In November 2014, Ausenco Engineering Canada Inc. (Ausenco) was commissioned by the Proponent to complete the Project Feasibility Study and the NI 43-101 Technical Report for the co-development of the Touquoy and Beaver Dam deposits. Following the successful completion of project financing, construction of the Touquoy Gold Project commenced in June 2016 with commercial production announced in March 2018. For the Beaver Dam Mine Project, regulatory consultation began in October 2014 with a Provincial “One Window Process: Mineral Development in Nova Scotia” meeting to present the planned Project and to receive feedback on the regulatory regime and regional expertise. ~~The permitted Touquoy Gold Project is under construction with operation scheduled to begin in September 2017.~~ The EIS was submitted to CEAA in June 2017. The Project is currently ~~in the permitting phase~~ under EIS/EARD review, and this revised EIS forms the basis for responding to Round 1 of Information Requisitions (IRs). Fifteen Mile Stream and Cochrane Hill Projects are in the pre-submission phases of the EIS/EARD review process. ~~Advanced exploration activities are underway at both Cochrane Hill and Fifteen Mile Stream.~~

~~The Proponent, formerly Spur Ventures Inc., was made aware of the permitted Touquoy Gold Project and other assets in Nova Scotia that were controlled by an Australian-listed company called Atlantic Gold NL. Upon completion of satisfactory due diligence, the two companies merged in August 2014 and Spur Ventures subsequently changed its name to Atlantic Gold Corporation (Atlantic Gold). Shortly after completing this merger, Atlantic Gold subsequently acquired Acadian Mining Corp from Lion Gold Mining Canada Inc. in September 2014. This acquisition gave Atlantic Gold access to the Beaver Dam property and other properties and holdings in Nova Scotia.~~

~~Environmental data collection began in September 2014 and diamond drilling began in October 2014 at the Beaver Dam site. In November 2014, Ausenco Engineering Canada Inc. (Ausenco) was commissioned by Atlantic Gold to complete the Project Feasibility Study and the NI 43-101 Technical Report for the co-development of the Touquoy and Beaver Dam deposits that is the MRC Project. Following the successful completion of project financing, construction of the Touquoy Gold Project commenced in June 2016 with commercial production announced in October 2017. For the Beaver Dam portion of the MRC Project, regulatory consultation began in October 2014 with a Provincial “One Window Process: Mineral Development in Nova Scotia” meeting to present the planned Project and to receive feedback on the regulatory regime and regional expertise.~~

The Beaver Dam property is held under a single mineral exploration license EL50421, currently held by Annapolis Properties Corporation (APC), a wholly owned subsidiary of Acadian Mining Corporation which in turn is a wholly owned subsidiary of ~~Atlantic Gold~~ the Proponent. License EL50421, issue date May 13, 1976, is comprised of 76 contiguous claims which cover an area of approximately ~~569~~ 1230 hectares.

License EL50421 is an amalgamation of EL05920 and EL06175 which was reissued as EL50421 in August 2014. License EL05920 represented the amalgamation of three pre-existing exploration licenses;

EL00047, EL04790 and EL04516 which were acquired in 2002 by Tempus Corporation; Tempus subsequently became Acadian Gold and later Acadian Mining. ~~The licenses were regrouped in 2003 as EL05920 and reissued by the Nova Scotia Department of Natural Resources (NSDNR) in 2005~~. Acadian owns 100% interest in license EL50421; however, portions of the license are subject to differing agreements made prior to its acquisition by Tempus.

Although ~~As the corporate entity that would develop, manage and operate the Project, Atlantic Gold is the parent company of subsidiaries which are listed on the Nova Scotia Registry of Joint Stocks:~~ Annapolis Properties Corporation ~~which~~ holds the mineral exploration license EL50421 for the Beaver Dam property; ~~and~~ the Proponent, which holds the existing permits, leases and licenses for the Touquoy Gold Project, will develop, manage and operate the Beaver Dam Gold Project.

1.2.2 Corporate Governance and Management Structure

The Proponent is committed to the highest practical standards of corporate governance and to being a responsible corporate citizen. Safe production and environmental stewardship are keys to the Proponent's organization. The company relies upon its senior management team and Board of Directors who have extensive experience with past mining developments worldwide.

The current senior management team of Atlantic Gold:

- Steven Dean – Chairman, Chief Executive Officer (CEO) and Director
- Maryse Bélanger – President, Chief Operating Officer and Director (COO)
- Chris Batalha – Chief Financial Officer and Corporate Secretary
- ~~John Thomas – VP Projects~~
- Tom Ellard – VP Business Integration & people
- Alastair Tiver – VP Mine Development
- Tony Woodfine – General Manager, Touquoy Gold Mine Project
- Sally Goodman – Chief Geologist
- Doug Currie – General Manager, Exploration
- James Millard – Manager Environment and Permitting
- Neil Schofield – Consulting Resource Geologist
- ~~Sean Thompson – Manager Investor Relations~~

The CEO reports to the eight-member Board of Directors:

- Steven Dean – Chairman and CEO
- ~~John Morgan – Director~~
- Robert Atkinson – Director
- Maryse Belanger – President, Chief Operating Officer & Director
- Wally Bucknell – Director

- William Armstrong – Director
- David Black – Director
- Donald Siemens – Director
- Ryan Beedie – Director

Traded on the Toronto Stock Exchange (TSX) as AGB-V, Atlantic Gold is committed to meeting or exceeding the standards set by the TSX Venture Exchange article and Canadian securities regulators. The Company has a Nominating and Corporate Governance Committee, an Audit Committee and a Compensation Committee, as well as policies and codes, such as Code of Conduct which includes obligations regarding environmental standards, health and safety, contributions to local communities, and respect and tolerance. Any breaches of this Code must be immediately reported to the Chair of the Nominating and Corporate Governance Committee.

The Board of Directors recently directed the Proponent to develop an Environmental Management System (EMS) based on environmental risk. An EMS is viewed by the Board and senior management as key for due diligence from perspectives of fiscal, legal, social, and environmental responsibility. Development and implementation of the EMS with associated procedures in an Environmental Protection Plan (EPP) will include all phases of the Proponent's development projects, including exploration, construction to operation, maintenance, monitoring and ultimately closure, as well as integrate other aspects such as documentation. The EPP will also address specific contingency planning and spill response procedures.

The EMS will ensure mechanisms are in place such that corporate policies associated with fiscal, legal, social and environmental responsibility will be implemented and respected for the Atlantic Gold projects. The overall responsibility to develop the EMS rests with the COO while technical development and implementation of the EMS and its EPP will be a key area of accountability of the Manager of Environment and Community Relations. Technical staff on site will be responsible for ensuring the EPP is implemented on a daily basis.

As part of its commitment to corporate responsibility and incorporation of best practices, the Proponent has established a Geotechnical and Tailings Dam Review Board (Review Board) for design, construction and operation phases of the Atlantic Gold projects. This includes tailings management, waste rock storage and open pit mining activities. Reporting to Atlantic Gold's COO, the Review Board is established to provide ongoing, independent confirmation to the Proponent by internationally-recognized experts that the design, construction, operation and closure of the Atlantic Gold projects conform with international best practice and to minimize impact in compliance with its permits and licenses. The Review Board is independent, and its scope includes reviewing, commenting, questioning, critiquing and advising on all aspects of including, but not limited to:

- Engineering design;
- Construction practices;
- Operation and maintenance practices;
- Closure and post-closure requirements;
- Stability;
- Water management and treatment, including both surface and ground water;

- Geochemical considerations;
- Management systems;
- Budget and staffing;
- Emergency preparedness and response planning; and
- Community interaction.

The proponent intends to maintain suitable insurance and bonding to ensure its commitments are met. This includes maintaining financial bonding to ensure that adequate reclamation security is in place at all times during the construction, development and operational phases of the Company's mining projects, as well as appropriate environmental impairment liability insurance. As part of the existing Touquoy Gold Project, both reclamation security and environmental liability insurance are maintained as per requirements of the Province of Nova Scotia.

Further the proponent commits to completing its operations in adherence with best available practices (BAPs) and industry standards as per guides developed by Mining Association of Canada, such as the Towards Sustainable Mining initiative, and the Canadian Dam Association.

1.2.3 Proponent Personnel Details

A corporate office in Vancouver, British Columbia and a local office in Moose River Gold Mines, Nova Scotia are maintained in support of the Atlantic Gold projects. Key management and technical staff will be located in both locations for the duration of the Beaver Dam Mine Project. The addresses for both office locations are provided in Table 1.2-1.

Table 1.2-1 Office Locations

Corporate Office	Local Office
Suite 3083, Three Bentall Centre 595 Burrard Street, P.O. Box 49298 Vancouver, British Columbia Canada V7X 1L3 Tel: (604) 689-5564 Fax: (604) 566-9050	6749 Moose River Road Moose River Gold Mines RR2 Middle Musquodoboit, Nova Scotia Canada B0N 1X0 Tel: (902) 384-2772

All communications regarding the EA for the Project should be sent to the Manager of Environment and ~~Community Relations~~Permitting as directed by the COO. The contact information for these two roles is outlined in Table 1.2-2.

Table 1.2-2 Proponent Contacts

Position	Proponent
Chief Operating Officer	**Maryse Bélanger** Vancouver, British Columbia Phone: (604) 689-5564 Email: mbelanger@atlanticgoldcorporation.com
Manager Environment and Permitting	**James Millard** Middle Musquodoboit, Nova Scotia Phone: (902) 384.2772 Email: jmillard@atlanticgoldcorporation.com

1.2.4 Environmental Assessment Study Team

The EIS was prepared by a consulting team comprised of GHD Limited (GHD) under contract to the Proponent. GHD had direct input from McCallum Environmental Limited (MEL). GHD focused on physical and socio-economic Valued Components (VC), while MEL focused on biophysical VCs. GHD and MEL are consulting firms with extensive experience conducting environmental studies, assessments, and permitting for mining developments in Nova Scotia. Staff of Atlantic Gold provided input and review of the submission.

The contact information for the consulting team is listed in Table 1.2-3.

Table 1.2-3 EA Study Team

GHD Limited Team Leader	McCallum Environmental Limited Team Leader
Peter Oram, P.Geo. Phone: (902) 468-1248 Email: peter.oram@ghd.com 45 Akerley Blvd Dartmouth, Nova Scotia Canada B3B 1J7	Meghan Milloy, MES Phone: (902) 446-8252 Email: meghan@mccallumenvironmental.com Unit 115, 2 Bluewater Road Bedford, Nova Scotia Canada B4B 1G7

Atlantic Gold, GHD, and MEL will be herein referred to as the “EA Study Team”.

Sub-contractors and their role in completing supporting documentation for the preparation of this EIS are included in Table 1.2-4.

Table 1.2-4 Sub-contractors Providing Supporting Information

Sub-contractor	Contributing Role
Cultural Resource Management Group Limited	Prepared an archaeological assessment report for the Project
Confederacy of Mainland Mi'kmaq - Environmental Services	Prepared a Mi'kmaq Ecological Knowledge Study report for the Project
~~Peter Clifton and Associates~~	~~Prepared an assessment of potential open pit a groundwater inflows for the Project~~
Stantec	Prepared the following studies at the Touquoy Mine Site; a water and tailings management plan, groundwater flow and solute transport model, and an assimilative capacity study of Moose River
Intrinsik	Prepared an evaluation of exposure potential related to dust deposition from Haul Road traffic onto soils, berries, and vegetation as well as an aquatic effects assessment for the Killag and Moose Rivers
Lorax Environmental	Prepared geochemical source term predictions and an ML/ARD assessment report
Wood Environment & Infrastructure Solutions	Prepared a Beaver Dam Mine Site conceptual treatment approach
Allnorth Engineering, Consulting, Project Management, and Surveying	Reviewed the engineering feasibility of the new construction portion of the Haul Road
Opus International Consultants	Prepared Roadway Review – Beaver Dam Road to Mooseland Road
Ausenco Engineering Canada Incorporated	Prepared a feasibility study for the Project

1.3 Regulatory Framework and Role of Government

The federal, provincial, and municipal regulatory framework outlines requirements for the EA process, the permits required for construction, operation and reclamation, and the conditions under which the Project will be operated. General legislation that may be applicable to the Project is outlined in Table 1.3-1, while key legislation which directly drives the development of the EIS is explained in more detail in the coming sections.

Table 1.3-1 Legislation Potentially Applicable to the Project

Legislation	Physical Activity and/or Trigger	Regulatory Authority
FEDERAL		
CEAA 2012	Assessment due to the construction, operation, decommissioning of a gold mine with an ore production capacity greater than 600 tonnes per day.	CEAA
Fisheries Act	Potential authorization and compensation due to physical activities in wetlands, watercourses, and water bodies.	DFO
Fisheries Act – *Metal and Diamond Mining Effluent Regulations*	Environmental Effects Monitoring program due to mining effluent discharge to aquatic habitat.	DFO
Migratory Birds Convention Act – Migratory Birds Regulations	Potential authorization due to physical activities potentially relocating birds and destroying their habitat.	ECCC
Species at Risk Act	Potential authorization due to physical activities potentially destroying SARA listed species and/or their habitat.	DFO/ECCC
Navigation Protection Act	Potential authorization to opt works out of the NPA regime that may have approvals in accordance with repealed NWPA.	TC
Canadian Environmental *Protection Act*	Promotes sustainable development through pollution prevention and the protection of the environment and human health from risks associated with toxic substances.	ECCC
Transportation of Dangerous *Goods Act*	The movement of dangerous goods to, form, and within the site must comply with applicable regulations under the Transportation of Dangerous Goods Act.	TC
PROVINCIAL		
Environment Act – *EA Regulations – Schedule A*	Assessment due to the construction, operation, decommissioning of a facility that extracts or processes metallic or non-metallic minerals.	NSE
Environment Act – Activities Designation Regulations	Industrial Approval for the construction, operation, or reclamation of a surface mine using explosives and procuring mineral bearing ore.	NSE

Legislation	Physical Activity and/or Trigger	Regulatory Authority
Environment Act – Activities Designation Regulations	Water approval and/or notification for water withdrawal, alteration of water bodies, watercourses, and/or wetlands.	NSE
Environment Act – *Air Quality Regulations*	Ambient air quality standards for baseline environmental conditions discussion.	NSE
Special Places Protection Act and Regulations	Authorization required prior to conducting intrusive archaeological work.	NSCCH
Wildlife Act	Prohibits taking, hunting, killing or possessing eagles, osprey, falcons, hawks, owls, and any other protected wildlife.	~~NSDNR~~ NSL&F
Endangered Species Act	Prohibits killing, injuring, disturbing, taking, or interfering with endangered or threatened species and/or their habitat.	~~NSDNR~~ NSL&F
Crown Lands Act	Crown Lands Lease due to new Haul Road construction being located on Crown Lands.	~~NSDNR~~ NSL&F
Municipal Government Act	Authorizes municipalities to develop Municipal Planning Strategies and Land Use By-laws.	NSDMA
MUNICIPAL		
National Building Code of Canada	Approval for construction and occupation of buildings.	HRM

The Project is also driven by guidelines, policies, and standards that may be applicable during design, construction, operation, and reclamation. Those that may potentially be applicable to the Project are listed below, while key guidance documents which are directly applicable to the development of the EIS are listed in the coming sections.

Federal

- Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (FWAL) (CCME 1999a);
- CCME Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health (CCME 1999b);
- CCME Canadian Sediment Quality Guidelines for the Protection of Aquatic Life (CCME 2001);
- CCME Canada Wide Standards for Particulate Matter (PM) and Ozone (CCME 2010);
- Environmental Codes of Practice for Metal Mines (ECCC 2009);

- Guidelines for the Assessment of Alternatives for Mine Waste Disposal (ECCC 2011);
- Streamlining the Approvals Process for Metal Mines with Tailings Impoundment Areas (ECCC 2012);
- Guidance Document for Flow Measurement of Metal Mining Effluents (ECCC 2001);
- Guidance Document for Sampling and Analysis of Metal Mining Effluents (ECCC 2002);
- Guide for Reporting to the National Pollutant Release Inventory (NPRI) 2016 and 2017 (ECCC 2016a); and
- Federal Policy on Wetland Conservation (ECCC 1991).

Provincial

- Guidelines for Environmental Noise Measurement and Assessment (NSE 1990);
- Toward a Greener Future: Nova Scotia's Climate Change Action Plan (NSE 2009);
- Guide to Consider Climate Change in Project Development in Nova Scotia (NSE 2011a);
- Nova Scotia Wetland Conservation Policy (NSE 2011b);
- From Strategy to Action, An Action Plan for the Path We Share, A Natural Resource Strategy for Nova Scotia (NSDNR 2011a);
- The Path We Share: A Natural Resource Strategy for Nova Scotia 2011-2020 (NSDNR 2011b);
- Water for Life: Nova Scotia's Water Resource Management Strategy (NSE 2010);
- Nova Scotia Standard Specifications: Highway Construction and Maintenance (NSTIR 1997);
- Erosion and Sediment Control Handbook for Construction Sites (NSE 1988);
- Guide to Altering Watercourses (NSE 2015a);
- Nova Scotia Watercourse Alterations Standard (NSE 2015b);
- Generic Environmental Protection Plan for Construction of 100 Series Highways (NSTIR 2007);
- Storm Drainage Works Approval Policy (NSE 2002a).

Municipal

- Musquodoboit Valley/Dutch Settlement Municipal Planning Strategy (HRM 1996a);
- Musquodoboit Valley/Dutch Settlement Land Use By-law (HRM 1996b);
- Eastern Shore (East) Municipal Planning Strategy (HRM 1996c); and
- Eastern Shore (East) Land Use By-law (HRM 1996d).

1.3.1 Federal Regulatory Framework

1.3.1.1 Canadian Environmental Assessment Act, 2012

CEAA 2012 regulates the Government of Canada's EA process and the *Regulations Designating Physical Activities* (amended December 31, 2014) specify the physical activities to which *CEAA 2012* applies. The

Project is a designated project in accordance with Section 16(c) of these *Regulations*, as it is a project which involves:

> *The construction, operation, decommissioning, and abandonment of a new rare earth element mine or gold mine, other than a placer mine, with an ore production capacity of 600 t/day or more.*

Key regulatory events in accordance with *CEAA 2012* which have given rise to the completion of this EIS are provided in Table 1.3-2. Additional details for all of these events can be found on the Canadian Environmental Assessment Registry (CEAR).

Table 1.3-2 Timeline of Events in Accordance with CEAA 2012

Date	Event
October 16, 2015	The proponent and GHD submit a Project Description document to CEAA in order to initiate the EA determination process (GHD 2015).
October 19, 2015	CEAA releases a public notice inviting comments on the Project Description document in order to acquire assistance in the EA determination process. The public has 20 days to comment.
December 3, 2015	CEAA releases the Notice of EA Determination indicating that a federal EA is required for the Beaver Dam Mine Project.
December 7, 2015	CEAA releases the Notice of Commencement of an EA.
December 7, 2015	CEAA releases the draft EIS Guidelines and a public notice inviting comments on the guidelines in order to ensure they reflect which aspects of the environment may be affected and should be examined during the EA. The public has 37 days to comment.
January 19, 2016	CEAA releases the final EIS Guidelines specific to the Beaver Dam Mine Project.
January 25, 2016	CEAA releases a public notice inviting eligible individuals and groups to apply for federal funding in order to enable their participation in the upcoming steps of the environmental assessment.
April 29, 2016	CEAA releases the results of funding allocation for participation in the upcoming steps of the environmental assessment.
Project Initiation to March 2017	Baseline data collection, engagement with regulators, stakeholders, and Mi'kmaq, and drafting of the EIS.
March 27, 2017	The Proponent submits the Beaver Dam Mine Project EIS for conformity review.
April 27, 2017	CEAA issues a letter providing the outcome of the Beaver Dam Mine Project EIS conformity review.

Date	Event
June 2, 2017	The Proponent re-submits the Beaver Dam Mine Project EIS for conformity review.
June 28, 2017	Beaver Dam Mine Project meets conformity and commences formal review process under CEAA
Aug 9 and 27, 2017	CEAA provided Information Requests to the Proponent (Round 1: Part 1 and Part 2)

CEAA will prepare and publish a draft EA report which considers all public and government comments, and details conclusions regarding the potential for environmental effects from the Project. The draft EA report will be subject to another public review period before being finalized. Once finalized, the Minister of the Environment will complete a review and issue a decision, which will include a determination of significance of environmental effects. The Project is contingent upon an approved EA decision statement that allows the Project to proceed.

1.3.1.2 Fisheries Act, 1985

The *Fisheries Act* is administered by Fisheries and Oceans Canada (DFO) and generally protects the sustainability and productivity of recreational, commercial, and indigenous fisheries in Canada.

Under Section 35(1) *no person shall carry on any work, undertaking, or activity that results in serious harm to fish that are part of a commercial, recreational, or Aboriginal fishery, or fish that support such a fishery* unless authorized by or carried on in accordance with regulations issued in accordance with the *Fisheries Act*. In addition, Section 36(3) prohibits the discharge or deposition of *a deleterious substance in water frequented by fish* unless authorized or carried on in accordance with those same regulations.

As a result of anticipated physical activities potentially occurring in wetlands, watercourses, and water bodies, authorization in accordance with Section 35(2) of the *Fisheries Act* may be required.

Metal and Diamond Mining Effluent Regulations

The Metal and Diamond Mining Effluent Regulations (MDMER) are made under the Fisheries Act and apply to mines that exceed an effluent flow rate of $50m^3$ per day, based on effluent deposited from all final discharge points of the mine and deposit of a deleterious substance in any water or place referred to in subsection 36(3) of the Act.

As a result of anticipated collection and discharge of surface water runoff and mine discharge water through settling ponds, effluent monitoring in accordance with the Section 2(1) of the MDMER may be required.

1.3.1.3 Migratory Birds Convention Act, 1994

Section 5 of the *Migratory Birds Convention Act* (*MBCA*) protects migratory birds, their nests, and their eggs from hunting, trafficking, and commercialization. A permit is required to disturb, destroy, or take a nest, egg, nest shelter, eider duck shelter, or duck box of a migratory bird.

In addition, Section 5.1 of the *MCBA* prohibits the discharge or deposition of a substance harmful to migratory birds *in waters or an area frequented by migratory birds or in a place from which the substance* *may enter such waters or such an area*. The discharge or deposition of a substance that may combine with a substance already present to create a harmful substance is also prohibited in Section 5.1.

Migratory Birds Regulations

The *Migratory Birds Regulations* (*MBR*) is made under the *MBCA* and may apply to the Project as a result of anticipated physical activities potentially relocating birds and destroying their habitat. An authorization in accordance with Section 4(1) of the *MBR* may be required.

1.3.1.4 Species at Risk Act, 2002

The *Species at Risk Act* (SARA) protects wildlife species from becoming extinct through prohibitions against killing, harming, harassing, capturing or taking species at risk (SAR), and against destroying their critical habitats. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) identifies species of special concern that may then qualify for legal protection and recovery in accordance with *SARA*. *SARA*'s mandate is to provide for the recovery of SAR and to ensure through sound management that species of concern do not require *SARA* listing. DFO is responsible for aquatic SAR, while ECCC is responsible for terrestrial SAR.

As a result of anticipated physical activities potentially occurring in wetlands, watercourses, and water bodies, as well as the potential destruction of sensitive terrestrial habitat, authorization in accordance with SARA may be required.

1.3.1.5 Navigation Protection Act, 1985

The *Navigation Protection Act* (*NPA*), formerly the *Navigable Waters Protection Act* (*NWPA*), was amended in April 2014 and effectively changed the definition of navigable water under this legislation.

Prior to the most recent amendment, navigable waters included all bodies or courses of water that were capable of being navigated by any type of floating vessel for transportation, recreation, or commerce. This definition created the need for works in, on, under, or over any water body or watercourse to obtain a Navigable Waters Protection Approval.

Following the most recent amendment, a schedule was added to the *NPA* that lists scheduled waters for which regulatory approval is required for works that risk a substantial interference with navigation. The schedule lists three oceans, 62 rivers, and 97 lakes, none of which are located in the area of the Project.

Although no scheduled waters are located in the area of the Project, works completed prior to the most recent amendment may have obtained a Navigable Waters Protection Approval in accordance with the repealed *NWPA*, which are still valid in accordance with the *NPA*.

As a result of anticipated physical activities potentially occurring in, on, under, or over a watercourse or water body, authorization from Transport Canada (TC) to opt the works out of the *NPA* regime may be required. The opt-out option must be exercised by April 1, 2019 (NPA 2014). The Proponent will identify to TC the existing crossings on which alterations/work are being proposed and will opt out of the *NPA* regime as required. A full list of watercourses and water bodies located within the Beaver Dam Mine Site and Haul Road is provided in Tables 6.7-4 to 6.7-6.

1.3.1.6 Federal Guidance Applicable to the Project

In addition to the EIS Guidelines developed for the Project, other guidance documents from CEAA that have been consulted include but are not limited to:

- Operational Policy Statement Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012 (CEAA 2013a);
- Operational Policy Statement Addressing "Purpose of" and "Alternative Means" under the Canadian Environmental Assessment Act, 2012 (CEAA 2013b);
- Operational Policy Statement Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012 (CEAA 2015a);
- Draft Technical Guidance for Assessing Cumulative Environmental Effects Under the Canadian Environmental Assessment Act, 2012 (CEAA 2014a); and
- Technical Guidance for Assessing Physical and Cultural Heritage or any Structure, Site, or Thing that is of Historical, Archaeological, Paleontological, or Architectural Significance under the Canadian Environmental Assessment Act, 2012 (CEAA 2014b).

1.3.2 Provincial Regulatory Framework

1.3.2.1 Environment Act, 1995

Environmental Assessment Regulations

The Environmental Assessment Regulations made under Section 49 of the *Environment Act* regulates the Government of Nova Scotia's EA process. Projects that trigger the EA process are sub-divided into two classes – Class I and Class II. The Project triggers a Class I EA in accordance with Schedule A, Section B (1a) of these regulations, as it is a project which involves:

- *A facility that extracts or processes metallic or non-metallic minerals.*

This EIS will substitute and fulfill all the requirements of a provincial Environmental Assessment Registration Document (EARD). Table ES-1 outlines the requirements of the EARD and how they have been addressed in the EIS.

Activities Designation Regulations

Many of the provincial permits anticipated to be required for the Project are regulated in accordance with the *Activities Designation Regulations* made under Section 66 of the *Environment Act*. An Industrial Approval (IA) will be required in accordance with Section 16(2d) of these regulations, as it is a project that involves:

- *A surface mine where an opening or excavation is made in the ground from the surface which may require the use of explosives for the purpose of procuring any mineral bearing ore, including coal, and any associated infrastructure.*

The IA process, known as Part V of the *Environment Act* seeks to guide the proponent in determining the way in which a project, after EA Approval, is to be monitored for compliance targets, objectives set through the EA process, and commitments made by proponents through various means such as public and Indigenous Peoples consultation. It is a well understood process by the Proponent, having been part of the process for the existing Touquoy operation that has an IA.

Activities required to facilitate the Project, including wetland and watercourse alteration and groundwater and surface water withdrawals, may require approvals in accordance with these regulations as well. These permitting requirements will be initiated once EA approval has been received from the province.

1.3.2.2 Provincial Guidance Applicable to the Project

Provincial guidance documents that have been consulted in preparation of this EIS include:

- A Proponents Guide to Environmental Assessment (NSE 2001);
- Guide to Preparing an EA Registration Document for Mining Developments in Nova Scotia (NSE 2002b);
- Guide to Considering Climate Change in Environmental Assessment in Nova Scotia (NSE 2011c); and
- Guide to Addressing Wildlife Species and Habitat in an EA Registration Document (NSE 2005).

1.3.3 Municipal Regulatory Framework

The Halifax Regional Municipality is divided into 21 community plan areas that have their own set of land use strategies and by-laws. The Project straddles the boundary of the Musquodoboit Valley/Dutch Settlement Plan Area and the Eastern Shore (East) Plan Area.

The Beaver Dam Mine Site and Touquoy Mine Site are located in the Musquodoboit Valley and Dutch Settlement Plan Area. The Land Use By-law and Municipal Planning Strategy for this area were last amended in October 2014. The area is zoned mixed use, and extractive facilities, of which mining related infrastructure is one, are permitted within this zoning designation. The by-law for mixed use land use prescribes minimum separation distances from features such as lot lines, dwellings, watercourses, domestic wells, and residential zones. The physical activity of mining or extraction is not specified in the by-law as it is governed in the provincial and federal regulatory regime (pers. comm. L. Walsh 2016). The Municipal Planning Strategy describes mining as an important land use within the Plan Area from an economic perspective; however, extractive operations can potentially create harmful environmental effects. The Municipal Planning Strategy also states *these concerns are addressed by the provincial Department of Environment through their permitting process*.

The majority of the Haul Road is located in the Eastern Shore (East) Plan Area, while a minor portion is located in the Musquodoboit Valley and Dutch Settlement Plan Area. The area is zoned mixed use under the Musquodoboit Valley and Dutch Settlement Land Use By-law, and rural resource under the Eastern Shore (East) Land Use By-law. Haul roads are not specified in either by-law as these are governed in the provincial regulatory regime (pers. comm. L. Walsh 2016).

1.3.4 Indigenous Peoples

In 2004 and 2005, the Supreme Court of Canada decided the Crown (provincial and federal) has a duty to consult with Indigenous Peoples when contemplating decisions or actions that may adversely affect their established or potential indigenous rights and treaty rights. The provincial government typically delegates certain procedural aspects of this consultation to the proponent of a project. The federal government always acts as the consultation coordinator to integrate the Government of Canada’s indigenous consultation activities into the EA process. This duty cannot be delegated to proponents.

The Made-in-Nova Scotia Process is the forum for the Mi'kmaq, Nova Scotia and Canada to resolve issues related to Mi'kmaq treaty rights, Aboriginal rights, including Aboriginal title, and Mi'kmaq governance. The process involves the Mi'kmaq of Nova Scotia as represented by the Assembly of Nova Scotia Mi'kmaq Chiefs and the provincial and federal governments.

Through the provincial Indigenous Peoples consultation process, the EA Study Team was delegated aspects of the consultation. This engagement of the Mi'kmaq of Nova Scotia by the Proponent referenced two key guidance documents which have influenced the EA process for the Project:

- Proponents' Guide: The Role of Proponents in Crown Consultation with the Mi'kmaq of Nova Scotia (NSOAA 2009); and
- Mi'kmaq Ecological Knowledge Study Protocol, 2nd Edition (KMKNO 2007).

  Other pertinent guidance in the federal regulatory framework which has influenced the EA process for the Project includes:

- Aboriginal Consultation and Accommodation – Updated Guidelines for Federal Officials to Fulfill the Duty to Consult (AANDC 2011);
- Technical Guidance for Assessing the Current Use of Lands and Resources for Traditional Purposes under the Canadian Environmental Assessment Act, 2012 (CEAA 2015b)
- Reference Guide Considering Aboriginal Traditional Knowledge in Environmental Assessments Conducted Under the Canadian Environmental Assessment Act, 2012 (CEAA 2014c).
- In Nova Scotia, treaty rights were established in law following the 1999 decision in the Donald Marshall Jr. case which confirms the right of the Mi'kmaq to hunt, fish, and gather to earn a moderate livelihood. These are protected under Section 35 of the *Constitution Act*, 1982.

1.4 Purpose of the Project

The implementation of the Project will provide additional ore to the existing Touquoy processing plant. This will extend the life of the ~~MRC~~ Touquoy Mine Site to continue to provide economic and social benefits with minimal additional infrastructure. Completing the Project with safe production, environmental stewardship and community engagement is key for the Proponent to ensure that the Province, the community, and the Mi'kmaq of Nova Scotia have maximum benefit.

Worldwide annual gold production is about 2500 to 3000 tonnes. Gold is used primarily for jewelry and as a storage form of wealth with China and India forming the majority of ~~most of~~ the demand. Canada produced about 5% of the world total in past years. With the Proponent's four gold development projects in Nova Scotia, there is much opportunity to supply gold with existing and expected future demand.

The Proponent has recognized that the quantity and unusual style of gold mineralization at the Beaver Dam Mine Site will support a commercially viable surface mining operation with on-site crushing and off-site processing of ore. The amount of gold expected to be recovered will represent more than one-third of the gold produced from the historic goldfields of Nova Scotia since the 1860s.

The Proponent wishes to develop this resource in line with all applicable regulatory requirements and recognizes the significant potential benefits to the local economy, the Province of Nova Scotia, the Mi'kmaq of Nova Scotia and the company in completing this Project. The Proponent has designed a project that is in line with the intent of NSL&F for efficient use of mineral resources and to "*promote the concepts of environmental responsibility and sustainable development, stewardship of the mineral resource sector, and integrated resource planning.*"

All phases of the Project will provide employment opportunities for local residents and Indigenous Peoples, as well as provide tax revenue for the municipal, provincial, and federal levels of government. It is anticipated that additional labour force will be required during construction and a smaller, but still significant, labour force will be required during operation. Indirect employment will be generated by the Project through the use of external contractors and suppliers. Tax revenue in the millions of dollars per year will be generated through corporate income taxes paid by the Proponent, as well as its contractors and suppliers. Socio-economic benefits that will occur as a result of the Project are discussed further in Section 1.6.2.

1.5 Guiding Principles

1.5.1 Planning Tool

At its foundation, EA is a planning tool used to ensure that projects are carefully planned to avoid or mitigate possible negative environmental effects and to maximize potential benefits. Use of the EA process early in a project's planning phase can be used to encourage proponents to develop their projects in the most sustainable manner. The use of the EIS Guidelines required the Proponent to carefully review and consider the Project, including its alternatives, and the potential effects on valued components

1.5.2 Public Participation

The EIS Guidelines require that the Proponent provide current information about the Project to the general public and especially the communities likely to be most affected by Project activities. Within the provincial and federal EA processes, there are distinct public comment periods, including the opportunity to comment on the EIS. To maximize public participation, proponents are required engage the public directly and early on in the EA process.

The Proponent has been engaging stakeholders, including the local community, non-governmental organizations, governmental departments, and the local community since planning and permitting began on the Touquoy Gold Project over a decade ago. More specific to Beaver Dam Mine Project, specific engagement activities occurred in past year to facilitate public participation. This included open houses in May 2016, presentations and meeting with community organizations and expansion of the existing Community Liaison Committee (CLC).

Comments from the public were considered in the development of the EIS in terms of planning the Project and its assessment for each VC; responses from the Proponent are documented in this EIS.

Refer to Section 3 of this EIS for additional details regarding the public consultation and engagement program.

1.5.3 Indigenous Engagement

The EIS Guidelines require that the Proponent engage with Indigenous Groups that may be affected by the Project.

Within the provincial and federal EA processes and as part of the Made-in-Nova Scotia Process, there are distinct consultation processes completed by the Crown. To maximize engagement of Indigenous Peoples in the EA process, proponents are required engage Indigenous Peoples directly and early on in the EA process.

The Proponent engaged with the Mi'kmaq of Nova Scotia to obtain views on:

- Effects of changes to the environment on the Mi'kmaq of Nova Scotia, specifically: health and socio-economic conditions; physical and cultural heritage, including any structure, site or thing that is of historical, archaeological, paleontological or architectural significance; and current use of lands and resources for traditional purposes; and

- Potential adverse impacts of the Project on potential or established Aboriginal or Treaty rights, title and related interests, in respect of the Crown's duty to consult, and where appropriate, accommodate the Mi'kmaq of Nova Scotia.

The information gathered by the proponent during its engagement with Indigenous Peoples helps to contribute to the Crown's understanding of any potential adverse impacts of the Project on potential or established Aboriginal or treaty rights, title and related interests, and the effectiveness of measures proposed to avoid or minimize those impacts.

The Proponent has been engaging the Mi'kmaq of Nova Scotia since planning and permitting began on the Touquoy Gold Project over a decade ago. More specific to the Project, specific engagement activities occurred in past year to engage the Mi'kmaq of Nova Scotia. This included open houses in May 2016, many presentations and meetings with different Mi'kmaq groups, and expansion of the existing CLC to include representatives of the two nearest Mi'kmaq communities, Millbrook First Nation and Sipekne'katik First Nation. Recent engagement efforts through 2018 and 2019 have taken place with Millbrook, Sipekne'katik and KMKNO relating to project technical updates, mitigation and monitoring plans, changes to Project infrastructure including waste rock stockpiles and the Preferred Alternative Haul Road, and discussions relating to thresholds of significance with Millbrook First Nation.

Comments from the Mi'kmaq of Nova Scotia were considered in the development of the EIS in terms of planning the Project and its assessment for each VC; responses from the Proponent are documented in this EIS. Refer to Section 4 of this EIS for additional details regarding the Indigenous Peoples consultation and engagement program.

1.5.4 Precautionary Approach Application

The EIS Guidelines require that the Proponent demonstrate how all aspects of the Project have been examined and planned in a precautionary manner to avoid serious or irreversible environmental effects. This EIS applies the precautionary approach through the following assessment methodologies:

- provides extensive detail about the existing environment and develops mitigation measures to eliminate, reduce, or control the effect Project activities have on the environment;
- considers project design that will minimize disturbance to the existing environment;
- outlines contingency plans that address worst-case accidents and malfunctions;
- outlines follow-up and monitoring programs to verify project activity related impact predictions; and
- anticipates other projects in the area in an effort to eliminate, reduce, or control cumulative effects.

The application of a precautionary approach in developing this EIS will allow the EA to act as a planning tool which will be used to ensure the Project avoids or mitigates potential environment effects and promotes sustainable development.

1.6 Benefits of the Project

1.6.1 Environmental Benefits

The environmental benefits of the Project to Nova Scotia are numerous to correct past practices with respect to the environment. Given the area has been subjected to extensive exploration, mining, and logging activity over the past 150 years, baseline conditions show obvious effects from these historic activities. The current condition of the Beaver Dam Mine Site is disturbed and fragmented habitat based on significant timber harvesting, associated road building and yarding areas and historic exploration/mining activity. The Project Area (PA) contains a diversity of habitat types and landscape features but has experienced a considerable amount of disturbance and habitat fragmentation as a result of these activities. The level of disturbance within the Beaver Dam Mine Site disproportionately affects uplands, over wetlands. As such, the level of new fragmentation associated with the Beaver Dam Mine Site is anticipated to be moderate, given the current level of disturbance.

The poor condition of the majority of existing Haul Road culvert crossings directly contributes to poor surface water quality and fish passage in watercourses and wetlands along the Beaver Dam Mines Road and the Moose River Cross Road. Upgrades to this existing Haul Road will include culvert replacements at the 20 locations and 3 new bridges, where determined to be necessary. It is expected that correctly installed culverts will increase fish passage and positively affect fish habitat through improved surface water quality.

All baseline environmental investigations for the Project have added to the scientific understanding of the area and improved background data held by the province. Background data helps increase the knowledge base of its users and thus increases public ecological awareness and promotes conservation of natural ecosystems.

At closure, reclamation will occur on the Beaver Dam Mine Site and the Touquoy Mine Site. This reclamation plan will be secured with a bond held by the Province of Nova Scotia to ensure there are sufficient funds to reclaim the site at any point during the Project. The plan for reclamation requires approval of the Nova Scotia Department of ~~Natural Resources~~Lands and Forests.

1.6.2 Socio-economic Benefits

KPMG International completed an Economic Impact Assessment of the Moose River Consolidated (MRC) Project to evaluate the economic benefits stemming from the Proponent’s mining projects in Nova Scotia (KPMG 2015). This assessment considered the Touquoy and Beaver Dam Mine Projects together and found that socio-economic benefits will stem primarily from the construction and operation phases of the Beaver Dam Mine Project.

Construction activities will involve preparing the Beaver Dam Mine Site, setting up infrastructure and facilities, and purchasing mining processing equipment to enable the MRC Project to reach full production. Much of the spending associated with these activities will be incurred in Nova Scotia and Canada. As per the KPMG report, it was projected that construction costs will be approximately $146 million, with approximately $97.6 million, or 67%, being spent in Nova Scotia, and approximately $111.9 million, or 77%, being spent in Canada. As a result of this spending, it is anticipated that 391 full time equivalent jobs will be created in Nova Scotia per year during construction. For Canada as a whole, the construction phase will create 437 full time equivalent jobs per year. Tax revenues stemming from the construction phase are expected to be $4.1 million for the Government of Nova Scotia and $5.5 million for the

Government of Canada. This is a conservative estimate as corporate income taxes paid by contractors and suppliers cannot be estimated.

Operational mining and processing activities will involve the deployment and operation of new mining production capacity. Similar to the construction phase, much of the spending associated with operation of the MRC Project will be incurred in Nova Scotia and Canada. As per the KPMG report, it was projected that annual operating costs will be approximately $52.3 million, with approximately $38.1 million, or 73%, being spent in Nova Scotia, and approximately $39.4 million, or 75%, being spent in Canada. The costs include several spending components, the most important being:

- salaries and benefits for 27% of total annual operating costs;
- cyanide, lime, and reagents for 24% of total annual operating costs;
- diesel for 22% of total annual operating costs;
- wear parts and spare parts for 15% of total annual operating costs; and
- electricity (Touquoy only) for 7% of total annual operating costs.

As a result of this spending, it was anticipated in the KPMG report that 228 yearly and recurrent full-time equivalent jobs will be created in Nova Scotia during operation. For Canada as a whole, the operation phase will create 278 yearly and recurrent full-time equivalent jobs during operation. Tax revenues stemming from the operation phase are expected to be $10.2 million annually for the Government of Nova Scotia and $8.1 million annually for the Government of Canada. These represent conservative estimates as corporate income taxes paid by suppliers cannot be estimated.

The Province of Nova Scotia's unemployment rate is higher than the national average (8.8%>6.9%) and its gross domestic product (GDP) growth has been the slowest of all Canadian provinces. In addition, the GDP per capita is the second lowest in Canada. The MRC Project would greatly benefit the Province of Nova Scotia due to substantial upfront investments and significant annual operation costs contributing to job creation and government tax revenue.

The Proponent is committed to working with the local community and the Mi'kmaq of Nova Scotia to maximize socio-economic benefits as the Company developments its projects in the Province, including the Beaver Dam Mine Project.

2 Project Description

2.1 Project Location and History

The Beaver Dam Mine Project, as proposed, encompasses three primary components from Marinette to Moose River Gold Mines, Halifax County, Nova Scotia. The Beaver Dam Mine Site will be located at the eastern end of the Beaver Dam Mines Road in Marinette, the Haul Road will span from the Beaver Dam Mine Site to the Touquoy Mine Site located at Moose River where the third component, consisting of the processing and tailings management (exhausted pit) facility, is located.

The Beaver Dam mine site is in an area of low topographic relief. The majority of the area is at 140 metres above sea level (masl) with scattered drumlins reaching 165 to 175 masl and Cameron Flowage channeling through a topographic low of 130 masl. Drainage is generally to the southeast along a number of poorly drained streams, shallow lakes, and wetlands. The Beaver Dam gold deposit is located in an area of Nova Scotia dominated by the Meguma Supergroup, consisting of a thick basal greywacke Goldenville Group and a thick overlying, finer grained, argillite Halifax Group. Mineralization at the Beaver Dam gold deposit occurs in the north-dipping southern limb of an overturned anticline with gold hosted both within quartz veins and disseminated throughout the intervening inter-bedded argillite and greywacke.

No federal lands will be used to undertake the Project. The nearest federal lands are the Beaver Lake Indian Reserve (IR) 17, which is a satellite community of the Millbrook First Nation and located approximately 5 km southwest of the Beaver Dam mine site. At its nearest point, the Haul Road route is approximately 3 km east of Beaver Lake IR 17. No federal lands are in close proximity to the Touquoy Mine Site. Figure 2.1-1 displays all three locations and the ownership of land in which they occupy.

All blasting will occur more than 5 km away from any residential structures. There are no hospitals, retirement hospices, treatment facilities, schools or day care centres located within 20 km of the site. Hwy 224 is the nearest access point to the mine located approximately 7 km from the site to the west. There is no residential development near the Project. The closest point to permanent residences is 5.7 km south of the mine at Beaver Lake IR on Hwy 224. Two seasonal and one permanent residence are located within 100 m of the Haul Road, as noted on Figure 2.1-2.

2.1.1 Beaver Dam Mine Site

The Beaver Dam Mine Site will be developed on approximately 167 hectares (ha) of land owned by the Northern Timber Nova Scotia Corporation (Northern Timber) in Marinette, Halifax County, Nova Scotia. Access to this land for mining purposes will be granted by an agreement between Northern Timber and the Proponent. The approximate centre point of the Beaver Dam Mine Site is 521319 E 4990700 N (UTM Zone 20 NAD83 CSRS).

The area is described as having low topographic relief with average elevations of approximately 140 masl and scattered drumlins reaching approximately 165 to 175 masl. Drainage in the area is generally southeast along a number of poorly drained streams, shallow lakes, and wetlands that flow out into Cameron Flowage (130 masl) and the Killag River; however, a drainage divide is present inside the southwest boundary of the mine site that drains water to the south through Paul Brook. The Beaver Dam Mine Site is bordered on all sides by forest in various stages of regrowth due to heavy logging activities in the region, and waterbodies, watercourses, and wetlands draining several catchment areas within the Project Area (PA).

The area has been subject to exploration and mining activity since gold was first discovered in 1868. Between 1871 and 1949, there were intermittent attempts to develop and mine the area, initially focused on the Austen Shaft area and later the Mill Shaft area located approximately 1.2 km west of the Austen Shaft. The small Papke Pit located approximately 400 m west of the Austen Shaft was excavated in 1926; however, the majority of development was focused on a belt of quartz veins in greywacke and slates that was approximately 23 m wide where intersected from the Austen Shaft. Approximately 967 ounces of gold production is recorded for Beaver Dam between 1889 and 1941. From 1978 until 1988, several companies drilled a combined 251 diamond drill holes for 47,935 m. Some of these drill holes were completed underground via an exploration decline installed in the mid-1980s that reached a maximum depth of 100 m below surface. In 1987, a small open pit was also excavated in the Austen Shaft zone. Approximately 2,445 ounces of gold production was also recorded for Beaver Dam between 1986 and 1989. Between 2005 and 2009 two companies drilled a combined 153 diamond drill holes for 22,010 m and completed several other exploration programs including an aeromagnetic survey, a till survey, and a follow-up reverse circulation drilling program for geochemical purposes. The Proponent secured rights to the property in 2014 and executed an exploration program whereby 38 diamond drill holes for 7,810 m were completed over the proposed surface mine area with the goal of increasing subsurface knowledge of the site and converting inferred gold resources to measured or indicated resources.

The Beaver Dam property is held under a single mineral exploration license EL50421, currently held by Annapolis Properties Corporation (APC), a wholly owned subsidiary of Acadian Mining Corporation which in turn is a wholly owned subsidiary of Atlantic Gold Corporation. License EL50421, issue date May 13, 1976, is comprised of 76 contiguous claims which cover an area of approximately 569 1230 hectares. The Proponent owned companies (DDV Gold Ltd. and Annapolis Properties) also own five other exploration licenses adjacent to the Beaver Dam property (EL05927, EL07295, EL10407, EL50544, and EL08220). Figure 2.1-3 displays the approximate extent of EL50421.

The provincial abandoned mine openings (AMO) database records 20 AMOs within the Beaver Dam Mine Site. Of these openings, 18 (90%) will be consumed by the proposed surface mine. The openings consist of shafts, pits, and raises that have had various forms of safety protection afforded to them over the years. AMOs are depicted on Figure 2.1-4, Existing Mine Conditions and on Figure 2.1-5, Abandoned Mine Workings.

The area is zoned mixed use under the Musquodoboit Valley and Dutch Settlement Land Use By-law. Extractive facilities, of which mining related infrastructure is classified, are permitted within this zoning designation. The physical activity of mining or extraction is not specified in the by-law as it is governed in the provincial and federal regulatory regime (pers. comm. L. Walsh 2016).

The Beaver Dam mine site is located approximately five km north of the nearest residence which is located within the boundaries of the Beaver Lake IR 17.

2.1.2 Haul Road for Transporting Ore

The Haul Road will be developed on land owned by Northern Timber, the Nova Scotia Department of Lands and Forestry (NSDL&F), and other private enterprises and landowners. The general course of the Haul Road already exists in the form of forestry roads and seasonal access roads; however, deviations that result in new road construction to fulfill safe design standards will encroach on Crown and private land. Portions that require upgrades only will generally follow the existing woods road alignment and will encroach on both Crown and private land. The portion requiring new construction through a “greenfield” environment is located on land currently owned by Northern Timber and NSDL&F. With the exception of one permanent home and one seasonal cottage near the intersection of Beaver Dam Mines Road and Hwy 224 and a seasonal residence near the intersection of the Haul Road and the Mooseland Road, there are no residences along the proposed Haul Road alignment.

As part of this study, an alternative section of road alignment (Preferred Alternative Haul Road), which would consist of new construction, has been identified just north of the existing Haul Road near Mooseland. This Preferred Alternative Haul Road would bypass private land and the residence near the currently planned intersection with Mooseland Road. However, the use of this alternative is subject further review of the proposed alignment including landowner concerns, traditional use and constructability costs. Both alignments have been evaluated for residual effects within this EIS (primary Haul Road and the Preferred Alternative Haul Road).

Beaver Lake IR 17, located approximately 3 km west of the Haul Road at its nearest point, hosts five permanent homes and four seasonal cottages. It abuts Hwy 224, which currently experiences considerable heavy truck traffic from forestry and other resource operations in the region. Other residences are located along Hwy 224 in the area but outside the boundaries of the IR. Figure 2.1-2 displays these residences, along with the boundaries of the IR, and their proximity to the Haul Road.

The area is zoned mixed use under the Musquodoboit Valley and Dutch Settlement Land Use By-law, and rural resource under the Eastern Shore (East) Land Use By-law. Haul roads are not specified in either by-law as these are governed in the provincial regulatory regime (pers. comm. L. Walsh 2016).

2.1.3 Touquoy Mine Site

The Touquoy Mine Site is a fully permitted and approved facility currently operating as part of the Touquoy Gold Mine Project in Moose River, Halifax County, Nova Scotia. It is located on land owned by the Proponent and NSDL&F and centered at 504599 E and 4981255 N (UTM Zone 20 NAD 83 CSRS). Access to Crown land for the construction of the Touquoy Project has been granted through a Crown Land Lease Agreement with NSDL&F (Lease No. 2794371 and Petition No. 37668).

The area of the Touquoy Mine Site (2017) is zoned mixed use under the Musquodoboit Valley and Dutch Settlement Land Use By-law. Processing of ore and the management of tailings (exhausted pit) is not specified in the by-law as these activities are governed in the provincial and federal regulatory regime (pers. comm. L. Walsh 2016).

Camp Kidston, which operates only in the summer months, is located 3.5 km northeast of the site. The nearest permanent full-time occupied residences are located approximately 5.8 km to the north of the open pit along Caribou Road. The next closest permanent residences to the Touquoy Mine Site are approximately 7.4 km to the northwest and 11.7 km to the southeast.

2.1.4 Ecological Setting

The Beaver Dam Mine Site is located in an area with low topographic relief. Average elevations are approximately 140 masl with scattered drumlins reaching approximate elevations between 165 to 175 masl. Much of the terrain in the PA consists of a patchwork of mature, immature, regenerating and disturbed tree stands of mixed wood forest, wetlands, and vegetation.

There are four mapped waterbodies located within the Beaver Dam Mine Site. Crusher Lake is located in the western section of the Beaver Dam Mine Site, Mud Lake is located in the northwestern corner, and

Cameron Flowage is located in the northeast corner, near the location of the proposed open pit. The fourth mapped waterbody (unnamed) is located in the southwest corner, as a headwater open water wetland draining to Paul Brook. Five mapped watercourses are located within the Beaver Dam Mine Site.

Within the Haul Road footprint, there are sixteen (16) mapped linear watercourses, including two major rivers: West River Sheet Harbour River and Morgan River. Five small mapped waterbodies are documented along the Haul Road just west of Lake Alma. During field assessments, however, these small waterbodies were confirmed to be wetland habitat.

The Haul Road mirrors the landscape described for the Beaver Dam Mine Site area in that it is a patchwork of forests in varying stages of regrowth with abundant watercourses, wetlands and generally low relief.

There are several watercourses in the vicinity of the Touquoy Mine Site. The Touquoy Mine Site is currently an operating mine (as of October 2017) and as a result, the runoff from the site infrastructure areas has been altered and is managed and controlled by means of collection ditches and ponds. Moose River is the largest watercourse adjacent to the property and flows along the western border of the mine site. A tributary to the Moose River (known as Watercourse No. 4) flows south through the property, between the open pit and tailing management area. Scraggy Lake is located to the south of the property and is a water supply source for the Touquoy Mine Site. Fish River drains Square Lake to Scraggy Lake and both lakes are part of the Fish River Watershed that flows west and then south into Lake Charlotte, eventually emptying into Ship Harbour.

Overall, current and historic land use throughout the PA has resulted in a patchwork of mature, immature, regenerating and disturbed forest stands. The PA contains a diversity of habitat types and landscape features but is largely disturbed with habitat fragmentation caused by historic mine operations, and current and historic timber harvesting practices. Generally speaking, uplands within the PA contain immature or uneven-aged coniferous stands or mixed wood stands. Several pockets of mature coniferous forests are scattered throughout the PA but over mature stands were generally infrequent. Pure deciduous stands (including both tolerant and intolerant hardwood forests) are infrequent within the Beaver Dam Mine Site, though they do occur occasionally along the Haul Road.

Significant Habitats within the Provincial Landscape Viewer (NSDNR 2015) are identified as:

- Mainland Moose Concentration Area (entire Project Area);
- Deer Wintering Areas (6.8 km west of Beaver Dam Mine Site);
- Areas with Species of Concern (4.5 km northeast of Beaver Dam mine; 1.8 km and 7.5 km northeast of Touquoy Mine Site; immediately south and adjacent to Touquoy Mine Site;

  Provincial Landscape Viewer (NSDNR 2015) indicates the following protected areas within 10 km of the proposed Project:

- Nature Reserves
  - Tait Lake (1.0 km north of Beaver Dam Mine Site);
  - Cowan Brook (9.5 km south of Touquoy Mine Site)
- Wilderness Areas
  - Tangier Grand Lake (2.2 km south of intersection of Cross Road and Mooseland Road);
  - Twelve Mile Stream (4 parcels – closest is 4.5 km northeast of Beaver Dam Mine Site);
  - Ship Harbour Long Lake (west and adjacent to Mooseland Rd, immediately south of Touquoy Mine Site);

- Natural Water Supply Area
  - Middle Musquodoboit (9 km north of Beaver Dam mine, 6.3 km north of Touquoy mine).
- Game Sanctuary
  - Liscomb (no restrictions to mining – 7.3 km east of site)

2.2 Project Components

The Beaver Dam Mine Project will operate as a satellite surface mine with a proposed ore extraction rate of 2 million t/y. Ore produced at Beaver Dam Mine Site will be crushed on site, loaded into trucks, and transported along the Haul Road for processing at an existing facility located at the Touquoy Mine Site in Moose River. Tailings will be disposed of in the exhausted Touquoy open pit.

The primary components associated with the Beaver Dam Mine Project include the following:

- Beaver Dam Mine Site
  - surface mine/Open pit for extracting ore and waste rock,
  - mine site Haul Roads,
  - waste material storage piles for waste rock, till, and topsoil,
  - run of mine (ROM), high grade, and low grade ore stockpiles,
  - crusher and operational facilities; and,
  - water management
- Haul Road for transporting crushed ore; and
- the existing Touquoy Mine Site

Figures 2.2-1 to 2.2-3 display the location of components at the Beaver Dam Mine Site, the Haul Road, and the location of the relevant components of the Touquoy Mine Site related to the Beaver Dam Mine Project.

2.2.1 Beaver Dam Mine Site

2.2.1.1 Surface Mine

The primary feature of the Beaver Dam Mine Site will be an open pit from which a total of 47.3 million tonnes (Mt) of combined ore, non-ore bearing waste rock, and till will be removed. Figure 2.2-1 displays the development of the open pit in two phases over the four-year extraction/operations period. Phase one targets the south portion of the deposit and will produce approximately 22 months' worth of mill feed. The open pit will be advanced from the surface at 130 masl down to 45 masl. Phase two will develop the open pit towards the north and east wall and extend the bottom of pit below the first phase. Phase two will produce approximately 21 months' worth of mill feed and advance the open pit from the surface at 130 masl to the new bottom of pit at -45 masl (i.e. 45 metres below sea level). At completion, the open pit will measure about 900 m along its east-west axis, about 300-450 m along its north-south axis, and have a maximum depth of approximately 170 m based on the ore which is currently delineated. The total area comprising the open pit will be approximately 30 ha.

Clearing, grubbing, grading, and stockpiling of vegetation, topsoil, and till in the pit area will be conducted progressively prior to accessing bedrock for mining purposes, to avoid erosion. All topsoil and till will be stored in stockpiles for use in reclamation and construction of berms, impoundments, mine site roads, and/or general site grading. Stockpile locations can be viewed on Figure 2.2-1. Once vegetation, topsoil, and till have been removed, drilling and blasting will be used to mine ore and non-ore bearing waste rock, as well as establish benches along rock walls.

Holes will be drilled into the host rock to receive explosives used for blasting. Previous exploration drilling has mapped the host rock for ore-bearing potential. Further grade control drilling will be undertaken to confirm any local variation in ore distribution allowing blast patterns to be executed to maximize production of ore and minimize production of non-ore bearing waste rock. All blasting activities will be conducted by a licensed contractor.

On average, 35,480 tonnes of rock will be extracted from the open pit per day. Of that, 5,480 tonnes will be ore-bearing and 30,000 tonnes will be waste rock. Ore and non-ore bearing waste rock will be loaded into off-highway haul trucks for transport out of the pit. From there, ore will be separated into run of mine (ROM), high grade and lowgrade stockpiles. ROM ore will go straight to the crusher while high grade and low grade ore will be progressively processed throughout the mine life. Non-ore bearing waste rock will be stockpiled at its final disposal point and managed and reclaimed in place.

2.2.1.2 Mine Site Roads

Mine site roads will be constructed to enable the mining fleet (loaders, dozers, off-highway haul trucks) to access the stockpile locations and site facilities. The primary use of mine site roads will be the transportation of ore and non-ore bearing waste rock from the open pit to stockpile locations. Mine site Haul Roads will be dual lane and connect the pit exit with the topsoil, till, non-ore bearing waste rock stockpiles and run of mine (ROM) stockpiles. The roads will be constructed out of non-ore bearing waste rock from the open pit and be approximately 27 m wide, including berms and drainage, with a maximum speed limit of 40 km/h.

The mine access/ore haulage road will be constructed to connect the property exit with the crushed ore stockpile and operational facility area. The road will be dual lane and will have a gravel base and be approximately 16 m wide, including berms and drainage, with a maximum speed limit of 50 km/h. A pit perimeter road on top of the berm surrounding the pit will be a gravel base and be 12 m wide. The general location of the mine site roads is displayed on Figure 2.2-1.

2.2.1.3 Waste Material Stockpiles

Waste material storage at the mine site will include six topsoil, two till, and two non-ore bearing waste rock stockpiles comprising a combined total of 98 ha. All these locations will be cleared and grubbed concurrently with the surface mine area. The till and waste rock stockpile areas will also have topsoil removed and stored at the topsoil stockpile locations.

The six topsoil stockpiles will have capacities ranging from 0.04 Mt to 0.20 Mt of material with final average grade elevations of between 145 masl and 170 masl, respectively. The two till stockpiles will have capacities of 2.3 Mt and 1.7 Mt with final average grade elevations of 185 masl and 170 masl, respectively. Topsoil and till stockpiles will be stored in single lifts of 10 m and 15 m, respectively, with 3.0:1 and 2.6:1 slopes, respectively.

The two waste rock stockpiles will have a capacities of 20.7 Mt and 14.8 Mt of material and final peak grade elevations of 210 masl and 190 masl respectively. Waste rock will be stored in multiple lifts of 15 m with each lift having an active slope of 1.5:1. A safety berm will separate each lift resulting in overall slope angle of 2.6:1. A 20 m wide dual lane Haul Road running up the side of each stockpile will provide progressive access to all lifts.

The general location of the waste material storage facilities is displayed on Figure 2.2-1.

2.2.1.4 Ore Stockpiles

The ore stockpiles (10 ha) will include high grade (HG) and low grade (LG) ore piles, located north of the crusher and operational facilities pad, and a ROM stockpile at the crusher.

The high grade ore stockpile will store ore with a gold grade above 0.50 grams per tonne (g/t). It will store ore mined during pre-production and during periods when extraction exceeds the capacity of the ROM stockpile. The size of this stockpile prior to reclaim and processing is estimated to be 0. 649 Mt. The low grade ore stockpile will store ore with a gold grade between 0.40 g/t and 0.50 g/t. It will be stored and re-handled through the crusher once the mine has been exhausted. The estimated size of this stockpile prior to reclaim and processing is estimated to be 349 kt. HG and LG stockpiles will be constructed in 15 m lifts with each having an active slope of 1.5:1. A safety berm will separate each lift resulting in overall slope angle of 2.6:1.

The ROM stockpile will have up to a 30-day capacity for storing ore during plant shut-downs or short term periods where ore extraction from the mine exceeds crusher or plant capacity. The ROM stockpile can also accommodate plant feed if ore hauling from the mine is reduced for weather or other reasons.

The general location of the ore stockpiles is displayed on Figure 2.2-1.

2.2.1.5 Operational Facilities

The following operational facilities (15 ha) at the Beaver Dam Mine Site will be located in a central ROM and facilities pad that provides access to the Haul Road:

- Primary crusher, feed conveyor and crushed ore stockpile;
- Pre-fabricated office facility and workshop building;
- Diesel fuel storage and distribution system;
- Skid-mounted diesel generators and power distribution overhead transmission lines;
- vehicle washdown facility;
- raw water and potable water tank;
- underground septic tanks and leach drains;
- Laboratory
- fire protection systems; and
- pole mounted lighting;

Figure 2.2-1 displays the general location of all the above ROM and facilities components.

A primary crushing facility consisting of a grizzly feeder, jaw crusher, stacking conveyor and crushed ore stockpile will be required for the Beaver Dam Mine Site. Used Touquoy equipment will be utilized where practical and available to establish the primary crushing circuit at Beaver Dam.

A large administration building is not required for the Beaver Dam Mine Site. Instead, a temporary prefabricated facility equipped with office space, washroom facilities, a mine dry room, and a first aid facility will be provided. In addition, a workshop facility for general maintenance of the mining fleet will be established in conjunction with a separate building for maintenance of the on-highway haul truck fleet will be installed on a slab. The three prefabricated buildings will be located in the operational facilities area.

The diesel storage and distribution facility from the Touquoy Mine Site will be relocated to the Beaver Dam Mine Site, where practical and available, to fuel the mining fleet, generators, and haul trucks. Diesel will be delivered to the double-walled aboveground tanks via licensed tanker trucks and distributed to the mining fleet, generators, and haul trucks at the facility or via a stationary pump system or via one dedicated refueling truck. The facility will contain a low flow pump for light vehicles and a high flow pump for mine vehicles. The refueling truck will obtain fuel from this stationary pump system for delivery where required. An automatic shut-off will be fitted to the pumps to prevent spillage. A small gasoline storage area may be included or may be satisfied by local retail outlets. The diesel fuel aboveground storage tank(s) will be located on a concrete pad. It is anticipated that approximately 40,000 litres of capacity for diesel fuel storage will be required, with final configuration to be determined based on final equipment selection.

The power demand required for the Beaver Dam Mine Site and short mine life does not justify construction of a permanent electrical grid tie-in. As a result, two (duty and standby) self-contained, skid mounted, 500 kilowatt (kW) diesel powered generators will provide 600 volt (V) electrical power to all surface consumers via 60 hertz (HZ), three phase, four wire overhead power lines. The generator fuel tank will receive diesel fuel from the dedicated fuel tank.

Raw water at the Beaver Dam Mine Site will be required for fire protection and other processing requirements. Sources of raw water include surface water runoff and raw water pumped from Cameron Flowage. Raw water drawn from Cameron Flowage will be pumped by a single duty submersible water pump to a combination raw water and firewater reserve storage tank. Two (duty and standby) centrifugal pumps will supply various users including, but not limited to, the vehicle wash down facility and the de-dusting crusher area locations. There is no requirement for decant water and potable water will be delivered via specialized truck. Raw and potable water storage will be located in the operational facilities area. One or two (1 or 2) drilled water wells will provide water for domestic use assuming adequate groundwater supply. Alternatively, domestic water supply could be provided from Cameron Flowage (treated) or by off-site suppliers.

Sewage from the Beaver Dam Mine Site office facility will flow by gravity drain via a piped network that will be buried below the frost line to septic tanks equipped with leach drains. No chemical waste will be disposed of through the septic system. The septic tanks will be pumped out as required by a licensed contractor. All solid waste generated at the Beaver Dam Mine Site will be stored in appropriate containers and disposed of at an approved facility off-site.

The laboratory will be situated adjacent to the site facilities building. The building houses all laboratory equipment for the site to enable sample preparation. Any mechanical items associated with the dust collection equipment will be located external to the building. Prepared samples will be transported to the Touquoy Mine Site for assaying. Fire protection for the site buildings will be via a “wet system” with hydrants located around the site buildings area. The water contained within the lower portion of the raw water tank will be reserved for fire protection. Fire detection systems will be installed in all buildings and in key areas of the Beaver Dam Mine Site.

In each area, a combination of heat and smoke detectors will be provided with break-glass units mounted externally to the buildings. The large primary mining fleet including excavators, front end loader, haul truck, dozers and drills will be fitted with fire suppression systems in case of fire.

The water truck will be fitted with a pump and 2.5 inch hydrant hose reel for firefighting. Supplementary hand-held fire extinguishers, each suitable for its specific area, will be mounted in all buildings and vehicles. It is intended that additional firefighting support will be provided by the local fire authority in Sheet Harbour.

Outdoor lighting for conveyors at the Beaver Dam mine site will be provided by 3 m pole-mounted high-pressure sodium weatherproof lights, while 8 m pole-mounted floodlights will be utilized for the ROM and crushing area, as well as the remainder of the operational facilities pad.

2.2.1.6 Water Management

Surface water run-off from the Beaver Dam Mine Site crusher pad will flow by gravity, with the aid of berms and channels, to a collection pond located to the south of the crusher pad. A culvert located beneath the mine entrance road will facilitate decant overflow from the collection pond to a discharge channel that will run down gradient to the south and ultimately discharges into wetland area (Wetland 64) located to the south of the Beaver Dam Mine Site. Surface water run-off from the eastern and western waste rock stockpiles, low grade ore stockpiles, Beaver Dam Mine Site roads, and some natural area will flow by gravity, with the aid of berms and channels, to the north settling pond, located west of the pit. This settling pond will also receive water from the pit dewatering program. Overflow from the north settling pond is directed to the Killag River outfall (Cameron Flowage). Runoff from the till stockpiles located to the southeast of the open pit and east of the mine facilities area will be captured with the aid of channels around the stockpile perimeter and diverted north to Cameron Flowage by gravity via separate water discharge structures and engineered channels. At this time, it is not anticipated that a collection pond would be required, however such a pond can be constructed should settling of solids prior to discharge be required.

The discharge structures on the north settling pond and collection pond will be equipped with flow-control devices. Final design of the ponds will be submitted as part of the Provincial Industrial Approval process. Based on results from recent surface and groundwater quality modelling, an effluent treatment plant will be utilized as required to ensure that any discharge meets the applicable federal MDMER criteria. Potential reagents include flocculants for solids settling, iron sulphate and oxidizers for metals precipitation, and liming for pH adjustment. If treatment for metals is required, the metal sludge will be collected and temporarily or permanently stored on site or shipped offsite to an appropriate landfill facility. The options for sludge collection include the use of geotubes and /or clarifiers. The effluent treatment at the Beaver Dam Mine Site will be conceptually similar to the plant currently used at the Touquoy Mine Site. Refer to Appendix G.2 for technical memo on water treatment and conceptual design which includes details regarding reagent use and storage. Effluent treatment and reagent use at the Touquoy Mine Site will be the same system as currently permitted.

Minimal volumes of water will be re-used from the north settling pond and/or collection pond for on-site dust suppression purposes, as required (assuming the water meets applicable regulatory criteria). The majority of water collected in the north settling pond will be released to Cameron Flowage. Smaller volumes will be released south into Wetland 64 from the collection pond. Magnesium chloride or other approved chemical dust suppressant will be utilized at the Beaver Dam Mine Site in the cases where the use of water is deemed ineffective (e.g., under peak summer and winter conditions).

A berm surrounding the pit will direct surface water runoff into a water diversion channel that discharges to the settling pond to the west. Since this water is non-mine contact water, there will be a high likelihood that this water can be discharged directly to the Killag River should it meet applicable water quality criteria. A water diversion ditch will be established around the perimeter of the open pit to intercept any surface water that infiltrates the berm and flows into the mine. This ditch will direct water to in-mine sumps where it will be pumped out of the mine and into the north settling pond (located west of the open pit).

Should it be required, sub-horizontal drain holes will be established in the pit walls as they are exposed. On the active bench floor, the water that is collected from these drain holes will be directed to a sump where it can be pumped from the mine to the north settling pond.

Surface run-off entering the mine will be handled by pumps installed in each active mine bottom as part of the flexible and moveable bench scale pumping system. The mine sump pumps will be connected to semi-permanent and permanent HDPE piping systems to convey water directly to the settling pond located west of the surface mine. The in-mine sumps will be installed with each box cut as the benching is advanced.

Refer to Figure 6.7-15 – 6.7-16 for surface water management conceptual design and structures.

2.2.1.7 Haul Roads for Transporting Ore

As Beaver Dam Mine Site will operate as a satellite surface mine, ore produced will require transport by road to the Touquoy Mine Site (Figure 2.2-2). Portions of the existing woods roads (Section 1 and Section 4A/B; approximately 15.4 km) between Beaver Dam Mine Site and the Touquoy Mine Site will require upgrading to a dual lane road to facilitate the safe passage of two-way truck traffic at 70 km/h. The total length of the Haul Road is 30.1 km.

A new section of road (Section 3B; approximately 4.0 km in length) constructed to the same design standards through a greenfield environment will be required connecting the Beaver Dam Mines Road/Highway 224 intersection with an existing woods road. The alignment displayed in Figure 2.2-2 is based on a preliminary engineering design. Final design will consider safety, social and environmental constraints to ensure the best-case scenario that will optimize worker safety and minimize potential environmental effects. The new 4.0 km section of road is being construction to avoid travel on Hwy 224, through the community at Beaver Lake IR 17.

The upgraded and newly constructed Haul Road will be designed to accommodate up to a 68t gross vehicle weights in either a B-Train or C-Train configuration year-round. Where upgrades will follow the course of the existing woods roads, the width will be increased from approximately 4 m to 10 m, with an additional width of 6 m, on average, to account for sloping and ditching on both sides of the road. Where new road construction is required, including deviations from the existing roads to ensure safe design standards, the daylighted corridor for the Haul Road will be approximately 16 m wide (on average). Wider areas of disturbance will exist along the route where the natural topography exceeds design grades. In these areas, increased cut and fill will be required to reduce grade and maintain safe design standards. Where possible existing roads will be used in an effort to minimize disturbance of undeveloped areas.

Construction material will be sourced from three quarries located along the length of the road with additional requirements for construction material, if required, sourced from either the Touquoy or Beaver Dam Mine Sites or other local approved facilities.

The Haul Road will be upgraded where required to enable the safe and economic transportation of ore. Relict portions of the Haul Road may be properly reclaimed at the end of the Project lifespan or returned to the original owner as per the lease arrangement. Re-vegetation will be encouraged on relict portions of the Haul Road, and opportunities will be explored to enhance wetlands and improve fish habitat, as discussed in Sections 6.8 and 6.9.

For the purposes of this description, the Haul Road has been sectioned off as follows (refer to Figure 2.2-2):

Section 1

- 7.2 km of unsealed two lane private road historically used for logging known as Beaver Dam Mines Road and currently owned by Northern Timber with varying quality from the Beaver Dam Mine Site to Hwy 224,
- the intersection between the Beaver Dam Mines Road, Hwy 224, and the new construction will be designed to meet Nova Scotia Transportation and Infrastructure Renewal (NSTIR) standards,
- the extent of required Haul Road upgrades and new construction will encroach on land owned by Northern Timber and NSDL&F, and
- upgrades to this section of the Haul Road will also require replacement or new installation of up to 9 culverts, and upgrades to, or replacement of, single lane bridges with dual lane bridges across 2 watercourses. All upgrades will be made to government standards and permit requirements;

Section 3B

- Approximately 4.0 km of new construction from the Beaver Dam Mines Road and Hwy 224 intersection to the Moose River Cross Road through a greenfield environment,
- the land required for new construction is currently owned by Northern Timber and NSDLF, and
- construction of the Haul Road will also require installation of one stream culvert. Others may be required to maintain flow in some wetlands. All installations will be made to NSE standards and permit requirements;

Section 4A/B

- 8.2 km portion of the Moose River Cross Road that ends at the intersection with the Mooseland Road. This section is an unsealed single lane private road historically used for logging and currently owned by Northern Timber and others with varying road quality along its length,
- the intersection between the Moose River Cross Road and Mooseland Road will be designed to meet NSTIR standards,
- the extent of required Haul Road upgrades and new construction will encroach on land currently owned by Northern Timber, NSDL&F, Musquodoboit Lumber Limited, Deepwood Estates Limited, Prest Bros Limited, and private residences, and
- upgrades to this section of the Haul Road will also require replacement or new installation of up to 10 culverts and upgrades to, or replacement of, a single lane bridge with a dual lane bridge across one watercourse (WC-AD, Morgan River). All upgrades will be made to NSE standards and permit requirements; and

Section 5A/B

- 10.7 km of sealed and unsealed dual lane provincial local road known as Mooseland Road and owned by NSTIR suitable for heavy traffic from the Moose River Cross Road to the Touquoy Mine processing facility.

Haul Road upgrades will utilize existing road centre lines where possible to minimize encroachment on adjacent lands. Where encroachment on Crown land is unavoidable, lease agreements through NSDL&F will be pursued. Similarly, where encroachment on private land is unavoidable, lease or purchase agreements will be pursued with the individual land owners. Leases will be in place prior to the beginning of any site work.

Section 4C

For purpose of this study an alternative 5.75 km of Haul Road construction has been identified as a Preferred Alternative Haul Road, east of Mooseland Road. The proposed alignment in Figure 2.2-2 is based on a preliminary engineering design with final design subject to applicable safety, social and environmental constraints. This Preferred Alternative Haul Road would primarily be a new road construction but would require some upgrades of existing woods roads. As with the primary Haul Road, the alternative would be constructed to the same design standards as described above. The Preferred Alternative Haul Road would avoid private land and a single residence located near the Mooseland Road intersection and reduce the total haul by approximately 2.6 km. However, it would result in higher construction costs. The decision to adopt this alternative is subject to further review of the proposed alignment with respect to landowner concerns, traditional use and construction costs.

The Haul Road incorporating the Preferred Alternative Haul Road section would be 27.5 km long. Sections 1 and 3B would remain unchanged while Sections 4A/B and 5A/B would be adjusted (Section 4B and 5A avoided), as follows:

Section 4A

- 3.9 km portion of the Moose River Cross Road that ends at the Preferred Alternative Haul Road (Section 4C). This section is a combination of existing unsealed single lane private road of varying quality, historically used for logging and owned by Northern Timber and others and greenfield environment,
- the extent of required Haul Road upgrades and new construction will encroach on land currently owned by Northern Timber, and NSDLF, and
- upgrades to this section of the Haul Road will also require replacement or new installation of up to 8 culverts. All upgrades will be made to applicable standards and permit requirements;

Section 5B

- 6.7 km of sealed and unsealed dual lane provincial local road known as Mooseland Road and owned by NSTIR suitable for heavy traffic from the Preferred Alternative Haul Road (Section 4C) to the Touquoy Mine Site.

2.2.2 Touquoy Mine Site

The Beaver Dam Mine Project will utilize the existing permitted processing facility at the Touquoy site to process Beaver Dam ore. Processing of ore from the Beaver Dam gold deposit at the existing Touquoy processing plant will begin upon completion of mining ore from the Touquoy deposit. Beaver Dam tailings will not be stored in the Touquoy tailings management facility, but instead will be permanently stored in the exhausted Touquoy pit after that deposit has been mined. This allows the Touquoy Mine Site footprint to be maintained as originally permitted and no tailings management will be needed at the Beaver Dam mine site. All other aspects of the Touquoy Gold Project will remain as assessed and approved through the Nova Scotia EA process in 2008 and as approved and regulated under the Touquoy Industrial Approval (IA).

Changes to the Touquoy Mine Site as a result of the Beaver Dam Mine Project will include the following:

- an increase in the duration of ore processing (four additional years);
- minor alterations to the Touquoy processing facility to accommodate Beaver Dam ore; and
- disposal of tailings from Beaver Dam ore processing in the exhausted Touquoy mine.

The Touquoy Mine Site will be operational for an additional four years beyond the current lifespan anticipated for the Touquoy Project. There will be no increase in the Touquoy processing rate to accommodate Beaver Dam ore. This will result in four additional years of ore processing, water management, and tailings management (exhausted pit). The Touquoy processing facility main building houses ball mill, gravity recovery, reagent make-up, elution, and refinery sections. The crushing, carbon in leach (CIL), and cyanide destruction sections are located outdoors. Tailings produced from processing Beaver Dam ore will be stored in the exhausted Touquoy open pit. Water from the deposited tailings will be recirculated through the processing facility in a closed loop. Make up water requirements will be sourced from Scraggy Lake or other sources as per existing approvals. Figure 2.2-3 displays the location of these components. A technical report that presents the technical water and tailings management plan, including tailings deposition and the overall mine site water balance including the direction of flow between components, effluent discharge locations, mine component drainage areas, and locations of MDMER final discharge is provided in Appendix G.4, The existing Effluent Treatment Plant will be used will be utilized during closure until such time regulatory discharge requirements are met and excess water from the pit discharges to the Moose River along a constructed discharge outline.

The additional operational life of the Touquoy Mine Site involves no new footprint disturbance to the existing Touquoy facility or property. The Beaver Dam tailings will be managed in the exhausted Touquoy open pit. As originally planned in the approved Touquoy Gold Project Reclamation Plan, the inflow of groundwater, surface flow and precipitation into the pit will naturally create a lake upon closure of the site. Air emissions generated from the Touquoy Mine Site associated with the processing of Beaver Dam ore will be limited to emissions from the existing permitted plant operation during processing. The primary potential effect of the continued use of the Touquoy Mine Site is on surface water and groundwater quality associated with processing the Beaver Dam ore through the use of the exhausted open pit for tailings storage. It should be noted that geochemical and water quantity/quality data collected during the operational phase of the current permitted Touquoy Mine Site has been utilized to model surface and groundwater and to make predictions of future water quantity and quality. As the Touquoy operation progresses, these predictive models will continue to be refined and revised as warranted.

An amendment to the Touquoy IA will be sought as necessary to accommodate these changes. As well, the currently approved Reclamation Plan will be updated to reflect the above changes and re-submitted.

2.2.2.1 Currently Approved Operations at the Touquoy Mine Site

The Touquoy Gold Project was described in a Provincial EARD and planned as a surface operation using drilling and blasting, with processing on site. Production is estimated at approximately 5,480 tonnes of ore per day with a total ore production estimate over the life of the mine of at least 9.2 million tonnes for recovery of 0.4 million ounces (oz.) of gold. The Touquoy Gold Project is currently in its second year of commercial production, the mine life is estimated to be five to seven years for processing of Touquoy ore, three to four years for processing of Beaver Dam ore based on favorable permitting, and two years for closure and decommissioning.

The open pit and associated infrastructure is centered on areas of previous (bulk sample in 1980's) and historic mining activity at Moose River Gold Mines. The Touquoy facilities include an open pit, processing plant, tailings storage facility, waste rock piles, power and water supply systems, offices, and a service support complex. The total area of the development at the Touquoy Mine Site is approximately 265 ha. The open pit and mine site roads will occupy approximately 40 ha, processing plant and service complex will occupy approximately 60 ha, the tailings management facilities will occupy approximately 130 ha, and the waste rock stockpile will occupy approximately 35 ha.

Ore is mined from the nearby Touquoy pit and delivered to the mill for processing. Processing involves size reduction of the ore by crushing and grinding and recovery of the contained gold by mechanical and chemical processes. Recovery entails gravity concentration, carbon-in-leach (CIL), elution and carbon regeneration, electro-winning and smelting, and cyanide destruction. Tailings from processing of the Touquoy ore are deposited in the permitted TMF. Water associated with the Touquoy tailings is recycled for use in processing. At closure, all facilities will be removed, disturbed lands rehabilitated, and the property returned to otherwise functional use.

As part of the conceptual reclamation plan for the Touquoy Mine Site identified in the Provincial EARD, all site facilities will be removed, and the pit will be allowed to fill with water forming a lake. The flooding of the pit will create a lake approximately 15 ha in size with edge habitat.

2.2.2.2 Touquoy Gold Mine Environmental Assessment

An Environmental Assessment Registration Document (EARD) was submitted for the Touquoy Gold Mine on March 15, 2007 As a result of the subsequent review, a Focus Report was requested by the Minister of Environment and Labour to provide additional details on certain specific aspects of the project. The nature of the Focus Report was detailed in the Terms of Reference (TOR) in a public letter to DDV Gold dated April 15, 2007. The Focus Report was submitted on November 19, 2007.

The EARD assessed the potential environmental effects of the Touquoy Project on biophysical and socio-economic Valued Environmental Components (VECs). This assessment was based on inputs from members of the public, the Mi'kmaq community, government regulators and the professional judgement of the study team. The VECs identified and evaluated for the Touquoy Gold Mine included:

- Air Quality;
- Noise;
- Surface Water Resources;
- Geology and Hydrogeology;
- Terrestrial Resources;
- Wetlands;
- Archaeological and Cultural Resources; and
- Population and Economy.

Species of special concern were also considered within each applicable VEC.

A review of the EARD and Focus Report identified that the following VECs were evaluated in terms of effects of the processing of ore during the Touquoy project: air quality, noise, surface water resources, and terrestrial resources. The remaining VECs were evaluated in terms of the effects of construction, mining operations, and use of the tailings management facility, and no additional effects were anticipated in the EARD or the Focus Report beyond the scope of these operations.

2.2.2.3 Existing Industrial Approval at the Touquoy Mine Site

An Industrial Approval (IA) was developed by NSE to add specific conditions for environmental management and monitoring associated with the construction, operation and reclamation phases of the Touquoy Project. The IA contains over one hundred specific requirements in 25 sections which include but are not limited to the following:

- Particulate emissions (dust) and sound levels;
- Blasting management and monitoring;

- Air emissions from plant operations;
- Groundwater and surface water management and monitoring;
- Liquid effluent discharge management and monitoring;
- Tailings management and requirement for an engineer of record for the tailings management facility;
- Management and containment of historic tailings;
- Management of waste rock and sampling procedures;
- Handling, storage and management of reagents;
- Contingency / emergency response plan;
- Environmental impairment liability insurance requirements;
- Complaint response procedures;
- Community liaison committee (CLC) facilitation;
- Reporting requirements; and
- Reclamation planning and posting of bond to ensure completed.

The IA has specific requirements at various project stages of the Touquoy Project. This included installation of 32 nested pairs of groundwater monitoring wells prior to construction and completion of four quarterly monitoring events prior to operation. Subsequent to the start of operations, an additional 10 groundwater wells have been installed monitored: 8 shallow wells, and 1 nested pair. These groundwater monitoring data as well as surface water monitoring data are now being collected at the Touquoy Mine Site and are being used to periodically update the surface and groundwater modelling predictions for operations and post closure. The current compliance monitoring locations at the Touquoy Mine Site for groundwater and surface water are shown on Figure 2.2-4.

It is anticipated that many of the components of the Touquoy Project IA will be included in a future Beaver Dam Mine Project IA application reviewed by NSE prior to the Beaver Dam Mine Project commencing. As with other federal and provincial permits and approvals, these will be issued after the EA process is completed; typically, the conditions and framing of follow up programs as part of EA approval are reflected as appropriate at the permitting level.

2.2.2.4 Ongoing Operations at Touquoy Mine Site and Benefits to the Beaver Dam Project

Prior to the use of the Touquoy facility for the processing of Beaver Dam ore and storage of tailings in the exhausted Touquoy pit, approximately five years of operational data from the Touquoy operations will have been collected and modelling studies will be updated based on a review of these data. Monitoring of the current Touquoy Project includes air and noise monitoring, surface water monitoring of nearby water bodies, and groundwater monitoring of an extensive network of near and far groundwater monitoring wells. This ability to have actual data from an operational setting that is very similar to that proposed at Beaver Dam Mine Site is unique and important. The two sites have similar geology, ore, mining methods, wetlands and surface water bodies in close proximity to the extraction areas. The Proponent will utilize these operational data to update models and provide greater refinement in the potential effect prediction for the Beaver Dam tailings deposition in the exhausted Touquoy pit.

Mining by nature is complex and necessitates the proper use of personnel and equipment in creating an operation that is safe, benefits communities, and is executed in a manner that minimizes potential harm to the current and future natural settings. This operational expertise gained through the development and operation of the Touquoy Mine will be applied at the Beaver Dam Mine Site as proposed. The primarily local workforce will be able to be used at the Beaver Dam facility as it is in the same general area (within 30 kilometres) and they will have over 5 years of additional operational experience beyond what they had prior to the Touquoy Project being opened.

2.3 Project Activities

This section provides a description of activities to be carried out during each phase, information on the location of each activity, expected outputs and an indication of each activity's magnitude and scale.

2.3.1 Site Preparation and Construction (Year 1)

2.3.1.1 Beaver Dam Mine Site

Site preparation at the Beaver Dam Mine Site will begin one year prior to operations commencing, with construction of key infrastructure following shortly thereafter. The following activities will be undertaken to prepare the Beaver Dam Mine Site for construction activities:

- clearing, grubbing, and grading;
- drilling and rock blasting;
- establishment of topsoil, till, and waste rock stockpiles; and
- existing settling pond dewatering.

Once site preparation activities have been completed, construction will commence and involve the following activities:

- watercourse and wetland alteration;
- mine site road construction;
- surface infrastructure installation and construction;
- pit pre-stripping; and
- collection ditch and settling pond construction.

The Beaver Dam Mine Site will have a total disturbed area of approximately 167 ha, consisting of the pit (30 ha); material storage (98 ha), including six topsoil, two till, and two non-ore bearing waste rock stockpiles; operational facilities (15 ha); settling ponds and water diversion structures (7 ha); and mine site roads (7 ha). Ore stockpiles will comprise approximately 10 ha during operations but are not anticipated to remain at the completion of the Project. The footprint and locations of the material stockpiles was altered to address Boreal Felt Lichen 500 m critical function zone as set out in the Recovery Strategy for the Boreal Felt Lichen (*Erioderma pedicellatum*) Atlantic Population, in Canada (2018).

Site Preparation

Clearing, grubbing, grading, and stockpiling of vegetation, topsoil, and till in the pit area will be conducted progressively prior to accessing host rock for mining purposes, to avoid erosion. All topsoil and till will be stored in stockpiles for use in reclamation and construction of berms, impoundments, mine site roads and/or general site grading. Vegetation clearing will be conducted in compliance with nesting bird directives from NSDL&F and Environment and Climate Change Canada. Once vegetation, topsoil, and till have been removed, drilling and blasting will be used to mine ore and non-ore bearing waste rock, as well as to establish benches along rock walls. Holes will be drilled into the host rock to receive explosives used for blasting. The pit will be mined down to the 125 bench (bench floor elevation in metres above sea level). A berm surrounding the pit will be constructed to act as an access road and a flood berm.

Areas of waste material storage at the Beaver Dam Mine Site will include six topsoil stockpiles, two till stockpiles, and two non-ore bearing waste rock stockpiles. All these locations will be cleared and grubbed concurrently with the pit. The till and waste rock stockpile areas will also have topsoil removed and stored at the topsoil stockpile locations. The existing settling pond at the Beaver Dam Mine Site has been identified as a wetland during the baseline studies (Wetland 59). Inflow into the wetland will be removed and the wetland will be dewatered in preparation for the open pit development. As discussed in Section 6.9, brook trout have been confirmed within this wetland and a fish rescue and relocation program is anticipated as an approval requirement prior to the pit development.

Site Construction

Mine site Haul Roads will be constructed to enable the mining fleet (loaders, dozers, haul trucks) to access various site locations including the open pit, stockpiles and primary crusher ROM pad area. A waste haulage road will be constructed connecting the pit exit with the topsoil, till, and non-ore bearing waste rock stockpiles. An ore haulage road will also be constructed connecting the pit exit and ROM stockpile. The roads will be dual lane and approximately 27 m wide, including berms and drainage, with a maximum speed limit of 40 km/h.

The mine access/ore haulage road will be constructed to connect the property exit with the crushed ore stockpile and operational facility area. The road will be dual lane and will have a gravel base and be approximately 17.5 m wide, including berms and drainage, with a maximum speed limit of 50 km/h. A pit perimeter road on top of the berm surrounding the pit will be a gravel base and be 12 m wide.

Borrow and quarry materials for the construction of the mine roads will be sourced from the pit during initial development and the processing areas. No other borrow and quarry pit areas are anticipated. The general location of the mine site roads is displayed on Figure 2.2-1.

Where practical, mobile equipment and some support facilities will be transported from the Touquoy Mine Site to the Beaver Dam Mine Site for re-use. A simple satellite primary crushing facility consisting of a grizzly feeder, jaw crusher, and primary coarse ore stockpile feed conveyor will be required for the Beaver Dam Mine Site. Where practical, equipment will be relocated from Touquoy. In the event this is not possible new or used equipment will be sourced and installed. Such equipment would include the primary crushing circuit, diesel storage and distribution facility for refueling the mining fleet, generators, and mining fleet.

Outdoor lighting for conveyors at the Beaver Dam Mine Site will be provided by 3 m pole-mounted high-pressure sodium weatherproof lights, while 8 m pole-mounted floodlights will be utilized for the ROM and crushing area, as well as the remainder of the operational facilities pad.

A temporary prefabricated facility equipped with office space, washroom facilities, a mine dry room, and a first aid facility will be provided. In addition, workshop facilities for general maintenance of the mining fleet and ore haulage fleet will be constructed.

A mobile vehicle wash down facility likely consisting of manually directed water jets and a high pressure hot water and steam generator cleaner will be provided for the Beaver Dam Mine Site. The bulk of the mud will be washed off equipment within the pit area with surface water run-off captured within a sump.

Final cleaning will occur in the maintenance shop where runoff from cleaning operations will be captured in a cleanout sump and processed via a triple interceptor oil trap and oil-water separation device.

Surface and ground water management facilities to include monitoring wells, ditches and berms will also be constructed during this period. A collection pond will be constructed to the south of the site facilities pad to collect surface water run-off from this area, ROM pad, primary crusher and crushed ore stockpile. A culvert will be constructed beneath the mine access road and will facilitate decant overflow from the pond along a discharge channel that will run down gradient to the south and ultimately discharge into wetland areas to the south of the Beaver Dam mine site. A settling pond will be constructed west of the open pit and will collect surface water run-off from the non-ore bearing waste rock stockpile, mine site roads, and ore stockpiles. This settling pond will also receive water from the open pit dewatering program. Runoff from the till stockpiles will be captured and directed into a collection pond located on the eastern side of the open pit. Water from both these ponds will be gradually decanted to Cameron Flowage by gravity via separate water discharge structures and engineered channels.

The discharge structures on all the settling ponds will be equipped with flow-control devices. The final design of the collection and settling ponds will be submitted as part of the IA application and process.

A berm will be constructed surrounding the pit to prevent shallow groundwater flow and/or surface water originating in Cameron Flowage from entering the pit. A water diversion ditch will be established around the perimeter of the open pit to intercept any surface water that infiltrates the berm and flows into the mine. This ditch will direct water to in-pit sumps where it will be directed to collection ponds located to the east and west of the open pit.

Development of the Beaver Dam Mine Site will cause direct and in-direct impacts to wetlands mostly within the construction phase of the Project. Direct impacts will be associated with clearing, grubbing, infilling and development of the mine and its associated infrastructure. Wetlands located within the Beaver Dam Mine Site are discussed further in Section 6.8.

Increased environmental disturbance is anticipated during initial site preparation, when drilling and blasting is being undertaken in the surface mine and clearing is being undertaken, and during the construction of stockpiles, berms, and surface mine roads.

2.3.1.2 Haul Road

Site preparation for the Haul Road will begin one year prior to operations commencing, with construction of key infrastructure following shortly thereafter. The following activities will be undertaken to prepare the Haul Road for construction activities:

- clearing, grubbing, and grading; and
- topsoil, till, and waste rock management.

Once site preparation activities have been completed, construction will commence and involve the following activities:

- watercourse and wetland alteration;
- culvert and bridge upgrades and construction; and
- Haul Road construction and upgrades.

Clearing and grubbing will be conducted prior to upgrading or construction of the Haul Road. Saleable timber will be cut and stockpiled along the road length and the remaining vegetation mulched. Topsoil will be removed and stockpiled along the road length or used in berm construction, water diversion or reclamation of relict portions woods roads not required as part of the realignment.

Where upgrades follow existing woods roads, the width will be increased from approximately 4 m to 10 m, with an additional 3 m on either side to account for sloping and ditching on average. The portions of the Haul Road that require upgrading are anticipated to include approximately 17.8 ha of disturbance.

New road construction totaling approximately 4.0 km, built through a “greenfield” environment, will also be required to avoid travel on Hwy 224 and through Beaver Lake IR 17. The new road construction through the “greenfield” environment is anticipated to result in 6.4 ha of disturbance. The new construction will have a daylighted corridor of approximately 16 m width (on average) with wider areas of disturbance associated with cut and fill sections required to minimize grade and maintain safe design standards. Where possible existing roads will be used in order to minimize newly disturbed areas.

The upgraded and newly constructed Haul Road will be designed to accommodate up to a 68t gross vehicle weight in either a B-Train or C-Train configuration year-round. It is estimated for construction at total of approximately 275,000 m3 of material will be excavated during the bulk earthworks phase of construction. The majority of this material will be utilized as fill to establish rough grading of the road. An additional 400,000 T of rock will be required for final grading comprising approximately 225,000 T rock fill for the road base and 175,000 T of gravel for the road surface. Construction material will be sourced from three quarries located along the length of the road with additional requirements for construction material, if required, sourced from either the Touquoy or Beaver Dam Mine Sites or local approved facilities. Road construction will allow for a clear porous subgrade or cross drainage culverts in order for wetland hydrology to be maintained post-construction. Sources of suitably tested clear stone may include the Haul Road corridor and/or the Beaver Dam Mine Site and Touquoy Mine Site or local approved facilities.

Three watercourses between 6 and 13 m wide are currently crossed via single lane timber bridges; these will be replaced by dual lane clear-span pre-engineered single arch modular bridges with an approximate lifespan of 30 years. Smaller watercourse crossings currently utilize culverts of varying sizes, makes, and conditions. Where the upgraded Haul Road follows the course of the existing Haul Road, culverts will be replaced by 600 mm corrugated steel culverts, each designed to extend 2 m beyond the edge of the Haul Road. Where deviations from the existing course are required, culverts of the same design will be installed beneath the new span and culverts beneath the old span will be removed where appropriate to facilitate the restoration of corresponding watercourses and to improve fish passage. Haul Road grades will be designed to maintain a minimum cover of 1 m over all culverts. Culverts will be installed in accordance with DFO and NSE guidance to reduce potential impacts to fish and fish habitat. Where appropriate, the Proponent will work to install open bottom box culverts to reduce potential impact on the watercourses and associated fish habitat during road construction. Wetlands that are expected or confirmed to support fish habitat will be partially altered within the Haul Road to support road upgrades, widening and re-alignment as required.

The Haul Road will be upgraded where required to enable the safe and economic transportation of ore. Along the existing Haul Road at locations where the proposed road upgrade alignment will fall, it is anticipated that there could be up to 13 locations where there will be opportunity to improve fish habitat with new culvert installation and old culvert removed, up to 13 net zero scenarios where a new culvert could be installed, and 8 watercourses that will not be affected. Relict portions of the existing portions of the Haul Road that are not reclaimed during Haul Road construction will be properly reclaimed at the end of the Project lifespan or returned to the original owner as per any future lease arrangements.

Speed limit and right-of-way signage will be installed, and all haul truck operators will receive operator training to minimize the risk of collisions. All intersections will be designed to NSTIR Standards. Final design will consider safety and environmental constraints to ensure the best-case scenario for worker safety and environmental effects is developed.

Increased environmental disturbance is anticipated during initial site preparation, construction of new portions of the Haul Road, and during the replacement/upgrades that will be completed to culverts and bridges.

Should the alternative 5.75 km of Preferred Alternative Haul Road identified east of Mooseland Road be constructed, the site preparation and construction activities described above will still apply. However, the Preferred Alternative Haul Road will result in an additional six additional water crossings that would consist of a combination of bridges (at least two) and culverts (at up to four) installations.

Prior to construction it is anticipated that the following authorizations will be required:

- Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR)
    - Highway 224 crossing (preliminary discussions have occurred)
    - Haulage along Mooseland Road (preliminary discussions have occurred)
- Nova Scotia Department of Lands and Forestry (NSL&F)
    - Crown land access/lease (preliminary discussions have occurred)
- Nova Scotia Department of Environment (NSE)
    - Watercourse/Wetland alteration
- Department of Fisheries and Oceans
    - Fish habitat alteration

Authorizations will be sought during the Beaver Dam IA process.

2.3.1.3 Touquoy Mine Site

General

The Touquoy process plant is located east of Moose River, north east of the Touquoy open pit and north-west of the tailings storage facility. The approach by road to the plant will be from the east via the Mooseland Road.

The Touquoy plant, in particular the crushing circuit, has been designed for simple modification to handle the Beaver Dam feed ore once Touquoy pit is exhausted. The Ball Mill has been sized to accommodate the harder ore from Beaver Dam. Consequently, the Touquoy process flowsheets will remain fundamentally unchanged with the processing of Beaver Dam ore.

The main plant building houses the grinding, gravity recovery, reagent, elution and refinery sections. The crushing, preleach thickener and CIL sections are located outdoors. The fine ore stockpile is covered for snow protection and dust control. The existing three stage crushing circuit is based on modular mobile crushing equipment to allow the modifications necessary to allow the introduction of Beaver Dam ore to Touquoy.

In order to accept Beaver Dam ore, a truck unloading facility will be added, a new vibrating feeder and new collection conveyor will be fitted to tie-in to the existing secondary feed conveyor between the Touquoy ROM hopper and secondary crusher. No changes will be made to the remainder of the processing facility.

Crushing Circuit

Primary crushing of ore is performed at the Beaver Dam Mine Site. A primary jaw crusher module will be installed at the Beaver Dam crushing station. This will include a ROM hopper, primary jaw crusher and stockpile feed conveyor. ROM ore will be directed tipped or fed into the ROM hopper, crushed, and then conveyed via the stockpile feed conveyor to a coarse ore stockpile. This stockpile which will provide a buffer for haul trucks that transport the ore to the Touquoy Mine Site for secondary crushing and treatment. Haul trucks will provide daily ore transport between the Beaver Dam coarse ore stockpile and Touquoy Mine Site.

Crushed ore from the Beaver Dam Mine Site will be transported to the Touquoy Mine Site and fed into the Touquoy ROM hopper by front end loader where it will be transferred by conveyor to the secondary crushing module. Both the secondary and tertiary crushers are similarly sized cone crushers and are designed to produce a fine ore product of P80 of 10 mm. This material is conveyed by a stockpile feed conveyor to the 12,000 t fine ore stockpile (FOS).

The FOS is protected with a cover to reduce moisture, prevent freezing, and minimize dust from the fine ore.

Grinding

The fine ore is transferred from the FOS via conveyor into the grinding circuit to be processed through one single pinion ball mill in closed circuit with hydrocyclones producing a final product of P80 150 µm. The mill has a nominal solids throughput of 5,479 t/d and can process 250 t/h at 91.3% availability. The overall ball mill circulating load is 250%. The mill has been sized to handle both the Touquoy and Beaver Dam ores without any mechanical adjustment required during the transition between mines. The Beaver Dam ore is expected to operate at a higher ball volume and steel ball consumption than Touquoy ore to compensate for the difference in hardness and abrasion characteristics.

Mill slurry discharge overflows onto a rubber lined trommel screen with trommel oversize discharging to a bunker for regular collection and disposal by a skid steer loader. The trommel undersize gravitates to the cyclone feed hopper where the slurry is diluted with process water and pumped with a duty/standby cyclone feed pump to the cyclone cluster. A density meter monitors and controls the amount of process water required to produce a target density to the cyclones. The cyclone underflow is split, with up to 30% feeding the gravity circuit and the remaining underflow stream gravitating back to the ball mill.

The cyclone produces a fine ground overflow product of P80 150 µm which is sampled and then gravitates to the vibrating trash screen. Oversize debris is removed and falls to a trash bin at ground level. The trash screen underflow flows by gravity to the pre-leach thickener.

Gravity and Intensive Cyanidation

A portion of the cyclone underflow (up to 30%) is split and fed into two 50% duty parallel gravity concentrator trains. The gold concentrate recovered is treated in an intensive batch leach system designed to handle 2.4 t/d of concentrate. The resulting concentrated gold solution is pumped to a dedicated eluate tank at the gold room.

The equipment is arranged to provide a gravity cascade under the cyclones. The gravity circuit splitter box provides the feed slurry to the two gravity concentrator trains. Each train consists of a scalping screen, gravity concentrator and gravity area electric chain hoist. The two gravity concentrators in parallel are sized for 188 t/h solids feed rate.

A controlled split of the cyclone underflow to each train is provided with orifice plates located in the underflow launder. The oversize from the scalping screen gravitates to the ball mill feed chute, while the undersize feeds the concentrator. The concentrate gravitates to the intensive cyanidation circuit at ground level.

The intensive cyanidation circuit receives the periodic gold concentrate for treatment in an intensive leach reactor. The gold containing pregnant solution pumps periodically to a dedicated eluate tank in the gold room.

The tailings from the concentrators are transferred back to the ball mill circuit for further processing.

Carbon-in-Leach (CIL)

The trash screen underflow is increased from 35 to 50% solids in the pre-leach thickener in preparation for the CIL step. The trash screen underflow enters the preleach feedwell after mixing with metered flocculant. Thickener overflow gravitates to the process water standpipe and is recycled for plant use while the underflow slurry is pumped to the leach feed box for slurry conditioning prior to leaching.

The leach feed from the thickener underflow is pumped to a linear primary CIL feed sampler. The leach feed slurry is mixed with lime slurry in the leach feed box to raise the slurry pH for cyanide gold extraction. The feed box gravitates to the leach tank and optionally can feed directly to CIL Tank 1.

The circuit is a hybrid CIL type and consists of one leach tank and six adsorption tanks in series, each having a live volume of 1,169 m3. The design allows for a 250 t/h solids feed rate at 50% solids for an average 24-hour residence time. Each tank is interconnected with launders to allow slurry to flow sequentially by gravity to each tank in the train.

Barren carbon enters the adsorption circuit at CIL Tank 6. The carbon advances countercurrent to the main slurry flow during periodic transfers of slurry and carbon using air lift movement from a downstream to upstream tank. Carbon concentrations of 10 to 15 g/L are required in all tanks. Carbon will be retained in the upstream tank by an inter-tank screen. The countercurrent process is repeated until the carbon becomes loaded and reaches CIL Tank 1. Then a recessed impeller pump is used to transfer slurry and carbon to a loaded carbon recovery screen. The loaded carbon is washed with water and released to the acid wash column located inside the main plant, in the desorption area. The slurry will be returned to CIL Tank 1.

Following elution of the loaded carbon and thermal regeneration, the barren carbon is screened and reports to CIL Tank 6. Fine carbon is discarded to the CIL tailings hopper.

Tailings slurry from CIL Tank 6 flows by gravity to the vibrating carbon safety screen to recover any carbon in the event of damage, wear or other issues with the CIL Tank 6 inter-stage screen. Recovered carbon is collected in a bin that can be manually transferred for re-use or disposal. Tailings discharging from the safety screen gravitates to the cyanide detox Tank 1 in the cyanide detoxification circuit.

Desorption and Regeneration

The following operations are carried out in the desorption and regeneration areas:

- Acid washing of carbon.
- Stripping of gold from loaded carbon.
- Regeneration of carbon.

This circuit comprises a fibre reinforced plastic column located within the process building. A separate acid-proofed concrete bund is provided under the acid wash column area to ensure that all spillage is captured and kept separate from other process streams. Transfer and fill operations of the acid wash column are controlled manually. All other aspects of the acid wash and the pumping sequence are automated.

A pressure Zadra elution comprising an elution column, strip solution tank, strip solution pump and a strip solution heater package operates in a closed loop with the electro-winning cells located inside the Gold room.

The elution column is a pressure vessel with a live volume equivalent to 6 t of carbon. The elution column is constructed from carbon steel and includes insulation of all hot surfaces. The column is located next to the acid wash column and shares a bund and a sump pump with the strip solution and transfer water tanks.

The strip solution heater package is located inside the process building, near the elution column, but separately bunded. Within this package there is a recovery heat exchanger, trim heat exchanger, direct-fired heater, control panel, all interconnecting electrics and pipework. The heater is a direct-fired type with a propane fuel modulating burner. The heater is designed for a heat output to maintain the strip solution at 145 °C during the stripping cycle. Both heat exchangers are plate and frame type and ensure that the nominal temperature of solution entering the electro-winning cells is <100 °C.

After completion of the elution process barren carbon is transferred from the elution column to the kiln dewatering screen and into the carbon regeneration kiln feed hopper. In the kiln feed hopper, any residual and interstitial water is drained from the carbon before it enters the kiln. The kiln is a horizontal rotary unit sized for a feed rate of 330 kg/h at 75% utilization and is propane-fired.

The kiln operates at 650–750 °C and has a nominal retention time of 15 minutes to allow reactivation to occur. Regenerated carbon discharges from the kiln to a quench tank and is then pumped using a recessed impeller pump to the carbon sizing screen. The screen oversize returns to CIL Tank 6, while the quench water and fine carbon report to the tailings hopper via the carbon safety screen for disposal in the TMF. Fumes from the kiln pass through a wet scrubber to remove entrained minute carbon particles and then to atmosphere via an exhaust stack.

Gold Room

Three electrowinning sludging cells are used; one cell will be dedicated to the intensive cyanidation circuit and the other two to the elution circuit.

The electrowinning cell dedicated to the intensive cyanidation circuit is fed leach solution via a fixed speed centrifugal pump from the gravity leach liquor storage tank. Solution is pumped to the electrowinning cell and then gravitates back into the gravity leach solution storage tank in a closed loop until suitable gold recovery is achieved. The duration of this cycle varies with the quantity of gold recovered by gravity but is typically less than 24 hours.

The two electrowinning cells dedicated to the elution circuit operate in a closed loop with the elution column and associated equipment. Eluate flows directly from the top of the elution column to the electrowinning cells after cooling through heat exchangers. The eluate flows through the electrowinning cells and then gravitates back to the strip solution tank and then to the elution column in a continuous closed loop. The duration of this cycle is about 16 hours.

Cyanide Handling and Detoxification

Cyanide

Sodium cyanide (NaCN) is a key reagent used to leach gold from a sold matrix to form a gold cyanide complex that can be extracted from the slurry by adsorption onto activated carbon.

NaCN is delivered in the form of in dry briquettes from an approved supplier as per the International Cyanide Management Code (ICMC) standards. NaCN deliveries are made by truck in one tonne secured (strapped)wooden crates. Within the crates the NaCN is double and sealed close. At site the sodium cyanide is stored in a locked fenced area within the secure reagent building and kept under camera surveillance.

Prior to use, NaCN is mixed with water and sodium hydroxide (NaOH) for dilution and pH control within a mixing tank. Prior to mixing, operators will suit up in full personnel protective equipment (PPE) including Tyvek suits and powdered air purifying respirators (PAPR). Water and NaOH are added to the cyanide mix tank. The wooden crates are opened, and a gantry crane lifts the bags out and transports them to the mix tank. The bags are lifted by crane into the bag cutter on top of the mix tank and the door is shut to enclose the bag. The bag is slowly lowered onto the bag cutter and the dry solids are emptied into the mix tank. The bag cutter has water sprays to clean the cyanide bags prior to removing from the enclosure. This process is repeated for 4 cyanide (NaCN) bags to achieve a mix concentration of ~22%. Once the NaCN storage tank level is below 20% the mix tank is then transferred to the storage tank for distribution throughout the plant.

Cyanide is added into three areas; Leach tank #1, Intensive Leach Reactor (ILR) and Barren Eluate tank #12. Leach tank #1 is a continuous addition whenever the leach circuit is being fed with ore. It is controlled based on constant cyanide titrations throughout the leach/CIL circuit. The ILR and Barren Eluate tank are dosed based on a batch process. When a batch is ready, the dosage is controlled based on a flowmeter to a targeted concentration. All these addition points have pH control reagents (NaOH or Lime) with automated interlocks that will not permit NaCN addition until a suitable pH is achieved to avoid the formation of hydrogen cyanide (HCN) gas.

Cyanide target concentrations are as follows:

- Leach tank # 1 = 50ppm (0.005%). By the end of the CIL circuit (CIL tank #6), the remaining cyanide is about 30ppm (0.003%)
- ILR= 14, 000ppm (1.4%). Once the process is complete, this small volume (5.2m3) is transferred and diluted in the much larger Leach/CIL circuit (9,100m3) for consumption.
- Barren Eluate Tank #12= 1000ppm (0.1%). Once the process is complete, the remaining cyanide stays in the tank to be re-used during the next batch. Each new batch, the cyanide is just topped up to the target concentration.

Cyanide Destruction

Cyanide destruction occurs within the cyanide destruction circuit. Slurry passing through the carbon safety screen gravitates to two 300 m3 cyanide detoxification tanks which are designed on the conventional air-SO2 process and can operate in series or parallel for operational flexibility. The average slurry residence time at 250 t/h is 1.5 hours.

The tanks utilize high shear agitators and air injection to enhance high oxygen dissolution in the slurry to meet the high oxygen demand of the cyanide destruction process. Sodium metabisulphite and copper sulphate solutions are dosed into either tank providing the oxidizing agent and catalyst respectively for the cyanide destruction. Acid generation is neutralized by the addition of lime slurry to the detox tanks via a ring main.

The detoxified slurry stream gravitates to the tailings hopper from where it is pumped through a single pipeline to the TMF by variable speed tailings pumps (1 duty/1 standby). The tailings slurry is then discharged at selected outlet points around the periphery of the facility. Pipe runs are designed to be self-draining to avoid dead legs.

Contingency measures for cyanide detoxification include primary linear and secondary rotary vezin tailings samplers taking representative tailings samples after the slurry has been detoxified and prior to entering the tailings hopper. The cyanide destruction and tailings hopper area has a dedicated bunded concrete area for collecting spillage. A local sump pump returns any spillage to the carbon safety screen. The area is enclosed for cold weather protection. A CNWAD analyzer automatically monitors slurry levels and an HCN detector provides monitoring for airborne gas.

Shutdown procedures are in place in the event of process upsets including cyanide detoxification.

Tailings Disposal

Prior to the completion of mining operations at Touquoy, a tailings line will be routed to the exhausted Touquoy pit in preparation to receive Beaver Dam tailings. Tailings will flow by gravity to the open pit. Initially, reclaim water will be withdrawn from the supernatant pond in the existing TMF to supply processing water needs for Beaver Dam ore. A reclaim water pump and barge, with a new pipeline to the process water tank, will be installed when process water accumulation from the tailings slurry deposited in the pit is adequate. The transition from the TMF to the open pit reclaim water system is expected to be smooth requiring minimal downtime and no extra fresh water requirements beyond what is currently permitted from Scraggy Lake under Touquoy water withdrawal approvals. The existing TMF will only be used for initial process water requirements and will not be used for tailings storage in the processing of Beaver Dam ore.

Supernatant water collected in the open pit will be pumped to the process water tank located next to the pre-leach thickener. The sections of the tailings and reclaim pipelines between the plant site and open pit will be double-walled and run in HDPE lined trenches to an adequately sized lined collection ponds capable of containing the volume of the pipeline. Monitoring systems will be installed on the pipelines for leak detection and shutdown procedures.

The Touquoy Project currently employs an Operation, Maintenance and Surveillance (OMS) Manual for the existing TMF. This manual will be updated in advance of using the open pit for storage of Beaver Dam tailings in order to reflect changes in operating conditions and environmental factors. As well, Touquoy also currently employs an Emergency and Spill Response Plan which will also be updated, Environmental monitoring will continue as prescribed under the Touquoy IA which will be amended as necessary to reflect the changes in processing of Beaver Dam ore and storage of Beaver Dam tailings.

The minor works necessary to modify the Touquoy Mine Site for Beaver Dam ore, as described above, will begin before initiation of operation of the Beaver Dam Mine Site. This transition phase will likely not exceed two months.

No other changes will be made to the remainder of the processing facility and no additional land disturbances are anticipated to prepare the Touquoy Mine Site to receive Beaver Dam ore.

2.3.1.4 Existing Environmental Mitigation and Monitoring Requirements Associated with Construction

The construction activities at Touquoy site required for the Beaver Dam project are minimal and within the existing Touquoy project footprint. The existing Touquoy IA well addresses construction activities, such as sediment and erosion control and spill protection and containment associated with construction equipment, e.g., fueling.

The existing environmental monitoring requirements at Touquoy include surface and groundwater monitoring as part of the IA. This will have occurred for about five years before construction activities associated with the Beaver Dam Mine Project commences. Also, existing approvals for wetland alteration include requirements for monitoring and compensation; these will be completed during the life of the Touquoy Gold Mine and no additional disturbance of wetlands is required as part of the Beaver Dam Mine Project activities at Touquoy.

Project Schedule

During the one-year construction phase, flexibility in the schedule may be employed to take advantage of seasonality. The upgrades to the Touquoy processing facility are not anticipated to exceed two months. This will likely be completed near the end of Year 1, after exhaustion of the Touquoy pit. Details regarding the time of year when activities will begin will be determined at a later date and addressed during the IA process.

The Project Schedule will be discussed in more detail in Section 2.5.

2.3.2 Operation and Maintenance (Years 2 to 5)

2.3.2.1 Beaver Dam Mine Site

During operation and maintenance of the Beaver Dam Mine Site the following activities will be undertaken:

- surface mine operation and maintenance
    - drilling and rock blasting;
    - surface mine dewatering;
- ore management;
- waste rock management;
- surface water management;
- dust and noise management;
- petroleum products management; and
- site maintenance and repairs.

Surface Mine Operation and Maintenance

Once accessible, in-situ rock will be drilled and blasted on 5 m bench heights. Diesel powered rotary drills will be used for production drilling and horizontal high wall depressurization drilling on the ultimate pit walls if required. Blasting will occur at the same time of day two or three times a week. Dedicated reverse circulation grade control drilling and sampling will be used to define ore and waste rock limits, while a fleet management system will track each load transported from the surface mine.

Phase one targets the south portion of the deposit and will produce approximately 22 months' worth of mill feed. The open pit will be advanced from the exit at 130 masl down to the pit floor at 45 masl. Phase two will develop the open pit towards the north and east wall and extend the pit floor below the first phase. Phase two will produce approximately 21 months' worth of mill feed and advance the surface mine from the exit at 130 masl to the new pit floor at -45 masl (i.e. 45 metres below sea level). At completion, the surface mine will measure about 900 m along its east-west axis, about 300-450 m along its north-south axis, and have a depth of approximately 170 m based on the current delineation of ore. The total area comprising the surface mine will be 30 ha. The ore production anticipated during the operation of the surface mine is discussed in greater detail in Section 2.5.

A contract explosives supplier will provide the blasting materials for the mine. Emulsion will be the primary blasting agent as the majority of holes will be wet. It is anticipated that explosives and all accessories will be supplied on an as needed basis from the contractor's base location off-site and delivered to the site explosive storage facilities or directly to the blast holes using the contractor's equipment. If required, magazines will be suitably located to conform with quantity and distance requirements as regulated by Natural Resources Canada (NRCAN). All on and off-site permitting requirements will be the responsibility of the contractor through NRCAN.

Diesel powered hydraulic excavators and a wheel loader will load both ore and waste rock into separate haul trucks. These loading units will also function to re-handle mine material, and load overburden and topsoil, as well as conduct mine clean up, road construction, and snow removal. The off-highway rigid frame haul trucks will have a 64 tonne capacity and haul ore to the ROM pad and ore stockpiles as required, while waste rock will be hauled to the waste rock stockpiles. If dust is generated from hauling during warmer months, it will be controlled by applying water to the Haul Roads utilizing a specialized water truck. At the ROM pad, off-highway haul trucks will dump ore material directly into the primary crusher or place it in an active stockpile on the pad to be re-handled as crusher feed later on. Active stockpiles will be constructed in lifts. Loading of stockpiled ore into the primary crusher will be accomplished via a diesel-powered wheel loader. At the waste rock stockpiles, haul trucks will dump waste rock and diesel-powered track dozers will spread it into lifts.

As all ore processing will be carried out at the existing Touquoy processing facility, no mill reagents, including cyanide, will be utilized at the Beaver Dam Mine Site. No changes will be made to the mill reagents used in the Touquoy gravity/CIL process as described in Section 2.6.4 due to the processing of Beaver Dam ore. All mill reagents used at the Touquoy will continue to be transported, stored, used, and disposed of, where necessary, in accordance with existing Touquoy standard operating procedures, permits, approvals and relevant regulations.

The only chemicals expected to be used at the Beaver Dam Mine Site, not including fuels, oils, lubricants, coolants, etc., are:

- flocculants, which will likely be used to meet suspended solids discharge limits at the discharge point; and,
- chemical dust suppressants, such as magnesium chloride, to supplement the use of water in controlling fugitive dust generation on roads and other trafficable areas. Chemical dust suppressants will be considered for use when conditions render water use alone inefficient in controlling fugitive dust from traffic.
- In the event water treatment is required during the operational or post closure phases of mine development, reagents could include ferric sulphate (for arsenic and other metals removal), oxidizers such as hydrogen peroxide and potassium permanganate, lime for pH adjustment, and flocculants for final sludge removal.

The anticipated 246 person workforce at the Beaver Dam Mine Site will include approximately 105 mine personnel (working two or three shifts per day of 12 or 8 hours respectively, or approximately 26 persons per shift (includes 26 on leave at any time). The workforce also includes 60 haul truck drivers, 57 plant staff (at the Touquoy Mine Site), and 24 general and administrative staff (between the Beaver Dam mine site and the Touquoy Mine Site). An allowance of 10 days per year of no mine production has been assumed to allow for adverse weather conditions. No group transportation to the mine site or on-site lodging are anticipated at this time so long as the local labour pool can supply the necessary labour requirements.

A summary of the major mining equipment fleet requirements is provided in Table 2.3-1.

Table 2.3-1 Beaver Dam Primary Mining and Hauling Equipment Requirements

Activity and Equipment	Requirement				
	2022 (Partial year)	2023	2024	2025	2026 (Partial year)
Drilling					
Diesel DTH Tracked Drill, 110 mm holes	4	5	4	2	1
Diesel RC Tracked Drill, 135 mm holes	2	2	2	2	2
Loading					
Hydraulic Excavator – 4.55 m3 bucket	4	4	3	2	2
Wheel Loader – 7.0 m3 bucket	2	2	2	1	1
Hauling					
Haul Truck – 64 tonne payload	13	13	11	5	4

To facilitate successful mining operations, the following in situ support services will be available:

- mine site road maintenance;
- mine floor and ramp maintenance;
- ditching;
- reclamation and environmental controls;
- surface mine dewatering;
- surface mine lighting;
- mine safety and rescue;
- transportation of personnel and operating supplies; and,
- snow removal.

A summary of the equipment chosen to conduct these support services and their specific role is provided in Table 2.3-2.

Table 2.3-2 Beaver Dam Operational Equipment Requirements

Equipment	Function	Requirement
Motor Grader (4.3 m blade)	Mine site road maintenance	1
Water/Gravel Truck	Mine site road maintenance	1
Track Dozer (325 kW)	Waste rock stockpile maintenance	3
Water Pumps (150 m3/h)	Mine sump dewatering	2

Equipment	Function	Requirement
Track Dozer (237 kW)	Mine support and construction	1
Wheel Loader (5.5 m3)	Mine support and construction	1
Hydraulic Excavator (2 m3)	Utility excavator and rock breaker	2
On-highway Dump Truck	Utility material movement	2
Fuel and Lube Truck	Mobile fuel/lube service	2
Shuttle Bus (16 passenger)	Employee transportation	1
Backhoe Loader (69 kW)	Utility loader and stemming loader	1
Pickup Trucks (1/4 tonne)	Staff transportation	7
Light Plants (20 kW)	Surface mine lighting	6
Skid Steer (54 kW)	Utility material movement	1
Track Dozer (149 kW)	Utility material movement	1
Maintenance Trucks	Mobile maintenance crew and tool transport	2
Mobile Crane (36 tonne capacity)	Mobile maintenance material handling	1
Float Trailer (55 tonne capacity)	Equipment transport	1
Forklift (3 tonne capacity)	Shop material and tire handling	1
Mobile steam cleaner	Mobile maintenance equipment cleaning	1

The majority of this equipment will be utilized during the site preparation and construction phase as well. Maintenance activities for the mobile mining, hauling, and operation equipment will be performed in the field and at the mine maintenance workshop facility located near the primary crusher. All field maintenance will be performed with dedicated maintenance equipment operated by qualified staff. A grader will be used to maintain the mine site roads. Snow clearing will be conducted regularly during the winter months. No salting of mine Haul Roads is anticipated during winter conditions for traction.

The maximum anticipated daily volume on the Highway #224 and Beaver Dam Mines Road associated with the Beaver Dam Project is estimated to be 175 (passenger and service vehicles). In reality, based on use of the Haul Road, intermittent service vehicle schedules and car-pooling, the number on #224 could be reduced by 50% to around 85-90 per day over a 24 hour period or roughly 4 per hour on the #224. Traffic on Highway #224 is expected to remain within the traffic count ranges as provided by NSTIR (refer to Section 6.16.3).

The Beaver Dam Mine Site will require a water source for fire protection and dust control. Raw water will be pumped either directly from Cameron Flowage or recycled from the site water collection ponds or ditches assuming the water quality meets regulatory requirements. Water will be distributed from the storage tank to various users including, but not limited to, the site facilities facility and primary crusher location if required. Dust control will occur as required and will consist primarily of wet suppression controls using only water on unpaved surfaces. However, in some high traffic areas including site facilities and internal access roads, a chemical suppressant (e.g., Magnesium Chloride) may be used to more effectively control dust. This will be applied during the summer/fall months (May to October) in liquid form using the mine water truck and in granular form during the colder months (November to April). There is no requirement for decant water and potable water will be delivered via specialized truck.

Daily domestic water usage is based on approximately 30 employees on the mine site at any time. It is anticipated that one drilled domestic water well will be required to provide water for sanitary usage as domestic wells in this area generally yield 5 to 10 L/min based on a literature review of several sources and the demand is estimated at less than 5 L/min. The use of a storage tank on-site and water demand equipment will keep extraction rates within the well capability.

A mobile vehicle wash down unit likely consisting of manually directed water jets and a high-pressure hot water and steam generator cleaner will be utilized at the Beaver Dam Mine Site.

Surface water runoff from truck washing will be contained and directed to the site collection pond. Sampling will determine whether this wastewater stream will require treatment prior to release to the receiving environment.

Sewage from the Beaver Dam Mine Site office facility will flow by gravity drain via a piped network buried below the frost line to septic tanks equipped with leach drains. No chemical waste will be disposed of through the septic system. The septic tanks will be pumped out as required by a contractor.

Hazardous wastes, such as used oil, lubricants, batteries and antifreeze will be collected by qualified hazardous waste contractors and taken off-site for re-cycling or disposal in accordance with relevant legislation. General non-mine waste will be collected by a contractor and transported off site for disposal.

Ore Management

On average, 35,480 tonnes of rock will be extracted from the surface mine per day, and an average total of 2 million tonnes of ore will be extracted per year. Of that, 5,480 tonnes will be ore-bearing and 30,000 tonnes will be waste rock. Ore and non-ore bearing waste rock will be loaded into off-highway haul trucks for transport out of the open pit. From there, ore will be separated into low and high grade stockpiles prior to entering the crusher, while non-ore bearing waste rock will be stockpiled for final disposal.

The ore stockpiles (10 ha) will include low grade and high grade ore piles, located north of the crusher and operational facilities pad, and a ROM stockpile at the crusher. Acid rock drainage potential was analyzed and is discussed further in Section 6.7.6.1 Results indicated that the majority of the ore deposit is net acid consuming.

The ROM stockpile will likely have up to a 30-day capacity for storing ore during plant shut-downs or short-term periods where ore extraction from the mine exceeds crusher or plant capacity. The ROM stockpile can also accommodate plant feed if ore hauling from the mine is reduced for weather or other reasons.

The high grade ore stockpile will store ore with a gold grade above 0.50 grams per tonne (g/t). It will store ore mined during pre-production and during periods when extraction exceeds the capacity of the ROM stockpile. The low grade ore stockpile will temporarily store ore which will be re-handled through the crusher once the mine has been exhausted. Re-handling of the stockpiled ore will take place during Years 4 and 5 of operations.

Table 2.3-3 identifies the tonnage of waste rock broken down by PAG and NPAG for both argillite and greywacke.

Table 2.3-3 Waste Rock: PAG and NPAG within Argillite and Greywacke

Unit	Total Waste (Mt)		PAG Waste		NPAG Waste	
	(Mt)	Total %	(Mt)	PAG%	(Mt)	NPAG%
Argillite	12.8	34%	7.9	62%	4.8	38%
Greywacke	24.8	66%	6.5	26%	18.4	74%
Total	37.6	100%	14.4	38%	23.2	62%

Waste Rock Management

Material storage at the mine site will include six topsoil stockpiles, two till stockpiles, and two non-ore bearing waste rock stockpile comprising a total of 98 ha. The waste rock stockpiles will have a total capacity of 39.5 Mt

In general topsoil have been located throughout the site adjacent to stripped areas in order minimize stockpile sizes and to better facilitate reclamation. Total capacity of the topsoil stockpiles id estimated at 0.94 Mt. In addition to the topsoil stockpiles, two overburden/till stockpiles have been located to the south east of the open pit. Each stockpile will a capacity of 1.7 Mt and 2.3 Mt and a maximum peak grade of 170 masl and 185 masl respectively.

Two non-ore bearing waste rock stockpiles will be constructed to the south and to the west of the open pit with a combined capacity of 35.5Mt. The stockpile located to the south will have a maximum peak grade elevation of 210 masl while the stockpile to the west will be raised to a maximum peak elevation of 190 masl. Each stockpile will be constructed in multiple lifts of 10 m with each lift having an active slope of 2:1. A 20 m dual lane Haul Road running up the north side of each stockpile will provide progressive access to all lifts.

Surface Water Management

Surface water run-off from the Beaver Dam Mine Site crusher pad will flow by gravity, with the aid of berms and channels, to a collection pond located to the south of the crusher pad. A culvert located beneath the mine entrance road will facilitate decant overflow from the collection pond to a discharge channel that will run down gradient to the south and ultimately discharges into wetland area (Wetland 64) located to the south of the Beaver Dam Mine Site.

Surface water run-off from the eastern and western waste rock stockpiles, low grade ore stockpiles, Beaver Dam Mine Site roads, and some natural area will flow by gravity, with the aid of berms and channels, to the north settling pond, located west of the pit. This settling pond will also receive water from the pit dewatering program. Overflow from the north settling pond is directed to the Killag River outfall (Cameron Flowage).

Runoff from the till stockpiles located to the southeast of the open pit and east of the mine facilities area will be captured with the aid of channels around the stockpile perimeter and diverted north to Cameron Flowage by gravity via separate water discharge structures and engineered channels.

The discharge structures on all settling ponds will be equipped with flow-control devices. The final design of the collection and settling ponds including the discharge points and proposed monitoring programs will be submitted as part of the IA process.

A berm surrounding the pit will direct surface water runoff into a water diversion channel that discharges to the settling pond to the west. Since this water is non-mine contact water, there will be a high likelihood that this water can be discharged directly to the Killag River should it meet applicable water quality criteria. A water diversion ditch will be established around the perimeter of the open pit to intercept any surface water that infiltrates the berm and flows into the mine. This ditch will direct water to in-mine sumps where it will be pumped out of the mine and into the north settling pond (located west of the open pit).

Should it be required, sub-horizontal drain holes will be established in the pit walls as they are exposed. On the active bench floor, the water that is collected from these drain holes will be directed to a sump where it can be pumped from the mine to the north settling pond.

Surface run-off entering the mine will be handled by pumps installed in each active mine bottom as part of the flexible and moveable bench scale pumping system. The mine sump pumps will be connected to semi-permanent and permanent HDPE piping systems to convey water directly to the settling pond located west of the surface mine. The in-mine sumps will be installed with each box cut as the benching is advanced.

Water will be re-used on site for dust suppression purposes, as required. The majority of water collected in the settling and collection ponds will be released to Cameron Flowage, however, the maximum anticipated water re-used on the mine site for dust suppression purposes is approximately 500 m^3 daily; this will occur on an as-needed basis only, assuming the water from settling ponds and collection ponds meets appropriate criteria. If not, water could be drawn, with appropriate permitting, from Cameron Flowage.

Between 1986 and 2018, several hydrogeological investigations were conducted on the mine site. The data obtained from these studies were used to characterize the baseline hydrogeology for the site and were used as to model and develop predictions for groundwater-surface water interactions on the site during construction, operations, and closure phases. Key predictions made were the maximum extend of groundwater drawdown around the open pit, the rate and quality of groundwater seepage into the open pit, and any seepage expected to discharge to surface water bodies. Details of the groundwater baseline and modelling studies are presented in Section 6.6 of this report.

Petroleum Products Management

Diesel fuel will be used in all mobile equipment and to power on-site generators throughout the operational phase of the Project. Other petroleum based and non-petroleum based liquids will be used for equipment maintenance. Propane is not currently anticipated to be utilized at Beaver Dam as buildings will be electrically heated using power from diesel-powered generators; however, an economic assessment will be completed during the design phase to confirm the associated carbon footprint and costs for each heating fuel.

The delivery of diesel fuel will be conducted by tanker trucks from suppliers who routinely transport and distribute petroleum products. Transfer of these products from the tanker truck to double-walled tanks with bollards will be constantly supervised by the delivery person to ensure constant observation and immediate response should a spill occur. Based on anticipated equipment, associated efficiency ratings, and hours of operation, diesel fuel consumption by operational equipment and haul trucks has been estimated to be approximately 9.02 million litres of diesel fuel per year during full scale operations. During construction and decommissioning, diesel fuel consumption will be approximately 3.7 million litres per year.

Diesel fuel storage will be located near the primary crusher and adjacent to diesel generators. Fuel will be distributed to equipment consumers by means of a stationary pump system and a dedicated fuel truck. The fleet of road trucks required to transport crushed ore from the Beaver Dam Mine Site to the process plant at the Touquoy Mine Site will be refueled at Beaver Dam or Touquoy as needed using a stationary pump system.

Where practical and available, the diesel storage and distribution facility from the Touquoy Mine Site will be relocated to the Beaver Dam mine site to fuel the mining fleet, generators, and haul trucks. It is anticipated that a total storage capacity of 40,000 litres will be required, with final configuration to be determined based on final equipment selection.

Increased environmental disturbance is anticipated during drilling and rock blasting, transportation of ore from the surface mine to the various stockpiles, maintenance activities, and at times of surface water discharge to Cameron Flowage.

2.3.2.2 Haul Road

During operation and maintenance of the Haul Road the following activities will be undertaken:

- ore transport; and
- Haul Road maintenance and repairs.

Ore Transport

Crushed ore from the Beaver Dam Mine Site will be transported to the Touquoy Mine Site by truck travelling along the upgraded Haul Road. The route is Beaver Dam Mines Road to Hwy 224 to logging roads herein referred to as the Moose River Cross Road to Mooseland Road for a total distance of 30.1 km. It is anticipated that ore will be hauled under contract between the two sites, however, this is subject to further review and availability of suitable qualified contractors.

Approximately 20 highway trucks will be required to transport the ore from the Beaver Dam Mine Site to the Touquoy Mine Site. The exact number will depend on final payloads and the hauling schedules, which will likely be a single 12-hour shift, or two 8 hour shifts per day operating between the hours of 6:00am to 11:00pm. The number of return truck trips per day will be an annual average of approximately 185 for 350 days per year for the anticipated duration of the Project (3.6 years). This is an increase from the current average daily traffic on the Haul Road (when forestry operations are not occurring) which is estimated to be approximately 10 vehicles per day. Hours of operation during active hauling will likely occur between 6:00am to 11:00pm. The exact number trucks will depend on final payloads and the hauling schedules. During construction and pre-production (8 months), truck traffic will be reduced and will be associated with construction and upgrade of the Haul Road and transportation of equipment between the Touquoy Mine Site and the Beaver Dam Mine Site.

Approximately 60 individuals will be required to operate the transport fleet.

Haul Road Maintenance and Repairs

All grading, maintenance, snow clearing, gritting and dust suppression conducted on the Haul Road will be completed by a third-party contractor. With regards to Haul Road maintenance it is anticipated that only minor surface repairs will be undertaken during the planned haulage schedule. Most of the road maintenance will occur outside of the planned hauling schedule so as not to impede the haul trucks and increase the safety risk on the road. Apart from road surface maintenance it is anticipated that major repairs will be localized in kept to a minimum with appropriate road design.

Snow clearing will be undertaken using an on-highway truck outfitted with a snow plough sand spreader. Clearing will occur on an as needed basis throughout the winter months and will require operations outside the planned haulage schedule depending upon the snowfall event. The sand spreader will be utilized during the winter months for traction control. In addition, localized salting during significant ice events will occur for safety reasons. Salting will be restricted to road sections with steeper grades and at least 30m from any watercourses.

Dust control will occur as required and will consist of a combination of chemical suppressant and/or water on unpaved surfaces. In order to provide longer term dust suppression, particularly throughout the winter months where water is not practical, an approved chemical dust suppressant will be applied to the road surface. Periodic application is anticipated depending upon road conditions and traffic. To support chemical dust suppression and provide short term suppression of dust throughout the warmer drier months, water will be applied. A water truck will spray the width of the Haul Road and operate during the haulage period.

Increased environmental disturbance is anticipated during peak transport times (12 to 16 hours per day) and during maintenance activities along the Haul Road.

2.3.2.3 Touquoy Mine Site

During operation and maintenance of the Touquoy Mine Site the following activities will be undertaken:

- ore processing; and
- tailings management (exhausted pit).

Ore Processing

Other than the primary ore crushing, no mineral processing will be undertaken at the Beaver Dam Mine Site. All processing will be completed at the Touquoy Mine Site after mining from the Touquoy pit has been exhausted.

The Touquoy plant is designed to treat Beaver Dam ore with no modifications other than an increase in the total weight of grinding balls in the ball mill to accommodate the slightly harder ore from the Beaver Dam pit. This will not require any larger equipment.

Details regarding water and tailings management (exhausted pit) are provided in the Integrated Water and Tailings Management Plan presented in Appendix G.2. A summary is provided below for operational and closure phases of the project.

Tailings Management - Operations

There is no requirement for tailings management at the Beaver Dam Mine Site as all mineral processing will be undertaken at the Touquoy Mine Site. Tailings generated from this operation will be pumped to the mined-out Touquoy pit for storage and covered with water to create a lake during reclamation. The approved Touquoy Environmental Assessment stated that the pit would be allowed to fill naturally with water over a period of time through precipitation, surface flow and groundwater in-flow. No change to this method is planned to follow the deposition of Beaver Dam tails, except that the time frame for refilling will be shorter given the decrease in available volume taken by the tailings.

The processing of Beaver Dam ore at Touquoy involves the continued use of Touquoy water management facilities but flow patterns will be altered and rerouted as described, below. The Tailings Management Facility (TMF) will continue to receive surface runoff from the waste rock pile, seepage collection ditches, and direct precipitation and will continue to operate under the existing Industrial Approval (IA) which includes TMF effluent treatment plant operation and discharge to Scraggy Lake. Runoff from the mill site pond and run-of-mine (ROM) stockpile will continue to be collected and routed to the plant for use as make up water for the processing of Beaver Dam ore. Dewatering of the open pit to the TMF will cease at the end of Touquoy open pit mine life which will allow water inflows to accumulate in the open pit. At initial stages of Beaver Dam ore processing, reclaim water will be directed to the mill from the TMF through the existing decant tower or floating barge infrastructure for processing of Beaver Dam ore. Delay of water reclaim from the open pit will allow time for water inflows to collect in the pit as a start-up process water supply. When water is to be reclaimed from the open pit, the existing floating barge and associated infrastructure will be relocated from the TMF to the exhausted open pit. The barge will raise with the water and tailings elevation in the pit, decreasing pump head and associated pumping costs over time. If required, additional Beaver Dam ore processing start-up water supply will be sourced from Scraggy Lake, subject to NSE water withdrawal approval. Freshwater make-up for the process will continue to be sourced from Scraggy Lake as provided in existing water withdrawal approvals. Additional make-up process water required in a dry year will be sourced from effluent from the TMF treatment plant or Scraggy Lake, subject to NSE approval. Beaver dam tailings will be deposited in the open pit. The existing tailings slurry pipeline from the mill will be redirected from the TMF to the Touquoy open pit.

Tailings Management - Closure

During the closure phase, the objective is for water in the pit lake to meet the reclamation regulatory water quality requirements or site-specific criteria. Key water management features are described below.

The existing TMF effluent treatment plant and downstream discharge facilities will continue to be in operation to treat TMF water surplus. At the cessation of tailings deposition to the Touquoy open pit, the open pit will fill with water. During this period, there may be an opportunity to treat the pit lake as a batch reactor with the objective of adjusting the pH to precipitate metals thus improving discharge quality. Surplus water in the open pit will be pumped to the TMF for treatment, until such time as water quality monitoring indicates that water quality is suitable for direct discharge to the environment. Until water quality meets discharge criteria, the water level in the pit lake will be maintained at or below elevation 104 masl (i.e. corresponding to the shallow permeable zone), thus reducing seepage to Moose River and normalizing treatment rates to the extent feasible. A minimum of 1 m water cover will be maintained above the deposited tailings to facilitate pumping. The water cover depth will vary over the tailings depositional period. The effluent treatment plant will operate intermittently during non-frozen periods (April – November, inclusive) to lower the pit lake to 103 masl seasonally by the end of November, thus providing storage over the period when the effluent treatment plan is shut down during the winter months. Assuming the existing effluent treatment rate of 400 m^3/hr, the effluent treatment plant would be in operation for an additional 4.4 months to pump and treat the annual climate normal surplus of the open pit watershed of 436,000 m^3. Operation of the existing effluent treatment plant will be modified to accommodate Beaver Dam water surplus or additional capacity will be added to effluent treatment plant to treat water over a shorter period simultaneously.

The effluent treatment plant and downstream discharge facilities are not required for the Project once effluent discharge meets regulatory discharge criteria and will not require treatment. Surplus water in the open pit will be discharged via a constructed spillway/conveyance channel to Moose River, subject to meeting regulatory discharge criteria. The spillway and conveyance channel will be sized to accommodate the inflow design flood in accordance with the Canadian Dam Association (CDA) guidelines. The spillway invert is set at elevation 108 m, approximately 2 m below the lowest open pit elevation to prevent overtopping.

2.3.2.4 Existing Environmental Mitigation and Monitoring Requirements Associated with Operations

There is an existing IA for the Touquoy Project which has specific environmental mitigation and monitoring requirements. This is relevant to the Beaver Dam Mine Project in two ways:

- Monitoring data is being collected since 2016 and will continue to be collected through to the start of the Beaver Dam Mine Project as part of requirements under the existing IA. This provides much background data to support the follow up programs anticipated at the Touquoy site for the Beaver Dam Mine Project;

- Mitigation measures required as part of the IA and other associated Touquoy Gold Mine environmental management plans will continue to be implemented as part of the Beaver Dam Mine Project.

Given the operational activities at the Touquoy Mine Site are limited to processing of ore and management of tailings (exhausted pit), existing mitigation and monitoring requirements applicable are directly related to atmospheric emissions, surface water and groundwater.

2.3.3 Decommissioning and Reclamation (Years 5 to 7 and Beyond)

Preamble on Decommissioning

The purpose of site reclamation is to improve aesthetics and allow the site to return to its pre-development state or to a future planned use, while decreasing the potential for environmental risk.

The Proponent will establish lease agreements with the province and private land owners for the life of the surface mine. Land leased for the Beaver Dam Mine Site, Haul Road, and Touquoy Mine Site will be returned to the province and private owners following the completion of operations, equipment decommissioning and removal, and the acceptance of decommissioning and reclamation activities by Nova Scotia Environment.

It should be noted that the Proponent will not be the owner of any of the lands associated with the Project and therefore the final reclamation efforts will be largely determined by the land owners and through the lease agreements that will be established. The Proponent recognizes the requirements for reclamation through the NS Environment Act and Mineral Resources Act and the role that NSE and NSDL&F have in determining reclamation activities, bonds and plans. The Proponent is well familiar with these requirements and agencies through the development of the Touquoy Mine and the development of the accepted Reclamation Plan and bond values for that mine. This knowledge and history are advantageous for the successful development of the Reclamation Plan for the Beaver Dam Mine that would be required at the Industrial Approval stage of the Beaver Dam Mine development.

Beaver Dam Mine Site Description at Closure

At closure, the Site will include the following:

- All mine site facilities will have been removed;
- The open pit will be allowed to fill with water to eventually form a lake with a wetland edge habitat;
- The waste rock pile will be capped with topsoil and re-seeded and all disturbed areas will be re-vegetated;
- The till stockpile will be re-vegetated if there are any residual materials following reclamation;
- Mine site roads will remain in place, and ultimately will be returned to the land owner for forestry and recreational use;
- The Haul Road will be returned to the land owners in an upgraded condition with habitat and wetland improvements;
- Water treatment at discharge location into the Killag River from the pit, as required, will continue, and monitoring programs will be on-going;
- Fences will be removed once the majority of closure activities are completed;

The Touquoy Mine Site will be reclaimed under a separate plan developed for the Touquoy Project and already approved by regulatory agencies. As mentioned previously, the currently approved Reclamation Plan will be updated to reflect the above changes associated with processing Beaver Dam ore and re-submitted. Water treatment at discharge location into the Moose River from the pit, as required, will occur, and monitoring programs will be on-going.

Ultimately the land will be returned to conditions similar to its original state as a natural woodland and wetland habitat used for recreation and forestry. The existing conditions at the site have been previously described as being in a disturbed state in many areas and therefore improvements at the site will be realized through the reclamation activities proposed.

2.3.3.1 Reclamation Objectives and Goals

The objective of the Final Reclamation Plan is to return the site to a safe and stable condition, compatible with the surrounding landscape and anticipated final land use. The plan will employ recognized reclamation best practices, acknowledged principles of ecological restoration, and consultation with relevant stakeholders including the Millbrook First Nation and other Mi'kmaq communities. In the past, the site has hosted numerous mining/exploration activities (exploration declines, roads, camps, settling ponds, and small waste piles of rock and overburden), along with successive tree harvesting and silviculture operations. Evidence of recreational land use (hunting and off-road vehicles) and surface water use (fishing and boating) directly within the Beaver Dam Mine Site is limited and suggests these activities could be re-instated once the surface mine ceases operation and reclamation activities have been completed.

The goals of a successful Final Reclamation Plan include:

- remove all equipment and infrastructure not necessary for future use and care of the site;
- stabilize the terrestrial environment and revegetate the site to encourage regrowth of native species;
- minimize disruption to the aquatic environment; and
- restore land and surface water use potential.

The reclamation goals are designed to enable eventual abandonment of the site in a safe and stable state. In order to achieve these goals, the Proponent will undertake general decommissioning and reclamation activities as described below.

2.3.3.2 Conceptual Reclamation Plan

Two of the three components affected by the Project will be included in reclamation activities. The Touquoy Mine Site will be reclaimed under a separate approved plan developed for the Touquoy Project.

Reclamation Plan requirements in Nova Scotia include the need to submit a Conceptual Plan at the EA stage, a Reclamation Plan as part of the IA stage, and a Final Reclamation Plan six months prior to mine closure. The submission of a Conceptual Plan in concurrence with the EA allows the public, regulators, and Indigenous Peoples to provide comments the Proponent can consider in the development of the Reclamation Plan. The Reclamation Plan will be used as the basis to determine the bond amounts and requirements at the Industrial Approval stage of the Project. The submission of a Final Reclamation Plan six months prior to surface mine closure will allow the Proponent to incorporate knowledge of the site gained through site preparation and construction, and operation and maintenance. Public and Indigenous Peoples consultation and engagement will also be sought for the development of the Final Reclamation Plan through the Community Liaison Committee (CLC) or other technical advisory committee as determined through consultation with the Mi'kmaq and local stakeholders, as concerns raised during the development of the Reclamation Plan at the IA stage may have changed.

Surface Mine

At the end of mine operations at the Beaver Dam Mine Site, the dewatering pumps from the open pit will be decommissioned, and the pit will be allowed to flood. Based on the water balance report completed for the site (refer to Appendix G.5) the filling of the pit will take approximately 15 years. The reclamation plan submitted as part of an Industrial Approval process will detail information relative to pit security measures for public and animal safety during the refilling period. These measures require the input of multiple agencies to meet regulatory and corporate requirements.

Water levels in the Beaver Dam Mine Site pit will rise quickly in the initial years following cessation of operations but will slow as water reaches wider areas of the pit and a greater volume is required to increase water level. This will immerse sulphide mineralization in the walls of the pit limiting the potential for acid generation. If the quality of the water in the surface mine deteriorates relative to background levels, effluent treatment will be employed.

Flooding of the pit will create a lake with a shallow water wetland border with an approximate area of 15 ha. The existing settling pond that was excavated during exploration activities during the 1980's serves as a model for this reclamation goal. The existing settling pond, referred to herein as Wetland 59, is hydrologically connected to Cameron Flowage via a watercourse equipped with an earthen and timber dam that controls discharge. The watercourse currently provides habitat for fish (brook trout) and possibly Atlantic Salmon and American Eel.

Over the past 30 years, connectivity between the existing settling pond and Cameron Flowage has been intermittent. During operations of the mine, no direct connectivity between the pit and Cameron Flowage will be present. During decommissioning, the pit will be filled with water, creating a lake, with the re-establishment of a connection between the newly formed lake and Cameron Flowage.

Mine Site Roads and Haul Roads

The loose-surface, all weather roads established on the site to facilitate operations will remain in place to enable closure activities, monitoring, and provide access for commercial and recreational activities after closure is completed, and ultimately will be returned to the land owner.

The Haul Road will be returned to the land owners in an upgraded condition with habitat and watercourse improvements. The majority of the lands proposed for the mining operation and infrastructure are majority owned by a commercial forestry operation (Northern Timber) with a minority of land along the Haul Road belonging to the Provincial Crown and other forestry companies. Relict portions of the Haul Road that were not reclaimed during construction will be improved by completing earthworks to encourage re-vegetation, placing windrow, and/or seeding with highway mix. Available local materials will be used for reclamation of the relict areas of the Haul Road.

Waste Rock Stockpiles

The waste rock stockpiles will be constructed with 1.5:1 active slopes in 10 m lifts proceeding from north to south. During mining, as a lift is completed, a safety berm will be incorporated reducing the overall slope down to 2.6:1 or less. For reclamation, berm crests will be resloped to permit covering with soil and re-seeding. This approach will minimize the amount of exposed waste rock at any given time and reduce the potential for erosion and acid rock drainage (ARD).

Topsoil will be stockpiled in six locations during construction and used to facilitate re-vegetation at the end of the surface mine life and, when practical, during operation. All disturbed areas, most notably the waste rock and till storage piles, will be reclaimed with topsoil and growing medium to a depth matching the native surroundings. Re-vegetation will employ hardy pioneer species and grasses to colonize disturbed areas and stabilize soil. Native species will be planted to hasten a return to a natural ecosystem reflecting the pre-development site. Organic debris (roots, stumps, brush) will also be stockpiled and mulched to provide biomass for reclamation.

Ore Stockpiles

No ore stockpiles are expected to remain at the end of the surface mine life. The cutoff grade is 0.4 g/t and the current production plan calls for all material above cutoff grade to be milled. The Proponent has hedged a portion of its production to ensure that any interim stockpiles that may exist can be processed profitably in the unlikely event that the mine closes early. If economics deem low grade ore to be unprofitable, then any remaining low-grade ore stockpiles will be remediated or returned to the surface mine. Remediation would involve three options:

1. If the low grade ore is demonstrating NPAG, cover with available till/clay and revegetate;
2. Alternatively, cover the stockpile with a compacted clay cover and drainage (filter layer) to minimize infiltration of surface water into the stockpile. The clay cover will be covered with topsoil and revegetated; or,
3. Any remaining low grade ore would be re-handled back into the mined out pit at Beaver Dam for permanent storage under water.

Operational Facilities

Buildings, equipment, and other infrastructure will be dismantled and salvaged or sold as scrap depending on condition and markets. Concrete foundations will be destroyed and buried. Minor excavations will be filled, or barriers erected to eliminate hazard to the public or wildlife. Ancillary facilities (truck shop, fuel farm, generators) will be used to support reclamation activities for the surface mine and waste rock stockpile before final decommissioning. Fences will be removed once the majority of closure activities are completed.

If soil is encountered that is contaminated with hydrocarbons from the fuel farm and shop areas, it will be disposed of at an approved soil treatment facility. Dismantling procedures for all equipment and facilities will ensure that workers and the public are not exposed to hazardous materials or products used in or resulting from operations.

Water Management

All surface water runoff in the vicinity of the surface mine will be directed as dispersed flow into the pit to decrease filling time. The flooded pit will have shallow wetlands along its perimeter. Runoff from remaining waste rock and till stockpiles will be directed to the pit prior to release to the environment. It is expected that progressively capping and re-vegetating the waste rock pile will reduce erosion and limit the potential for ARD; therefore, inhibiting the mobility of any potentially deleterious substances.

Increased environmental disturbance is anticipated during initial site decommissioning, when operational facilities are dismantled, and the site surfaces are re-vegetated. Increased environmental disturbances are not anticipated during post-reclamation monitoring.

Touquoy Mine Site

The Touquoy Mine Site will be reclaimed under the separate plan that was developed for and approved by regulatory agencies for the Touquoy Project. As mentioned previously, changes to the Touquoy Mine Site and reclamation obligations as a result of processing Beaver Dam ore are expected to be minimal with the only significant change being the subaqueous storage of tailings in the open pit and associated water quality considerations. The currently approved Touquoy Reclamation Plan will be updated to reflect described changes associated with processing Beaver Dam ore and submitted in accordance with IA requirements and the Mineral Resources Act.

The Touquoy Gold Project reclamation plan is developed, updated and finalized as required under the IA and requires approval of NSE in consultation with DNR. The reclamation plan for the Touquoy Gold Mine is secured by a bond posted by the Proponent totaling $10.2 million, which is intended to allow the Province to reclaim the site at all phases of the Touquoy Gold Mine. This plan includes allowing the pit to fill with water naturally from inflow of surface and ground waters and precipitation. Also required in the reclamation plan is ongoing monitoring post-closure to demonstrate stability of the site. This monitoring will cease in consultation with NSE once stability has been demonstrated by the monitoring data by comparing with baseline and operational data.

It is anticipated that the Project will have an IA with many similar components as the Touquoy Gold Mine IA; this will likely include a specific closure and reclamation plan associated with the Beaver Dam Mine Project and accompanying requirement to post a bond to ensure this work is completed. Similar to the Touquoy Gold Mine reclamation plan, environmental monitoring will be completed after closure until stability of the site and surrounding environs is demonstrated to regulatory authorities.

2.3.3.3 Post Closure Monitoring

Beaver Dam Mine Site Surface Mine

During decommissioning, the pit will be filled with water, creating a lake, with the re-establishment of a connection between the newly formed lake and Cameron Flowage. Water treatment will continue, as required, at this discharge location and monitoring programs will be on-going until such time that discharge water quality meets appropriate confirmed criteria at the point of discharge. This post closure phase is estimated to be 15-20 years in length and is subject to revision with expected refinements to model predictions.

Touquoy Mine Site Surface Mine

During decommissioning, the tailings will be covered with water and the pit will fill, creating a lake, with the re-establishment of a connection between the newly formed lake and Moose River. Water treatment will continue, as required, at this discharge location and monitoring programs will be on-going until such time that discharge water quality meets appropriate confirmed criteria at the point of discharge. This post closure phase is estimated to be 15-20 years in length and is subject to revision with expected refinements to model predictions.

2.3.3.4 Reclamation Schedule

The estimated time line for decommissioning reclamation for the Beaver Dam Mine Site is presented in the table below.

Table 2.3-4 Beaver Dam Reclamation Schedule

Reclamation Activity	No. of Years	Start Date*	End Date
Construction	1	2021	2022
Operations	4-5	2022	2027
Decommissioning (Mine & Haul Road)	0.5	2027	2028
Reclamation	1+	2028	2029
Post Closure (Monitoring)	3+	2029	2032+
*schedule is preliminary based on permitting and current model predictions that are subject to refinement			

2.3.4 Greenhouse Gas Emissions

Greenhouse Gas (GHG) emissions were considered for each phase of work for the life of the Project (construction, operation, and decommissioning) for the mine site and the Haul Road. The primary sources of emissions from each work phase are stationary and mobile fuel combustion sources. These fuel combustion GHG-specific emissions include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). During the operation phase of the Beaver Dam mine, rock blasting using explosives was also considered as part of the GHG emissions that would be generated. For rock blasting, the explosive considered in the assessment was ammonium nitrate with fuel oil (ANFO), which is an explosive used by the Proponent at other project sites.

GHG emissions from Nova Scotia reported in 2014 were 16,600 kilotonnes CO2e (ECCC 2016b). Based on the Project GHG assessment, in an average full year of operation of the Beaver Dam mine (most GHG-intensive phase), including operation of the mine site, hauling of ore, and the processing of ore at the Touquoy facility, the Project facilities would emit 37.13 kilotonnes CO2e - approximately 0.22% of the reported 2014 GHG total for Nova Scotia. All operation, hauling, and processing for the life-of-Project would represent approximately 1.25% of the provincial one-year total.

2.3.5 Summary of Changes to Project Activities

No changes have occurred to the Project Activities since the completion of the Project Description (GHD 2015), with the exception of the original adjustment to the Haul Road configuration, the proposed Preferred Alternative Haul Road alignment and the change in configuration to the proposed waste rock stockpiles.

Two options were originally considered for a section of the Haul Road configuration. To determine the preferred option, the potential effects of the alternate Haul Road configuration on valued components were reviewed along with the outcome of stakeholder and Mi'kmaq engagement and the engineering feasibility review of the both routes, including estimated costs and practical engineering considerations.

The original Haul Road alignment utilized existing roads for transport of crushed ore from the Beaver Dam Mine to the Touquoy processing facility. The original Haul Road route included four sections of road, following the existing Beaver Dam Mines Road southwest to Hwy 224 (7.2 km); Hwy 224 northwest to the Moose River Cross Road (so called) (5.1 km); following the Moose River Cross Road southwest to the Mooseland Road (12.1 km); and then following the Mooseland Road northwest to the Touquoy Mine Site (11.3 km).

The total length of the original Haul Road configuration is 35.7 km. A portion of Route 224 is adjacent and provides access to Beaver Lake Indian Reserve 17 (Beaver Lake IR 17), a satellite community of the Millbrook First Nation.

The second original Haul Road configuration proposed to utilize the same existing roads for transport of crushed ore from the Beaver Dam Mine to the processing facility at Touquoy, with the exception of the elimination of 5.1 km of Route 224 and 3.9 km of the Moose River Cross Road, and the addition of approximately 4.0 km of newly constructed road. The updated Haul Road configuration includes four sections of road, following the existing Beaver Dam Mines Road southwest to Hwy 224 (7.2 km); crossing Hwy 224 to follow a newly constructed road through a greenfield environment (4.0 km); following the Moose River Cross Road southwest to the Mooseland Road (8.2 km); and then following the Mooseland Road northwest to the Touquoy Mine Site (11.3 km). This is the current Haul Road configuration for the purposes of this EIS.

The total length of the proposed primary Haul Road configuration is 30.1 km. The Haul Road alignment completely avoids travel on Hwy 224. Beaver Lake IR 17 is located approximately 3 km west of the Haul Road at its nearest point; the original Haul Road alignment included travelling along Hwy 224, which abuts the Beaver Lake IR 17.

The Haul Road alignment is approximately 5.0 km shorter in length than the original Haul Road alignment. This will result in a decrease in GHG emissions and dust generated by truck traffic during the life of the Project. The Haul Road alignment allows truck traffic to avoid travelling directly through the Beaver Lake IR 17 and minimizes truck traffic on Hwy 224.

Included in this study is a Preferred Alternative Haul Road approximately 5.7 km in length. The Preferred Alternative Haul Road would avoid private land and a single residence located near the Mooseland Road intersection and reduce the total haul by approximately 2.6 km but would result in higher construction costs. The decision to adopt this alternative is subject to further review of the proposed alignment with respect to landowner concerns, traditional use and construction costs. This alternative is evaluated in this EIS.

2.4 Accidents and Malfunctions

Accidents and malfunctions have the potential to occur through every phase of the Project. In order to decrease the likelihood of occurrence and level of magnitude should these accidents and malfunctions occur, the Proponent will implement a preventative system approach to environmental protection, and worker health and safety. Contractors will be subject to the same health, safety, and environment policies and procedures, and all personnel (employees and contractors) will receive site specific training to prevent and mitigate workplace accidents and malfunctions. The health, safety, and environment policies and procedures implemented for the Touquoy Gold Mine Project will be extrapolated to the Beaver Dam Mine Project and made site specific where required.

Accidents and malfunctions that have the potential to occur through every phase of the Project are described in the follow subsections, while an analysis of the risks, a determination of their effects, and preliminary emergency response measures for these potential accidents and malfunctions is included in Section 6.18 of this EIS.

2.4.1 Structural Failures

2.4.1.1 Surface Mine Slope Failure

All phases of the Project have the potential for slope failures within the footprint of the pit. During the initial stages of site preparation and construction slope failures will be limited to overburden. As blasting, and ore and non-ore bearing waste rock extraction commences, bedrock faces will have the potential to fail. Based on the current delineation of ore, the pit will be excavated through bedrock to an end depth of approximately 170 m below ground surface. Bench heights and bench face angles as prescribed by a geotechnical study (O'Bryan et. al., 2015) will be implemented for specific depths and zones of the pit in order to minimize the potential for slope failures.

2.4.1.2 Stockpile Slope Failure

All phases of the Project have the potential for slope failures in the topsoil, till, and waste rock stockpiles. In general, slopes will be designed and constructed at an angle determined by geotechnical analysis and acceptable safety factors, thereby reducing the likelihood of a slope failure. Topsoil and till stockpiles will be stored in single lifts of 10 m and 15 m, respectively, with 1.5:1 active slopes. The waste rock stockpile will be stored in multiple lifts of 10 m with each lift having an active slope of 1.5:1. Where stockpiles exceed 10 m in height a safety berm will be incorporated reducing the overall slope down to 2.6:1 or less. For reclamation, berm crests will be re-sloped to permit covering with soil and re-seeding further reducing the potential for localized failure. Ore stockpiles will be constructed in 15 m lifts with each lift having an active slope of 1.5:1. These stockpiles will be progressively reclaimed throughout the mine life thus eliminating any long-term risk.

2.4.1.3 Settling Pond Failure

All phases of the Project have the potential for a settling pond failure. Surface water run-off from the non-ore bearing waste rock stockpile, mine site roads, and ore stockpiles will flow by gravity, with the aid of berms and channels, to a settling pond located west of the pit. This settling pond will also receive water from the pit dewatering program. Runoff from the till stockpiles will be captured and directed into a collection pond located on the eastern side of the pit. Water from both the western and eastern collection ponds will be gradually decanted to Cameron Flowage by gravity via separate water discharge structures and engineered channels.

Surface run-off water from the Beaver Dam mine site ROM pad, primary crusher, crushed ore stockpile and facilities pad will flow by gravity, with the aid of berms and channels, to a collection pond located to the south of the facilities pad. A culvert located beneath the mine entrance road will facilitate decant overflow from the pond. to a discharge channel that will run down gradient to the south and ultimately discharges into wetland area located to the south of the Beaver Dam Mine Site.

The settling ponds will be designed to accommodate up to a 1 in 100-year precipitation event. For a greater than 1 in 100-year precipitation event, which in Nova Scotia is identified as approximately 115 mm in a 24 hour storm, a spillway into the water diversion structures will be used for overflow. In the case of a storm event or infrastructure failure, settling ponds will be monitored regularly.

2.4.1.4 Infrastructure Failure

Portions of all phases of the Project have the potential for infrastructure failure. Infrastructure at the Beaver Dam Mine Site will be minimal and given the short life of the Project, failure should not occur without being caused by extreme natural causes, such as a hurricane or earthquake, or human error.

2.4.2 Accidents

2.4.2.1 Tailings and Reclaim Water Pipelines Spills

Prior to the completion of mining operations at the Touquoy Mine Site, a tailings line will be routed to the exhausted Touquoy pit in preparation to receive Beaver Dam tailings. Tailings will flow by gravity from the mill to the open pit. Initially, reclaim water will continue to be withdrawn from the supernatant pond in the existing TMF via the existing reclaim works to supply processing water needs for Beaver Dam ore. A reclaim water pump and barge, with a new pipeline to the process water tank, will be installed when process water accumulation from the tailings slurry deposited in the open pit is adequate. The transition from the TMF to the open pit reclaim water system is expected to be smooth, requiring minimal downtime and no extra fresh water requirements beyond what is currently permitted from Scraggy Lake under Touquoy's water withdrawal approvals. The existing TMF will only be used for initial process water requirements and will not be used for tailings storage in the processing of Beaver Dam ore.

Supernatant water collected in the open pit will be pumped to the process water tank located next to the pre-leach thickener. The sections of the tailings and reclaim pipelines between the plant site and open pit will be double-walled and run in HDPE lined trenches to an adequately sized lined collection ponds capable of containing the volume of the pipeline. Monitoring systems will be installed on the pipelines for leak detection and triggering shutdown procedures.

The Touquoy Gold Mine Project currently employs an Operation, Maintenance and Surveillance (OMS) Manual for the existing TMF. This manual will be updated in advance of using the open pit for storage of Beaver Dam tailings in order to reflect changes in operating conditions and environmental factors. As well, Touquoy also currently employs an Emergency and Spill Response Plan which will also be updated. Environmental monitoring will continue as prescribed under the Touquoy IA which will be amended as necessary to reflect the changes in processing of Beaver Dam ore and storage of Beaver Dam tailings in the exhausted Touquoy pit.

2.4.2.2 Fuel and/or Other Spills

All phases of the Project will involve the use of fuels, as well as equipment maintenance and servicing fluids. Generators and the majority of mobile equipment will utilize diesel fuel, which will be stored on-site in double-walled aboveground storage tanks. A small gasoline storage area may be included or may be satisfied by local retail outlets. Equipment maintenance and servicing fluids will include hydraulic oils, motor oils, greases, brake and steering fluids, antifreeze, and minor amounts of other maintenance fluids. The construction and operation phases will also utilize diesel fuel and ammonium nitrate as blasting agents. Ammonium nitrate will not be stored on-site.

The source of greatest risk for potential spills and releases of diesel fuel relates to the improper execution of procedures for transfer and handling to and from stationary and mobile tankage. Other sources of potential spills and releases of diesel fuel relate to equipment failures, damage to storage or piping systems, mobile equipment accidents, and mobile refueling truck accidents. Releases of maintenance fluids pose a lesser risk in terms of magnitude, but can still occur due to equipment failures, damage to storage containers, and mobile equipment accidents.

2.4.2.3 Unplanned Explosive Events

Explosives will be required for construction and operations but are not anticipated for closure and reclamation phases. The potential for an unplanned explosive event is therefore limited to the site preparation and construction, and operation phases of the Project. Explosives will be supplied and handled by a licensed contractor. This operator will be responsible for obtaining licences and permits associated with the use, manufacture, and storage of explosives. Explosives transportation, manufacturing, storage, contractor certifications, explosives handling, employee training programs, work instructions, inspections, reporting, and documentation will be undertaken in compliance with the *Explosives Act* (1985) and *Transportation of Dangerous Goods Act* (1992) and other relevant legislation.

2.4.2.4 Mobile Equipment Accident

All phases of the Project will have the potential for vehicular accidents to occur. Mobile equipment for the Project includes those outlined in Tables 2.3-1 and 2.3-2 of this EIS. The majority of mobile equipment traffic will be limited to the Beaver Dam Mine Site where guided traffic patterns, speed limits, right-of-way signage, and training will minimize the risk of vehicular accidents. The remaining mobile equipment will include haul trucks, which will travel from the Beaver Dam Mine Site to the Touquoy Mine Site, a distance of approximately 30 km. The number of return truck trips per day will be an annual average of approximately 185 (370 one-way trips) or between 31 and 23 trucks per hour for 12 or 16 hours per day, 350 days per year for the duration of the mine Project (3.3 years). During construction and pre-production (8 months), the number of trips will be less. The Haul Road will be dual lane and designed to facilitate the safe passage of two-way truck traffic at 70 km/h. Speed limit and Right-of-way signage will be installed and all haul truck operators will receive operator training to minimize the risk of haul truck collisions. All intersections will be designed to NSTIR Standards. A mobile equipment accident may result in fuel and/or other spills, fires, and/or injury or death to site workers and the general public.

2.4.3 Other Malfunctions

2.4.3.1 Forest and/or Site Fires

All phases of the Project will have the potential for forest and/or site fires to occur. A forest fire may occur through human or natural causes, while a site fire may occur due to an equipment failure and/or human error. Forest fires have the potential to affect the Project at the Beaver Dam Mine Site and at the Touquoy Mine Site; however, due to a lack of vegetation at both locations, it is unlikely that a site fire could spread to and affect the surrounding forest. Forest fires along the Haul Road have the potential to affect Haul road operations and likewise, site fires along the Haul Road could spread to and affect the surrounding forest. Firefighting equipment will be maintained on site and on mobile vehicles and equipment and personnel will be trained in emergency response procedures, including firefighting.

2.5 Project Schedule

Site preparation and construction for the Beaver Dam Mine Project will begin in 2021 prior to exhaustion of the Touquoy pit so that the ore supply from the Beaver Dam Mine Site to the Touquoy Mine Site will follow shortly after the mining operations at Touquoy have ceased. Site preparation including clearing and grubbing will begin in 2021 outside of the approved breeding bird window, wherever practicable.

Year 1 (2021)

Clearing, grubbing, and removal of topsoil and till from the pit, till stockpile locations, and waste rock stockpile location, as well as removal of waste rock from the top benches of the pit by drilling and blasting will begin one year prior to relocation of the primary crusher from the Touquoy Mine Site. Clearing and grubbing will also occur during this time for the operational facilities location, and along the Haul Road. Vegetation clearing will be conducted in compliance with nesting bird directives from NSDL&F and

Environment and Climate Change Canada. Subsequently, stockpiles for topsoil and till will be built, and the initial lift of the waste rock stockpile will be constructed. Surface and ground water management facilities including monitoring wells, ditches and berms will also be constructed during this period. The pit will be mined down to the 125 bench (bench floor elevation). A berm surrounding the pit will be constructed to act as an access road and a flood berm.

Haul Road construction and upgrades between Beaver Dam and Touquoy will be completed in the year prior to Touquoy mine operations ceasing. It is anticipated that material used in the construction and upgrading of the Haul Road will be sourced from three quarries located along the length of the road with additional requirements for base material, if required, sourced from either the Touquoy or Beaver Dam Mine Sites or licensed approved facilities. Construction of the Haul Road will be undertaken by contractor utilizing their own equipment. The responsibility of material sourcing will lie with the contractor. However, the use of any rock for construction purposes will be supported by appropriate geochemical and physical properties testing and data. Ongoing data collection at the Touquoy Mine Site during its current development will be used.

All other development work for the operational facilities construction and commissioning of the support infrastructure at the Beaver Dam Mine Site will be completed in the eight months prior to completion of pit operation at the Touquoy Mine Site.

Local power supply infrastructure, installation of the fuel storage facility, and other supporting infrastructure will be linked to the start of early mining pre-strip operations. During the one year construction phase, flexibility in the schedule may be employed to take advantage of seasonality, etc.

After exhaustion of the Touquoy pit and before initiation of operation of the Beaver Dam pit, a transition phase not exceeding two months is expected, during which time commissioning of equipment relocated from the Touquoy Mine Site or installed new at the Beaver Dam Mine Site will be undertaken, the Touquoy processing facility will undergo minor alterations in preparation to receive Beaver Dam ore, and the tailings line will be re-routed to discharge wet tailings from Beaver Dam ore to the exhausted Touquoy pit.

Years 2 to 6 (2022 to 2027)

Operation of the Beaver Dam Project is planned to begin at the start of 2022 and continue through mid 2027. Pre-production mining will last approximately three months, with full-scale operation lasting four years and four months as outlined in Table 2.5-1.

The anticipated mining schedule will consist of 24 hours per day, while trucking will consist of 12 to 16 hours per day within the window of 6:00am to 11:00pm, and crushing and other site operations will be 24 hours per day.

Table 2.5-1 Beaver Dam Mine Project Production Schedule

Phase Mined (kt)	2021	2022	2023	2024	2025	2026	2027
Beaver Dam South Phase	114	11,219	9,449	1,088	-	-	-
Beaver Dam North Pushback	51	3,160	5,051	8,670	5,952	2,355	172

Years 6 to 8 and Beyond (2027-2029+)

Decommissioning of the Beaver Dam Mine Site will require approximately three to five years after cessation of operations. Two years will be needed to remove equipment and infrastructure, as well as complete re-grading and re-vegetation of the site, after which monitoring will continue until deemed no longer necessary. Monitoring will continue until the site reaches reclamation objectives and requirements.

The general schedule for development of the Project is provided in Table 2.5-2.

Table 2.5-2 Beaver Dam Construction, Operation, and Reclamation Schedule

Event	Timeline
Beaver Dam Construction	Q4 2021
Beaver Dam Operation	Q1 2022 to Q2 2027
Touquoy Partial Reclamation (waste rock stockpile and tailings management facility) and Environmental Monitoring	2023-2026+
Beaver Dam Reclamation and Environmental Monitoring	2027-2029+
Touquoy Complete Reclamation (processing facility, surface mine/beaver dam tailings management facility) and Environmental Monitoring	2027-2029+

2.6 Alternative Means of Carrying out the Project

In accordance with Section 19(1)(g) of CEAA 2012, environmental assessments for designated projects must consider alternative means of carrying out the Project that are technically and economically feasible, as well as the environmental effects of any such alternatives.

The process for consideration of alternative means is outlined in the CEAA Operational Policy Statement entitled "*Addressing "Purpose of" and "Alternative Means" under the Canadian Environmental Assessment Act, 2012*" and includes the following steps:

- Step 1 – identify technically and economically feasible alternative means;
- Step 2 – list their potential effects on valued components;
- Step 3 – select the approach for the analysis of alternative means; and
- Step 4 – assess the environmental effects of alternative means.

The evaluated alternative means of carrying out the Project are discussed following identification of alternative means. A summary of the assessment of alternative means is provided in Table 2.6-1 in Section 2.6.11 of this EIS.

2.6.1 Identification of Alternative Means

Alternative means of carrying out the Project are defined as means of similar technical character or methods that are functionally the same. Alternative means differ from alternatives in that they represent the various technical and economically-feasible ways that a project can be carried out, and which are within the Proponent's scope and control.

As a minimum, the EIS Guidelines require the Proponent to conduct an alternative means analysis for the following Project components:

- mine type;
- ore extraction methods;
- ore processing methods;
- ore processing locations;
- ore transportation;
- energy source;
- project component locations;
- water supply and management; and
- mine waste management facilities.

A qualitative approach primarily utilizing the professional knowledge and judgement of the EA Study Team has been employed for the assessment of alternative means and considers all four steps outlined in Section 2.6 of this EIS.

2.6.2 Mine Type

The potential alternatives to mining the Beaver Dam ore are through open pit (ramp access) and underground (shaft access) methods.

Open Pit Mining

Open pit mining requires the removal of overburden (topsoil, till) and non-ore bearing waste rock, followed by the stepped development of concentric levels into the deposit with an inclined roadway connecting subsequent levels. Open pit mining methods are best suited to:

- shallow ore deposits at or near surface that are covered by shallow overburden;
- large deposits with a uniformly distributed ore body or scattered randomly distrusted pockets; and
- high tonnage, low grade deposits which are not economical using underground mining methods.

Underground Mining

Underground mining typically requires the construction of a vertical, underground shaft from surface to a targeted depth into the ore body. Horizontal tunnels are then driven from the shaft at strategic intervals to access the ore body. Underground mining methods are best suited for:

- smaller ore bodies which are higher in grade; and
- disseminated ore bodies that easily traceable underground.

VCs Potentially Affected

The environmental effects of underground mining would be similar to those of open pit mining at the Beaver Dam Mine Site with the need for the infrastructure noted for the surface operation with a smaller disturbed footprint but likely a longer duration for ore extraction and overall project activities.

Preferred Approach

In this particular instance the gold at the Beaver Dam Mine Site is relatively uniformly distributed, and at relatively low grades, throughout the local rock mass to the extent that large scale, high volume throughput from an open pit is commercially viable. Concentrations of gold of sufficient grade, continuity or predictability in quartz veins, or other specific sites at the Beaver Dam Mine Site to support a commercially viable underground operation have not been identified through exploration and feasibility studies completed to date. An underground mine configuration for the Beaver Dam gold deposit is not currently a viable option.

Mining can theoretically be undertaken by either underground or open pit methods, but underground mining as a primary extraction method does not make practical or economic sense in this situation. In this particular case, the resource is near surface. The proximity to surface and lower grade make it amenable to open pit methods. A continuation of the surface mining into an underground operation may be viable depending on the final depth of the deposit but this is currently not under consideration and would not be economic unless there was a dramatic increase in gold price.

2.6.3 Ore Extraction Methods

Drilling and Blasting

Drilling and blasting is proposed to extract ore at the Beaver Dam Mine Site. Drilling and blasting is generally accepted as the most efficient method of breaking large volumes of rock. Drilling and blasting will generate noise; however, the noise from drilling would be significantly less than that generated by rock breaking. Blasting will generate short duration noise less frequently.

Rock Breaking (Ripping)

Rock breaking, or ripping, involves the use of heavy equipment that breaks the rock by inserting hardened metal teeth or prongs into fractures or planes of weak within the rock. Rock breaking creates continuous significant noise. Due to the extremely hard nature of the ore in the vicinity of the Beaver Dam Mine Site, rock breaking is not considered to be economically, technically, or environmentally feasible.

VCs Potentially Affected

The atmospheric environment is the key VC that would be affected by both drilling and blasting, and rock breaking (ripping); however, ripping would create significantly more noise over a continuous time period whereas drilling and blasting creates noise at lower levels and blasting occurs less frequently.

Preferred Approach

Drilling and blasting is the preferred approach for ore extraction from the Beaver Dam Mine Site. Alternative methods of extracting ore, such as rock breaking (ripping), are not technically or economically feasible due to the extremely hard nature of the ore in the vicinity of the mine site. There are no feasible alternatives to ore extraction at the Beaver Dam Mine Site.

2.6.4 Ore Processing Methods

Gravity/CIL Processing

The gravity/CIL processing methodology described in Section 2.3.1.3 of this EIS represents the most conventional processing option. It is the preferred processing option in Canada and is used worldwide in almost all major gold mining/processing operations. Two independent experienced consultant gold metallurgists have determined that gravity/CIL processing is extremely well suited to this particular ore in that gold recoveries are very high (about 95%) resulting in maximum use of the resource, and the cyanide destruction process is highly efficient (Ausenco 2015). Furthermore, gold doré is produced at the Touquoy facility, with minimal off-site value-adding.

Gravity/Flotation

Regardless of the above, a second processing option, gravity/flotation with either intense cyanidation or smelting of the flotation concentrate, has been explored. Gravity/flotation recoveries are also very high (about 95%), with the flotation concentrate comprising 4 to 5% of the total throughput. On the basis of expected daily throughput, about 200 tonnes of concentrate would be produced per day. The gold in the flotation concentrate may be recovered either by high intensity cyanidation or by off-site smelting.

High intensity cyanidation of the float concentrate will require at least the same quantity of sodium cyanide as conventional CIL (since the same amount of gold is available for dissolution) or possibly more. This multi-stage process is unorthodox, inherently more complex than conventional CIL processing and commercially unattractive with no perceived advantage.

This multi-stage process could potentially be undertaken off site with the concentrate transported to an existing CIL plant for contract treatment, the closest plants being in Quebec and Ontario. Enquiries have been made to eleven such operations with no availability offered. Indicative costs, including freight, determined from this exercise show this option to be commercially unattractive, with the added disadvantage of substantial off-site value-adding and reduced benefits to Nova Scotia.

The flotation concentrate could also potentially be transported elsewhere for smelting to recover the gold. Indicative costs for freight and contract treatment of the concentrate at Falconbridge's Horne smelter in Rouyn-Noranda have been obtained and these confirm this option to be commercially unviable, and again with substantial resultant off-site value-adding and reduced benefits to Nova Scotia.

VCs Potentially Affected

Environmental effects are generally similar in both alternatives. The same quantity of sodium cyanide is required in both alternatives, if not more for gravity/flotation. Smelting required during the flotation process would require transport to an off-site facility, thereby generating additional GHG emissions. The key VCs affected by the use of gravity/flotation processing would include the atmospheric environment.

Preferred Approach

Having carefully examined the above processing options the Proponent has selected conventional gravity/CIL as its preferred processing methodology. The required equipment is in place at the Touquoy Mine Site prior to the Beaver Dam operation beginning thus reducing infrastructure needs at the Beaver Dam Mine Site.

2.6.5 Ore Processing Locations

Touquoy Mine Site

No new processing or tailings facility is planned for this site – ore will be trucked to Touquoy for milling and tailings will be deposited in the exhausted Touquoy pit. The Touquoy plant is designed to treat Beaver Dam ore with no modifications other than an increase in the total weight of grinding balls in the ball mill to accommodate the slightly harder ore from the Beaver Dam pit.

Beaver Dam Mine Site

If the economics of the Project change significantly such that this Project could be developed without Touquoy then a mill and a tailings storage plan for the Beaver Dam Mine Site would be required, which would involve a significant increase in the Project footprint. Alternatives to processing ore at the Touquoy site are cost prohibitive and environmentally inferior.

VCs Potentially Affected

Construction of an additional processing and tailings management facility would affect all VCs being considered in this EIS.

Preferred Approach

The preferred approach for ore processing locations is to utilize the Touquoy Mine Site for the milling of Beaver Dam ore, and depositing tailings in the exhausted Touquoy pit.

2.6.6 Ore Transportation

Off-site processing at the Touquoy Mine Site involves the transport of material via local roadways. This haul is an increase in the cost of production and will generate additional greenhouse gases from the highway truck fleet as compared to on-site processing. This will be at least partially offset by the significant environmental benefits of processing Beaver Dam ore at the Touquoy mill and the storage of tailings in the exhausted Touquoy pit. No other gold processing facilities exist within the economic trucking limit that can handle the planned volume of material. In addition, no new construction or expansion of the approved processing or tailings storage facilities at Touquoy to process Beaver Dam ore is required.

Alterative Haul Road Routes

Alternative Haul Road routes were considered to transport the Beaver Dam ore to Touquoy for processing. The original Haul Road route considered included approximately 5.1 km of travel along Hwy 224 (Alternate Section 2; Figure 2.2-2) and 3.9 km along Moose River Cross Road (Alternate Section 3A). The current Haul Road configuration includes a more direct route on the Moose River Cross Road. Specifically, the travel along Hwy 224 itself has been replaced with a direct route of 4.0 km of new construction which allows direct crossing of Hwy 224 (Section 3B; Figure 2.2-2). This increases the travel along private logging roads and eliminates the travel along Hwy 224 completely as only a direct crossing is required. The total Haul Road is then reduced by 5 km (from 35.1 km to 30.1 km).

Included as part of this revised EIS is a Preferred Alternative Haul Road section of road, approximately 5.75 km in length, which if adopted would avoid residences and private land. This alternative section of road would replace approximately 4.3 km of the proposed Mooseland Cross Road (Section 4B) and approximately 4.0 km of Mooseland Road (Section 5A). The total haul distance would be reduced from 30.1 km to 27.5 km. This Preferred Alternative Haul Road has been proposed as a secondary option in order to address potential landowners and residential locations with the proposed updated alignment and is fully evaluated in this EIS.

It is intended to use sized waste rock from the local borrow pits or Beaver Dam waste rock as the surge rock base material to reduce the cost and disturbance of the road upgrading and new construction activity.

VCs Potentially Affected

The key VCs affected by the Alternative Haul Road locations are the atmospheric environment, Indigenous Peoples populations, and socio-economic conditions due to additional noise and dust being generated along Hwy 224, near Beaver Lake IR 17. Air, noise and light considerations are also evaluated for the Preferred Alternative Haul Road, as this route is farther away from residences and private land considerations.

Preferred Approach

The Haul Road as currently planned is the preferred approach. The current Haul Road route for the Project reduces the total length and eliminates travel along Hwy 224, including the passing of Beaver Lake IR 17 which is a satellite community of Millbrook First Nation.

2.6.7 Energy Source

Diesel-Powered Generators

Two (duty and standby) self-contained, skid mounted, 500 kilowatt (kW) diesel powered generators will provide 600 volt (V) electrical power to all Beaver Dam surface consumers via 60 hertz (HZ), three phase, four wire overhead power lines. The generator fuel tank will receive diesel fuel from the dedicated refueling truck and has a one-day capacity at maximum power demand.

Alternative Energy Sources

The power demand required for the Beaver Dam Mine Site is insufficient to justify construction of a permanent grid tie-in to the existing electrical distribution lines.

Renewable energy sources are considered technically feasible but would also not be economically feasible or practicable due to the short duration of the Project.

VCs Potentially Affected

The key VCs affected by the use of diesel-powered generators on the mine site include the atmospheric environment, surface water, wetlands, fish and fish habitat, and habitat and flora.

The key VCs affected by a permanent grid tie-in include the atmospheric environment, wetlands, habitat and flora, and terrestrial fauna due to disturbances caused by constructing a right-of-way for the power lines.

The environmental effects associated with a renewable energy source would depend on the renewable energy technology used; however, air emissions would likely be reduced.

Preferred Approach

The preferred approach based on economic and environmental feasibility is to provide electrical power to the Beaver Dam mine site through the use of diesel-powered generators.

2.6.8 Project Component Locations

There are no alternatives for the positioning of the open pit – the gold deposit is fixed and the open pit has been designed to envelope the existing settling pond (wetland 59). The settling pond that had been previously established on the Beaver Dam Mine Site will largely become part of the proposed open pit and thereby reclaimed. The Project components have also been placed to generally avoid heritage resources that have been identified during field investigations.

The waste rock stockpiles have been re-positioned to be located down-gradient of nearby watercourses and waterbodies and removed from the Boreal Felt Lichen Critical Function Zone. The site configuration, including other Project components, has been specifically designed to avoid interference with aquatic habitat, and hence it is the preferred option to minimize environmental effects. Wetlands were avoided to the greatest extent possible for the placement of site infrastructure and the use of existing roads has been maximized in site layout planning as well.

VCs Potentially Affected

The key VCs affected by altering the Project component locations include wetlands, surface water, fish and fish habitat, and physical and cultural heritage resources.

Preferred Approach

The preferred approach is to maintain project component locations as shown on Figure 2.2-1. This limits the impacts to watercourses, avoids wetlands to the greatest extent possible, and avoids the Critical Function Zone for the Boreal Felt Lichen.

2.6.9 Water Supply and Management

On-Site Water Supply and Management

Water use on the Beaver Dam Mine Site will be limited to water required for dust control, the vehicle wash down facility, fire protection, and domestic water usage. Sources of raw water include water collected during mine dewatering, surface water runoff from waste rock piles and constructed areas and, if needed, raw water pumped from Cameron Flowage. Raw water drawn from Cameron Flowage, if needed, would be pumped by a single duty submersible water pump to a combination raw water and firewater reserve storage tank. Two (duty and standby) centrifugal pumps will supply various users including, but not limited to, the vehicle wash down facility and the de-dusting crusher area locations. Potable water will be delivered via specialized truck to the site for use in facilities at the crusher area for personnel. It is anticipated that one drilled domestic water well will be required to provide water for sanitary usage as domestic wells in this area generally yield 5 to 10 L/min and the demand is estimated at less than 5 L/min. Dust control will occur as required and will consist of wet suppression controls on unpaved surfaces using water, or chemical dust suppressants, as required.

Off-Site Water Supply

Alternatives for water supply, such as transporting all required water to the Beaver Dam Mine Site were considered but the availability of adequate water for site operations (for site staff only and dust control) is a more reasonable approach, is economically sound and is technically feasible. One domestic water well will be required based on the demand anticipated and regional water resources studies confirm the low amount (less than 10 litres per minute) is easily available.

Surface Water Management

Surface water run-off from the Beaver Dam Mine Site crusher pad will flow by gravity, with the aid of berms and channels, to a collection pond located to the south of the crusher pad. A culvert located beneath the mine entrance road will facilitate decant overflow from the collection pond to a discharge channel that will run down gradient to the south and ultimately discharges into wetland area (Wetland 64) located to the south of the Beaver Dam Mine Site. Surface water run-off from the eastern and western waste rock stockpiles, low grade ore stockpiles, Beaver Dam Mine Site roads, and some natural area will flow by gravity, with the aid of berms and channels, to the north settling pond, located west of the pit. This settling pond will also receive water from the pit dewatering program. Overflow from the north settling pond is directed to the Killag River outfall (Cameron Flowage). On-site control of water with batch discharges when water quality meets applicable standards is typical for this type of operation and the most technically and economically feasible.

Runoff from the till stockpiles located to the southeast of the open pit and east of the mine facilities area will be captured with the aid of channels around the stockpile perimeter and diverted north to Cameron Flowage by gravity via separate water discharge structures and engineered channels. At this time, it is not anticipated that a collection pond would be required, however such a pond can be constructed should settling of solids prior to discharge be required.

No alternatives for water supply management were considered to be technically or environmentally feasible. Cameron Flowage is a valuable local and regional watercourse and direct discharge without settling and back-up ability for other treatment is not acceptable to the Proponent.

VCs Potentially Affected

The key VCs affected by the transportation of potable water to the Beaver Dam Mine Site include the atmospheric environment. If all required water were transported to the Project, a greater volume of emissions would be generated during the transport of water.

Preferred Approach

On-site water collected from surface water run-off and pit dewatering will be used for dust control, the vehicle wash down, and fire protection. Domestic water requirements will be fulfilled by potable water delivery, and an on-site drilled well for sanitary usage.

2.6.10 Mine Waste Management Facilities

2.6.10.1 Waste Rock Storage

Stockpile

The two waste rock stockpiles will have a capacities of 20.7 Mt and 14.8 Mt of material and final peak grade elevations of 210 masl and 190 masl respectively. Waste rock will be stored in multiple lifts of 15 m with each lift having an active slope of 1.5:1. This approach will minimize the amount of exposed waste rock at any given time and reduce the potential for erosion and acid rock drainage (ARD). A safety berm will separate each lift resulting in overall slope angle of 2.6:1. A 20 m wide dual lane Haul Road running up the side of each stockpile will provide progressive access to all lifts. At reclamation, the waste rock stockpile will be reclaimed with topsoil and growing medium to a depth matching the native surroundings. After final shaping and vegetating, the piles will mirror current local topography and landscapes.

Backfill

Backfilling of the open pit with waste rock would eliminate the permanent storage stockpile as described above. However, the same stockpile would still be required to be constructed over the life of the mine and then re-handled to place back in the pit at closure and the footprint would require reclamation. Such re-handling would result in additional emissions due to equipment use and would be cost prohibitive for the overall Project viability. As well, backfilling with broken rock would overfill the open pit due to the swell factor, requiring reclamation of the open pit area as well as the remaining excess waste rock.

VCs Potentially Affected

Environmental effects are generally similar in both alternatives as the stockpile is required in both cases and either the stockpile itself or the footprint would be reclaimed at closure. Additional atmospheric effects are associated with the backfill alternative due to the extensive equipment use requirements associated with re-handling the waste rock.

Preferred Approach

The preferred approach for mine waste rock management includes the on-site management of using the waste rock stockpile.

2.6.10.2 Tailings Storage

Touquoy Open Pit

As processing of Beaver Dam ore at the Touquoy Mine Site is not scheduled to commence until mining at Touquoy is complete, the mined out open pit at Touquoy will be available for storage of tailings. The mined out Touquoy open pit will provide a very stable natural containment structure for tailings and will have the capacity to store all projected Beaver Dam tailings. Hydrogeological assessments of the Touquoy open pit indicate that it will eventually fill with water from rainfall, runoff and groundwater infiltration creating an in-pit lake which is in accordance with the approved closure plan. Tailings storage in the pit will therefore be sub-aqueous and will require no additional disturbance.

Touquoy TMF

The existing TMF at Touquoy was designed to accommodate projected tailings volumes generated from processing of Touquoy ore and does not have the capacity to store all the projected Beaver Dam tailings under the approved design. The tailings dams were constructed using a downstream construction technique. As a result, expansion of the Touquoy TMF to accommodate Beaver Dam tailings would require continued raising of the dams by downstream construction. This would result in substantially higher dams and a much larger footprint. Such expansion would also impact other existing infrastructure such as the polishing pond which would have to be decommissioned and re-established further away. For these reasons, this alternative is not considered to be favorable economically, technically, or environmentally.

Beaver Dam TMF

There is no requirement for tailings management at the Beaver Dam Mine Site as all mineral processing is proposed be done at the Touquoy Mine Site as per Section 2.6.5 above. It is not considered economically or environmentally feasible for tailings to be transported back to the Beaver Dam Mine Site following processing at Touquoy.

Processing of ore at the Beaver Dam Mine Site would require construction of a new gravity/CIL cyanide processing facility as described in Section 2.3.1.3 and Section 2.6.4 above, duplicating the existing facility at the Touquoy Mine Site. As well, storage of tailings on-site at the Beaver Dam Mine Site would require construction of a new Tailings Management Facility along with all of the associated raw water requirements and water management structures, including pumphouse, raw water line, tailings line, reclaim water line and water storage tanks. All of this additional infrastructure would substantially increase the disturbance footprint at the Beaver Dam Mine Site and potential environmental effects. For these reasons, this alternative is not considered to be favorable economically, technically, or environmentally.

VCs Potentially Affected

The key VCs potentially affected by the use of the exhausted Touquoy open pit for tailings storage are surface water and groundwater quality as described in more detail in Section 2.2.2.3 above. It should be noted however that an existing monitoring program is already in place under the Touquoy Industrial Approval and that groundwater and surface water quality and quantity will continue to be monitored over the life of the Touquoy site as part of existing approvals for approved life span of the facility and for the proposed extended life of the Touquoy Mine Site associated with processing of Beaver Dam ore. As well, there will be over 7 years of data available prior to the Beaver Dam tailings being introduced to the exhausted Touquoy pit, which will enhance water quality modeling and predictions.

The key VCs potentially affected by the expansion and use of the Touquoy TMF are the same as for using the open pit, surface and groundwater quality, plus additional VCs associated with the increased disturbance area.

Construction of an additional processing and tailings management facility at the Beaver Dam Mine Site would affect all VCs being considered in this EIS.

Preferred Approach

The preferred approach for tailings management is to manage Beaver Dam tailings at the Touquoy Mine Site by storage in the mined out open pit.

2.6.11 The Preferred Approach

Based on the consideration of technical and economic feasibility, environmental effects, and socioeconomic effects, the preferred approach for the Project consists of:

- An open pit gold mine located at the Beaver Dam Mine Site;
- Ore extraction methods that employ drilling and blasting;
- Ore processing methods that employ gravity/CIL processing methodology which represents the most conventional processing option and is the preferred processing option in Canada;
- Processing Beaver Dam ore at the Touquoy Mine Site once reserves at Touquoy have been exhausted;
- Transportation of ore from the Beaver Dam Mine Site to the Touquoy Mine Site for processing via a 30.1 km Haul Road, which will include upgrades to approximately 15.4 km of existing road and approximately 4.0 km of new road construction through a greenfield environment;
- Consideration of a Preferred Alternative Haul Road, to reduce interaction with residences and private landowners;
- The use of two (duty and standby) self-contained, skid mounted, 500 kilowatt (kW) diesel powered generators to provide) electrical power to the Beaver Dam Mine Site;
- Project component locations as shown on Figure 2.2-1;
- On-Site water supply and management, with delivery of potable water;
- Waste rock management stockpiles located on the Beaver Dam Mine Site; and
- Tailings management by storage of tailings from Beaver Dam ore processed at the Touquoy facility in the mined out Touquoy open pit.

A summary of the review of alternative means to carry out the Project is presented in Table 2.6-1 for each Project component of activity. This provides justification on the preferred approach for the Project relative to technical feasibility, economic feasibility and environmental and social effects. The VCs considered are noted as applicable under the environmental and social effects.

Table 2.6-1 Summary of Alternative Means of Undertaking the Project

Project Component or Activity	Alternative Means	Technical Feasibility	Economic Feasibility	Environmental Effects	Preferred Option
Mine Type	Surface Mine	Technically Feasible	Economically Feasible	Environmental effects are associated with the surface mine construction and operation; however, no significant residual environmental effects are anticipated for the Beaver Dam Mine Site.	Yes
	Underground Mine	Not Technically Feasible considering the configuration of the gold deposit.	Not Economically Feasible	Not assessed	No
Ore Extraction Methods	Blasting	Technically Feasible	Economically Feasible	Environmental effects include noise and dust impacts; however blasting will be conducted in shorter duration and will be controlled.	Yes
	Rock Breaking	Not Technically Feasible considering the hardness of the ore deposit	Not Economically Feasible based on the hardness of the ore deposit	Environmental effects include continual noise and dust impacts.	No
Ore Processing Methods	Gravity/CIL	Technically Feasible considering it is the preferred processing option in Canada and is used worldwide in almost all major gold mining/processing operations. Well suited to this particular ore	Economically Feasible	Environmental effects are generally similar in both alternatives: the same quantity of sodium cyanide is required in both alternatives, if not more for gravity/flotation.	Yes
	Gravity/Flotation	Not Technically Feasible based on an unorthodox complex multi-stage	Not Economically Feasible as it requires a complex multi-stage	Environmental effects are generally similar in both alternatives: the same quantity	No

Table 2.6-1 Summary of Alternative Means of Undertaking the Project

Project Component or Activity	Alternative Means	Technical Feasibility	Economic Feasibility	Environmental Effects	Preferred Option
		process for cyanidation or off-site smelting	process or additional off-Site smelting.	of sodium cyanide is required in both alternatives, if not more for gravity/flotation. Smelting would require transport to an off-site facility.	
Ore Processing Locations	Touquoy	Technically Feasible as the Touquoy facility is already designed to treat Beaver Dam ore with minimal modifications.	Economically Feasible as the infrastructure for processing Beaver Dam ore is already in place. Haul Road upgrades will need to be completed but are off-set by the benefits of using the existing processing facility.	Environmental effects for the Touquoy facility have previously been identified. Processing Beaver Dam ore at the Touquoy facility will result in an additional four years of processing beyond the current lifespan of the Touquoy Project and will result in an increase in the cost of production and greenhouse gas emissions due to transporting ore to Touquoy.	Yes
	Beaver Dam	Technically Feasible	Not Economically Feasible as the infrastructure for processing Beaver Dam ore is already in place at the Touquoy facility.	Environmental effects of processing ore at the Beaver Dam Mine Site are greater in this scenario as a second processing facility and tailings management facility would be required to be constructed and operated. Construction of an additional processing and tailings management facility would affect all VCs being considered in this EIS.	No
Ore Transportation	Haul Road avoiding Hwy	Technically Feasible	Economically Feasible	Environmental effects are similar for both alternatives. Construction of 4.0 km of new	Yes

Table 2.6-1 Summary of Alternative Means of Undertaking the Project

Project Component or Activity	Alternative Means	Technical Feasibility	Economic Feasibility	Environmental Effects	Preferred Option
	224 via new construction			Haul Road will cause additional environmental effects than simply upgrading the Haul Road; however the new road eliminates travel along Hwy 224 and the passing of Beaver Lake IR 17, which reduces potential effects on those residents. The Preferred Alternative Haul Road reduces interaction with residence and private landowners.	
	Haul Road along Hwy 224	Technically Feasible	Economically Feasible	Environmental effects are similar for both alternatives. Travel along Hwy 224 through the Beaver Lake IR will cause noise and dust issues for residents due to the increased truck traffic.	No
Energy Source	On-site Generators	Technically Feasible	Economically Feasible	Environmental effects will include emissions associated with two diesel fuel-powered generators.	Yes
	Provincial Grid Tie-in	Technically Feasible	Not Economically Feasible as the current power demand is insufficient to justify the construction of a permanent grid tie-in.	Environmental effects would include construction of a right-of-way for electrical lines, including noise and emissions generated during construction and habitat and vegetation loss in the right-of-way.	No
	Renewable Energy Sources	Technically Feasible	Not Economically Feasible due to short duration of Project	Environmental effects would depend on renewable energy	No

Table 2.6-1 Summary of Alternative Means of Undertaking the Project

Project Component or Activity	Alternative Means	Technical Feasibility	Economic Feasibility	Environmental Effects	Preferred Option
				technology used; however, air emissions would be reduced	
Project Component Locations	As shown on Figure 2.2-1	Technically Feasible	Economically Feasible	Environmental effects will include loss of habitat; however this configuration avoids interference with aquatic habitats and Critical Function Zone for Boreal Felt Lichen.	Yes
	Alternative Locations	Technically Feasible	Not Economically Feasible as this would require the reconfiguration of the components	Environmental effects would be similar in both scenarios; however, the alternative location of the waste rock stockpile could interfere with nearby aquatic habitat and Boreal Felt Lichen. Project components have also been positioned to generally avoid identified heritage resources.	No
Water Supply and Management	On-site water supply and management, with delivery of potable water	Technically Feasible	Economically Feasible	Environmental effects will include emissions associated with the transport of potable water to the mine site.	Yes
	Alternative sources of water	Technically Feasible	Not Economically Feasible to transport all water requirements to the mine site.	Environmental effects would include a greater volume of emissions generated during the transport of all water to the mine site.	No
	Waste rock stockpiles	Technically Feasible	Economically Feasible	Stockpiles to be rehabilitated at closure	Yes

Table 2.6-1 Summary of Alternative Means of Undertaking the Project

Project Component or Activity	Alternative Means	Technical Feasibility	Economic Feasibility	Environmental Effects	Preferred Option
Mine Waste Management Facilities					
	Waste rock backfill in open pit	Technically Feasible	Not Economically Feasible	Stockpile disturbed area footprint , backfilled open pit and excess waste rock require reclamation after backfill	No
	Beaver Dam tailings stored in Touquoy open pit	Technically Feasible	Economically Feasible	Potential environmental effects on surface and groundwater	Yes
	Beaver Dam tailings stored in expanded Touquoy TMF	Technically Feasible	Not Economically Feasible	Potential environmental effects on surface and groundwater; Increased disturbed footprint area; higher TMF dams increasing failure risk.	No
	Beaver Dam tailings stored in new TMF at Beaver Dam site	Technically Feasible	Not Economically Feasible to transport tailings back to Beaver Dam; Not Economically Feasible to construct new processing facility at Beaver Dam; Not Economically Feasible to construct new TMF at Beaver Dam	Potential effects on all VCs. Substantially larger disturbed area at Beaver Dam and potential environmental effects associated with significant additional infrastructure development.	No

3 Public Consultation and Engagement Program

3.1 Objectives

The Proponent is committed to stakeholder and rightsholders consultation and engagement as part of its Beaver Dam ~~MRC~~ Project. Using key values of openness, transparency, collaboration and respect, the Proponent has continued to work with the local community, non-governmental organizations (NGOs), regulatory agencies, and interested members of the public for over a decade. As part of the planning and permitting of the Touquoy Gold Mine, the Proponent developed relationships with members of the local community and NGOs, such as the Moose River Gold Mine Museum Society. A Community Liaison Committee (CLC) has been in place since 2011.

Both federal and provincial EA legislation requires consultation with the public to recognize concerns about adverse effects of the environment and identification of steps taken by the proponent to address these concerns; therefore, these are specifically identified in the EIS related to Beaver Dam Mine Project. Beyond the regulatory requirements, the Proponent strongly believes that meaningful engagement is crucial to the success of any development. The Proponent is committed to maintaining stakeholder consultation and engagement throughout the life of its Beaver Dam ~~MRC~~ Project; these activities extend well beyond the EA process.

3.2 Engagement Strategy

A community engagement strategy has been developed by the Proponent for the ~~MRC~~ Project. It sets out the formal engagement activities that the Proponent will undertake throughout all phases of its exploration activities and mining operations in Nova Scotia. This includes the development, operation and reclamation of the ~~MRC~~ Project, which includes the permitted Touquoy Mine Site and the proposed Beaver Dam Mine Site. The Proponent is also active in efforts ~~will also seek~~ to provide broader awareness relative to ~~include~~ advanced exploration activities at Cochrane Hill and Fifteen Mile Stream.

A successful community engagement strategy also provides flexibility to allow adaptation to the needs of the community. In 2016, the Proponent developed its strategy for community engagement to coincide with the start of construction of the permitted Touquoy Gold Mine and the development of the EA for the Project. ~~These elements listed below will be built upon over time as the MRC Project develops.~~

3.2.1 Community Liaison Committee

Community engagement is important to the Proponent and the Community Liaison Committee (CLC) is its cornerstone. The CLC is diverse with representation from the surrounding communities; it was recently expanded to a nine-member CLC. The volunteer membership acts as an advisory board to the Proponent. The CLC provides a mechanism for information exchange between communities and the company, as well as a forum to share questions, concerns, and input regarding ~~the MRC Project~~ Touquoy Mine Site and the Beaver Dam Mine Site. The CLC ~~plans to~~ meet quarterly with the potential for additional meetings depending on interest and Project developments.

The current members are: Charles Brown (Musquodoboit Harbour), ~~Jennifer Copage (Sipekne'katik First Nation)~~, Rick Deale (Middle Musquodoboit), Gilbert Fahie (Mooseland), ~~Gerald Gloade (Millbrook First Nation)~~, John Kennedy (Pleasant Harbour)~~,~~ Gary Leslie (Upper Musquodoboit)~~, Marilyn Munroe (Sheet Harbour)~~, and Barry Prest (Mooseland). The CLC is currently recruiting for members to bring the membership back to full.

A draft Terms of Reference for the CLC was developed and approved by the CLC on June 24th, 2017. ~~will be finalized by the CLC early in 2017~~ (refer to Appendix A.1). The Terms of Reference sets out the governance for the CLC and defines its objective as an advisory body to the Proponent with volunteer members representing local communities. On October 13th, 2018 the CLC made a formal motion to include the Project in the Terms of Reference and will provide advise to the Proponent on issues related to this Project in addition to the Touquoy Project. Cochrane Hill and Fifteen Mile Stream will have their own separate CLCs.

As defined in the ~~draft~~ Terms of Reference, guests, such as technical consultants or community groups, may be invited to the CLC meetings where topics of interest are planned. To date, the CLC has received presentations from Intrinsik Corp on MDMER, Cyanco on Cyanide, and from a local community group (Eastern Shore Forestry Watch). ~~like Eastern Shore Forestry Watch.~~

3.2.2 Open Houses and Town Hall Meetings

Open houses allow a proponent ~~developer~~ to inform the general public about a proposed project, and conversely, interested members of the public have the opportunity to view information and speak directly with representatives of the Proponent. This allows one-on-one discussions to answer questions of the visitor. For many members of the public, this can be a more comfortable form of communicating with the proponent than town hall type meetings.

The meetings can take many forms but usually involve information boards and displays showing the location of the proposed project in relation to nearby communities, fact and figures pertaining to the development, and an update of the general public on the status and progress of development activities, such as the EA and anticipated construction schedule.

Many open houses have been held as part of the Touquoy Gold Project over the past decade. More recently, in spring 2016, four meetings were held to update the local communities on the construction start of the Touquoy Gold Project and provide specific details on the proposed Project. In response to concerns on traffic potentially associated with the work at the Touquoy Gold Project, a town hall meeting was held in Mooseland in late 2016.

3.2.3 Presentations and Meetings with Local Community Groups

The Proponent has made presentations to many organizations, community groups and educational institutions on its exploration and mine development activities in Nova Scotia. To date, these organizations include but are not limited to, Sheet Harbour Chamber of Commerce, Council of the Municipality of the District of St. Mary's, and engineering students at Dalhousie University. Depending on interest of community groups, the Proponent will continue to make presentations to share information about its operations in Nova Scotia.

The Proponent has and will continue to meet with local community groups in a smaller venue, including the Eastern Shore Forestry Watch, Moose River Gold Mines Museum Society and Nova Scotia Salmon Association. Depending on interest of community groups as the Project develops, the Proponent will continue to meet with community groups to provide information and respond to any concerns. This may include local ATV clubs, environmental groups, business development organizations and other interested community groups.

The Proponent presented at the Musquodoboit Harbour and Area Chamber of Commerce and Civic Affairs Town Hall meeting on February 21, 2018 and provided an update on the Project and answered questions from the attendees. Approximately 15 members of the public attended, including the local municipal councilor.

On October 19, 2018 the Proponent met with 4 representatives of the Sheet Harbour Chamber of Commerce to provide a general updated on the Project and seek feedback on the best way to engage with this community. The Proponent offered to come speak with the entire membership and this is tentatively planned for February 2019.

3.2.4 Community Bulletins (Newsletter)

Starting in May of 2018, the Proponent launched ~~is developing~~ a quarterly community bulletin. The purpose of the bulletin is to ~~will be to~~ ~~continue to~~ keep the community informed about the Project, provide information on the Proponent's activities in the local community and provide basic technical information on the Proponent's projects. ~~The first edition of this newsletter is planned to be mailed out prior to start of operation of the Touquoy Gold Project to help encourage engagement and increase information dissemination. Afterward the newsletter will be posted online and emailed to those interested in receiving the regular newsletter~~. The bulletin will continue indefinitely so that community members are kept informed throughout all stages of the Project.

3.2.5 Signage

The Proponent posts, and will post, signs at their Project sites with contact details and other general information. For example, in the instance of the Touquoy Gold Project, the blasting schedule is posted for public information. Working with local groups, such as the Moose River Gold Mine Museum Society, interpretative panels on the Proponent Projects may be integrated into the Moose River Gold Mine Provincial Park.

3.2.6 Website, Email, Phone Line and other Digital Media

The Proponent has established a ~~is developing a~~ "~~Community~~" "Responsibility" tab on its organizational website. The website continues to be populated with new information and the Proponent intends for the website to be a hub of information for reference by the community. The purpose of this tab is to:

- Inform and update the public about the Project;
- Address community questions gathered from other communication channels; and
- Provide information for further engagement.

The website ~~is~~ provides a sign up location for the quarterly community bulletin (newsletter), which as of November 1, 2018 has 119 email addresses on its distribution list. The Proponent has issued 3 Community Bulletins, and 2 Special Bulletins to announce public comments periods for the Fifteen Mile Stream and Cochrane Hill Gold Projects. The May 15th, 2018 bulletin was delivered to 109 people and had an open rate of 69.5%. The June 31st, 2018 bulletin was delivered to 114 people and had an open rate of 44.6%. The October 15^{th,} 2018 bulletin was delivered to 119 people and had a 47% open rate. The open rate demonstrates interest in the bulletin and that people are opening the email. The bulletin has also been forwarded by the initial recipients meaning the distribution network is wider than the initial recipients.

The Proponent has established an email address - communityrelations@atlanticgoldcorporation.com - specifically as a point of contact for the public that ~~will be~~ is monitored regularly.

~~the development of an email list for interested members of the public~~. ~~The website also allows interested members of the public to sign up for newsletter.~~

The Proponent will continue to monitor various social media channels for posts and comments regarding the Project. The purpose of this monitoring will be to check for information being shared regarding the Project, to better understand public questions and concerns, and to identify opportunities to engage. The Proponent will also explore the potential of creating their own social media presence.

The Proponent established a community phone line (902-391-4653) in March 2018 where the public can call in the event there are questions or concerns, or to request a meeting with a representative. This phone line is answered during business hours. This phone line has been advertised on the website, in all newsletters and on a business card given out to those who have expressed interest in further communicating with the Proponent.

3.2.7 Media and Press Releases

The Proponent posts news releases to promote accurate information about the Project. Most news releases to date are associated with the Proponent's business interests; however, this has been ~~will be~~ expanded to include Nova Scotia media outlets in order to better communicate the benefits of the mine developments with the broader community, address public questions and concerns, and encourage engagement.

The Proponent is also considering regular advertising and content in the Guysborough Journal to assist in sharing information on the Project.

3.2.8 Meetings with Local Residents and Land Owners

Until early 2018, m~~e~~eetings with local residents and land owners have occurred opportunistically where specific interests are expressed. ~~This will continue especially as it relates to land owners associated with the haul road and Mine Site at Beaver Dam.~~

In the spring of 2018, the Proponent initiated a more formal engagement process with adjacent land owners and sent letters and offered to meet with property owners potentially impacted by the Haul Road and the Beaver Dam Mine Site. The Proponent has also reached out to land owners whose land may be required for mine infrastructure. The Proponent will continue to communicate directly with potentially impacted land owners to resolve land issues.

3.2.9 Complaints Response Procedure

Associated with the ongoing work for the Touquoy Gold Project, a formal complaints response procedure has been developed and is implemented by the Proponent when a complaint is received from the public. This information is shared with the CLC and Nova Scotia Environment on a quarterly basis.

3.3 Regulatory Consultation

Regulatory engagement on the Project has been ongoing since October 2014 with a Provincial "One Window Process: Mineral Development in Nova Scotia" meeting. This initial meeting was intended to present the planned Project and to receive feedback on the regulatory regime and regional expertise.

Departments from federal and provincial governments have been consulted on the Project, including:

- CEA Agency;

- Fisheries and Oceans;
- Environment and Climate Change Canada;
- Canadian Wildlife Service;
- Health Canada;
- Transport Canada;
- Natural Resources Canada;
- Nova Scotia Environment;
- Nova Scotia Transportation and Infrastructure Renewal;
- Nova Scotia Lands and Forestry (formerly Nova Scotia Department of Natural Resources);
- Nova Scotia Energy and Mines (formerly Nova Scotia Department of Natural Resources); and
- Nova Scotia Office Aboriginal Affairs.

Consultation includes one-on-one meetings or correspondence, larger meetings or workshops and site visits. A one-day workshop was held on May 13, 2016 for interested provincial and federal regulators. On November 29, 2016 a site visit and tour was held for interested provincial and federal regulators and representatives of the two closest Mi'kmaq communities, Sipekne'katik and Millbrook, and staff of the Kwilmu'kw Maw-klusuaqn Negotiation Office (KMKNO).

3.4 Public Engagement Activities

While broader engagement on the Project has occurred for over a decade and will continue as per the community engagement strategy, specific public engagement activities have occurred to support the environmental assessment process ~~EA~~ for the Project since the federal process was commenced in December 2015. Specifically, this includes community open houses and ongoing two-way information sharing with the CLC. These are detailed below and are included in the summary of engagement activities conducted with stakeholders and the Mi'kmaq of Nova Scotia since ~~EA~~ EIS commencement in December 2015 (Appendix A.2).

3.4.1 Community Open Houses

Four open houses were held in May 2016; two of these were open to the public while the other two were open to First Nations community members as described under Indigenous Peoples engagement. Two more open houses were held in 2018 with Millbrook First Nation and are outlined in the Indigenous Peoples section.

The two public open houses were advertised in the local papers, including the Eastern Shore Cooperator (monthly print issued on May 5), Guysborough Journal (weekly print issued on May 16) and the Town Cryer (monthly print issued on May 2). The members of the CLC also circulated information. Flyers were also posted in local communities. The dates and locations were as follows:

- May 18, 2016 at Natural Resources Education Centre, 12014 Hwy 224, Middle Musquodoboit
- May 19, 2016 at Sheet Harbour Lions Club, 183 Pool Road, Sheet Harbour

The format and layout were the same for all open houses. Each open house was hosted from 3pm to 8pm with refreshment provided. Upon entry, attendees were asked to sign in and were provided a comment form to complete at end of their stay. Maps were also available for viewing on table and a 3D model of the Beaver Dam Mine Site was used to demonstrate the existing conditions, proposed full mine development (including pit and waste rock pile) and reclamation of the site.

A total of fifteen panels were placed on easels with the Proponent and its consultants hosting the panels. After a welcome and introduction to the Proponent and the Project background (three panels), an overview of open pit mining, process of gold recovery, and economic benefits of the Project was provided (three panels). The next three panels provided an update on the Touquoy Gold Project which was soon to begin construction (June 2016). Before the one closing panel, the five panels focused on the Beaver Dam Mine Project and the engagement opportunities, specifically:

- Presentation of the site location, the gold deposit and the existing site features;
- Map of the proposed site plan at the Beaver Dam Gold Mine;
- Information on the transportation of ore, including both options considered for the route and the trucking rate;
- Overview of the EA process for the Project including the ongoing baseline studies for the VCs and the regulatory process with opportunities for public participation; and
- Opportunities for community and Mi'kmaq engagement, including an overview of the CLC and an invitation for expressions of interest from residents who are interested in joining the CLC.

A total of 94 interested community members attended these two open houses (i.e., Middle Musquodoboit had a total of 61 attendees with 49 providing contact information and/or contact information; Sheet Harbour had a total of 33 attendees with 32 providing name and/or contact information). In total, nine comment forms were completed, two expressed interest in joining the CLC, and many resumes were provided to the Proponent.

3.4.2 Community Liaison Committee

Six CLC meetings were held in 2016. Of these, the last two meetings held on October 29, 2016 and December 3, 2016 included the expanded membership of nine. In 2016, The CLC membership represented different communities, including: Middle Musquodoboit, Millbrook First Nation, Mooseland, Musquodoboit Harbour, Sheet Harbour, Sipekne'katik First Nation, Pleasant Harbour, and Upper Musquodoboit.

Each community is represented by one member except for Mooseland which has two representatives due to its proximity to the Touquoy Gold Project and the proposed Haul Road for the Beaver Dam ore.

Due to the ongoing preparation of the EIS for the Project, a special meeting on December 3, 2016 was held to focus on the Project. As per the Terms of Reference, the CLC may invite guests who may be interested in topics in forthcoming meetings. The CLC invited representatives from the Eastern Shore Forestry Watch (Barbara Markovits and two guests) and the Nova Scotia Salmon Association (Eddie Halfyard and guest).

The meeting was about 2.5 hours in duration. Presentations were made by staff of the Proponent and the EA Study Team, maps were provided and a 3D model of the Beaver Dam Mine Site was used to demonstrate the existing conditions, proposed full mine development (including pit and waste rock pile), and reclamation of the site. Questions and answers were facilitated. The agenda included:

- Introduction and special purpose of the meeting;
- Overview of the Project;
- Review of participation opportunities in the federal and provincial EA processes;
- Presentation of summary assessment for each VC; and
- Description of timelines of the Project.

Offers to meet with specific members of the CLC and/or NGOs present to provide additional information on the Project were made by the Proponent.

In 2017, the CLC met 2 times and in 2018, the CLC has met three times, with another scheduled in January 2019. The CLC membership continues to fluctuate as members resign and new ones are recruited. The most significant membership change is the agreed upon withdrawal of Millbrook First Nation and Sipekne'katik First Nation on the CLC. Both First Nation Communities have elected to not participate in the CLC and have decided to directly engage with the Proponent. The Proponent has made it clear to both Millbrook and Sipekne'katik First Nations that they are welcome to rejoin the CLC or attend as guests.

In an effort to promote transparency and understanding of the role of the CLC, the Proponent has started to publish the meeting notes for the Touquoy/Beaver Dam CLC, which can be found at http://www.atlanticgoldcorporation.com/projects/tourquay_gold_project/.

3.5 Key Issued Raised and Proponent Responses

The following table provides a summary of key issues raised during public consultation and engagement activities relative to the EA of the Project. For each key issue identified, a summary of the Proponent's response is provided along with reference(s) to sections in the EIS which more fully addresses the issue.

Table 3.5-1 Summary of Key Issues Raised During Stakeholder Engagement

Key Issue	Summary of Proponent Response	Primary EIS Reference
Concern about metals leaching from waste rock pile, including arsenic, and acid rock drainage	Leaching of metals is not expected, e.g., arsenic is expected to be within baseline conditions. Acidic runoff is not anticipated to be a concern. Surface water management and monitoring will be in place to identify trends.	Section ~~6.2.3.4~~ 6.5.3.4 Bedrock Geology; Section; ~~6.3~~ 6.7 Surface Water, including ~~6.3.7~~ 6.7.8 Mitigation and Monitoring
Concern about effect on water quantity in Cameron Flowage from pit development	Local hydrogeological conditions ensure that groundwater will be maintained to recharge Cameron Flowage. Baseline and ongoing monitoring of surface water and groundwater levels will be in place to identify trends.	Section ~~6.4.6~~ 6.6.6 Project Activities and Groundwater Quality and Quantity Interactions and Effects
Questions about contingency planning for accidents and malfunctions	Hazards have been identified and assessed based on risk with mitigations and contingency planning in place. Future detailed planning and implementation of the Project will further address potential accidents and malfunctions.	Section ~~6.15~~ 6.18 Accidents and Malfunctions
Concern about wetlands being impacted at Beaver Dam Mine Site and future compensation	Where possible, wetlands have been avoided; otherwise minimization of effects was incorporated into Project planning. Any wetlands altered must have NSE approval and will require compensation.	Section ~~6.5~~ 6.8 Wetlands, including ~~6.5.7~~ 6.8.8 Mitigation and Monitoring
Questions about addressing species at risk if identified in Project area	Species of conservation interest (SOCI) and species at risk (SAR) have been assessed. Effect is minimal and where a potential Project interaction, mitigation and monitoring plans are identified for priority species, including fish, vascular flora and lichens, terrestrial fauna and birds.	Section ~~6.10.7~~ 6.13.8 Mitigation and Monitoring for SOCI and SAR.
Concern about effect on habitat from Haul Road construction	Effects of road construction will be minimized by using existing corridors where possible and improving drainage where damaged culverts exist. Effects and mitigation measures are specifically identified for ecological VCs, including habitat and flora.	Section 2.2.1.7 Haul Roads for Transporting Ore, and key sections for each VC in Section 6 Environmental Effects Assessment.
Concern about volumes of truck traffic in context of safety on public roadways and recreational vehicles	Potential interaction exists with operation of the Haul Road and the public; the risk of a mobile equipment accident has been assessed as low with mitigations in place including design of Hwy 224 crossing, appropriate signage, and haul truck driver training	Section 2.3.2.2 Haul Road; Section 6.16.7 Project Activities and Health and Socio-economic Conditions Interactions and Effects; and ~~6.15.3.7~~ 6.18.4 Mobile Equipment Accident
Request to prefer Haul Road option that does not travel along Hwy 224	Based comments received on two options during the stakeholder and Mi'kmaq engagement, the Proponent completed a feasibility	Section 2.2.1.7 Haul Roads for Transporting Ore; Section 2.3.5 Summary of Changes to Project

Key Issue	Summary of Proponent Response	Primary EIS Reference
	review of the second option which does not pass by any residences. This was selected and is carried forward in the EA.	Activities; Section 2.6.6 Ore Transportation
Concern on cyanide use at plant for gold processing	The approved Touquoy Gold Project includes a gravity/CIL processing of the ore using a highly efficient cyanide destruction process. This use of this existing plant will be extended for the processing of ore from the Beaver Dam Mine Site. Mitigations for transportation, handling storage and processing will be incorporated into the extended use of the plant.	Section 2.3.2 Operations and Maintenance associated with the processing plant; Section 2.6.4 Ore Processing Methods;
Concern on effect of tailings disposal in mined-out Touquoy pit	Use of the approved pit as part of the Touquoy Gold Project allows the existing footprint to be used and eliminates the need to process the tailings at the Beaver Dam Mine Site. Geological conditions predict minimal effect on the receiving environment; conditions will be monitored and compared with the developing baseline data set for the Touquoy Gold Project.	Section 2.3.2 Operations and Maintenance associated with tailings management (exhausted pit), and key sections for surface water and groundwater in Section 6 Environmental Effects Assessment
Request to be informed on the Project activities	The Proponent is committed to maintaining its CLC for the life of the Project. Other aspects of community engagement will continue as per the community engagement strategy.	Section 3.6 Ongoing Community Engagement; Section ~~6.13.7~~ 6.16.9 Mitigation and Monitoring associated with socio-economic considerations

The issues raised during public consultation and engagement activities were incorporated into the design of the Project and the development of the EIS. Improvements to planning and design as a result of feedback from this engagement includes, but is not limited to, minimizing Project footprint, including limiting direct effects to watercourses and wetlands, and changing the Haul Road to cross Hwy 224 rather than travel along Hwy 224 to avoid passing by residences and to minimize travel on Hwy 224. In terms of the development of the EIS, there were no additional VCs included other than those identified in the CEA Agency Guidelines; however, many specific monitoring commitments have been made by the Proponent to address concerns, including noise and dust associated with the Haul Road. The Proponent has made strong commitments to ongoing community engagement, including local community organizations. These commitments are summarized in Sections 9 and 10.

The meetings, site visits, telephone calls, emails, and other correspondence that formed the stakeholder and the Mi'kmaq of Nova Scotia engagement activities are included in Appendix A.2.

3.6 Ongoing Community Engagement

As per the engagement strategy, there are many tools to engage stakeholders, including members of the local community, government regulators, NGOs, land owners, and members of the public. As part of submitting the EIS to respective government authorities, the engagement to date associated with the Project was documented, including a summary of issues raised and Proponent responses. The Proponent has a broad objective to continue to engage the community and will continue to implement its strategy. Relative to the Project, specific commitments are made by the Proponent in terms of engagement during the next steps in the EA processes, including:

- Sharing key aspects of the EIS with interested NGOs and/or CLC members;
- Holding meetings with interested NGOs, including Eastern Shore Forestry Watch Association and Nova Scotia Salmon Association;
- Aligning in data collection and mitigation measures with local organizations, specifically with the ongoing field work of Nova Scotia Salmon Association; and
- Answering specific questions posed directly to the company by providing additional information where feasible.

As part of the understanding that engagement plans need to be flexible, the Proponent will address and respond to additional stakeholders identified or issues noted as the EA moves forward and into Project development, operation and reclamation

4 Indigenous Peoples Consultation and Engagement Program

4.1 Objectives

The Proponent is committed to meaningful engagement of the Mi'kmaq of Nova Scotia as part of the Project. Engagement began as part of planning and environmental assessment of the Touquoy Gold Mine over a decade ago. This engagement has focused on the Assembly of Nova Scotia Mi'kmaq Chiefs and staff of the KMKNO, as well as the community members, staff and Chief and Council of each of the nearest two Mi'kmaq communities, Millbrook and Sipekne'katik First Nations.

While the government's duty to consult cannot be delegated to proponents, procedural aspects can be delegated. In addition, both the federal and provincial EA processes include requirements for engagement of Indigenous Peoples. The information gathered by the Proponent during its engagement with Indigenous Peoples helps to contribute to the Crown's understanding of any potential adverse impacts of the Project on potential or established Aboriginal or treaty rights, title and related interests, and the effectiveness of measures proposed to avoid or minimize those impacts.

The Made-in-Nova Scotia Process is the forum for the Mi'kmaq, Nova Scotia, and Canada to resolve issues related to Mi'kmaq treaty rights, Aboriginal rights, including Aboriginal title, and Mi'kmaq governance. The process involves the Mi'kmaq of Nova Scotia as represented by the Assembly of Nova Scotia Mi'kmaq Chiefs and the provincial and federal governments. Both the federal and provincial governments have requirements for consultation under the Updated Guidelines for Federal Officials to Fulfill the Duty to Consult: 2011, and the Mi'kmaq-Nova Scotia-Canada Consultation Terms of Reference. Further, the Nova Scotia *Environmental Assessment Regulations* include a requirement to identify concerns of Indigenous People about potential adverse effects and steps taken, or proposed to be taken, by the proponent to address concerns, as well as the steps taken to identify these concerns.

The EIS Guidelines (CEA Agency 2016) for the Project's federal EA process give guidance to the Proponent to complete specific aspects of Mi'kmaq engagement. For indigenous groups with potential to be most affected by the Project, it was expected that the Proponent would strive toward developing a productive and constructive relationship based on ongoing dialogue with the groups in order to support information gathering and effects assessment. In addition, federal funding was provided under CEAA 2012 to support Indigenous Peoples participation in the EA; this includes funding awarded to the KMKNO and to Millbrook and Sipekne'katik First Nations.

As part of planning the Project, including preparation of the EIS, engagement has continued with the Mi'kmaq of Nova Scotia. The specific engagement activities related to Project are identified in the EIS. Beyond the regulatory requirements, the Proponent strongly believes that meaningful and long term engagement of the Mi'kmaq of Nova Scotia is crucial to the success of any development. The Proponent is committed to maintaining Mi'kmaq engagement throughout the life of the Project; these activities extend well beyond the EA process of the Project.

With the receipt of Information Requests from the Agency after the Proponent submitted the EIS in 2017, the Proponent has continued to engage with the Mi'kmaq of Nova Scotia on a regular basis to better understand existing land uses.

4.2 Indigenous People in Nova Scotia

The Mi'kmaq are the original people of Nova Scotia and remain the predominant Indigenous Peoples within the Province. The courts have confirmed that the Mi'kmaq of Nova Scotia have both Aboriginal and Treaty rights protected under Section 35 of the *Constitution Act*. The nature and extent of those rights, as well as the responsibilities and authorities of governments with respect to those rights, are the subject of negotiation between the federal and provincial governments and the Mi'kmaq of Nova Scotia, as described above.

The Mi'kmaq Nation of Nova Scotia has a general interest in all lands and resources as the Mi'kmaq Nation maintain that they did not give up their land rights through treaty, voluntary cessation, or otherwise. The Mi'kmaq of Nova Scotia maintains a claim of Aboriginal title to the lands and waters of Nova Scotia and adjacent areas of the offshore.

As part of the Umbrella and Framework Agreements developed for the Made-in-Nova Scotia Process, a draft Consultation Terms of Reference was adopted in 2007. After a three-year pilot period the thirteen Mi'kmaq communities, through the Assembly of Nova Scotia Mi'kmaq Chiefs, signed the M'kmaq-Nova Scotia-Canada Consultation Terms of Reference (TOR) in 2010 with the Governments of Canada and Nova Scotia. The TOR lays out a process for the parties to follow when governments wish to consult with the Mi'kmaq of Nova Scotia. The Made-in-Nova Scotia Negotiation Process and the historic development of the Consultation Terms of Reference are based on the principle of the Mi'kmaq of Nova Scotia as one Mi'kmaq Nation.

Nova Scotia has thirteen Mi'kmaq First Nations with a total registered population of 16,760 as of 2017, including both on- and off-reserve populations (AANDC 2017). The Assembly of Nova Scotia Mi'kmaq Chiefs represents all thirteen communities in dealings with the Crown. The Kwilmu'kw Maw-klusuaqn Negotiation Office (KMKNO) is the administrative group that represents the Assembly of Nova Scotia Mi'kmaq Chiefs in the consultation and negotiations with the Province of Nova Scotia and the Government of Canada. Millbrook and Sipekne'katik First Nations have chosen to consult through their own community Chief and Councils, rather than the KMKNO.

As part of engagement of the Mi'kmaq of Nova Scotia, the following are groups who were listed in the CEAA 2012 Guidelines as being possibly affected by the Project. These include the thirteen Mi'kmaq First Nations in Nova Scotia, the Assembly of Nova Scotia Mi'kmaq Chiefs, and the KMKNO:

- Acadia First Nation;
- Annapolis Valley First Nation;
- Bear River First Nation;
- Chapel Island First Nation;
- Eskasoni First Nation;
- Glooscap First Nation;
- Membertou First Nation;
- Millbrook First Nation;
- Paq'tnkek (Afton) First Nation;
- Pictou Landing First Nation;
- Sipekne'katik First Nation;
- Wagmatcook First Nation;
- We'koqma'q First Nation and
- Assembly of Nova Scotia Mi'kmaq Chiefs and the KMKNO.

In addition, there is a Native Council of Nova Scotia which is a self-governing authority for the large community of Mi'kmaq or other Indigenous Peoples residing off-reserve in Nova Scotia. The Native Council has established thirteen geographic zones encompassing the Province of Nova Scotia and has an elected Office of Chief and President.

The two closest Mi’kmaq communities of Millbrook and Sipekne’katik First Nations have registered total populations of 1,831 and 2,645, respectively (AANDC 2017). As stated above, the two communities have chosen to represent themselves directly in consultation with the Crown. As part of Millbrook First Nation, there are two communities near the Beaver Dam Mine Project: Beaver Lake Indian Reserve (IR) I7 with an on-reserve population of about 21 and Sheet Harbour IR 36 with an on-reserve population of about 25 (Statistics Canada 2017).

The approach to Mi’kmaq engagement and development of the EIS has been in keeping with this framework for engaging the Mi’kmaq of Nova Scotia as a Nation via the KMKNO while specific issues relating to the closest communities have been the focus of engagement with Millbrook and Sipekne’katik First Nations. This same approach has been used when discussing the sharing of potential Project benefits with the Mi’kmaq of Nova Scotia; that is, the Proponent was directed by KMKNO to discuss directly with Sipekne’katik and Millbrook First Nations, as well as holding discussions with the KMKNO on behalf of the Assembly.

4.3 Engagement Strategy

An engagement strategy for the Mi’kmaq of Nova Scotia has been developed by the Proponent for the development, operation and reclamation of the permitted and under construction Touquoy Gold Mine and the proposed Beaver Dam Mine Project. Like the strategy for community engagement, it sets out the formal engagement activities with the Mi’kmaq of Nova Scotia that the Proponent will undertake throughout all phases of its exploration activities and mining operations in Nova Scotia. Over time, this also may include additional developments based on results of the ongoing advanced exploration activities at Cochrane Hill and Fifteen Mile Stream.

Engagement planning for Indigenous Peoples is specific and unique to the Mi’kmaq of Nova Scotia; however, it aligns with the broader community engagement activities where appropriate. Like the planning for community engagement, the Mi’kmaq engagement plans allow for flexibility to allow adaptation based on feedback from the Mi’kmaq and ongoing development of the Proponent’s Projects. The following are general engagement tools that were described in Section 3.2 which will be built upon over time as the Project develops:

- Community Liaison Committee;
- Open houses and town hall meetings;
- Presentations and meetings with local community groups;
- Newsletters;
- Signage;
- Website, email, phone line and other digital media;
- Media and press releases;
- Meetings with local residents and land owners; and
- Complaints response procedure.

In 2016, the Proponent developed its strategy for Mi’kmaq engagement to coincide with the start of construction of the permitted Touquoy Gold Mine and the development of the EA for the Beaver Dam Mine Project. These elements listed below are specific to Mi’kmaq engagement and are often supported by community engagement activities listed above. These elements of the Mi'kmaq engagement strategy will be built upon over time as the Project develops.

As part of the Proponent's Mi'kmaq engagement strategy, the following elements will be further developed to build on the decade-long relationship that has been built on mutual understanding and transparency:

- Two-way sharing of meaningful information via face-to-face meetings, development of plain language materials, and site visits;
- Developing benefit agreements with the Assembly and the two closest communities to share Project benefits in terms of economic development, support for training and education and building capacity for future opportunities;
- Supporting cultural and traditional activities of the Mi'kmaq of Nova Scotia;
- Involving the Mi'kmaq of Nova Scotia in ongoing initiatives, such as the development and implementation of environmental monitoring plans, wetland compensation planning and the CLC; and
- Maintaining flexibility and open lines of communication to adjust the implementation as the relationship and Project develops.

The focus of engagement will be with the Assembly and the KMKNO, the communities of Millbrook and Sipekne'katik, and the Native Council of Nova Scotia. Other interested communities represented by the Assembly will be offered information and opportunity to meet. In addition, Mi'kmaq organizations in Nova Scotia who deliver services to their members will be engaged; for example, the Mi'kmaw Conservation Group has and is developing additional capacity in environmental monitoring, environmental education and habitat restoration. Aligning mutual interests, such as environmental protection specifically related to current use of land and resources for traditional purposes, is a core part of the Proponent's Mi'kmaq engagement strategy. Engagement to date has been positive and productive; this relationship ~~as defined under the~~ was formalized in a 2014 Memorandum of Understanding (since expired) with the Assembly. ~~will continue for the life of all of~~ A proactive and open relationship will be the goal for all of the Proponent's development in Nova Scotia.

4.4 Indigenous Peoples Engagement Activities

The objective of Mi'kmaq engagement relative to the development of the EIS for the Project is to gather views from Mi'kmaq groups with respect to both potential environmental effects of the Project and the potential adverse impacts of the Project on potential or established Aboriginal or treaty rights, title and related interests.

While broader engagement on the Touquoy Project has occurred for over a decade and will continue as per the Mi'kmaq engagement strategy, specific public engagement activities have occurred to support the EA for the Project since the federal process was commenced in December 2015.

These include aspects specific to the Project including:

- CLC, where two members were appointed by their Chief and Council as representatives of Millbrook First Nation and Sipekne'katik First Nation. Although Millbrook First Nation and Sipekne'katik First Nation have both withdrawn from the CLC, the Proponent will continue to invite them to the CLC as guests.;
- Open houses, specifically two community open houses occurred in May on lands of Millbrook and Sipekne'katik First Nations prior to the two public open houses;
- Presentations to Chief and Council of Millbrook First Nation and of Sipekne'katik First Nation, as well as the Benefits Committee Chiefs of the Assembly;

- Meetings, information sharing and correspondence with the KMKNO and thirteen Mi'kmaq First Nations of Nova Scotia, as well as the Nova Scotia Native Council for the purpose of good governance;
- Mini employment fairs set up in collaboration with staff of Millbrook and Sipekne'katik First Nations, as well as sharing of employment opportunities with Millbrook and Sipekne'katik First Nations and the KMKNO, with ~~current~~ Mi'kmaq employment ~~at the under~~ during the construction of the Touquoy Gold Project exceeding ten percent;
- Ongoing dialogue on formal agreements in terms of participation and benefits sharing with Millbrook First Nation, Sipekne'katik First Nation and the Assembly of Nova Scotia Mi'kmaq Chiefs;
- Participation of staff of KMKNO and Millbrook and Sipekne'katik First Nations in a site visit and tour of the proposed Beaver Dam Mine Project with provincial and federal regulators on November 29, 2016; and
- Use of many tools for Mi'kmaq engagement that are used for the general community engagement, such as newsletters, signage, website, email and other digital media, media and press releases, meetings with local residents, and a complaints response procedure.
- Two Open Houses in January 2018 with Millbrook First Nation (one in Millbrook and one in Sheet Harbour) to address specific technical questions.
- Review of Project mitigation and monitoring with Sipekne'katik and KMKNO on September 12 and September 18, 2018, respectively.

These meetings, calls, site visits and correspondence are included in the summary of engagement activities conducted with the Mi'kmaq of Nova Scotia since EA commencement in December 2015 and are provided in Appendix A.2 along with engagement of stakeholders.

More detail is provided below on engagement of the two nearest Mi'kmaq communities specific to the Beaver Dam Mine Project.

4.4.1 Community Open Houses

As discussed in Section 3.4.1 of this EIS, four open houses were held in May 2016; two of these were open to the public while the other two were specific to community members of Millbrook First Nation and Sipekne'katik First Nation.

The two Mi'kmaq community open houses were advertised by staff of each community. In addition, community members were invited to attend the two public open houses if convenient (held on May 18, 2016 in Middle Musquodoboit and on May 19, 2016 in Sheet Harbour). The dates and locations for the two Mi'kmaq community open houses were:

- May 16, 2016 at Millbrook Community Hall, 72 Church Rd, Truro
- May 17, 2016 at Saint Kateri Tekakwitha (Church Basement), Indian Brook

The format and layout were the same for all community open houses. Each open house was hosted from 3pm to 8pm with refreshments provided. Upon entry, attendees were asked to sign in and were provided a comment form to complete at end of their visit. Maps were also available for viewing on table and a 3D model of the Beaver Dam Mine Site was used to demonstrate the existing conditions, proposed full mine development (including pit and waste rock pile) and reclamation of the site.

A total of fifteen panels were placed on easels with the Proponent and its consultants hosting the panels. After a welcome and introduction to the Proponent and their Projects' background (three panels), an overview of open pit mining, process of gold recovery, and economic benefits of the projects was provided (three panels). The next three panels provided an update on the Touquoy Gold Project which was soon to begin construction (June 2016). Before the one closing panel, the five panels focused on the Beaver Dam Mine Project and the engagement opportunities, specifically:

- Presentation of the site location, the gold deposit and the existing site features;
- Map of the proposed site plan at the Beaver Dam Mine Site;
- Information on the transportation of ore, including both options considered for the route and the trucking rate;
- Overview of the EA process for the Project including the ongoing baseline studies for the VCs and the regulatory process with opportunities for public participation; and
- Opportunities for community and Mi'kmaq engagement, including an overview of the CLC and an invitation for expressions of interest from residents who are interested in joining the CLC.

A total of 32 interested community members attended these two open houses. Millbrook First Nation had a total of 16 attendees with 9 providing name and/or contact information. Sipekne'katik First Nation had a total of 16 attendees with 14 providing name and/or contact information. In total, four comment forms were completed; many attendees expressed an interest in employment and some provided resumes to the Proponent.

To address specific technical questions posed by Millbrook First Nation, the Proponent held two information sessions at Millbrook First Nation in Truro and Sheet Harbour IR #36 in Sheet Harbour in January 2018 that provided information on:

- Cyanide
- Reclamation and Contingency Planning,
- Ore Processing and Mine Processes
- Haul Road information.

Both information sessions included 17 poster boards which provided detailed information on each topic area. The poster boards showed, among other things, a map of the proposed location of mine infrastructure, an infographic that detailed ore processing, specific information on cyanide handling, shipping and use, a map of the Haul Road, and a list of Contingency and Management Plans that will be developed

On January 23rd, 2018 at the Millbrook Community Hall at 72 Church Road, Truro 14 members of the public, including the 2 consultants undertaking the IRTLUS for Millbrook First Nation and two representatives from the Agency attended the 2-hour session. The Proponent provided a PowerPoint presentation and hosted a question and answer session with attendees. The event ended with an Open House session where people were able to have one-on-one discussions with the Proponent's technical experts.

On January 24th at the Albert Noel Howe Multi-Purpose Community Center, 83 Church Point Rd, Sheet Harbour 16 members of the public, including the two consultants undertaking the IRTLUS for Millbrook First Nation, attended the 1-hour session. The Proponent also received requests from 7 people for additional information on the Project. This session took an open house format, where the poster boards were placed in the room and attendees reviewed them and had the opportunity to engage with the Proponent representatives to discuss specific issues or ask questions.

4.4.2 Community Liaison Committee

As discussed in Section 3.4.2 of this EIS, in 2016 the CLC was ~~recently~~ expanded to a nine-member committee including representation of the two closest Mi'kmaq communities, Millbrook First Nation and Sipekne'katik First Nation. The volunteer CLC membership acts as an advisory board to the Proponent and provides a mechanism for two-way information exchange between communities and the company.

A ~~draft~~ Terms of Reference for the CLC was ~~developed~~ approved ~~and will be finalized~~ by the CLC early in 2017 (refer to Appendix A.1). The Terms of Reference sets out the governance for the CLC and defines its objective as an advisory body for the Proponent with volunteer members representing local communities.

Specific to the Project, a special meeting was held on December 3, 2016. Presentations were made by staff of the Proponent and the EA Study Team, maps were provided and a 3D model of the Beaver Dam Mine Site was used to demonstrate the existing conditions, proposed full mine development (including pit and waste rock pile) and reclamation of the site. Questions and answers were facilitated.

The agenda included:

- Introduction and special purpose of the meeting;
- Overview of the Project;
- Review of participation opportunities in the federal and provincial EA processes;
- Presentation of summary assessment for each VC; and
- Description of timelines of the Project.

Offers to meet specifically with Mi'kmaq representatives on the CLC to provide additional information on the Project were made by the Proponent. Discussions are ongoing to coordinate future engagement as per Section 4.6 of this EIS.

In the Spring of 2018, representatives of Millbrook First Nation and Sipekne'katik First Nation decided to cease participating in the CLC and communicate directly with the Proponent to ensure that their CLC participation would not be considered "consultation". The Proponent has offered to include the Mi'kmaq as guests at all future CLC meetings and would welcome their membership on the committee.

In October 2018, the CLC passed a motion to amend the Terms of Reference to formally include the Project. Both Cochrane Hill and Fifteen Mile Stream will have their own CLCs. The CLC will now review and provide advice on both Touquoy and Beaver Mine Sites, as both sites are located in close proximity to Sheet Harbour and Mooseland and will be connected by the proposed Haul Road.

4.4.3 Other Supports – Employment and Sponsorship Program

Employment Programs

The Proponent has initiated outreach to the Mi'kmaq to encourage and recruit employees from the various communities. This includes:

- Hosting a job fair at Membertou First Nation
- Hosting job fairs with any Mi'kmaq community or group who wishes one
- Developing a program to promote employment opportunities to Mi'kmaq students at Dalhousie University.
- On a case by case basis, providing specific job postings to individual Mi'kmaq communities for circulation to all community members.

- The Proponent is also considering creating a specific Mi’kmaq recruitment page on a new online recruiting tool that will be launch early in 2019.
- The Proponent is developing an Apprenticeship Program in conjunction with Nova Scotia Community College (NSCC), which will be open to Mi’kmaq communities.

Sponsorship and Support

The Proponent is committed to supporting the Mi’kmaw of Nova Scotia as they develop programs and initiatives that address critical aspects of importance to them. The Proponent seeks to be a supporter and a contributor, understanding that their support assists in the economic, social and cultural growth of individual communities and of the Mi’kmaq Nation as a whole.

The Proponent has provided or will provide the following supports:

- $15,000 in sponsorship to the 2018 Mi’kmaw Summer Games. In addition, the Proponent offered to provide transportation assistance to Millbrook First Nation and Sipekne’katik.
- Support to the Mawita’jik “Let Use Gather” 2019
- Contributed to a series of Mi’kmaq Safety Workshops in Mi’kmaq communities;
- Consider other specific requests.

4.5 Key Issues Raised and Proponent Responses

As part of submitting the EIS and EARD to respective government authorities, the Mi’kmaq engagement to date associated with the Beaver Dam Mine Project was documented, including a summary of key issues raised and proponent responses at the time of EIS submission. For each key issue identified in the following table, a summary of proponent response is provided along with reference(s) to sections in this EIS which address the issue.

Table 4.5-1 Summary of Key Issues Raised During Mi'kmaq Engagement

Key Issue	Summary of Proponent Response	Primary EIS Reference
Concern about air emissions and noise associated with mining operations and trucking	Air emissions and noise will be minimized with mitigation measures. Monitoring for air quality, including total suspended particulates, will be completed.	Section 6.3.8 Mitigation and Monitoring for ~~Atmospheric Environment~~ Air
Concern about water quality and quantity and potential effect on fish habitat	Surface water management associated with mining and processing is necessary to minimize effect on receiving water. Monitoring of surface water will be completed to identify any trends to ensure no residual effect on fish habitat.	Section ~~6.3~~ 6.7 Surface Water; Section ~~6.6.6~~ 6.9.6 Project Activities and Fish and Fish Habitat Interactions and Effects
Concern about effect on groundwater, specifically related to domestic wells at Beaver Lake, from development of pit at Beaver Dam	As the nearest domestic well is over 5km from the Beaver Dam Mine Site, no effect is expected on groundwater quality or quantity at Beaver Lake. A network of monitoring wells will be used to monitor groundwater quality and quantity at the Beaver Dam Mine Site.	Section ~~6.4.6~~ 6.6.6 Project Activities and Groundwater Quality and Quantity Interactions and Effects
Questions about plans for reclamation at the Beaver Dam Mine Site	The Beaver Dam Mine Site facilities will be removed, the pit will naturally fill with water and disturbed surfaces covered with stockpiled topsoil and re-vegetated. The site will be returned to land owner for forestry and recreational use.	Section 2.3.3 Decommissioning and Reclamation
Questions about contingency planning for accidents and malfunctions	Hazards have been identified and assessed based on risk. Mitigation measures and contingency planning will be in place to address potential accidents and malfunctions.	Section ~~6.15~~ 6.18 Accidents and Malfunctions
Concern on habitat loss from Project development, including forest, wetlands, flora and fauna	Disturbance exists on the Beaver Dam Mine Site which will be reclaimed at end of operation. The existing alignment of Haul Road was used where feasible and practical to minimize footprint. Existing facilities will be used for processing and tailings management (exhausted pit). Effect on habitat is minimal.	Section 2.2 Project Location and History, as well as effects assessments in Section 6
Concern about effect of haul truck traffic on birds	There is potential effect on birds due to noise and dust from haul truck traffic as well as potential bird strikes. This effect is limited to operational phase and was assessed to not be significant.	Section ~~6.9.6~~ 6.12.7 Project Activities and Birds Interactions and Effects
Concern about effect on traditional uses of the Mi'kmaq of Nova Scotia	Traditional uses include hunting, fishing, trapping and gathering medicinal food and plants as per the MEKS completed. Mitigation measures to protect the environment and ongoing engagement will minimize any effect to traditional use and access to resources.	Section ~~6.11.6~~ 6.14.6 Project Activities and Indigenous Peoples Interactions and Effects; Appendix M.1 Mi'kmaq Ecological Knowledge Study

Key Issue	Summary of Proponent Response	Primary EIS Reference
Request to prefer Haul Road option that does not travel along Hwy 224	Based comments received on two options during the stakeholder and Mi'kmaq engagement, the Proponent completed a feasibility review of the second option which does not pass by residences, including Beaver Lake IR17. This was selected and is carried forward in the EA.	Section ~~2.2.2~~ 2.2.1.7 Haul Roads for Transporting Ore; Section ~~2.3.4~~ 2.3.5 Summary of Changes to Project Activities; Section 2.6.6 Ore Transportation
Questions about cumulative effects of multiple projects in the region	A cumulative effects assessment was completed for each VC including current use of lands and resources for traditional purposes. Ongoing engagement specific to the Proponent's existing and any future projects will also occur with the Mi'kmaq of Nova Scotia.	Section 8.6 Cumulative Effects Summary; Section 4.7 Ongoing Indigenous Peoples Engagement
Request ongoing engagement of the Mi'kmaq of Nova Scotia	The Proponent is committed to ongoing Mi'kmaq engagement for the life of the MRC Project, including Beaver Dam Mine Project. Other aspects of Mi'kmaq engagement will continue as per the Mi'kmaq engagement strategy with focus on issues identified as part of the EA and additional issues that may arise as the Project develops.	Section ~~4.7~~ 4.6 Ongoing Indigenous Peoples Engagement; Section ~~6.11.7~~ 6.14.8 Mitigation and Monitoring associated with Indigenous Peoples

The issues raised during Mi'kmaq engagement activities were incorporated into the design of the Project and the development of the EIS. The fundamental change to the Project as a result of Mi'kmaq engagement was the change to the Haul Road to cross Hwy 224 which eliminated the haul trucks passing by the Mi'kmaq community of Beaver Lake. This addressed many concerns with safety, noise, air, and light emissions and other issues related to health and socio-economic aspects. It is the understanding of the Proponent based on engagement with the Mi'kmaq that the changed Haul Road was seen as a positive change as effects on the community of Beaver Lake were greatly reduced through this project design change.

In terms of the development of the EIS, there were no additional VCs included in addition to those identified in the CEA Agency Guidelines associated with the input from the Mi'kmaq of Nova Scotia. The VCs listed in the Guidelines addressed the issues brought forward during engagement. However, specific attention was paid to effects assessment of specific VCs, in particular groundwater and its potential effect on the potable water supply of Beaver Lake and the effect on local surface and groundwater quantity from pit development. In addition, focused questions from the Mi'kmaq of Nova Scotia on potential effects of accidents and malfunctions enhanced the development of this portion of the EIS, including the commitments to contingency planning.

As part of the Proponent's engagement of the Mi'kmaq completed to date on the Beaver Dam Mine Project, the potential effects and the proposed mitigation measures and monitoring programs were generally presented and discussed. The objective was to provide information on the Project to the Mi'kmaq and for the Proponent to better understand the views of the Mi'kmaq on the potential effects and proposed mitigation measures and monitoring programs; this supported the development of the EIS. It is the opinion of the Proponent that Mi'kmaq groups engaged were open to the Project as presented with its mitigation measures and monitoring programs; however, the views of the Mi'kmaq will be further developed as part of the detailed review of this EIS once released as part of their participation in the federal and provincial EA processes, including the federal funding allocated to the Mi'kmaq of Nova Scotia represented by the KMKNO and Sipekne'katik and Millbrook First Nations.

In response to the interest of the Mi'kmaq, the Proponent has made strong commitments to ongoing Mi'kmaq engagement, including specific activities to further support the participation of the Mi'kmaq in this EA process for the Beaver Dam Mine Project. The ongoing engagement ensures that the potential effects of the Project and the proposed mitigation measures and monitoring programs are understood by the Mi'kmaq of Nova Scotia in order to evaluate the effects on their communities and potential or established Aboriginal or treaty rights, title and related interests. It is anticipated the outcomes of ongoing engagement throughout the EA process and beyond will support the Project detailed design in all phases from pre-construction data collection to final reclamation.

The key meetings, site visits, telephone calls, emails, and other correspondence with Mi'kmaq groups engaged are tabulated in Appendix A.2 along with engagement of stakeholders**.**

4.6 Ongoing Indigenous Peoples Engagement

As part of submitting the EIS and EARD to respective government authorities, the engagement to date associated with the Beaver Dam Mine Project was documented, including a summary of issues raised and proponent responses. The Proponent has a broad objective to continue to engage the community and will continue to implement its strategy.

Relative to the Beaver Dam Mine Project, specific commitments are made by the Proponent in terms of Mi'kmaq engagement during the next steps in the EA processes, including:

- Offering to share key aspects of the EIS with staff of Millbrook and Sipekne'katik First Nations and the Assembly, including the MEKS;
- Holding meetings with key staff of KMKNO and Millbrook and Sipekne'katik First Nations;
- Offering opportunities for presentations and site visits to Chief and Councils, specifically Millbrook and Sipekne'katik First Nations,
- Having additional community open houses or site visits as deemed appropriate in consultation with staff and/or leadership of Mi'kmaq communities; and
- Answering specific questions posed directly by the Mi'kmaq to the Proponent by providing additional information and/or holding meetings where feasible.

As part of understanding that engagement planning need to be flexible, the Proponent will address and respond to additional questions or concerns identified or issues noted as the EA moves forward into Project development, operation and reclamation.

The Proponent has a broad objective to continue to engage the Mi'kmaq of Nova Scotia and will continue to implement its strategy. The Proponent is strongly committed to continue its engagement with the Mi'kmaq of Nova Scotia in the ongoing spirit of cooperation and with mutual benefit and respect

5 Environmental Effects Assessment Methodology

5.1 Scope of the Environmental Assessment

5.1.1 Designated Project

The Project being assessed through this EIS is a proposed surface gold mine consisting of the construction, operation, and decommissioning of a surface mine, Haul Road, and processing facility, known as the Beaver Dam Mine Project. The project will encompass three primary locations spanning from Marinette to Moose River Gold Mines, Halifax County, Nova Scotia.

The scope of the Project to be assessed in accordance with *CEAA 2012* and the *Environmental Assessment Regulations* made under the *Nova Scotia Environment Act* include the following components and activities:

Physical Components

- surface mine for extracting ore and waste rock;
- Mine Site roads;
- waste material storage piles for waste rock, till, and topsoil;
- Run-of-mine (ROM), high grade, and low-grade ore stockpiles;
- crusher and operational facilities;~~, and~~
- water management;
- haul roads for transporting ore; and
- Touquoy Mine Site (processing and tailings management using the exhausted Touquoy pit).

Physical Activities

- clearing, grubbing, and grading;
- drilling and rock blasting;
- topsoil, till, and waste rock management;
- existing settling pond dewatering;
- watercourse and wetland alteration;
- Mine Site road construction;
- surface infrastructure installation and construction;
- collection and settling pond construction;
- culvert and bridge upgrades and construction;
- Haul Road construction and upgrades;
- ore processing equipment upgrades;

- tailings line alteration;
- surface mine dewatering;
- ore management;
- waste rock management;
- surface water management;
- petroleum products management;
- site maintenance and repairs;
- ore transport;
- Haul Road maintenance and repairs;
- tailings management (exhausted pit);
- infrastructure demolition;
- site reclamation;
- environmental monitoring; and
- general waste management.

These components and activities reflect the scope of the Project outlined in Section 3.1 of the EIS Guidelines and reflect the components and activities that would occur throughout the duration of the Project. The effects assessment outlined in Section 6 of this EIS is formed based on these components and activities. ~~No facilities for the manufacture and storage of explosives will be present on site, therefore, these items are excluded from the Project scope.~~

Refer to Section 2.2 and Section 2.3 of this EIS for additional details regarding Project components and activities. Refer to Tables 5.7-1, 5.7-2, and 5.7-3 for a review of the potential interactions between valued components (VCs) and the Project components/activities outlined above.

5.1.2 Factors to be Considered

This EIS considers all factors outlined in Section 19(1) of *CEAA 2012* and Section 3.2 of the EIS Guidelines. Specifically, this includes the following:

- environmental effects of the Project, including the environmental effects of malfunctions or accidents that may occur in connection with the Project and any cumulative environmental effects that are likely to result from the Project in combination with other physical activities that have been or will be carried out;
- the significance of effects;
- comments from the public;
- mitigation measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the Project;
- the requirements of the follow-up program in respect of the Project;
- the purpose of the Project;

- alternative means of carrying out the Project that are technically and economically feasible and the environmental effects of any such alternatives;
- any change to the Project that may be caused by the environment; and
- the results of any relevant regional study pursuant to CEAA 2012.

5.1.3 Scope of Factors to be Considered

The scope of the factors to be considered focuses this EIS on relevant issues and concerns. As indicated in Section 5(1) of *CEAA 2012*, the environmental effects that are to be considered regarding an act or thing, a physical activity, a designated project, or a project are:

(a) a change that may be caused to the following components of the environment that are within the legislative authority of Parliament:
  - *(i) fish and fish habitat as defined in subsection 2(1) of the* Fisheries Act*,*
  - *(ii) aquatic species as defined in subsection 2(1) of the* Species at Risk Act*,*
  - *(iii) migratory birds as defined in subsection 2(1) of the* Migratory Birds Convection Act, 1994*, and*
  - *(iv) any other component of the environment that is set out in Schedule 2;*

(b) a change that may be caused to the environment that would occur
  - *(i) on federal lands,*
  - *(ii) in a province other than the one in which the act or thing is done or where the physical activity, the designated project or the project is being carried out, or*
  - *(iii) outside Canada; and*

(c) with respect to aboriginal peoples, an effect occurring in Canada of any change that may be caused to the environment on
  - *(i) health and socio-economic conditions,*
  - *(ii) physical and cultural heritage,*
  - *(iii) the current use of lands and resources for traditional purposes, or*
  - *(iv) any structure, site, or thing that is of historical, archaeological, paleontological, or architectural significance.*

Certain additional environmental effects must be considered under Section 5(2) of CEAA 2012 where the carrying out of the physical activity, the designated project, or the Project requires a federal authority to exercise a power or perform a duty or function conferred on it under any Act of Parliament other than *CEAA 2012*. As the Project may require an authorization from DFO, the following environmental effects have also been considered:

(a) a change~~, other than those referred to in paragraphs 5(1)(a), (b)~~ that may be caused to the environment and that is directly linked or necessarily incidental to a federal authority's exercise of a power or performance of a duty or function that would permit the carrying out, in whole or in part, of the physical activity, the designated project or the Project; and

(b) an effect, other than those referred to in paragraph 1(c), of any change referred to in paragraph (a) on
  - *(i) health and socio-economic conditions,*
  - *(ii) physical and cultural heritage, or*

- *Any structure, site or thing that is of historical, archaeological, paleontological, or architectural significance.*

These categories of direct and indirect environmental effects have been considered in defining the scope of the assessment, including the selection of VCs and identification of spatial and temporal boundaries.

5.2 Overview of Approach

The methodology used to conduct the EA and predict the effects of the Project was developed to meet the requirements of the EIS Guidelines issued by CEAA on January 19, 2016. The EIS Guidelines include requirements for EA's under CEAA 2012 and the *Nova Scotia Environmental Assessment Regulations* made under the *Nova Scotia Environment Act*. In addition to these requirements, the EA methodology was developed to incorporate:

- input from Indigenous Peoples and the public throughout the duration of the Project;
- environmental and social points of interest to the scientific and regulatory communities; and
- other federal, provincial, and municipal legislative and regulatory requirements that may apply to the Project.

The following sections will describe the methodology used to derive:

- the general rationale in ~~valued component~~ VC selection;
- the spatial, temporal, administrative, and technical boundaries for assessing effects on VCs;
- the standard and/or threshold for characterizing and determining significance of residual effects;
- the programs developed to assess the baseline condition of those VCs;
- the anticipated Project and environment interactions for the duration of the Project;
- the prediction of effects that Project activities may have on VCs;
- the mitigation measures that will be used to eliminate, reduce, or control the potential effects of Project activities;
- the residual effects that may remain after mitigation measures are applied and the significance of those residual effects;
- the cumulative effects ~~residual effects of~~ the Project may have in combination with the residual effects of other projects within temporal and spatial confines of the Project;
- the follow-up and monitoring programs proposed to verify the accuracy of predicted impacts; and
- the effects of the environment on the Project.

The defined methodology described herein has allowed the EA Study Team to carefully examine Project activities to ensure they will not cause serious or irreversible harm to the environment.

5.3 Valued Components Selection

The methodology used to conduct this EA is based on the identification and assessment of potential environmental effects of the Project on VCs. VCs refer to environmental, biophysical, or human features that may be affected by the Project that are of value or interest because they have been identified to be of concern to Indigenous Peoples, regulators, the EA Study Team, and/or the general public. Their value not only relates to its role in the ecosystem, but also the value humans place on it.

The selection of VCs was based on consideration of the following:

- regulatory guidance and requirements, specifically those outlined in Section 6.2 of the EIS Guidelines provided by CEAA on January 19, 2016 and Section 5 of CEAA 2012. Refer to Section 5.1.3 of this EIS for a discussion of CEAA 2012 Section 5 requirements;
- a review of federal, provincial, and municipal legislation, including an appraisal of species of conservation interest (SOCI) and SAR. Section 3.3.2 of the EIS Guidelines specifically requires consideration of the factors listed in Section 79 of SARA;
- workshops and discussions with representatives of CEAA, DFO, Environment and Climate Change Canada (ECCC), TC, NSE, and ~~NSDNR~~ NSL&F;
- concerns raised by the public through open house meetings hosted by the Proponent;
- concerns raised by Indigenous Peoples, including traditional ecological knowledge obtained through completion of a Mi'kmaq Ecological Knowledge Study (MEKS);
- technical aspects of the Project, including the nature and extent of Project activities;
- the existing physical, biophysical, and socio-economic conditions and characteristics of the Project area;
- a review of publicly available information and reports submitted in support to nearby and similar environmental assessments; and
- the professional experience of the EA Study Team.

Based on these considerations, the following VCs were selected to facilitate a focused and effective EA:

Physical VCs

- ~~atmospheric environment;~~
- noise, light, greenhouse gases, and air;
- geology, soil, and sediment quality;
- surface water quality and quantity; and
- groundwater quality and quantity.

Biophysical VCs

- wetlands;
- fish and fish habitat;
- habitat and flora;
- terrestrial fauna;
- birds; and
- Species of Conservation ~~Risk~~ Interest and Species at Risk.

Socio-economic VCs

- Indigenous Peoples;

- physical and cultural heritage; and
- ~~human health and~~ socio-economic conditions.

Table 5.3-1 summarizes the rationale for the selection of each VC; however, the rationale is expanded upon in their corresponding subsection within Section 6 of this EIS.

Table 5.3-1 Rationale for Selection of Valued Components

Environment	Valued Component	Relevance to Environmental Impact Statement										VC Selection Rationale
		Project – Environment Interaction	Legal Requirement	Scientific Interest	Biophysical Context	Socio-economic Context	Human Health	Human Quality of Life	Cultural	CEAA or Public Concern	Requirement of EIS Guidelines	
Physical Environment	~~Atmospheric Environment~~ Noise	D I	☑		☑		☑	☑		☑		• Potential for increases in noise • ~~Pathway for potential adverse effects to surface water quality, wetlands, fish and fish habitat, habitat and flora, birds, fauna, SOCI/SAR, and human health~~
	Light	D I	☑		☑		☑	☑		☑		• Potential for increases in ambient light levels
	Air	D I	☑		☑		☑	☑		☑		• Potential for direct adverse effects to air quality
	Greenhouse Gases	D I	☑		☑		☑	☑		☑		• Potential for direct contributions to climate change
	Geology, Soil, and Sediment	D I			☑		☑			☑		• Potential for direct adverse effects to soil and sediment • Potential for ARD from Halifax Formation bedrock

Environment	Valued Component	Relevance to Environmental Impact Statement										VC Selection Rationale
		Project – Environment Interaction	Legal Requirement	Scientific Interest	Biophysical Context	Socio-economic Context	Human Health	Human Quality of Life	Cultural	CEAA or Public Concern	Requirement of EIS Guidelines	
												• Pathway for potential adverse effects to surface water quality, wetlands, fish and fish habitat, habitat and flora, birds, fauna, SOCI/SAR, and human health
	Surface Water Quality and Quantity	D I	☑	☑	☑		☑	☑		☑		• Potential for direct adverse effects to surface water quality • Potential for direct adverse effects to surface water quantity • Pathway for potential adverse effects to wetlands, fish and fish habitat, birds, fauna, SOCI/SAR, and human health
	Groundwater Quality and Quantity	D	☑	☑						☑		• Potential for direct adverse effects to groundwater quality • Potential for direct adverse effects to ground water quantity
Biophysical Environment	Wetlands	D I	☑	☑	☑					☑		• Potential for direct loss and/or adverse effects to wetlands and their function • Pathway for potential adverse effects to surface water quality and quantity, fish and fish habitat, habitat and flora, birds, fauna, and SOCI/SAR

Environment	Valued Component	Relevance to Environmental Impact Statement										VC Selection Rationale
		Project – Environment Interaction	Legal Requirement	Scientific Interest	Biophysical Context	Socio-economic Context	Human Health	Human Quality of Life	Cultural	CEAA or Public Concern	Requirement of EIS Guidelines	
	Fish and Fish Habitat	D I	☑	☑	☑	☑	☑	☑		☑	☑	• Potential for direct adverse effects to fish and fish habitat • Pathway for potential adverse effects to birds, fauna, SOCI/SAR and human health
	Habitat and Flora	D I	☑	☑	☑	☑	☑	☑		☑		• Potential for direct loss of habitat • Potential for direct adverse effects to flora • Pathway for potential adverse effects to the atmospheric environment, surface water quality and quantity, wetlands, fish and fish habitat, birds, fauna, SOCI/SAR, Indigenous Peoples, and human health
	Birds	D I	☑	☑	☑	☑	☑	☑		☑	☑	• Potential for direct adverse effects to birds • Pathway for potential adverse effects to fauna, Indigenous Peoples, and human health
	Fauna	D I	☑	☑	☑	☑	☑	☑		☑		• Potential for direct adverse effects to fauna • Pathway for potential adverse effects to birds, Indigenous Peoples, and human health

Environment	Valued Component	Relevance to Environmental Impact Statement										VC Selection Rationale
		Project – Environment Interaction	Legal Requirement	Scientific Interest	Biophysical Context	Socio-economic Context	Human Health	Human Quality of Life	Cultural	CEAA or Public Concern	Requirement of EIS Guidelines	
	Species of Conservation Interest / Species At Risk	D I	☑	☑	☑					☑	☑	• Potential for direct adverse effects to SOCI/SAR • Pathway for potential adverse effects to birds and fauna
Socio-Economic Environment	Indigenous Peoples	D	☑			☑	☑	☑	☑	☑	☑	• Potential for direct adverse effects to the current use of land and resources for traditional purposes
	Physical and Cultural Heritage	D	☑			☑			☑			• Potential for direct adverse effects to archaeological sites
	~~Human Health and~~ Socio-economic Considerations	D				☑						• Employment opportunities • Economic spin-off • Contribution to government revenue through taxation
Legend (refer to Section 5.7 for examples) Type of Interaction D Direct Interaction I Indirect Interaction												

5.4 Project Boundaries

5.4.1 Temporal Boundaries

The temporal boundaries represent the duration over which Project activities interact with each ~~valued component~~ VC. Generally, the temporal boundary encompasses all Project phases (construction, operation, ~~and~~ decommissioning and reclamation, and post closure); however, the temporal boundary can vary depending on the ~~valued component~~ VC being considered.

The construction phase will be completed in one year, while the operation phase will last four years. Decommissioning and reclamation activities will commence after operation has ceased and likely occur over a three to five year period. Post Closure involves the required monitoring period once active reclamation and decommissioning is complete and is estimated to be 15-20 years in length (timeline for this phase will be refined through on-going geochemical testing and water quality modelling). Temporal boundaries for each VC are described in their corresponding subsection within Section 6 of this EIS.

5.4.2 Spatial Boundaries

The spatial boundaries represent anticipated geographic limits that will aid in defining the scale and range of interactions between Project activities and VCs. The following spatial boundaries will be used for this EIS.

Project Area (PA)

The PA encompasses the immediate area in which Project activities may occur and are likely to cause direct and indirect effects to VCs. This area has also been identified as the study area for the purposes of baseline investigations. The PA includes three primary components from Marinette to Moose River Gold Mines, Halifax County, NS. The Beaver Dam Mine Site will be located at the north end of the Beaver Dam Mines Road and the Haul Road will span from the Beaver Dam Mine Site west to Moose River Gold Mines, where the Touquoy Mine Site [processing and exhausted pit (to be used to dispose Beaver Dam tailings)] is located. ~~Based on Project activities and components, the three distinct PA’s are the Beaver Dam Mine Site, the haul road corridor, and the Touquoy processing and tailings management facility.~~ Figure 5.4-1 outlines the three PA’s (i.e. study areas).

Local Assessment Area (LAA)

The LAA encompasses adjacent areas outside of the PA where Project related effects to VCs are reasonably expected to occur. Generally, the LAA is limited to the area in which Project activities are likely to have indirect effects on VCs; however, the size of the LAA can vary depending on the VC being considered, and the biological and physical variables present.

Regional Assessment Area (RAA)

The RAA encompasses all Project and VC interactions including diffuse or longer range effects such as those from Project activities on the ~~atmospheric environment~~ greenhouse gases, ~~Indigenous Peoples, and the health~~ and socio-economic environments. The RAA may vary in size depending on the VC being considered, and the biological and physical variables present.

Spatial boundaries will vary for each VC and are described in Table 5.4-1, as well as their corresponding subsection within Section 6 of this EIS.

Table 5.4-1 Spatial Boundary Assessment by Valued Component

Environment	Valued Component	Project Area	Local Assessment	Regional Assessment	Spatial Boundary Selection Rationale
Physical Environment	~~Atmospheric Environment~~ Noise	☑	☑		• Effects from the Project on noise may potentially occur within and immediately adjacent to the Project area, therefore, the Project Area and Local Assessment Area are considered.
	Light	☑	☑		• Effects from the Project on ambient light may potentially occur within and immediately adjacent to the Project Area, therefore, the Project area and Local Assessment Area are considered.
	Air	☑	☑		• Effects from the Project on air quality may potentially occur within and immediately adjacent to the Project Area, therefore, the Project area and Local Assessment Area are considered.
	Greenhouse Gases	☑	☑	☑	• Effects from the Project on greenhouses gasses may potentially occur over a diffuse area and are related to provincial initiatives, therefore, the Project Area, Local Assessment Area, and Regional Assessment Area are considered.
	Geology, Soil, and Sediment Quality	☑			• Effects from the Project on geology, soil, and sediment may potentially occur within and immediately adjacent to the Project Area, therefore, the Project Area and Local Assessment Area are considered.
	Surface Water Quality and Quantity	☑	☑		• Effects from the Project on surface water quality and quantity may potentially occur within and immediately adjacent to the Project Area, therefore, the Project Area and Local Assessment Area are considered.
	Groundwater Quality and Quantity	☑	☑		• Effects from the Project on groundwater quality and quantity may potentially occur within and immediately adjacent to the Project Area, therefore, the Project Area and Local Assessment Area are considered.
	Wetlands	☑	☑		• Effects from the Project on wetlands may potentially occur within and immediately adjacent to the Project Area, therefore, the Project Area and Local Assessment Area are considered.

Environment	Valued Component	Project Area	Local Assessment	Regional Assessment	Spatial Boundary Selection Rationale
Biophysical Environment	Fish and Fish Habitat	☑	☑		• Effects from the Project on fish and fish habitat may potentially occur within and immediately adjacent to the Project Area, therefore, the Project Area and Local Assessment Area are considered.
	Habitat and Flora	☑	☑		• Effects from the Project on habitat and flora may potentially occur within and immediately adjacent to the Project Area, therefore, the Project Area and Local Assessment Area are considered.
	Birds	☑	☑		• Effects from the Project on birds may potentially occur within and immediately adjacent to the Project Area, therefore, the Project Area and Local Assessment Area are considered.
	Fauna	☑	☑		• Effects from the Project on fauna may potentially occur within and immediately adjacent to the Project Area, therefore, the Project Area and Local Assessment Area are considered.
	Species of Conservation Interest / Species At Risk	☑	☑		• Effects from the Project on species of conservation interest and species at risk may potentially occur within and immediately adjacent to the Project Area, therefore, the Project Area and Local Assessment Area are considered. ~~• Assessments for SAR/SOCI were also completed within the regional assessment areas (ACCDC reports).~~
Socio-Economic Environment	Indigenous Peoples	☑	☑		• Effects from the Project on Indigenous Peoples may potentially occur within and immediately adjacent to the Project Area, therefore, the Project Area and Local Assessment Area are considered.~~may potentially occur over a diffuse area and are provincial and federal initiatives, therefore, the Project area, local assessment area, and regional assessment area are considered.~~
	Physical and Cultural Heritage	☑			• Effects from the Project on physical and cultural heritage are likely limited to the Project area, therefore, only the Project Area is considered.
	~~Human Health and~~ Socio-economic Considerations	☑	☑	☑	• Effects from the Project on ~~human health and~~ socio-economic considerations of the area may potentially occur over a diffuse area, therefore, the Project Area, Local Assessment Area, and Regional Assessment Area are considered.

5.4.3 Administrative Boundaries

The administrative boundaries represent the regulatory, public policy, and/or economic limitations placed on the execution of the Project. The majority of administrative boundaries for the Project are outlined in Section 1.3 of this EIS. Administrative boundaries for each VC are described in their corresponding subsection within Section 6 of this EIS.

5.4.4 Technical Boundaries

The technical boundaries represent the limits of the EA Study Team's ability to assess a VC. The limitations to measure, assess, and/or monitor the effects of the Project on VCs may be theoretical or physical. These technical boundaries may create gaps in knowledge and understanding related to key conclusions, therefore, limiting the EA Study Team's ability to predict potential effects of the Project on a VC. Technical boundaries for each VC are described in their corresponding subsection within Section 6 of this EIS.

5.5 Standards or Thresholds for Characterizing and Determining Significance of Effects

Criteria or established thresholds for determining the significance of residual effects from Project activities are described for each VC in their corresponding subsection within Section 6 of this EIS. These criteria or threshold were developed through the following avenues:

- consultation with appropriate regulatory agency responsible for each VC;
- using information obtained in stakeholder and right holder consultation;
- using available information on the status and characteristic of each VC;
- using applicable regulatory documents, environmental standards, guidelines, and/or objectives, and
- using professional judgement of the EA Study Team.

These criteria or thresholds establish a level beyond which a residual effect would be considered significant. Thresholds may be based on regulations, standards, resource management objectives, scientific literature, and/or ecological processes. Significance criteria has been defined quantitatively where possible, and qualitatively with supporting justifications where no standards exist.

Additional analysis as defined in Table 5.10-1 is also identified and supports the characterization and significance determination for residual effects.

5.6 Baseline Conditions

Baseline conditions for each physical, biophysical, and socio-economic VC are described in their corresponding subsection within Section 6 of this EIS in order to characterize the existing environment for which the Project is being undertaken, to establish an understanding of the receiving environment, and to provide sufficient context to enable an understanding of how the Project may affect existing environmental conditions. Inclusion of existing conditions is limited to that which is necessary to assess the effects of the Project and support the development of mitigation measures, monitoring and follow-up programs. Existing conditions consider the effects of past and current projects occurring within and outside of the PA.

Various methodologies were employed to obtain baseline conditions for each VC. Those methodologies are outlined for each VC in their corresponding subsection within Section 6 of this EIS.

5.7 Anticipated Project-Environment Interaction

Interactions between Project activities, and the VCs outlined in Section 5.3 of this EIS will either be direct or indirect.

Direct interactions between the Project and VCs are typically more obvious and can be logically expected based on a good understanding of Project activities, and existing physical, biophysical, and socio-economic conditions and characteristics of the Project Area. Indirect interactions are less obvious and typically require an active pathway between Project activities and the VCs they are affecting. A pathway provides a link between a Project component or activity and VC, and facilitates the interaction and potential effect.

As an example, a direct effect may be the potential loss of a wetland through clearing, grubbing, and grading in preparation of surface mine construction. Clearing, grubbing, and grading may also decrease infiltration and therefore increase runoff from the site; resulting in a potential indirect effect on surface water quality and quantity. Poor surface water quality and quantity may then affect fish and fish habitat; this is an example of a VC acting as both the receptor of an effect and the pathway for an effect.

In order to determine the potential direct and indirect interactions between Project activities, and VCs the EA Study Team conducted the following:

- reviewed the anticipated components and activities required to construct, operate, and decommission the Project;
- selected VCs that may have the potential to be directly or indirectly affected ~~effected~~ by Project activities;
- assessed the direct effects that Project activities may have on VCs;
- identified anticipated pathways between Project activities and any receiving VCs; and
- assessed the indirect effect that Project activities may have on VCs.

Once the direct or indirect interaction between Project activities and VCs is established, assessing the magnitude ~~and~~ duration, and other criteria for significance determination of the effects of those interactions becomes much easier. Subsequently, evaluating mitigation measures to eliminate, reduce, or control the effects of those interactions becomes easier as well.

Accidents and malfunctions have been considered for every phase of the Project, however, they are separated in the Project-VC interaction table to present the actual accidents and malfunctions that may occur during these phases.

Table’s 5.7-1, 5.7-2, and 5.7-3 present the anticipated Project component and activities, and VCs interaction for ~~each Project area~~ the Beaver Dam Mine Site, Haul Road and the Preferred Alternative Haul Road, and Touquoy Mine Site. The rationale for including the Haul Road and the Preferred Alternative Haul Road in a single Table (Table 5.7-2) is that the project activities are consistent between each option.

Interactions noted in Table 5.7-3 are specific to those that relate to new interactions as a result of the ~~Beaver Dam Mine~~ Project and not those that pre-exist at Touquoy Mine Site as part of that site’s development, operation and reclamation.

Table 5.7-1 Potential Valued Components Interactions with Project Activities at Beaver Dam Mine Site

	Valued Components															
	Physical							Biophysical						Socio-economic		
	Noise	Light	Air	Greenhouse Gases	Geology, Soil, and Sediment Quality	Groundwater Quality and Quantity	Surface Water Quality and Quantity	Wetlands	Fish and Fish Habitat	Habitat and Flora	Terrestrial Fauna	Birds	SAR	Indigenous Peoples	Physical and Cultural Heritage	~~Health and Socioeconomic conditions~~
Site Preparation and Construction																
Clearing, Grubbing, and Grading	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Drilling and Rock Blasting	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Topsoil, Till, and Waste Rock Management	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Existing Settling Pond Dewatering					☑	☑	☑	☑	☑	☑		☑	☑	☑		
Watercourse and Wetland Alteration	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Mine Site Road Construction, including lighting	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Surface Infrastructure Installation and Construction, including lighting	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Collection and Settling Pond Construction, including lighting	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Environmental Monitoring														☑		☑
General Waste Management	☑	☑	☑	☑			☑				☑	☑	☑			
Operation and Maintenance																
Drilling and Rock Blasting	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑		☑
Surface Mine Dewatering	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑		☑
Ore Management	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑		☑
Waste Rock Management	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Surface Water Management					☑	☑	☑	☑	☑	☑	☑	☑	☑	☑		☑
Petroleum Products Management				☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑		☑
Site Maintenance and Repairs, including lighting	☑	☑	☑	☑			☑				☑	☑	☑	☑		☑
Environmental Monitoring														☑		☑

	Valued Components															
	Physical							Biophysical						Socio-economic		
	Noise	Light	Air	Greenhouse Gases	Geology, Soil, and Sediment Quality	Groundwater Quality and Quantity	Surface Water Quality and Quantity	Wetlands	Fish and Fish Habitat	Habitat and Flora	Terrestrial Fauna	Birds	SAR	Indigenous Peoples	Physical and Cultural Heritage	~~Health and Socioeconomic conditions~~
General Waste Management	☑	☑	☑	☑			☑				☑	☑	☑			
<u>Decommissioning and Reclamation</u>																
Infrastructure Demolition	☑	☑	☑	☑	☑		☑				☑	☑		☑		☑
Site Reclamation	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑		☑
Environmental Monitoring														☑		☑
General Waste Management	☑	☑	☑	☑			☑				☑	☑	☑			
<u>Accidents and Malfunctions</u>																
Fuel and/or other Spills		☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑		☑
Fire		☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑		☑
Slope Failure					☑	☑	☑	☑	☑	☑	☑	☑	☑		☑	☑
Collection/Settling Pond Failure					☑	☑	☑	☑	☑	☑	☑	☑	☑	☑		☑
Unplanned Explosive Event	☑		☑	☑	☑		☑	☑	☑	☑	☑	☑	☑	☑		☑
Mobile Equipment Accident	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑		☑	☑	☑	☑

Table 5.7-2 Potential Valued Components Interactions with Project Activities along Haul Road and Preferred Alternative Haul Road

	Valued Components															
	Physical							Biophysical						Socio-economic		
	Noise	Light	Air	Greenhouse Gases	Geology, Soil, Sediment Quality	Groundwater Quality and Quantity	Surface Water Quality and Quantity	Wetlands	Fish and Fish Habitat	Habitat and Flora	Terrestrial Fauna	Birds	SAR	Indigenous Peoples	Physical and Cultural Heritage	Socio-economic Conditions
Site Preparation and Construction																
Clearing, Grubbing, and Grading	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Drilling and Rock Blasting	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Topsoil, Till, and Waste Rock Management	☑	☑	☑	☑	☑		☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Watercourse and Wetland Alteration	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Culvert and Bridge Upgrades and Construction/Removal	☑	☑	☑	☑	☑		☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Haul Road Construction and Upgrades	☑	☑	☑	☑	☑		☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Environmental Monitoring														☑		☑
General Waste Management	☑	☑	☑	☑	☑		☑	☑	☑	☑	☑	☑	☑			
Operation and Maintenance																
Ore Transport	☑	☑	☑	☑	☑	☑	☑				☑			☑		☑
Road Lighting		☑									☑	☑	☑	☑		
Haul Road Maintenance and Repairs	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑		☑
Environmental Monitoring														☑		☑
Accidents and Malfunctions																
Fuel and/or other Spills			☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑		☑
Fire		☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑		☑
Haul Truck Accident	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑			☑		☑

Table 5.7-3 Potential Valued Components Interactions with Project Activities at Touquoy Mine Site ~~Processing and Tailings Management Facility~~

	Valued Components															
	Physical							Biophysical						Socio-economic		
	Noise	Light	Air	Greenhouse Gases	Geology, Soil, and Sediment Quality	Groundwater Quality and Quantity	Surface Water Quality and Quantity	Wetlands	Fish and Fish Habitat	Habitat and Flora	Terrestrial Fauna	Birds	SAR	Indigenous Peoples	Physical and Cultural Heritage	Socio-economic Conditions
<u>Site Preparation and Construction</u>																
Ore Processing Equipment Upgrades	☑	☑	☑	☑						☑				☑		
Tailings Line Alteration	☑						☑									
Environmental Monitoring														☑		☑
General Waste Management	☑	☑	☑	☑			☑				☑	☑	☑			
<u>Operation and Maintenance</u>																
Lighting of facility and Mine Site roads		☑										☑				
Ore Management and Processing	☑	☑				☑	☑									
Tailings Management (exhausted pit)	☑	☑				☑	☑		☑			☑	☑			
Environmental Monitoring														☑		☑
General Waste Management	☑	☑	☑	☑		☑	☑	☑	☑	☑	☑	☑	☑			
<u>Decommissioning and Reclamation</u>																
Environmental Monitoring														☑		☑
<u>Accidents and Malfunctions</u>																
Fuel and/or other Spills			☑		☑	☑	☑	☑	☑	☑	☑	☑	☑	☑		☑
Fire	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑		☑
Mobile Equipment Accident	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑			☑		☑
Tailings/Reclaim Waterline Event							☑		☑							
Cyanide Release			☑			☑	☑		☑	☑	☑	☑	☑	☑		☑

5.8 Effects Prediction

Potential Project-related effects are changes to the physical, biophysical, and/or human environment that are caused by Project activities. Interactions between VCs and Project activities are described in corresponding subsections within EIS Section 6 and form the basis for effects prediction. Establishment of interaction relationships between VCs and Project activities is described in EIS Section 5.7. Once these interaction relationships are established, determination of changes to VCs, defined as effects, as a result of Project activities is accomplished through:

- predicting adverse effects from Project activities, and evaluating the scope and scale of those effects;
- predicting adverse effects from the Preferred Alternative Haul Road;
- detailing mitigation measures triggered through regulatory requirements and/or best management practices to eliminate, reduce, or control the effect Project activities have on VCs;
- predicting cumulative effects from other projects occurring in the same spatial and temporal boundaries;
- determining residual effects remaining after mitigation measures are considered and cumulative effects are identified, to assess the significance of those effects in the context of each VC.

~~In order to determine if effects are significant prior to mitigation measures being implemented, thresholds for determination of significance will be developed for each individual VC based on the following:~~

5.9 Mitigation Measures

A variety of mitigation measures are typically available to eliminate, reduce, or control the effect Project activities have on the environment. These measures range from procedures within standard industry best management practices for construction and operation, policies and practices communicated through training programs and management plans, and/or engineering controls incorporated into the final design. Given the Proponents' experience with gold mining in the region, specifically the Touquoy Project, as well as past experience outlined in EIS Section 1.2.2, a number of mitigation measures were proactively incorporated into the Project design in order to eliminate, reduce, and/or control the effect of Project activities on the environment. Mitigation measures that are technically and economically feasible are considered for specific Project activity effects on VCs are described in corresponding subsections within EIS Section 6.

5.10 Residual Effects and the Determination of Significance

Residual effects are effects to VCs that are predicted to remain even after the implementation of mitigation measures. The process by which they are identified is as follows:

- Determine the potential interactions between VCs and Project activities and the effects those interactions will have;
- Assess effect of each mitigation strategy applied to the interactions;
- Characterize the extent and nature of the remaining, residual effects after mitigation measures have been applied for the Project;
- Characterize the extent and nature of the remaining, residual effects after mitigation measures have been applied for the Preferred Alternative Haul Road; and,

- Evaluation of the Project with each Haul Road option (Primary Haul Road and Preferred Alternative Haul Road).

In order to identify if residual effects are significant or not, consideration of the magnitude, geographical extent, duration, frequency, and reversibility~~, and ecological and social context~~ is required. Table 5.10-1 provides a description of these effects characteristics and the varying degrees in which they can contribute to the significance of an effect. Where possible, criteria will be described quantitatively. When residual effects cannot be characterized quantitatively, they will be characterized qualitatively.

It should be noted that each of the criteria will also incorporate the social and ecological context, reflecting the importance of the environmental attribute or feature to ecosystem health and function as well as the influence of past and current human activity and the disturbance associated with that activity. Further, timing considerations will be noted in the evaluation of the residual environmental effect for each VC, where applicable or relevant. For example, if the VC has a period of time for sensitive life stages (i.e. breeding/spawning), the VC will provide a description of the timing considerations as part of the evaluation.

Table 5.10-1 Characterization Criteria for Residual Environmental Effects

Characterization	Description	~~Definition of Qualitative Categories~~ Quantitative Measure or Definition of Qualitative Categories
Magnitude	The size or degree of the effects compared against baseline conditions or reference levels, and other applicable measurement parameters (i.e., standards, guidelines, objectives) ~~Refers to the expected size and/or severity of an adverse effect relative to existing conditions on a valued component from Project activities after mitigation~~	**Negligible (N)** – Differing from the average value for the existing environment/baseline conditions to a small degree, but within the range of natural variation and below a threshold value ~~no effect to valued component from Project activities~~ **Low (L)** – Differing from the average value for the existing environment/baseline conditions, outside the range of natural variation, and less than or equal to appropriate guideline or threshold value ~~an effect to VCs from Project activities but within the range of natural variability and does not affect population viability~~ **Moderate (M)** – Differing from the existing environment/ baseline conditions and natural variation, and marginally exceeding a guideline or threshold value ~~an effect to VCs from Project activities temporarily outside the range of natural variability and does not affect population viability~~ **High (H)** – Differing from the existing environment/ baseline conditions and natural variation, and exceeding a guideline or threshold value ~~an effect to VCs from Project activities exceeding the range of natural variability and may affect long term population viability~~
Geographic Extent	The geographic area over or throughout which the effects are likely to be measurable ~~Refers to the spatial extent of an adverse effect on a valued component from Project activities after mitigation~~	**Project Area (PA)** – the residual environmental direct and indirect ~~direct and indirect effects from Project activities are restricted to the Project area~~ **Local Assessment Area (LAA)** – Occurs beyond the PA and within the LAA ~~indirect effects from Project activities are restricted to the local assessment area immediately adjacent to the Project area~~ **Regional Assessment Area (RAA)** – Occurs beyond the PA and LAA and within the RAA ~~effects from Project activities extend beyond the Project area and local assessment area to effect a more diffuse and longer range geographic area~~

Characterization	Description	~~Definition of Qualitative Categories~~ Quantitative Measure or Definition of Qualitative Categories
Timing	Considers when the residual environmental effect is expected to occur. Timing considerations are noted in the evaluation of the residual environmental effect, where applicable or relevant.	**Not Applicable (N/A)** — seasonal aspects are unlikely to affect VC's (i.e. fisheries productivity). **Applicable** — seasonal aspects may affect VC's (i.e. fisheries productivity).
Duration	The time period over which the effects are likely to last ~~Refers to the period of time an adverse effect on a valued component from Project activities will persist after mitigation~~	**Short-Term (ST)** – effects are limited to occur from as little as 1 day to 12 months ~~effects extend for a portion of the Project activities~~ **Medium-Term (MT)** – effects can occur beyond 12 months and up to 3 years ~~effects extend through to the end of the Project activities~~ **Long-Term (LT)** – effects extend beyond 3 years ~~the end of the Project activities~~ **Permanent (P)** – valued component unlikely to recover to baseline conditions
Frequency	The rate of recurrence of the effects (or conditions causing the effect) ~~Refers to the number of times an adverse effect on a valued component from Project activities will occur after mitigation~~	**Once (O)** – effects occur once **Sporadic (S)** – effects occur at irregular intervals throughout the Project **Regular (R)** – effects occur at regular intervals throughout the Project **Continuous (C)** – effects occur continuously throughout the Project
Reversibility	The degree to which the effects can or will be reversed (typically measured by the time it will take to restore the environmental attribute or feature) ~~Refers to the potential that a valued component will recover to baseline conditions once reclamation,~~	**Reversible (R)** – VCs will recover to baseline conditions before or after Project activities have been completed. **Partially Reversible (PR) -** mitigation cannot guarantee a return to baseline conditions **Irreversible (IR)** – effects to VCs are permanent and will not recover to baseline conditions

Characterization	Description	~~Definition of Qualitative Categories~~ Quantitative Measure or Definition of Qualitative Categories
	~~restoration, compensation, and offset programs are considered~~	
~~Ecological or Social Context~~	~~Refers to the general setting and influence of past and current human activity and the disturbance associated with that activity~~	~~**High Disturbance (HD)** – effect to valued component occurs within a high disturbed area that has significant human presence~~ ~~**Moderate Disturbance (MD)** – effect to valued component occurs within a moderately disturbed area that has periodic human presence~~ ~~**Low Disturbance (LD)** – effect to valued component occurs in a relatively pristine area that has infrequent human presence~~

In conjunction with the effects characteristics outlined in Table 5.10-1, each VC will be assigned a standard or threshold as described in Section 5.5 of this EIS to determine the significance of an effect caused by the Project.

5.11 Follow-up and Effects Monitoring

Follow-up is a process to verify the accuracy of predicted effects and determine the degree to which mitigation measures were successful in eliminating, reducing, or controlling those effects. Follow-up programs will be developed for the ~~Beaver Dam Mine~~ Project and will be developed through careful consideration of each VC after effects assessment has occurred. These programs are outlined for each VC in their corresponding subsection within Section 6 of this EIS.

The Proponent will also evaluate the need for effects monitoring to ensure regulatory compliance. To supplement the effects monitoring, the Proponent will also develop and implement environmental management and contingency plans to prevent or address accidents or malfunctions that have the potential to occur and produce unexpected effects throughout the life of the Project.

5.12 Effects of the Environment on the Project

Effects of the environment on the Project consider potential changes to the Project that may result from interactions with the environment. Project components and activities were reviewed for interaction with the natural environment and effects caused by variations in meteorological conditions from wind, ice, and extreme precipitation events, as well natural hazards like seismic activity. A significant effect on the Project from the environment would include, but not be limited to, the following:

- environmental conditions cause harm to Project personnel and/or the public;
- environmental conditions cause extended delays in construction or a shutdown of operations;
- environmental conditions damages infrastructure and compromises safety; and
- environmental conditions damages infrastructure to the point repair is not feasible.

The assessment of effects of the environment on the Project includes discussion regarding potential interactions, as well as details regarding planning, design, and construction strategies for reducing the likelihood of potential effects on the Project, thereby reducing the likelihood of accidents and malfunctions caused by the environment.

Project components and activities have been designed to consider the hazards and limitations imposed by the natural environment on the Project. The effects of the environment on the Project are discussed further in Section 7.0.

6 Environmental Effects Assessment

Section 6.1 Environmental Effects Assessment in the EIS, has been replaced by 6.1 Noise, 6.2 Air, 6.3 Air, and 6.4 Greenhouse Gases in the revised EIS to provide a more thorough assessment of the identified VCs. The Air Section (6.2), Groundwater Section (6.6), Surface Water (6.7) and Indigenous (6.14) are updated stand alone sections due to quantitative modelling inclusion, and provision of additional data and analysis for the effects on Indigenous Peoples. All other chapters are edited, with mark up shown, to address Information Requests (IRs).

Each VC section has a stand alone Preferred Alternative Haul Road sub-section to evaluate this option, and a corresponding residual table for the Preferred Alternative Haul Road. Section 10 provides a summary of the identified residual effects of the Beaver Dam Mine Project, along side the Beaver Dam Mine Project with consideration of the Preferred Alternative Haul Road option.

6.1 Noise

6.1.1 Rationale for Valued Component Selection

Noise will be generated throughout the life of the Project at the Beaver Dam Mine Site, Haul Road, and Touquoy Mine Site. Sources of Project-related noise will include heavy machinery during the construction phase and heavy truck traffic during the construction and operational phases. The majority of mining operations will occur in the pit well below current ground surface, which will attenuate the effects of noise. During the construction and operation phase of the Beaver Dam Mine Site, rock blasting using explosives is a source noise and vibration that would be generated.

Noise and Vibration is provincially regulated via the *Workplace Health and Safety Regulations* and the *Pit and Quarry Guidelines* (1999), which protects the health of site workers and the general public at Project area boundaries, respectively. Changes to ambient noise levels and the presence of periodic vibrations have the potential to adversely affect fauna and birds by influencing migration and behavioral patterns.

6.1.2 Baseline Program Methodology

Baseline ambient noise levels were evaluated using a Quest Sound Pro-DL Class 1 Precision Integrating sound level metre (serial number BGG040024). Data collected was evaluated against the provincial *Pit and Quarry Guidelines* as a reference. Sound level measurements were collected at several sample locations near the Beaver Dam Mine Site boundary and along the Haul Road, and one location at the Touquoy Mine Site, taking into consideration the nearest receptors and proposed mining equipment operational locations. Sound level measurements were not undertaken at any additional locations (such as at the nearest residence to the Beaver Dam Mine Site). Ambient noise levels in the vicinity of the Beaver Dam Mine Site and the Haul Road provide a more conservative baseline for comparative purposes.

A preliminary acoustical model was undertaken to provide an order of magnitude estimation of the estimated noise from the crushing operations at the Beaver Dam Mine Site and haul truck travel along the Haul Road. The model included a generic crushing operation, including a jaw crusher, cone crusher, and screener placed at grade, as these are typically the loudest sources of noise, and considered site-specific topography. The noise sources and topography were input into an industry standard acoustic model. Computer Aided Noise Abatement Acoustical Modeling Software (Cadna A), version 4.6, is based on the

ISO 9613-2 standard "Acoustics – Attenuation of Sound During Propagation Outdoors - Part 2: General Method of Calculation." The Cadna A model is the industry standard for environmental noise modeling in Canada. The nearest receptor considered in the preliminary acoustical model included Beaver Lake IR 17, located approximately 5 km from the Mine Site and 3 km from the nearest point of the Haul Road.

A second acoustic assessment was conducted as part of the 2017 Noise Impact Study for the Project, focusing on seasonal and permanent receptors at both the Beaver Dam Mine Site and Touquoy Mine Site property boundaries (no residential points of reception). The impact of the proposed noise was quantified and compared with *Guidelines for Environmental Noise Measurement and Assessment* (2005), and *Pit and Quarry Guidelines* (1999) as defined in NSE documents. An estimated worst case facility sound level measurement for a 1 hour period was estimated for each receptor.

In order to predict the future worst-case noise impacts from the Project activities, representative octave band noise data was used, measured from processing equipment similar to what is noted to be required for the Project. This data was obtained from the Department of Environment Food and Rural Affairs (DEFRA) "Update of Noise Database for Prediction of Noise on Construction and Open Sites, 2005 and 2006". The United States Department of Transportation, Federal Highway Administration (FHWA) document "FHWA Roadway Construction Noise Model User's Guide, 2006" was used as a supplemental document to obtain sound level data for equipment not listed by DEFRA. Details of this assessment are found in Appendix B.1.

An acoustic assessment was conducted as part of the 2007 Focus Report for the Touquoy Mine Site, focusing on sound emissions from noise sources identified at the facility and determining effects on sensitive receptors including; Camp Kidston (3 km north of the Touquoy mine), the nearest full time resident (5 km north of the proposed open pit) and the Scraggy Lake area. Sound level impacts were compared to the Nova Scotia Guidelines for Environmental Noise Measurement and Assessment. An estimated worst case facility sound level measurement for a 1 hour period was estimated for each receptor near Touquoy Mine Site ~~(Figure 6.1-1).~~

The Table 6.1-1 below summarizes the baseline noise monitoring locations that are also shown on Figure 6.1-1.

Table 6.1-1 Baseline Noise Monitoring Locations

Sample Location	General Area	Sample Location Rationale
Location #1 (2008)	Approx. 450 m south of Crusher Lake	On site boundary, near Waste Rock Storage area
Location #2 (2008)	West end of Crusher Lake	500 m west of site boundary, northwest of Waste Rock Storage
Location #3 (2008)	Near northwest end of Cameron Flowage, east of Mud Lake	North edge of site boundary, at pit and water diversion channel
AN#1	North of Cameron Flowage	North of Pit
AN#2	West end of Crusher Lake	400 m west of site boundary, northwest of Waste Rock Storage; in close proximity to Location #2 (2008)

Sample Location	General Area	Sample Location Rationale
AN#3	East southeast of proposed stockpile area and ROM Pad	400 m east of site boundary, in Stockpile and ROM Pad area.
AN#4	Near junction of Beaver Dam Mines Road and Hwy 224, approx. 1.35 km NNW of Hwy 224	Proposed crusher location
Beaver Dam Road	Near junction of Beaver Dam Mines Road and Hwy 224, approx. 300 m NNW of Hwy 224.	East end of Haul Road
Mooseland Road	130 m north of Mooseland Road, 560 m east of Haul Road	West end of Haul Road
Location 1 (Touquoy)	North of the proposed open pit	Proposed open pit location
~~Location 2 (Touquoy)~~	~~Northeast of the proposed open pit~~	~~Proposed open pit location~~
~~Location 3 (Touquoy)~~	~~South of the proposed open pit~~	~~Proposed open pit location~~
~~Location 4 (Touquoy)~~	~~North of the Touquoy Gold Mine on Mooseland Road~~	~~North of the Touquoy Gold Mine~~
~~Location 5 (Touquoy)~~	~~East of the Touquoy Gold Mine on Mooseland Road~~	~~East of the Touquoy Gold Mine~~

6.1.3 Baseline Conditions

6.1.3.1 Ambient Noise

Ambient noise has been sampled at several representative locations. The key sensitive receptor in the area is the Beaver Lake IR 17; a satellite community of the Millbrook First Nation located approximately 5 km south of the Beaver Dam Mine Site. At its nearest point, the Haul Road is approximately 3 km east of Beaver Lake IR 17. Other receptors in the area include a permanent residence, and seasonal camps/cottages ~~along~~ near the Beaver Dam Mines Road at Highway 224, seasonal camps/cottages on the Cross Road near Mooseland Road, and residences along Mooseland Road. Receptors are located further along Highway 224 and Mooseland Road ~~in other directions increases in distance~~ up to 18 km over considerable changes in topography and are generally forested. Activities in these areas are ongoing and include recreational use (hunting, ATVs, etc).

Camp Kidston, which operates only in the summer months, is located 3.5 km northeast of the Touquoy Mine Site. The nearest permanent full-time occupied residences from the Touquoy Mine Site are located approximately 5.8 km to the north of the open pit along Caribou Road. The next closest permanent residences to the Touquoy Mine Site are approximately 7.4 km to the northwest and 11.7 km to the southeast. Sampling locations are shown in Figure 6.1-1.

Noise data was recorded in A-weighted decibels (dBA) and presented as equivalent continuous noise level (L_{eq}) averaged over a time period and compared to Nova Scotia Environment criteria by time of day.

Table 6.1-2 Baseline Ambient Noise Levels

Monitoring Location	Date	Time	Average Leq Value	NSE Criteria
Location #1 Waste Rock Pile (near current secondary logging road)				
	June 16, 2008	12:00 – 18:59	50.5	0700-1900 <65 dBA
	June 16, 2008	19:00 – 22:59	47.3	1900-2300 <60 dBA
	June 16-17, 2008	23:00 – 06:59	48.1	2300-0700 <55 dBA
	June 17, 2008	07:00 – 18:59	55.1	0700-1900 <65 dBA
	June 17, 2008	19:00 – 22:59	47.2	1900-2300 <60 dBA
	June 17-18, 2008	23:00 - 06:59	**58.9**	2300-0700 <55 dBA
	June 18, 2008	07:00 – 18:59	**67.0**	0700-1900 <65 dBA
	June 18, 2008	19:00 – 22:59	**62.0**	1900-2300 <60 dBA
	June 18-19, 2008	23:00 - 06:59	**60.2**	2300-0700 <55 dBA
	June 19, 2008	07:00 – 09:51	59.1	0700-1900 <65 dBA
Location #2 Northwest of Beaver Dam Mine Site (near secondary logging road)				
	June 11, 2008	11:30 – 18:59	32.0	0700-1900 <65 dBA
	June 11, 2008	19:00 – 22:59	31.0	1900-2300 <60 dBA
	June 11-12, 2008	23:00 - 06:59	30.2	2300-0700 <55 dBA
	June 12, 2008	07:00 – 18:59	41.6	0700-1900 <65 dBA
	June 12, 2008	19:00 – 22:59	38.1	1900-2300 <60 dBA
	June 12-13, 2008	23:00 - 06:59	31.6	2300-0700 <55 dBA
	June 13, 2008	07:00 – 18:59	51.1	0700-1900 <65 dBA
Location #3 North of Beaver Dam Mine Site (wilderness location on topographic high)				
	June 6, 2008	15:00 – 18:59	34.7	0700-1900 <65 dBA
	June 6, 2008	19:00 – 22:59	29.2	1900-2300 <60 dBA

Monitoring Location	Date	Time	Average Leq Value	NSE Criteria
	June 6-7, 2008	23:00 - 06:59	28.4	2300-0700 <55 dBA
	June 7, 2008	07:00 – 18:59	34.3	0700-1900 <65 dBA
	June 7, 2008	19:00 – 22:59	30.0	1900-2300 <60 dBA
	June 7-8, 2008	23:00 - 06:59	31.0	2300-0700 <55 dBA
	June 8, 2008	07:00 – 18:59	34.2	0700-1900 <65 dBA
	June 8, 2008	19:00 – 22:59	35.3	1900-2300 <60 dBA
	June 8-9, 2008	23:00 - 06:59	33.2	2300-0700 <55 dBA
	June 9, 2008	07:00 – 14:40	38.1	0700-1900 <65 dBA
AN#1 Northeast of Beaver Dam Mine Site (beside primary logging road)				
	October 20, 2014	13:26 – 18:59	45.8	0700-1900 <65 dBA
	October 20, 2014	19:00 – 22:59	30.9	1900-2300 <60 dBA
	October 20-21, 2014	23:00 - 06:59	30.0	2300-0700 <55 dBA
	October 20-21, 2014	07:00 – 11:58	32.4	0700-1900 <65 dBA
AN#2 Northwest of Beaver Dam Mine Site (near secondary logging road)				
	November 20, 2014	11:36 – 18:59	33.6	0700-1900 <65 dBA
	November 20, 2014	19:00 – 22:59	34.6	1900-2300 <60 dBA
	Nov. 20-21, 2014	23:00 - 06:59	27.4	2300-0700 <55 dBA
	November 21, 2014	07:00 – 11:30	32.4	0700-1900 <65 dBA
AN#3 South of crusher location (along primary logging road)				
	November 20, 2014	11:13 – 18:59	36.4	0700-1900 <65 dBA
	November 20, 2014	19:00 – 22:59	38.5	1900-2300 <60 dBA
	Nov. 20-21, 2014	23:00 - 06:59	29.3	2300-0700 <55 dBA
	November 21, 2014	07:00 – 11:12	29.9	0700-1900 <65 dBA
Beaver Dam Road (Haul Road) (near Highway 224)				
	September 8, 2016	11:26 -18:59	44.2	0700-1900 <65 dBA

Monitoring Location	Date	Time	Average Leq Value	NSE Criteria
	September 8, 2016	19:00 – 22:59	43.1	1900-2300 <60 dBA
	September 8-9, 2016	23:00 - 06:59	42.5	2300-0700 <55 dBA
	September 9, 2016	07:00 – 11:59	44.6	0700-1900 <65 dBA
Mooseland Road (Haul Road) (south of proposed truck route)				
	September 20, 2016	15:42 – 18:59	31.1	0700-1900 <65 dBA
	September 20, 2016	19:00 – 22:59	34.1	1900-2300 <60 dBA
	Sept. 20-21, 2016	23:00 - 06:59	36.0	2300-0700 <55 dBA
	September 21, 2016	07:00 – 15:37	36.9	0700-1900 <65 dBA
Location #1 (Touquoy Mine Site) (north of proposed open pit)				
	January 9, 2007	19:00 – 22:59	44.8	1900-2300 <60 dBA
	January 10, 2007	07:00 – 14:59	44.9	0700-1900 <65 dBA
	January 10, 2007	15:00 – 23:59	40.9	1900-2300 <60 dBA
	January 11, 2007	0:00 – 06:59	40.2	2300-0700 <55 dBA
	January 11, 2007	07:00 – 18:59	42.9	0700-1900 <65 dBA
	January 11, 2007	19:00 – 22:59	41.4	1900-2300 <60 dBA
	January 11-12, 2007	23:00 – 06:59	40.7	2300-0700 <55 dBA

Note: **Bold underline** - represent exceedances

Sound level measurements for all sample locations, except for Location #1 at the Beaver Dam Mine Site, met NSE *Pit and Quarry* criteria for all time intervals. Sample Location #1 was approximately 10 feet from a hauling road that was in use during the monitoring period contributing to elevated noise level readings. Typical sound sources would include recreational vehicles, traffic on local roadways and contribution from existing forestry operations. The degree to which these sources would influence the existing noise levels would vary depending on the time of day and season.

The noise monitoring locations were chosen to be representative receptors and also to understand the ambient noise at the Beaver Dam Mine Site, along the Haul Road, and at the Touquoy Mine Site. Location #1, 2 and 3 and AN #1, 2, and 3 were placed so to understand the noise levels directly around the Beaver Dam Mine Site. The Beaver Dam Mines Road site was chosen as the closest receptor to a ~~dwelling~~ permanent resident to the Beaver Dam Mine Site and the Haul Road. It is a surrogate for the Beaver Dam IR 17 location because the monitoring site would be more greatly affected by noise tha~~n~~ the IR but would also record the same vehicle traffic from Highway 224 as would pass by the Beaver Dam IR. The IR is located approximately 3 km north of this monitoring location. The Mooseland Road monitoring location was chosen as a mid-point between the nearest dwelling on the Mooseland Road and the Haul Road. Location #1 at Touquoy was chosen to understand the noise levels directly around the Touquoy Mine Site and proposed open pit.

At the measurement locations around the Beaver Dam Mine Site, based on the 2014 values (AN# 1,2,3) the average value is 33 dBA ±. The dominant noise sources noted are natural, including birds, the movement of leaves, and possibly the odd vehicle on a logging road. The measurement locations at Beaver Dam Mines Road and Mooseland Road would be mostly from natural sources. Mooseland Road measurements are comparable to the Beaver Dam Mine Site. It is located on a little used gravel road. The Beaver Dam Mines Road is elevated and is near a paved highway with regular traffic. This road also passes through Beaver Dam IR and ambient sound will be the same as at the measured location.

Based on the measured ambient sound levels discussed above, the estimated lowest baseline ambient sound levels throughout the Study Area are as follows:

- 7:00 AM to 7:00 PM 33 dBA
- 7:00 PM to 11:00 PM 31 dBA
- 11:00 PM to 7:00 AM 27 dBA

At the Touquoy Mine Site, noise monitoring will be undertaken throughout the ~~construction and~~ operation of the facility if any complaints or concerns are received. To date, no noise complaints have been received or are anticipated.

6.1.3.2 Predicted Noise levels

The methodologies used and assumptions made for the Noise Impact Study are provided in Appendix B.1. The assessment considered residential points of reception (POR) and property boundary (PBR) assessments. The calculated noise impacts at each POR are presented below.

Table 6.1-3 Predicted Noise Levels at Receptors

Receptor ID	Receptor Description	Predicted Total Sound Level (dBA)
POR01	Residence on Beaver Dam Mines Road at Hwy 224 (1.5 m AG)	49.9
POR02	Residence in Beaver Lake IR 17 (1.5 m AG)	32.2
POR03	Residence 2.5 km northeast of Mooseland, adjacent to Tangier River (1.5 m AG)	53.8
POR04	Residence on Mooseland Road, adjacent to Second Rocky Lake (1.5 m AG)	51.2
POR05	Receptor located on Scraggy Lake, approximately 185 m south of the southernmost polishing pond /dam berm of the Touquoy Site (1.5 m AG)	41.7

These predicted noise levels are within the nighttime exclusionary sound level limits specified in the NSEL document "Guidelines for Environmental Noise Measurement and Assessment, May 2005". The highest predicted noise levels occur at POR03, which is approximately 60 m from the Haul Road. Due to increased setback distances from the Haul Road and Mine Sites, noise levels at all other receptors, including those not listed above, would be expected to be lower than those at POR03.

The predicted noise levels at the property boundaries for each of the Beaver Dam Mine Site and Touquoy Mine Site are presented below:

Table 6.1-4 Predicted Noise Levels at Property Boundaries

Receptor ID	Receptor Description	Predicted Total Sound Level Range (dBA)
PBR01, PBR02	Beaver Dam Mine Site Property Boundaries	51.5 to 65.6
PBR03, PBR04	Touquoy Mine Site Property Boundaries	39.2 to 53.9

The highest predicted noise levels at the property boundaries of the Beaver Dam Mine Site exceed the criteria NSE *Pit and Quarry Guidelines* (1999) for all time periods. However, PBR01 is some distance from the mine workings while PBR02 is nearly adjacent to the open pit and Cameron Flowage. While the limits stated in these guidelines are clear and specific, they are not considered practical to meet for open pit mines with operations located close to the property lines. Mitigation of these noise excesses is not considered to be critical, as the predicted noise levels at the worst-case points of reception are within the applicable limits.

The predicted noise levels at the property boundary of the Haul Road are variable based on topography; however, 60 dBA (the evening limit) is the average noise levels from 20 to 40 m from the centerline of the road and the values attenuate to 55 dBa (the overnight limit) at less than 70 m from the center of the Haul Road. The predicted noise levels at the property boundaries of the Touquoy Mine Site are within the NSEL sound level limits for daytime and evening timeframes and are acceptable within the proposed hours of operation (no overnight trucking).

6.1.4 Consideration of Consultation and Engagement Results

Key issues raised during public consultation and Mi’kmaq engagement relating to atmospheric environment include noise from mining operations at the Beaver Dam Mine Site and trucking along the Haul Road. The change to the Haul Road alleviated these concerns with respect to passing by existing residences, especially concerns of Millbrook First Nation regarding its residents in Beaver Lake. Concerns about greenhouse gas emissions specifically associated with the trucking were also noted.

The results of the public consultation and Mi’kmaq engagement have been considered in the environmental effects assessment, including the Proponent’s commitments on mitigation and monitoring measures and proposed compliance and effects monitoring programs, as well as the Proponent’s broader commitment to ongoing public consultation and Mi’kmaq engagement. Specific to evaluating the effect on atmospheric environment, these are found within the following environmental effects assessment.

6.1.5 Effects Assessment Methodology

6.1.5.1 Boundaries

Spatial Boundaries

The spatial boundary used for the assessment of effects of noise are described below. ~~is the LAA, As the Project has the potential to cause direct and indirect effects, as well as cumulative effects compounded spatially and temporally. The affected area extends to nearby residential properties where provincial noise limits must be met.~~

The PA encompasses three primary components from Marinette to Moose River Gold Mines, Halifax County, NS. The Beaver Dam Mine Site will be located at the end of the Beaver Dam Mines Road and the Haul Road will span from the Beaver Dam Mine Site to Moose River Gold Mines, where the Touquoy Mine Site [processing and exhausted pit (to be used to dispose Beaver Dam tailings)] is located.

The LAA encompasses the distance at which noise sources from project components diminish to at or below predicted nighttime (overnight period limit) levels (55 dBA). Preliminary modelling has determined the distances at which noise sources from project components diminish to reach 55 dBA (Figure 6.1-2).

The RAA encompasses a 9 km maximum radius. The RAA includes the maximum distance from noise sources where the noise model output meets the lowest recorded ambient background noise levels (Figure 6.1-2).

As the Project has the potential to cause direct and indirect effects of ambient noise ~~light~~ outside of the PA, as well as cumulative effects compounded spatially and temporally from other Projects, ~~the RAA and LAA are the most appropriate spatial boundaries, respectively~~, the LAA is the appropriate boundary for evaluation of noise.

Temporal Boundaries

The temporal boundaries used for the assessment of effects to ambient noise are the construction phase, operational phase, and decommissioning and reclamation phase.

Technical Boundaries

No technical boundaries were identified for the effects assessment of noise.

Administrative Boundaries

Noise within the Project site is regulated by the province through the *Workplace Health and Safety Regulations*, which establishes the noise environment needed to maintain worker health. The Nova Scotia *Pit and Quarry Guidelines* (NSE 1999) indicate that noise levels at the boundaries of the Beaver Dam Mine Site and Touquoy Mine Site are not to exceed the following levels:

- L_{eq} ≤ 65 dBA between 0700 to 1900 hours (daytime)
- L_{eq} ≤ 60 dBA between 1900 to 2300 hours (evening)
- L_{eq} ≤ 55 dBA between 2300 to 0700 hours (night-time, Sunday and statutory holidays)

The *Guidelines for Environmental Noise Measurement and Assessment* (NSE ~~1990~~ 2005) also require these noise levels to be met at locations where people normally live, work, or take part in recreation.

6.1.5.2 Thresholds for Determination of Significance

A significant adverse effect is defined as an exceedance of the maximum noise or vibration limits , where the exceedance is due to noise from sources associated with the mine operation (including the Mine Sites or Haul Road), at a fixed dwelling with occupants present and the event occurs more than twice in the period of time that the standard is based.

Noise will be generated throughout the life of the Project on the Beaver Dam Mine Site, the Haul Road, and the Touquoy Mine Site. Sources of project-related noise may include heavy machinery and trucking during the construction phase and haul truck and mining machinery traffic during operational phase of the project. The majority of mining operations will occur in the pit well below current ground elevation, which will attenuate the effects of noise. During the construction and operation phase of the Project, rock blasting using explosives was also considered as noise and vibration that would be generated.

6.1.6 Project Activities and Noise Interactions and Effects

The key sensitive receptor in the area is the Beaver Lake IR 17; a satellite community of the Millbrook First Nation located approximately 5 km south of the Beaver Dam Mine Site. A permanent resident is located along the Beaver Dam Mines Road near Highway 224. A seasonal dwelling ~~seasonal camps and cottages are also located along the Beaver Dam Mines Road near Highway 224~~ is located on the Cross Road near Mooseland Road.

Camp Kidston, which operates only in the summer months, is located 3.5 km northeast of the Touquoy Mine Site. According to the Proponent, the nearest permanent full-time occupied residences are located approximately 5.8 km to the north of the open pit along Caribou Road.

The Touquoy Mine Site is ~~under construction~~ in production. The primary effect of the continued use of the Touquoy Mine Site is the continued generation of noise due to haul truck traffic on the site, processing of Beaver Dam ore. There are no new or additional effects from noise anticipated to be caused by the processing of ore and the management of tailings (exhausted pit) from the Project, as no new construction or disturbance is required at the Touquoy Mine Site related to the processing of Beaver Dam ore. The effects of noise previously described for the Touquoy Mine Site in the EARD and Focus Report are presented in the sections below.

Table 6.1-5 Potential Noise Interactions with Project Activities at Beaver Dam Mine Site

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Drilling and rock blasting in preparation of construction • Till and waste rock removal from site preparation transport and storage • Existing settling pond dewatering in preparation ~~of~~ for construction • Watercourse and wetland alteration in preparation of construction • Mine Site road construction • ~~Lighting of construction areas~~ • Equipment to power lighting at Mine Sites and along roads

Project Phase	Duration	Relevant Project Activity
		• Surface infrastructure installation and construction • Collection and settling ponds construction • General management of wastes derived from site preparation and construction activities • ~~Accidents and malfunctions to include fuel and other spills, forest fires, slope failure, an unplanned explosive event, and a mobile equipment accident~~
Operation and Maintenance	3-4 years	• Rock blasting to access and extract ore • Management of waste rock produced from crushing and preparing ore for transport • Petroleum products management • Site maintenance and repairs • ~~Lighting of facilities and Mine Site roads~~ • Equipment to power lighting at Mine Sites and along roads • ~~Environmental monitoring of the atmospheric environment~~ • General management of wastes derived from operation and maintenance activities • ~~Accidents and malfunctions to include fuel and other spills, forest fires, slope failure, an unplanned explosive event, and a mobile equipment accident~~
Decommissioning and Reclamation	1-2 years	• Infrastructure Demolition • Site reclamation activities • ~~Environmental monitoring~~ • ~~Accidents and malfunctions to include fuel and other spills, slope failure, and forest fires~~

Table 6.1-6 Potential Noise Interactions with Project Activities along Haul Road

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Drilling and rock blasting in preparation of construction • Till and waste rock from site preparation transport and storage • Watercourse and wetland alteration in preparation of construction • Haul road construction and upgrades • ~~Environmental monitoring of the atmospheric environment~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and a haul truck accident~~
Operation and Maintenance	3-4 years	• Ore transport • ~~Road lighting~~ • Equipment to power lighting at Mine Sites and along road • Haul road maintenance and repairs • ~~Environmental monitoring~~

Project Phase	Duration	Relevant Project Activity
		• ~~Accidents and malfunctions to include fuel and other spills, forest fires, and a haul truck accident~~
Decommissioning and Reclamation		N/A[1]
1 Decommissioning and Reclamation of the Haul Road is not expected. The Haul Road will be returned to owner for forestry industry activities		

Table 6.1-7 Potential Noise Interactions with Project Activities at ~~Touquoy Processing and Tailings Management Facility~~ Touquoy Mine Site

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Tailings pipeline, make-up water pipeline alteration, and relocation of reclaim infrastructure • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and mobile equipment accidents~~
Operation and Maintenance	3-4 years	• Ore management and processing • Lighting equipment for on-site ~~of~~ facilities and Mine Site roads • ~~Environmental monitoring of the atmospheric environment~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and mobile equipment accidents~~
Decommissioning and Reclamation	1-2 years	• ~~Environmental monitoring~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and mobile equipment accidents~~

6.1.6.1 Beaver Dam Mine Site and Haul Road

~~Sources of Project-related noise on the haul road may include heavy machinery and truck traffic during the construction and operational phases~~. The nearest permanent residential dwelling from the Beaver Dam Mine Site ~~(5 km~~) is located in the Beaver Lake IR 17. This is located approximately 5 km south of the Beaver Dam Mine Site and is separated from the Beaver Dam Mine Site by forest and two topographic ridges. These ridges block direct views from the houses to all work areas. The pit is located in a topographic depression and the crusher is in a more elevated position; however, distance to any sensitive receptors would mitigate any effects. The modelling supports a conclusion that ~~T~~the likelihood of any dwellings in this rural area being occasionally impacted by ~~sound~~ noise from the Beaver Dam Mine Site is very low. The majority of mining operations will occur in the pit well below ground surface thereby provide excellent noise shielding. The modelling used a conservative pit depth of 10 m, therefore, as the pit depth increases mining noise (blasting etc.) will diminish.

Sources of Project related noise on the Haul Road will include heavy machinery and truck traffic during the construction and operational phases. The nearest point of the Haul Road to the Beaver Lake IR 17 is approximately 3 km. The Haul Road is currently in use for forestry activities and occasional construction activities for road upgrades. ~~and~~ The activities on the Haul Road related to the Beaver Dam Mine Site will be similar in nature but larger in scale. The predicted sounds levels at the IR are equivalent to the lowest average (30 dBA) ambient values measured during sampling. The likelihood of the IR being impacted by sound from the Haul Road is also very low (Appendix B.1).

Further assessment of baseline monitoring before construction, during construction, and during mining operations will be conducted to ensure impacts are below the NSE guidelines and the Health Canada noise guidance which allows for an incremental increase in the percentage of highly annoyed population in the community to remain below 6.5% at sensitive receptors. The modelling supports that ~~Based on typical mining scenarios in rural regions of Nova Scotia,~~ the predicted sound levels at the Beaver Dam Mine Site boundaries have the potential to exceed the noise levels for daytime, evening, and overnight. ~~goals during both daytime and evening operations~~. However, at ~~1 km~~ 500 m from the Beaver Dam Mine Site, the sound levels ~~may be at or~~ are predicted to be below the noise goals, with sound levels dropping towards the ambient levels with distance. Blasting events may provide a slight spike in the sound levels at distance for a brief period of time at the same time of day (daytime) once or twice a week. This assessment was conducted prior to the change in the waste rock stockpile (WRSP) configuration and the introduction of the western waste rock stockpile. Given the distance from receptors, the topography, and proposed operational scenarios for waste rock stockpile construction, the assessment conclusions for the revised site are anticipated to be the same.

Predicted noise impacts were estimated using an acoustical model for provincial guidelines. The model was undertaken to predict noise from mining and crushing operation, and haul truck travel along the Haul Road. Site specific topography and mine layout was used for the model~~; however,~~ as well as all mobile sources, equipment, and open pit operations were ~~not~~ included. The results are cumulative for the equipment that was evaluated. Additional monitoring could be undertaken in the future if required as part of the IA process.

~~The mine operations are at times expected to increase the ambient sound levels for certain distances from the Mine Sites and ore haul road. Based on the baseline ambient sound level monitoring (see section 3.1 of this Study), ambient sound levels in the Study Area are as low as 33 dBA during the day, 31 dBA in the evening, and 27 dBA at night. Predicted noise levels from the proposed mine operations attenuate over large distances to these low ambient conditions. Figure 4A (Appendix X) shows a contour plot, indicating the areas in which predicted noise levels from mine operations exceed these minimum baseline ambient sound levels.~~

The mine operations are at times expected to increase the ambient sound levels for certain distances from the Beaver Dam Mine Site and Haul Road. Based on the baseline ambient sound level monitoring, ambient sound levels in the LAA are as low as 33 dBA during the day, 31 dBA in the evening, and 27 dBA at night. Predicted noise levels from the proposed mine operations attenuate over large distances to these low ambient conditions. For instance, sound levels at Beaver Lake IR are expected to be 33 dBA at night, so above baseline but well below the 55 dBA regulated threshold for the overnight period. Figure 6.1-1 shows a contour plot, indicating the areas in which predicted noise levels from mine operations exceed these minimum baseline ambient sound levels.

6.1.6.2 Touquoy Mine Site

At the Touquoy Mine Site, the primary source of noise during the processing of Beaver Dam ore will be the crushing circuit, CIL circuit, and service vehicles. All other processing equipment is located within the processing building. As indicated in the EARD, the maximum sound generated at the processing plant is 80 dBA, which attenuates to the background of 40 dBA over a distance of 500 m. Based on an additional acoustic assessment conducted as part of the Focus Report, predicted values at the sensitive receptors ranged from 34.6 dBA to 42.3 dBA. All estimated values are below the NSEL daytime sound level criteria on the dBA scale. Predicted noise levels at Scraggy Lake and Camp Kidston were approximately 2 dBA greater than daytime values measured in the baseline study. The predicted sound level at the farthest sensitive receptor from the proposed site was 34.6 dBA, which is below the baseline value measured. The Noise Impact Study (Appendix B.1) shows that the predicted levels for sound propagation from the Touquoy Mine Site for the Project will be below the noise thresholds (day/evening/night) at the property boundaries.

6.1.7 Preferred Alternative Haul Road

6.1.7.1 Rationale for Valued Component Selection

The same rationale was used for the valued component selection as indicated in 6.1.1.

6.1.7.2 Baseline Program Methodology

The same methodology was used for the baseline program for the Preferred Alternative Haul Road option as indicated in 6.1.2. No additional baseline studies were completed for this Haul Road option.

6.1.7.3 Baseline Conditions

Ambient noise has been sampled at several representative locations in this rural area. The key sensitive receptor in the area is the Beaver Lake IR 17; a satellite community of the Millbrook First Nation located approximately 5 km south of the Beaver Dam Mine Site. At its nearest point, the Preferred Alternative Haul Road is approximately 5.1 south west of Beaver Lake IR 17. Other receptors in the area include residences along Mooseland Road (2.5 km), seasonal dwellings on the Cross Rd (1.5 km), and other permanent residences located approximately 5.8 km to the north of the Touquoy Mine Site along Caribou Road. Activities in these areas are ongoing and include recreational use (hunting, ATVs, etc).

The Preferred Alternative Haul Road is located north of the primary Haul Road and is anticipated to have less of an impact on key receptors at Mooseland Road and the Cross Road, no change in the impact on Beaver Lake IR 17 and Beaver Dam Mine Road receptors.

6.1.7.4 Consideration of Consultation and Engagement Results

The Preferred Alternative Haul Road is the result of consultation and engagement on the primary Haul Road. The alternative Haul Road is further from human receptors located on the “Moose River Cross Road” so-called and from residents located on the Mooseland Road. Consultation and engagement results are presented in Section 6.1.4.

6.1.7.5 Effects Assessment Methodology

The effects assessment methodology of the Preferred Alternative Haul Road is as presented in Section 6.1.5. The spatial boundary of the PA for the Preferred Alternative Haul Road is confined only to this segment and assessed independently of the primary route. The LAA and RAA remain the same as indicated in Section 6.1.5.1.

As the Project has the potential to cause direct and indirect effects to noise outside of the Preferred Alternative Haul Road PA, the LAA is the appropriate boundary for evaluation of this VC.

The same Temporal, Technical, and Administrative Boundaries are considered for the Preferred Alternative Haul Road as indicated in Section 6.1.5.

6.1.7.5.1 **Thresholds for Determination of Significance**

The thresholds for determination of significance regarding noise within the Preferred Alternative Haul Road are identical to the thresholds for determination of significance for this VC, as presented within Section 6.1.5.1.

6.1.7.6 Project Activities and Noise Interactions and Effects

The key sensitive receptor in the area is the Beaver Lake IR 17; a satellite community of the Millbrook First Nation located approximately 5.1 km north east of the Preferred Alternative Haul Road. The Preferred Alternative Haul Road option is 1.5 km from the nearest receptor on the primary Haul Road and is located between the Touquoy Mine Site and Beaver Dam Mine Site. Other receptors in the area include residences along Mooseland Road, Based on the results of the acoustical modelling for the Haul Road, it can be extrapolated that given the same operational scenario (number and types of trucks) on the Preferred Alternative Haul Road, predicted sound levels would attenuate at to 60 dBA at or near the property boundary (30 m offset) and 55 dBA at approximately 70 m form the centerline of the road.

Potential interactions between Project activities and noise are outlined in tables 6.1-5 to 6.1-7, in Section 6.1.6. The Preferred Alternative Haul Road is located farther away from human receptors, such that there are no additional Project activities and noise interactions to discuss for this Haul Road option.

6.1.8 Mitigation ~~and Monitoring~~

Noise from the equipment and lack of effective mufflers is a source of noise. Procurement of equipment that meets best practices in terms of noise emissions, and regular maintenance of the equipment will reduce noise levels. Site workers will be trained to ensure equipment is used in ways that minimize noise and are maintained regularly. As part of the workplace health and safety program, noise monitors may be attached to workers from time to time to measure and monitor noise exposure over a shift.

The majority of mining operations will occur in the pit well below ground surface thereby provide excellent noise shielding and blasting will be restricted to daytime hours, per the NSE Pit and Quarry Guidelines. Additionally, traffic on the Haul Road will generally be restricted to ~~12 to~~ 16 hours per day during the operational phase. This will minimize noise along the Haul Road during evening hours. The forest surrounding the Beaver Dam Mine Site and the Haul Road will also provide a dampening effect to any noise generated. Topography and distance from receptors will also provide contribute to a reduction of Project-generated sound at a distance.

This combination of measures will adequately mitigate potential noise impacts. The mitigation procedures may vary as long as noise levels are in accordance with the regulatory approval.

Additionally, noise monitoring would be completed during each blasting event, as required by the conditions of any approval and as is typically the practice in Nova Scotia. Blast monitoring generally involves noise and vibration monitoring during each blasting event and includes monitoring at the nearest residence to the Beaver Dam Mine Site, which in this case would be at Beaver Lake IR 17.

Under the existing IA for the Touquoy facility, maximum sound levels are prescribed at property boundaries for days, evenings and weekends and monitoring is only required when requested by NSE in response to a complaint or concern. Mitigation measures will be implemented as necessary where sound levels are a concern, i.e., causing annoyance, and monitoring demonstrates exceedances. Mitigation of noise excesses at the property lines are not considered to be critical, as predicted noise levels at the worst-case points of reception are within the applicable limits (See Appendix B.1). To date, no noise complaints have been received or are anticipated. A complaint from the public and/or a First Nation community member would be a trigger for consideration of mitigation, as described below.

~~The Project is expected to have a low adverse residual impact on ambient noise.~~

Table 6.1-8 Mitigation for Noise

VC	Project Phase	Mitigation Measure
Noise	CON, OP	Restrict blasting to a specific and regular daytime schedule during weekdays
	CON, OP	Communicate general blasting schedule to the local community
	PC	Consider placement of stockpiles and infrastructure to mitigate noise migration from processing equipment
	PC	Consider the use of natural landforms when available as noise barriers when designing final site details and when placing fixed equipment
	OP	Operating hours for processing plants and trucking on the Haul Road will be limited to reduce nighttime noise levels
	OP	Regular check by site manager for excessive noise on site and in relation to sensitive receptors so that resolution can be timely
	CON, OP, DEC	Implement preventative maintenance plans for all mobile and stationary equipment
	PC	Noise-reduction as criteria in equipment selection
	CON, OP	Speed reduction
	CON, OP	Use equipment that meets appropriate noise emission standards for off-road diesel equipment
	CON, OP	Subcontractor agreements will include an obligation to comply with environmental protection including noise reduction
	CON, OP	Site design to reduce need for reversing and vehicle reversing alarms
	CON, OP	A procedure, including a response plan, will be available for public to be able to register complaints regarding noise concerns

6.1.9 Residual Effects and Significance

The predicted residual environmental effects of Project development and production on noise are assessed to be adverse, but not significant. The overall residual effect of the Project on noise is assessed as not likely to have significant adverse effects after mitigation measures have been implemented.

Table 6.1-9 Residual Environmental Effects for Noise

Project - VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Residual Environmental Effects Characteristics: Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Residual Effect	Significance of Residual Effect
Construction – Beaver Dam Mine Site and Haul Road (Noise from haul trucks, Haul Road widening and construction, and from blasting and drilling of in-situ rocks)	Equipment maintenance, best management practices, minimize blasting events.	A	M Moderate change from baseline conditions	LAA Noise generated will likely extend beyond the PA	N/A VC is not expected to be affected by timing	MT Effects can occur beyond 12 months and up to 3 years	R Effects occur regularly in the construction phase of the Project	R VC will recover to baseline conditions	Increased ambient noise	Not significant
Operational – Beaver Dam Mine Site, Haul Road, and Touquoy Mine Site at Points of Reception (Noise from haul trucks, from blasting and drilling of in-situ rocks and the crushing of ore)	Equipment maintenance, dust suppression, hardened surface where practical, vehicle speed reduction, use of large haul vehicles to minimize trips, stabilization of stockpile slopes, covering of haul trucks, minimize blasts.	A	L Less than or equal to appropriate guidelines or threshold values	LAA Compounds generated will extend beyond the PA into the LAA	N/A VC is not expected to be affected by timing	LT Effects may extend beyond 3 years	R Effects occur regularly in the operational phase of the Project	R VC will recover to baseline conditions	Increased ambient noise	Not significant
Operational – Haul Road at Property Lines (Noise from haul trucks, and site vehicles)	Equipment maintenance, haul truck operations < 24 hours per day to minimize noise disturbance, limited engine idling, shutting off vehicle when parked unless this is precluded for safety or maintenance reasons.	A	M Marginally exceeds guidelines or threshold values	LAA Noise generated is predicted to extend beyond the PA	N/A VC is not expected to be affected by timing	LT Effects may extend beyond 3 years	R Effects occur regularly in the operational phase of the Project	R VC will recover to baseline conditions	Increased ambient noise	Not significant
Operational – Beaver Dam Mine Site at Property Lines (Noise from blasting, crushing of ore, heavy machinery operation, and site vehicles)	Equipment maintenance, haul truck operations < 24 hours per day to minimize noise disturbance, limited engine idling, shutting off vehicle when parked unless this is precluded for safety or maintenance reasons.	A	H Exceeds guidelines or threshold values	LAA Noise generated is predicted to extend beyond the PA	N/A VC is not expected to be affected by timing	LT Effects may extend beyond 3 years	R Effects occur regularly in the operational phase of the Project	R VC will recover to baseline conditions	Increased ambient noise	Not significant
Operational – Touquoy Mine Site at Property Lines (Noise from blasting, crushing of ore, heavy machinery operation, and site vehicles)	Equipment maintenance, haul truck operations < 24 hours per day to minimize noise disturbance, limited engine idling, shutting off vehicle when parked unless this is precluded for safety or maintenance reasons.	A	N Negligible change from baseline conditions	LAA Noise generated is predicted to extend beyond the PA	N/A VC is not expected to be affected by timing	LT Effects may extend beyond 3 years	R Effects occur regularly in the operational phase of the Project	R VC will recover to baseline conditions	Increased ambient noise	Not significant

Project - VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Reclamation – Beaver Dam Mine Site (heavy machinery operation for infilling of pit, reclaiming stockpiles, etc.)	Equipment maintenance	A	L Minor change from baseline conditions	LAA Noise generated will likely extend beyond the PA	N/A VC is not expected to be affected by timing	MT Effects can occur beyond 12 months and up to 3 years	R Effects occur regularly in the reclamation phase of the Project	R VC will recover to baseline conditions	Increased ambient noise	Not significant

Legend (refer to Table 5.10-1 for definitions)

Nature of Effect	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
A Adverse	N Negligible	PA Project Area	N/A Not Applicable	ST Short-Term	O Once	R Reversible
P Positive	L Low	LAA Local Assessment Area	A Applicable	MT Medium-Term	S Sporadic	IR Irreversible
	M Moderate	RAA Regional Assessment Area		LT Long-Term	R Regular	PR Partially Reversible
	H High			P Permanent	C Continuous	

A significant adverse environmental effect for noise has not been predicted for the Project for the following reasons, with consideration of the ecological and social context of the LAA surrounding the Project:

- During Construction: Noise will be elevated above baseline for limited periods but for a short duration (12-24 months), with confirmed sporadic forestry, construction and trucking activities known to occur already in the LAA. The likelihood of receptors being regularly in close proximity to noise generation sites is very low.
- During Operations: Noise will be elevated above baseline during this period, however the likelihood of receptors being regularly in close proximity to noise generation sites is very low.
- During Closure: Noise will be elevated above baseline during reclamation activities involving mobile equipment and then drop to baseline for the post-closure period.

6.1.9.1 Preferred Alternative Haul Road Residual Effects and Significance

Table 6.1-10 Residual Environmental Effects for Noise within the Preferred Alternative Haul Road

Project - VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Preferred Alternative Haul Road (Noise from haul trucks, Haul Road widening and construction)	Equipment maintenance, best management practices, minimize blasting events.	A	M Moderate change from baseline conditions	LAA Noise generated will likely extend beyond the PA	N/A VC is not expected to be affected by timing	MT Effects can occur beyond 12 months and up to 3 years	R Effects occur regularly in the construction phase of the Project	R VC will recover to baseline conditions	Increased ambient noise	Not significant
Operational – Preferred Alternative Haul Road (Noise from haul trucks, and site vehicles)	Equipment maintenance, haul truck operations < 24 hours per day to minimize noise disturbance, shutting off vehicle when parked unless this is precluded for safety or maintenance reasons.	A	M Marginally exceeds guidelines or threshold values	LAA Noise generated is predicted to extend beyond the PA	N/A VC is not expected to be affected by timing	LT Effects may extend beyond 3 years	R Effects occur regularly in the operational phase of the Project	R VC will recover to baseline conditions	Increased ambient noise	Not significant

Legend (refer to Table 5.10-1 for definitions)

Nature of Effect	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
A Adverse	N Negligible	PA Project Area	N/A Not Applicable	ST Short-Term	O Once	R Reversible
P Positive	L Low	LAA Local Assessment Area	A Applicable	MT Medium-Term	S Sporadic	IR Irreversible
	M Moderate	RAA Regional Assessment Area		LT Long-Term	R Regular	PR Partially Reversible
	H High			P Permanent	C Continuous	

Table 6.1-9 was reviewed and it was determined that the construction and operation of the Haul Road were the only two VC interactions applicable to noise associated with the Preferred Alternative Haul Road. There were no changes in the significance criteria or overall significance for either of these VC interactions.

Mitigations presented in Table 6.1-8 will be established to reduce the impact of noise from Project activities.

6.1.10 Proposed Compliance and Effects Monitoring Program

Noise monitoring will be completed as directed by regulators or as a result of a complaint.

The Preliminary Environmental Effects Monitoring Plan (EEM), located in Appendix O.1, outlines any proposed preliminary methods, timing, frequency, and locations for ambient noise monitoring. This document will evolve through regulatory permitting, as well as public and Mi'kmaw engagement.

6.2 Air

6.2.1 Rationale for Valued Component Selection

Dust is typically considered a compound of concern from mining operations, and can be emitted from blasting/extraction operations, crushing, and especially traffic on unpaved roads. Dust and particulates will be generated throughout the life of the Project on the Beaver Dam Mine Site, along the Haul Road, and at the processing area at the Touquoy Mine Site.

Nova Scotia Environment regulates ambient total suspended particulate (TSP) in air, with guidelines for both 24-hour and annual averaging periods. Total suspended particulate typically includes airborne particles up to 30, 40 or even 100 µm in aerodynamic diameter. The Canadian Council of Ministers of the Environment (CCME) has published the Canadian Ambient Air Quality Criteria, which includes standards for $PM_{2.5}$ (particulate with aerodynamic diameter of 2.5 µm or less) for the 24-hour and annual averaging periods. PM_{10}, a mid-range size fraction (aerodynamic diameter of 10 µm or less, which includes $PM_{2.5}$) is not currently regulated in Canada but is sometimes assessed separately from TSP and $PM_{2.5}$.

For this assessment, air quality is a Valued Component, due to existing regulations at the provincial and federal level, and because of the effect air quality can have to human and ecological health. Particulates have been identified as the most significant indicator compounds for the assessment of air quality for this site, and three size fractions (total particulate, PM_{10} and $PM_{2.5}$) have been considered.

Results of the air quality assessment, as well as deposition (which is not regulated in Nova Scotia or federally) were also provided to other disciplines (human health risk) to enable further assessment.

6.2.2 Baseline Conditions

6.2.2.1 Climate and Meteorological Information

The Project is located within the Eastern Nova Scotia climatic region, which is generally characterized by high rainfall and cool temperatures, due to the influence of the Nova Scotia Current. The nearest climate station with historical data is the Middle Musquodoboit climate station (ID# 8203535) operated by the Meteorological Service of Canada (MSC). The station is located approximately 15 km northwest of the mine site, near Middle Musquodoboit (45° 04'N, 63° 06'N).

The following is a summary of average climate conditions at the Middle Musquodoboit station, based on climate normals published by Environment and Climate Change Canada for the period from 1971 to 2000. Wind data is taken from the Halifax Airport climate station (MSC ID# 202250), which is located approximately 45 km west of the mine site. This is the closest station to the site for which wind data exists.

Mean annual total precipitation is 1370 mm, which includes 165 cm of average snowfall per year (165 mm water equivalent). Highest precipitation generally occurs in the months of October and November, with lowest precipitation in the month of February. Measurable precipitation occurs on an average of 164 days per year, with 141 days of measurable rainfall, and 31 days of measurable snowfall.

The extreme one-day rainfall for the station is 173 mm on August 15, 1971 and extreme one-day snowfall is 70 cm on February 8, 1981.

Average temperature is 6.2 °C, with an average range from -6 °C to 18.1 °C. Temperature extremes can range from -34 °C to 35 °C. There is an average of 312 days per year with an average temperature above 0 °C.

Wind direction is generally westerly to northerly in January through April, southerly in May through October and again westerly to northerly in November and December. Wind speeds average approximately 16.5 km/h, with an average range of 13.3 km/h in August to 18.5 km/h in March. Maximum hourly speeds can range from 56 km/h in August to 89 km/h in February, with maximum gusts of up to 132 km/h recorded.

6.2.2.2 Ambient Air Quality Standards

NSE regulates ambient air quality via the Nova Scotia Air Quality Standards (NSAQS). The Canadian Ambient Air Quality Standards (CAAQS) are recommended air quality standards, frequently applied in Provinces or Territories that do not have their own air quality criteria. These standards are summarized in the table below, which will be used to assess significance of the air quality assessment.

There is currently no Nova Scotia or Canada-Wide standard for PM_{10}. For the purposes of comparison, the table below lists an Interim Standard previously reported for the Province of Ontario.

Table 6.2-1 Air Quality Standards for this Assessment

Indicator Compound	Averaging Period	Concentration µg/m³	Source
Total Suspended Particulate (TSP)	24-hour	120	NSAQS
	Annual	70	NSAQS
PM_{10}	24-hour	50	Ontario - Interim
$PM_{2.5}$	24-hour	27	CAAQS (2020)
	Annual	8.8	CAAQS (2020)

µg/m³ – micrograms per meter cubed
Ontario Interim guideline for PM_{10} no longer in effect, provided for informational purposes only
$PM_{2.5}$ 24-hour CAAQS for 2020 is based on the 3-year average of the 98th percentile of the daily 24-hour concentrations
$PM_{2.5}$ Annual CAAQS for 2020 is based on the 3-year average of the annual average concentrations

6.2.2.3 Baseline Air Quality Monitoring Program

Preliminary baseline particulate monitoring including TSP and PM_{10} was conducted following United States Environmental Protection Agency (USEPA) sample methodology (USEPA 2011).

Preliminary baseline particulate monitoring was conducted at three locations for the Beaver Dam Mine Site in 2008, four locations for the Beaver Dam Mine Site in 2014, and two locations for the Haul Road in 2016. Baseline particulate monitoring was conducted at five locations for the Touquoy Mine Site in 2007. Figure 6.1-1 display the locations during each monitoring event. The date and locations were determined based on meteorological forecasts for the sampling period, and the proximity to sensitive receptors and proposed mine features. A 24 hour sample was collected on an 8x10 filter utilizing a high-volume sampler calibrated at a flow rate of approximately 40 cubic feet per minute (CFM). Pre-weighed filters were submitted to Maxxam Analytics in Sydney, Nova Scotia, for final particulate weights. Concentrations of TSP and PM_{10} were calculated based on the final weight of particulate on the filters and the total volume of air sampled. Baseline particulate data was compared to the Nova Scotia Air Quality Standards (NSAQS).

A summary of these baseline measurements is presented in Table 6.2-2.

Total suspended particulate concentrations ranged from 1.7 to 41.7 µg/m³, with the highest value obtained at Location #2 during monitoring in June 2008. Results for PM_{10} concentrations ranged from 7.1 to 13.1 µg/m³, with the highest value also obtained at Location #2 during monitoring in June 2008. This monitoring station was located in a recently clear-cut area, which may have contributed to higher particulate levels in comparison to the other locations. This area was resampled in 2014 (AN-2). The 2014 results for that area were 4.6 µg/m³. All samples collected were below the NSAQS for TSP, there is no NSAQS for PM_{10}.

Table 6.2-2 Local Ambient Air Quality Program Results

Location	Date	TSP (µg/m³)	PM_{10} (µg/m³)
Location #1	June 5-6, 2008	19.4	9.1
Location #2	June 5-6, 2008	41.7	13.1
Location #3	June 5-6, 2008	12.9	7.1
AN#1	October 20-21, 2014	6.9	-
AN#2	October 20-21, 2014	4.6	-
AN#3	October 20-21, 2014	1.7	-
AN#4	October 20-21, 2014	3.9	-

Location	Date	TSP ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)
Beaver Dam Road	September 7-8, 2016	9.7	-
Mooseland Road	September 7-8, 2016	5.8	-
Location # 1 (Touquoy)	January 3, 2007	11.6	-
Location # 2 (Touquoy)	January 3, 2007	10.5	-
Location # 3 (Touquoy)	January 4, 2007	14.0	-
Location # 4 (Touquoy)	January 4, 2007	16.1	-
Location # 5 (Touquoy)	January 4, 2007	14.4	-

The data obtained as part of the baseline program reported herein provides a preliminary snapshot of air quality in the area of the Beaver Dam Mine Site and Haul Road, and a general understanding of local air quality. Due to a lack of other sources of data for ambient TSP, the background concentration for TSP is based on the maximum measured 24-hour TSP concentration (there are insufficient data to provide a meaningful 90th percentile value), and the average of all the TSP measurements. There is a great deal of uncertainty in how representative these values might be for background, but they represent the best available data at this time.

6.2.2.4 Regional Ambient Air Quality

Ambient air quality in Nova Scotia is monitored using a network of 13 sites operated by NSE and Environment and Climate Change Canada through the National Air Pollution Surveillance (NAPS) Network. Common air pollutants monitored at these stations include the following:

- SO_2;
- $PM_{2.5}$;
- volatile organic compounds (VOCs);
- O_3; and
- Oxides of Nitrogen (NO_2, NO, and total NOx).

Data collected at these stations is used by NSE to report the Air Quality Index (AQI) and by Environment and Climate Change Canada to report the Air Quality Health Index (AQHI). There are currently no permanent air monitoring stations within the vicinity of the Project.

Recent (2014 – 2016, the most recent three years for which all data are currently available) continuous monitoring data were obtained from the National Pollutant Surveillance Network (NAPS). The nearest representative stations which report concentrations for the indicator compounds identified for this assessment are:

- Lake Major, Nova Scotia (station ID 030120) – $PM_{2.5}$
- Port Hawkesbury, Nova Scotia (station ID 030201) – $PM_{2.5}$
- Aylesford Mountain, Nova Scotia (station ID 030701) – $PM_{2.5}$
- Pictou, Nova Scotia (station ID 030901) – $PM_{2.5}$

PM_{10} is not measured in many areas in Canada. Of the locations which do measure PM_{10}, most are in British Columbia urban centres, four are in Manitoba cities, one is in Regina, Saskatchewan, and four are in the Northwest Territories. In terms of locations that are somewhat comparable to the Project site (human habitation, regional activities that may generate airborne particulate, etc.), Norman Wells NW Regional Office (Station ID 129102) appears the most appropriate location that has recent data available. As such, this station has been included to provide context for PM_{10}, and $PM_{2.5}$ in this assessment. Total particulates are not measured routinely anywhere in Canada, and so cannot be represented by regional monitoring data. Lacking these data, the highest measured concentration of TSP from the baseline monitoring programs has been used for this assessment.

The background air concentrations used in the cumulative effects assessment are provided in Table 6.2-3.

An expanded data set showing the 25th, 50th, 75th, and 90th percentile values, as well as mean average, and maximum concentrations, for the indicator compounds is provided in the Air Quality Technical Memorandum (GHD, 2019) found in Appendix C.1.

Table 6.2-3 Background Concentrations of Indicator Compounds for Cumulative Effects Assessment

Compound	Averaging Period	Concentration ($\mu g/m^3$)	Source
TSP	24-hour	41.7	On-site monitoring (maximum)
	Annual	12.8	On-site monitoring (average)
PM_{10}	24-hour	31.0	Norman Wells NWT NAPS station
$PM_{2.5}$	24-hour	9.0	Port Hawkesbury NAPS station
	Annual	5.7	Port Hawkesbury NAPS station

Port Hawkesbury was identified as a station in reasonable proximity to the site, that is likely relatively comparable in terms of current human activity. Existing air quality at this location is likely similar to (or slightly worse – higher concentrations) than existing conditions at the Project site, and so for all species except PM_{10}, this location has been selected as “background”. It should be noted that the Norman Wells station generally had similar ambient air quality concentrations (up to the 90^{th} percentile) as the other stations reporting $PM_{2.5}$, however maximum $PM_{2.5}$ concentrations measured at this location much higher than other locations assessed. The Norman Wells station reported 90^{th} percentile PM_{10} roughly double the highest PM_{10} sample collected in the vicinity of the site, however with multiple years of data reporting, the Norman Wells station has been used as “background” for PM_{10} due to a paucity of data elsewhere. This is anticipated to be very conservative and may result in over predicting cumulative effects.

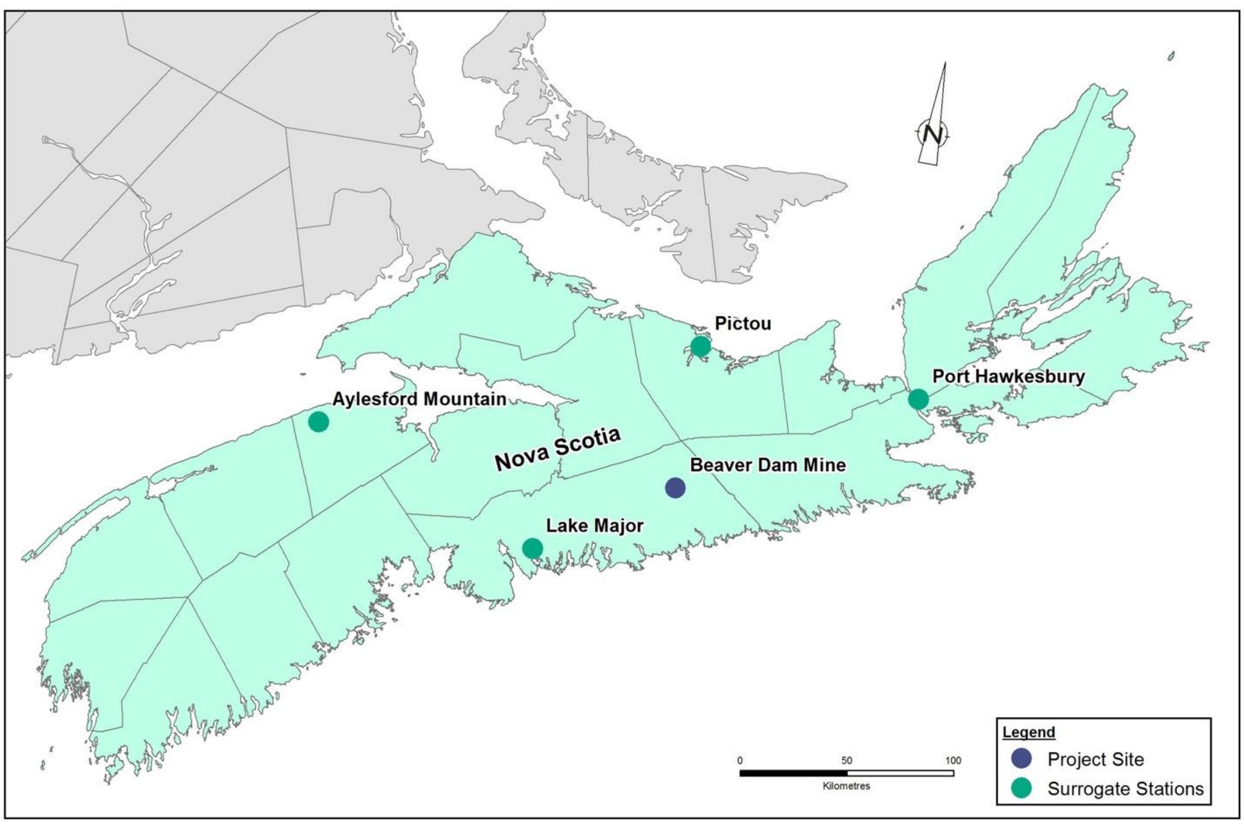


Figure 6.2-2 Nearest Monitoring Stations to Beaver Dam Mine Project Site

The Beaver Dam Mine Site is located in a relatively undeveloped rural region of Nova Scotia with infrequent industrial operations that would affect air quality. As the NAPS monitoring stations are typically located in areas with local industry, measured concentrations of indicators are likely lower at the Beaver Dam Mine Site than at NAPS stations. Background data selected for inclusion in the cumulative effects assessment, identified in Table 6.2-3 is generally considered to be conservative and possibly over-predictive of background concentrations in the project area.

6.2.3 Consideration of Consultation and Engagement Results

Key issues raised during public consultation and Mi’kmaq engagement relating to atmospheric environment include potential dust from mining operations at Beaver Dam and trucking along the Haul Road to both residential residences and use of the landscape for traditional harvesting purposes. The change to the Haul Road in part alleviated these concerns with respect to passing by existing residences, especially concerns of Millbrook First Nation regarding its residents in Beaver Lake.

The results of the public consultation and Mi'kmaq engagement have been considered in the environmental effects assessment, including the Proponent's commitments on mitigation and monitoring measures and proposed compliance and effects monitoring programs, as well as the Proponent's broader commitment to ongoing public consultation and Mi'kmaq engagement. Specific to evaluating the effect on the air valued component, these are found within the following environmental effects assessment.

6.2.4 Effects Assessment Methodology

6.2.4.1 Boundaries

Spatial Boundaries

The spatial boundary used for the assessment of effects of air are defined below:

The PA includes three primary components from Marinette to Moose River Gold Mines, Halifax County, NS. The Beaver Dam Mine Site will be located at the end of the Beaver Dam Mines Road and the Haul Road will span from the Beaver Dam Mine Site to Moose River Gold Mines, where the Touquoy Mine [processing and exhausted pit (to be used to dispose Beaver Dam tailings)] is located.

The LAA encompasses a 15 km zone in all directions from the PA. (Figure 6.2-1).

The RAA encompasses a 35 km buffer from the PA, maximum zone of influence. The RAA covers the extent of the modelling domain and is anticipated to be the maximum extent of particulate deposition under worst case scenarios (Figure 6.2-1).

As the Project has the potential to cause direct and indirect effects of air outside of the PA, the LAA is the most appropriate spatial boundary for air.

Temporal Boundaries

The temporal boundaries used for the assessment of effects to air are the construction phase, the operational phase, and the decommissioning and reclamation phase.

Technical Boundaries

No technical boundaries were identified for the effects assessment of the atmospheric environment.

Administrative Boundaries

Air quality is provincially regulated via the Nova Scotia *Air Quality Regulations*.

There may be other requirements for monitoring of the atmospheric environment through provincial approvals to be obtained prior to the start of the Project, specifically the Industrial Approval.

6.2.4.2 Air Dispersion Modelling Methodology

GHD performed air emission estimate calculations and dispersion modelling for the Project. Dispersion modelling was performed using the United States Environmental Protection Agency (USEPA) multi-source dispersion model AERMOD, following a modified methodology as prescribed by Ontario Regulation 419/05 (O. Reg. 419/05). There is currently no guidance on the use of models in Nova Scotia, and therefore the O. Reg. 419/05 requirements were used as a framework. The version of the air dispersion model used in this project is currently accepted in Ontario, and AERMOD is used across Canada and throughout the U.S. as a regulatory model of choice. AERMOD is an advanced steady state plume model that has the ability to incorporate building cavity downwash, actual source parameters, emission rates, terrain and historical meteorological information to predict ground level concentrations (GLCs) at specified locations.

Air compounds evaluated included TSP, PM_{10}, $PM_{2.5}$, nitrogen oxides (NOx), sulfur dioxide (SO_2) and volatile organic compounds (VOC). Particle deposition was also modelled, and the results provided to for the human health risk component of this Environmental Assessment. Per default model setup, plume depletion was turned on, such that material that settled out of the plume (deposited on the ground) was removed from the airborne concentrations reported by the model. Deposition is typically reported in grams per square metre (g/m^2) and the results may be used further to estimate health risks based on biological intake (i.e., ingestion). The gaseous compounds were screened out during the preliminary air quality assessment (Appendix C.1), only particulate concentrations were carried forward for the air quality impact assessment, and airborne particulate concentrations and particulate deposition were provided to other disciplines for their use.

The approximately 30 km Haul Road connecting Beaver Dam to Touquoy was modelled as a line volume source representing both road and tailpipe emissions from truck traffic associated with the Beaver Dam Mine Site. The Haul Roads are assumed to have a control efficiency of 75 percent. This will be achieved through the implementation of a fugitive dust best management plan as well as a dust suppressant.

The Beaver Dam Mine mining, crushing, and transfer operations will primarily operate from within an open pit. Although vehicle traffic is also expected, it was assumed that most of these operations also occur within the pit. Therefore, the Beaver Dam Mine Site emissions were modelled using as an open pit source such that all emissions from mining operations were summed and attributed to the pit source.

The Touquoy Mine Site consists of crushers and mining sources as volume sources. These sources were previously modelled in AERMOD for an Emissions Summary and Dispersion Modelling Assessment (CRA, 2007). As the Beaver Dam Mine Site will use the Touquoy Mine Site for its refining capabilities, the crushing and mining operations remained unchanged.

The Air Dispersion Modelling Assessment is provided in Appendix C.1 and contains further details on the modelling methodology, background air concentrations, and all modelling results.

A series of tiered receptor grids, located at ground level, were used to identify the maximum point of impingement (POI) outside the Beaver Dam Mine Site and Touquoy Mine Site, and along the connecting Haul Road.

Around both facilities, the receptor grids were set up with the following grid spacing:

- 20 m spacing within 200 m of the edge of a bounding box that encompassed all onsite facility sources
- 50 m spacing from 200 to 500 m
- 100 m spacing from 500 to 1,000 m
- 200 m spacing from 1,000 to 2,000 m
- 500 m spacing from 2,000 to 5,000 m

A property line ground level receptor grid with 10 m spacing was used to evaluate the maximum property boundary concentration. No receptors were placed inside either Mine’s property line.

Along the Haul Road, receptors were placed with a 100 m spacing to a distance of 1000 m on either side of the road. Permanent residents, seasonal camps and cottages are located along the Beaver Dam Mines Road near Highway 224 and the Mooseland Road. Four residential receptors, also shown in this figure, were evaluated in the air dispersion model including:

- Musquodoboit Lumber Company
- Deepwood Estates
- 9 Beaver Dam Mines Road
- 3373 Highway 224

A follow-up air monitoring program is currently underway at the Touquoy facility. Operational air data has been collected throughout the approved construction and will continue through the operations phases of the Touquoy facility, which will provide insight into the effects of the Touquoy Project on air quality prior to the processing of Beaver Dam ore.

6.2.4.3 <u>Country Foods Evaluation Methodology</u>

An evaluation on the potential effects of dust deposition from haul truck activity on soils, berries, and vegetation was completed by Intrinsik in 2018. The evaluation and report focus on the potential implications of harvesting and consuming vegetation for traditional purposes by Indigenous peoples in the area of the Project and aims to assess the potential human health impacts related to compounds released via ore dust deposition.

Intrinsik predicted soil metal concentrations through the use of equations from US EPA OSW (2005), deposition rates based on modelled estimates, and geochemistry “fingerprint” ratios for road dust. The approach to predicting human exposure from the consumption of berries and leafy vegetation was based *on Health Canada’s Federal Contaminated Site Risk Assessment Guidance on Human Health Preliminary Quantitative Risk Assessment (Version 2.0)* (2012). The final report is provided in Appendix C.2.

6.2.4.4 Thresholds for Determination of Significance

A significant adverse effect to air quality is defined as an exceedance of the Assessment Criteria at a residential or commercial location outside the property boundary, where the exceedance is due to emissions from the operation and the event occurs more than 2% of the time.

Air compounds that are of most concern from project operations include TSP, and $PM_{2.5}$. PM_{10} has been included for reference, as a particulate size fraction between TSP and $PM_{2.5}$, but has limited usefulness in determining compliance or significance due to a lack of background monitoring data. Products of combustion (nitrogen oxides (NOx), sulphur dioxide (SO_2), and volatile organic compounds (VOCs)) were included in the preliminary assessment and were screened as being insignificant. This is described in detail in the air quality technical memorandum (GHD, 2019).

The standards are used as thresholds for determination of significance and provided in the table below, and as described in Section 6.2.4.4, above.

Table 6.2-4 Ambient Air Quality Standards for this Assessment

Indicator Compound	Averaging Period	Concentration µg/m^3	Source
Total Suspended Particulate (TSP)	24-hour	120	NSAQS
	Annual	70	NSAQS
PM_{10}	24-hour	50	Ontario - Interim
$PM_{2.5}$	24-hour	27	CAAQS (2020)
	Annual	8.8	CAAQS (2020)

µg/m^3 – micrograms per meter cubed
Ontario Interim guideline for PM_{10} no longer in effect, provided for informational purposes only
$PM_{2.5}$ 24-hour CAAQS for 2020 is based on the 3-year average of the 98th percentile of the daily 24-hour concentrations
$PM_{2.5}$ Annual CAAQS for 2020 is based on the 3-year average of the annual average concentrations

6.2.5 Project Activities and Air Interactions and Effects

Project activities which may produce particulate emissions to air are identified in the following table for each stage of the Beaver Dam mine project reviewed, including site preparation and construction, operations and maintenance, and decommissioning and reclamation. The estimated duration of project phase is also provided.

Table 6.2-5 Potential Air Interactions with Project Activities at Beaver Dam Mine Site

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	Up to 2 years	• Clearing, grubbing, and grading in preparation of construction • Drilling and rock blasting in preparation of construction • Till and waste rock from site preparation transport and storage • Watercourse and wetland alteration in preparation of construction • Mine site road construction • Surface infrastructure installation and construction • Collection and settling pond construction • General management of waste rock and soil derived from preparation and construction activities • Accidents and malfunctions to include fuel and other spills, forest fires, slope failure, an unplanned explosive event, and mobile equipment accident
Operation and Maintenance	3-4 years	• Rock blasting and ore extraction • Management of waste rock produced from crushing and preparing ore for transport • General management of waste rock derived from operation and maintenance activities • Accidents and malfunctions to include fuel and other spills, forest fires, slope failure, an unplanned explosive event, and a mobile equipment accident
Decommissioning and Reclamation	1-2 years	• Infrastructure Demolition • Site reclamation activities • Accidents and malfunctions to include fuel and other spills, slope failure, and forest fires

The potential interactions identified for the development and use of the proposed Haul Road between Beaver Dam Mine Site and the Touquoy Mine Site is provided below. The interactions are expected to be the same for the Haul Road as for the mine sites, except the construction phase will be shorter, and as the road is not currently anticipated to be decommissioned, there are no effects associated with the Decommissioning and Reclamation phase.

Table 6.2-6 Potential Air Interactions with Project Activities along Haul Road

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Drilling and rock blasting in preparation of construction • Till and waste rock from site preparation transport and storage • Watercourse and wetland alteration in preparation of construction • Haul road construction and upgrades • Accidents and malfunctions to include fuel and other spills, forest fires, and a haul truck accident
Operation and Maintenance	3-4 years	• Ore transport • Haul road maintenance and repairs • Accidents and malfunctions to include fuel and other spills, forest fires, and a haul truck accident
Decommissioning and Reclamation		N/A[1]

[1] Decommissioning and Reclamation of the Haul Road is not expected. The Haul Road will be returned to owner for forestry industry

The potential interactions identified for the Touquoy Mine Site are provided below. The interactions are expected to be the same for the Touquoy Mine Site as for the Beaver Dam Mine Site, except that this location is already constructed (so there are no additional construction activities to be considered)

Table 6.2-7 Potential Air Interactions with Project Activities at Touquoy Mine Site

Project Phase	Duration	Relevant Project Activity
Operation and Maintenance	3-4 years	• Ore management and processing • Accidents and malfunctions to include fuel and other spills, forest fires, and mobile equipment accidents
Decommissioning and Reclamation	1-2 years	• Accidents and malfunctions to include fuel and other spills, forest fires, and mobile equipment accidents

6.2.5.1 Beaver Dam Mine Site

Dust emissions are the primary atmospheric issue for the Beaver Dam Mine Site and airborne particulate matter will be generated during construction and operation phases of the Project. Sources of project-related particulate matter at the Beaver Dam Mine Site may include the following:

- overburden removal;
- blasting;
- rock crushing;
- onsite heavy truck traffic;
- material loading;
- wind erosion of material storage piles;
- construction of mine site roads; and
- operation of other heavy machinery.

During operation, most of the dust will be generated at the Beaver Dam Mine Site will be due to material handling and crushing processes and trucking operations. Estimated emissions for the Beaver Dam Mine Site are provided in Table 6.2-8. The total emissions (in grams per second or g/s) are provided as the sum of the emissions from all sources as this site was modelled as an open pit source.

Table 6.2-8 Estimated Particulate Emissions from Beaver Dam Mine

Activity	Emission Rate (g/s)		
	TSP	PM_{10}	$PM_{2.5}$
Conveyors	2.87E-02	9.44E-03	2.67E-03
Crusher	2.46E-01	1.11E-01	2.05E-02
Truck Loading	6.57E-03	3.29E-03	1.64E-03
TOTAL	**2.84E-01**	**1.24E-01**	**2.48E-02**

6.2.5.2 Haul Road

Airborne particulate matter will be generated during construction and operation of the proposed Haul Road. Sources of project-related particulate matter would include upgrading the existing road to be suitable for the mine traffic, and truck traffic hauling ore from Beaver Dam Mine to the Touquoy site for processing. Emissions estimates for the operations phase (Haul Road traffic during mine operations) are provided in Table 6.2-9.

Table 6.2-9 Estimated Particulate Emissions from the Haul Road

Activity	Emission Rate (g/s)		
	TSP	PM_{10}	$PM_{2.5}$
Haul Trucks	4.28E01	1.16E01	1.16E00

6.2.5.3 Touquoy Mine Site

The Touquoy Mine Site is currently in operation. The primary effect of the continued use of the Touquoy Mine Site is the continued generation of dust due to haul truck traffic on the site. There are no new or additional effects to air quality anticipated to be caused by the processing of ore and the management of tailings (exhausted pit) from the Project, as no new construction or disturbance is required at the Touquoy Mine Site related to the processing of Beaver Dam ore. Air emissions generated from the Touquoy Mine Site associated with the processing of Beaver Dam ore will include emissions generated from the processing plant, including the carbon reactivation furnace, the electrowinning cells, and the barring furnace (gold smelting), as well as mobile equipment sources. Air emissions will occur from the processing plant, including CO_2, ammonia, off-gassing of hydrogen cyanide, and nitrogen oxides.

The Air Dispersion Modelling Assessment completed by GHD Ltd. considered the Touquoy processing facility as an input source, as the Beaver Dam Mine Site will use the Touquoy Mine Site for its refining capabilities. The crushing and mining emissions rates remained unchanged since being previously modelled for an Emissions Summary and Dispersion Modelling Assessment however emissions estimates have been updated using standard US EPA AP-42 emission factors and new dispersion modelling carried out. The emissions estimates are provided in Table 6.2-10. Emissions are shown from the two most significant sources at the Touquoy Mine Site: the crushing system (comprising primary, secondary, and tertiary crushing) and the ROMTRANS, which comprise the transfer operations around the Raw Material Storage Pile, including material handling, transferring and conveying, loading the ROM stockpiles, and unloading from the ROM stockpiles.

Table 6.2-10 Estimated Particulate Emissions from Touquoy Mine Site

Activity	Emission Rate (g/s)		
	TSP	PM_{10}	$PM_{2.5}$
Crushers	9.38E-02	4.22E-02	7.81E-03
ROMTRANS	8.42E-02	3.17E-02	1.58E-02

6.2.6 Modelling Results and Assessment

Based on the air emission modelling, the concentrations of products of combustion (SO_2, NOx, and VOCs) were screened out. Predicted concentrations of these compounds from the truck traffic on the Haul Road were at least an order of magnitude lower than relevant air quality criteria. VOCs, having no appropriate guideline, were modelled and the results were consistent with the other gaseous species. Therefore, these compounds have not been discussed further in this report and their full assessment can be found in the air quality technical memorandum (GHD, 2019). The results of the particulate modelling for each portion of the Project are provided below.

Figures 6.2-3 to 6.2-7 show isopleths of the maximum predicted concentrations from the dispersion modelling, the individual results associated with each Mine site, and the Haul Road, are described below. In all figures, where there is no colour, the predicted concentrations are below the lowest value provided in the colour scale on the figure; shades of green indicate areas where the predicted concentrations are above the lowest value on the colour scale but are predicted to meet relevant air quality standards at all times; yellow indicates areas where the Mines and Haul Road operations meet the air quality standards on their own, but may exceed guideline values when background concentrations are added (cumulative effects); and red indicates where the Mines and Haul Road operations exceed relevant air quality standards.

6.2.6.1 Beaver Dam Mine Site

Maximum predicted concentrations of emitted particulate species from the Beaver Dam Mine Site are presented in Table 6.2-11. This table summarizes the particulate size fraction considered, the averaging period, the assessment criteria against which the results are compared, the maximum predicted concentration from the modelling, the ambient background concentration, the cumulative effect (the modelled concentration from the site added to the assumed existing background concentration for that averaging period), and the % of the assessment criteria for the site modelling results alone and the cumulative effects.

For this site, maximum predicted concentrations occurred at the property boundary. Predicted concentrations for all indicator compounds and averaging periods were lower than existing background concentrations, and well below relevant assessment criteria. The cumulative effects were also found to be below the assessment criteria for all compounds and averaging periods.

Table 6.2-11 Maximum Predicted Concentrations due to Beaver Dam Site Operations

Compound	Averaging Period	Assessment Criteria (μg/m³)	Maximum Predicted Concentration (μg/m³)	% of Assessment Criteria	Background Concentration (μg/m³)	Cumulative Effect (μg/m³)	% of Assessment Criteria for Cumulative Effect
TSP	24-hour	120	3.8	3%	41.7	45.5	38%
	Annual	70	0.8	1%	12.4	13.2	19%
PM_{10}	24-hour	50	3.7	7%	31.0	34.7	69%
$PM_{2.5}$	24-hour	27	1.4	5%	9.0	10.4	39%
	Annual	8.8	0.3	3%	5.7	6.0	68%

6.2.6.2 Haul Road

Maximum predicted concentrations of emitted particulate species from the Haul Road are presented in Table 6.2-12. This table summarizes the particulate size fraction considered, the averaging period, the assessment criteria against which the results are compared, the maximum predicted concentration from the modelling, the ambient background concentration, the cumulative effect (the modelled concentration from the site added to the assumed existing background concentration for that averaging period), and the % of the assessment criteria for the site modelling results alone and the cumulative effects.

For this site, maximum predicted concentrations occurred within 30 m of the road, and predicted concentrations decreased, with increasing distance from the road. Predicted concentrations for TSP were found to be greater than the assessment criteria and existing background, indicating that TSP will not meet provincial guideline values at close proximity to the road. Isopleth figures (concentration gradients) provided in GDH (2019) illustrate the reduction of concentrations with increasing distance from the road, and the small size of area affected by either the Project or cumulative effects exceedances (Appendix C.1).

PM_{10} predicted concentrations were also above assumed background concentrations and greater than the interim Ontario standard at the maximum point of impingement, however this is not a regulated compound in Nova Scotia, or federally. $PM_{2.5}$ concentrations from road operations alone at the maximum point of impingement were below assessment criteria for this compound, but when added to assumed background, it is possible that annual $PM_{2.5}$ concentrations in close proximity to the road may exceed annual guideline values (but not on a 24 hour basis).

Table 6.2-12 Maximum Predicted Concentrations due to Haul Road Operations

Compound	Averaging Period	Assessment Criteria (µg/m³)	Maximum Predicted Concentration (µg/m³)	% of Assessment Criteria	Background Concentration (µg/m³)	Cumulative Effect (µg/m³)	% of Assessment Criteria for Cumulative Effect
TSP	24-hour	120	**251.1**	**209%**	41.7	**292.8**	**244%**
	Annual	70	**84.4**	**121%**	12.4	**96.7**	**138%**
PM_{10}	24-hour	50	**146.3**	**293%**	31.0	**177.3**	**355%**
$PM_{2.5}$	24-hour	27	16.2	60%	9.0	25.2	93%
	Annual	8.8	5.1	58%	5.7	**10.8**	**123%**

For all the TSP size fraction, predicted concentrations decrease rapidly with distance and predicted cumulative effects are anticipated to be below guideline values at approximately 200 m distance from the road or less.

The PM_{10} cumulative effects concentrations are more strongly affected by the assumed background concentration (which is, itself, 62% of the assessment criteria). Using this highly conservative assessment, it is estimated that PM_{10} cumulative effects concentrations would decline to values below the assessment guideline at all times within 800 m of the road. If background PM_{10} were found to be half the current estimate, this distance would drop to approximately 350 m from the road, and in many areas less, demonstrating that accurate background data are needed to fully understand this issue.

Modelled $PM_{2.5}$ from road activities alone was predicted to meet 24-hour CAAQS even at the 30 m distance, possibly exceeding annual guidelines at this maximum location, but over half of the contribution to annual concentrations was found to be from background sources. The exceedance of the annual average $PM_{2.5}$ guideline in the cumulative effects assessment is limited to a very few individual roadside receptors (30 m from the road), and is not predicted to occur over a wide area or at any of the sensitive receptors.

6.2.6.3 Touquoy Site

Maximum predicted concentrations of emitted particulate species from the Touquoy Mine Site are presented in Table 6.2-13. This table summarizes the particulate size fraction considered, the averaging period, the assessment criteria against which the results are compared, the maximum predicted concentration from the modelling, the ambient background concentration, the cumulative effect (the modelled concentration from the site added to the assumed existing background concentration for that averaging period), and the % of the assessment criteria for the site modelling results alone and the cumulative effects.

For this site, maximum predicted concentrations occurred at the property boundary. Predicted concentrations for all indicator compounds and averaging periods were lower than existing background concentrations, and well below relevant assessment criteria. The cumulative effects were also found to be below the assessment criteria for all compounds and averaging periods.

Table 6.2-13 Maximum Predicted Concentrations due to Touquoy Mine Site Operations

Compound	Averaging Period	Assessment Criteria (µg/m³)	Maximum Predicted Concentration (µg/m³)	% of Assessment Criteria	Background Concentration (µg/m³)	Cumulative Effect (µg/m³)	% of Assessment Criteria for Cumulative Effect
TSP	24-hour	120	3.1	3%	41.7	44.8	37%
	Annual	70	1.1	2%	12.4	13.4	19%
PM_{10}	24-hour	50	3.1	6%	31.0	34.1	68%
$PM_{2.5}$	24-hour	27	1.3	5%	9.0	10.3	38%
	Annual	8.8	0.4	5%	5.7	6.1	70%

6.2.6.4 Sensitive Receptors

As the maximum predicted concentrations of all particulate species occurred in close proximity to the Haul Road, the four identified sensitive receptors were specifically considered with respect to Haul Road operations. Results are provided in the following tables.

Table 6.2-14 Maximum Predicted Concentrations for the Musquodoboit Lumber Company

Compound	Averaging Period	Assessment Criteria (µg/m³)	Maximum Predicted Concentration (µg/m³)	% of Assessment Criteria	Background Concentration (µg/m³)	Cumulative Effect (µg/m³)	% of Assessment Criteria for Cumulative Effect
TSP	24-hour	120	15.0	13%	41.7	56.7	47%
	Annual	70	3.5	5%	12.4	15.9	23%
PM_{10}	24-hour	50	13.0	26%	31.0	44.0	88%
$PM_{2.5}$	24-hour	27	2.1	8%	9.0	11.1	41%
	Annual	8.8	0.5	6%	5.7	6.2	71%
Deposition (g/m2/yr)	Annual	—	13.2	—	—	—	—

Table 6.2-15 Maximum Predicted Concentrations for Deepwood Estates

Compound	Averaging Period	Assessment Criteria (µg/m³)	Maximum Predicted Concentration (µg/m³)	% of Assessment Criteria	Background Concentration (µg/m³)	Cumulative Effect (µg/m³)	% of Assessment Criteria for Cumulative Effect
TSP	24-hour	120	92.0	77%	41.7	**133.7**	**111%**
	Annual	70	31.5	45%	12.4	43.8	63%
PM_{10}	24-hour	50	82.1	165%	31.0	**113.1**	**226%**
$PM_{2.5}$	24-hour	27	9.7	36%	9.0	18.7	69%
	Annual	8.8	2.7	30%	5.7	8.4	95%
Deposition (g/m2/yr)	Annual	—	72.5	—	—	—	—

Table 6.2-16 Maximum Predicted Concentrations for 9 Beaver Dam Mines Road

Compound	Averaging Period	Assessment Criteria (µg/m³)	Maximum Predicted Concentration (µg/m³)	% of Assessment Criteria	Background Concentration (µg/m³)	Cumulative Effect (µg/m³)	% of Assessment Criteria for Cumulative Effect
TSP	24-hour	120	25.6	21%	41.7	67.3	56%
	Annual	70	9.6	14%	12.4	22.0	31%
PM_{10}	24-hour	50	41.1	82%	31.0	**72.1**	**144%**
$PM_{2.5}$	24-hour	27	5.3	20%	9.0	14.3	53%
	Annual	8.8	1.3	15%	5.7	7.0	80%
Deposition (g/m2/yr)	Annual	—	23.2	—	—	—	—

Table 6.2-17 Maximum Predicted Concentrations for 3373 Highway 224

Compound	Averaging Period	Assessment Criteria (µg/m³)	Maximum Predicted Concentration (µg/m³)	% of Assessment Criteria	Background Concentration (µg/m³)	Cumulative Effect (µg/m³)	% of Assessment Criteria for Cumulative Effect
TSP	24-hour	120	5.5	5%	41.7	67.5	56%
	Annual	70	1.3	2%	12.4	29.4	42%
PM_{10}	24-hour	50	7.9	16%	31.0	38.9	78%
$PM_{2.5}$	24-hour	27	1.3	5%	9.0	10.3	38%
	Annual	8.8	0.3	4%	5.7	6.0	69%
Deposition (g/m2/yr)	Annual	—	23.5		—	—	—

The results of this assessment found that TSP and $PM_{2.5}$ were not exceeded for the Project alone, at any of the sensitive receptor locations, for either the 24-hour averaging period, or annual average time frames. PM_{10} predictions for Project alone did not exceed guidelines at 3 of the 4 receptor locations, with the exception being Deepwood Estates. Maximum concentrations of PM_{10} exceeded the Ontario interim guideline less than 2% of the time at the Deepwood Estates receptor without the addition of the background air quality data (i.e., up to 7 days per year, the model predicts that Deepwood Estates may experience concentrations of PM_{10} above 50 µg/m^3 due to Haul Road operations alone, without including background).

The cumulative effects assessment for 24-hour TSP, PM_{10} and $PM_{2.5}$ showed no exceedances over guidelines with the exception of Deepwood Estates sensitive receptor (TSP and PM_{10}) and 9 Beaver Dam Mines Road sensitive receptor (PM_{10}). The predictions for Deepwood Estates are provided in Table 6.2-15 and those for 9 Beaver Dam Mines Road are shown in Table 6.2-16. The frequency of these occurrences is relatively low (both sites meet the guidelines at the 98th percentile), and the assumed background concentrations for this assessment are anticipated to be quite conservative, and hence the cumulative assessment results are potentially over estimated.

With the addition of background concentrations, 24-hour concentrations of TSP and PM_{10} may exceed their respective criteria at Deepwood Estates (Table 6.2-15) up to 0.3% of the time for TSP (1 day per year) and up to 57% of the time for PM_{10} (207 days per year). Again, due to the large uncertainty regarding the TSP and PM_{10} background concentrations, this frequency analysis expected to be over-predicting the results (as it relies on the maximum of 14 data points for TSP), and data from over 3000 km away for PM_{10}). At #9 Beaver Dam Mines Road (Table 6.2-16) 24-hour PM_{10} may also exceed the 24-hour assessment criteria (Table 6.2-16) when background concentrations are considered, though not due to Haul Road activity alone. A frequency analysis at this location suggests that Haul Road plus background sources together may result in 24-hour concentrations of PM_{10} greater than the Ontario Interim guideline of 50 µg/m^3 up to 13% of the time (or 47 days per year). As at Deepwood Estates, reliance on what could be elevated background concentrations for PM_{10} may result in over predicting these cumulative effects.

PM_{10} is not a regulated compound in Nova Scotia, or at the federal level in Canada, and the estimated background concentration of PM_{10}, 31 µg/m^3, represents 62% of the Interim guideline, so there is a great deal of uncertainty in the 24-hour PM_{10} assessment. While some measured PM_{10} data are available for areas near the Project site, the data are limited to only three 24-hour samples (ranging from 7.1 to 13.1 µg/m^3; GHD, 2019). Baseline data in this range would result in a more limited number of exceedances related to cumulative effects for $PM_{10.}$ The possible exceedance of 24-hour TSP and PM_{10} at Deepwood Estates should be a consideration for future monitoring programs, as well as ensuring that the Haul Road dust best management practices plan is implemented and monitored.

With regard to annual average time periods, there were no exceedances of either TSP or $PM_{2.5}$ at any of the sensitive receptor locations, for either Project alone or the cumulative effects assessment (Project + Background).

The prime focus with respect to potential health implications related to air quality exceedances, relative to these 3 parameters (TSP, PM_{10} and $PM_{2.5}$), is on $PM_{2.5}$, as this fraction of particulate matter is fine, and hence can travel more deeply into the lungs, and has been associated with adverse cardiovascular and respiratory health effects (CCME, 2018). The Project alone, and cumulative effects assessments related to $PM_{2.5}$ at the sensitive receptor locations indicated that neither the 24-hour nor annual average guidelines established as CAAQs will be exceeded. While $PM_{2.5}$ is considered a non-threshold acting substance, which indicates that any exposure can be associated with some degree of risk, the resulting cumulative effect predictions suggest that risk levels will be within acceptable ranges, as indicated by nationally-based standards established for this particulate fraction. While the annual average guideline for $PM_{2.5}$ is predicted to be exceeded at the Maximum Point of Impingement for the Haul Road, this location is not an area wherein people would be present over an annual time frame, and hence, exposures at these levels would not be incurred.

The exceedances related to TSP (24 hour – Deepwood Estates) and PM_{10} (24 hour – Deepwood Estates and #9 Beaver Dam Mines Road) are considered likely to be overestimated in the cumulative effects assessment, due to the conservatism related to the lack of local background data (as well as conservatism inherent in the dispersion modelling). Some exceedances would still be predicted to occur, even with more representative background data for both parameters, but the degree and frequency of cumulative effects exceedances would be expected to be less than that presented in this assessment. As indicated above, only areas in close proximity to the Haul Road are anticipated to exceed guidelines, and the implementation of both monitoring and a best management practices plan, will assist in confirming these predictions, and determining any potential need for additional mitigation.

All three size fractions of particulate assessed may exceed Assessment Criteria close to the Haul Road, but as there are no sensitive receptors along much of this route, this is considered not significant pending monitoring to demonstrate that the effects are not extending to residential or commercial areas. At the identified sensitive receptors, Haul Road operations alone are not anticipated to result in concentrations of particulate exceeding the Assessment Criteria more than 2% of the time, however the cumulative effects increase this frequency. Monitoring will be carried out to confirm the assessment of non-significance along the Haul Road and at the sensitive receptors, and to determine if the proposed dust mitigation will be sufficient to ensure there are no adverse air quality effects as a result of Haul Road operations.

6.2.6.5 Other Uses of the Data

A further evaluation was completed by Intrinsik to investigate the potential impact of the dust deposition as it relates to soil, berries, and vegetation as it relates to human consumption. To evaluate the potential impact of dust deposition to soils and plants beyond the property boundary, a separate evaluation was completed by Intrinsik.

The Intrinsik report concluded that metals will be released from dust deposition along the Haul Road, and have the potential to accumulate in soils, and thus vegetation. The effect of the dust deposition and accumulation in vegetation are likely to be localized to areas most impacted by dust loadings, and deposition would decrease with increasing distance from the Haul Road. The evaluation also predicted changes to soil concentrations of metals as a result of dust deposition from Haul Road activity. It is important to note that metals occur naturally in the environment and are present within existing soils and vegetation. All metals considered in the assessment, with the exception of aluminum and boron, are predicted to be below provincial and federal soil quality guidelines. Aluminum and boron soil concentrations are elevated above soil quality guidelines in baseline, likely due to natural enrichment. The additional incremental contribution from the Project to existing soil aluminum and boron concentrations is predicted to be minimal. Based on the estimated future soil concentrations of metals considered, some accumulation of metals within vegetation is anticipated to occur but would likely be localized to areas most affected by dust loadings which are generally limited in their spatial extent. Future berry concentrations were predicted to remain within the baseline berry concentrations ranges, with the exception of aluminum, and future leafy vegetation were predicted to remain within baseline leafy vegetation concentrations, with the exception of vanadium.

An assessment of potential risks related to consumption of berries and vegetation from areas near the Haul Road was conducted, and it is considered unlikely that ore dust deposition from the Haul Road at the rates considered in this assessment would result in levels of metals in berries and leafy vegetation that would be harmful to human health, if consumed.

The full report can be found in Appendix C.2.

6.2.7 Preferred Alternative Haul Road

6.2.7.1 Rationale for Valued Component Selection

The same rationale was used for the valued component selection as indicated in 6.2.1.

6.2.7.2 Baseline Program Methodology

The same methodology was used for the baseline program for the Preferred Alternative Haul Road option as indicated in 6.2.2. No additional baseline studies were completed for this Haul Road option.

6.2.7.3 Baseline Conditions

Ambient air has been sampled at several representative locations in this rural area. The key sensitive receptor in the area is the Beaver Lake IR 17; a satellite community of the Millbrook First Nation located approximately 5 km south of the Beaver Dam Mine Site. At its nearest point, the Preferred Alternative Haul Road is approximately 5.1 south west of Beaver Lake IR 17. Other receptors in the area include residences along Mooseland Road (2.5 km), seasonal dwellings on the Cross Rd (1.5 km), and other permanent residences located approximately 5.8 km to the north of the Touquoy Mine Site along Caribou Road. Activities in these areas are ongoing and include recreational use (hunting, ATVs, etc).

The Preferred Alternative Haul Road is located north of the primary Haul Road and is anticipated to have less of an impact on key receptors at Mooseland Road and the Cross Road and no change in the impact on Beaver Lake IR 17 and Beaver Dam Mine Road receptors.

6.2.7.4 Consideration of Consultation and Engagement Results

The Preferred Alternative Haul Road is the result of consultation and engagement on the primary Haul Road. The Preferred Alternative Haul Road is further from human receptors located on the "Moose River Cross Road" so-called and from residents located on the Mooseland Road. Consultation and engagement results are presented in Section 6.1.4.

6.2.7.5 Effects Assessment Methodology

The effects assessment methodology of the Preferred Alternative Haul Road is as presented in Section 6.2.5. The spatial boundary of the PA for the Preferred Alternative Haul Road is confined only to this segment and assessed independently of the primary route. The LAA and RAA remain the same as indicated in Section 6.1.5.1.

As the Project has the potential to cause direct and indirect effects to air outside of the Preferred Alternative Haul Road PA, the LAA is the appropriate boundary for evaluation of this VC.

The same Temporal, Technical, and Administrative Boundaries are considered for the Preferred Alternative Haul Road as indicated in Section 6.1.5.

6.2.7.5.1 Thresholds for Determination of Significance

The thresholds for determination of significance regarding air within the Preferred Alternative Haul Road are identical to the thresholds for determination of significance for this VC, as presented within Section 6.2.4.4.

6.2.7.6 Project Activities and Air Interactions and Effects

The identified sensitive receptors for the air quality assessment consisted of four residences in moderate proximity to the identified Haul Road between the Beaver Dam Mine and the Touquoy Mine (two of these receptors are less than 200 m distant from the road). The Preferred Alternative Haul Road option is located 1.5 km from the nearest sensitive receptor. This increased separation distance between the Haul Road and the identified sensitive receptors would decrease any residual air quality effects from re-suspended road dust (particulate).

As the Preferred Alternative Haul Road will result in lower airborne particulate concentrations from Haul Road traffic than the alternative assessed previously, no additional modelling is required.

6.2.8 Mitigation

Mitigation measures used to reduce and control air pollutants during construction, operation, and decommissioning phases are outlined in Table 6.2-18. Mitigation measures at the Touquoy Mine Site (as required by the IA, listed below) are anticipated to continue throughout the operation of the Touquoy Mine Site. Refer to Appendix C.3 for the Dust Control Plan.

The control of dust from the mining operations will focus on provision of moisture control measures, such as spraying with water as required. In-pit operations will not generally have much direct off-site impact, but could contribute to general dust levels at critical times if not controlled. The crushed ore stockpile at the Touquoy Mine Site will be covered to minimize wind and rain erosion; stockpiles will not be covered at the Beaver Dam Mine Site and may contribute to airborne dust. Dust control requires careful and consistently applied mitigation measures throughout the Project to ensure non-compliant or nuisance levels are avoided. The proposed mitigation measures for various process components are outlined below. These are similar to measures routinely used at most other Nova Scotia surface mine operations that allow for compliance with air quality guidelines at residential receptors.

Wind erosion from elevated waste rock piles containing finely divided material can be a major source of dust at mine sites. To prevent this occurrence, slopes on inactive stockpiles will be stabilized with mulching and/or vegetation, where appropriate. Waste rock piles will be sprayed with water as necessary to minimize fugitive dust.

Preventative measures to minimize dust produced on-site (Beaver Dam and Touquoy) and along the Haul Road include:

- Wet suppression controls on unpaved surfaces;
- Hardened surfaces where practical;
- Speed reduction to keep dust levels at minimum;
- Use of large haul vehicles so as to minimize trip frequency;
- Covering of haul trucks to minimize dust during transportation between the mine site and the Touquoy facility, and

- Stabilized slopes and cover on inactive stockpiles.

The application of mitigation measures that are outlined in Table 6.2-18 to reduce airborne particulate matter will be determined by maintaining regulatory compliance with the NSE Maximum Permissible Ground Level Concentrations listed in the Nova Scotia *Air Quality Regulations* and with the Canadian Ambient Air Quality Standards for fine particulate matter and ozone. There are no federal or Nova Scotia provincial air quality criteria for PM_{10}.

Ongoing monitoring will determine compliance with these standards, and any exceedance or complaint by the general public or First Nations will be discussed with regulators and/or the CLC, and mitigation programs and operational practices will be reviewed to determine the appropriate course of action.

In the event that the monitoring program identifies the need for additional dust mitigation measures for the Haul Road, options exist for further reduction in particulates including:

- An enhanced dust suppression application schedule.
- Use of other suppressants such as lignin, chlorides, asphalt emulsions, natural clay, plant oils or others methods.
- Road re-surfacing or treatments to reduce silt content.
- Paving portions of the Haul Road.

A complaint from the public and/or First Nations will be a trigger to evaluate mitigation options. The Site Manager will be responsible for consideration of preventative mitigative actions listed here and in Table 6.2-18. Dust suppression on the Haul Road is a planned mitigation (targeting 75% effectiveness).

Table 6.2-18 Mitigation for Air

VC	Project Phase	Mitigation Measure
Dust and Particulate Matter	CON, OP	Use wet suppression controls on unpaved surfaces
	CON, OP	Utilize paved surfaces where available
	CON, OP	Speed reduction
	OP	Apply stabilized covers on inactive stockpiles
	OP	Use mechanical sweeper on paved surfaces to prevent dust from remobilizing
	OP	Apply dust suppressants, when and where practicable, to target 75% effectiveness
	OP	Size haul vehicles appropriately to minimize trip frequency
	OP	Implement appropriate dust suppression measures for crusher trains and associated activities/stockpiles
	OP	Cover haul trucks to minimize dust during transportation between the mine site and the Touquoy facility
	OP	Implement Dust Suppression Plan
	OP	A procedure, including a response plan, will be available for public to be able to register complaints regarding dust concerns
	DEC, REC	Stabilize slopes on inactive stockpiles to a safe and long-term angle of repose
	DEC, REC	Use soil and organics stockpiles for final capping and stabilization. Hydroseed as required

6.2.9 Residual Effects and Significance

The Haul Road between the proposed Beaver Dam Mine and the Touquoy Mine Site is the source primarily responsible for the maximum predicted concentrations at both the gridded receptors and the sensitive receptors. Emissions of particulates from the Haul Road are predicted to result in some exceedances of the assessment criteria, for particulate species, at close proximity to the road. With the addition of regional background concentrations, the cumulative effects assessment suggests that these exceedances may extend up to 200 m on either side of the road. As exceedances are only anticipated in extremely close proximity to the road, this effect has been assessed as “not significant”. This will need to be confirmed through a monitoring program.

For the sensitive receptors, modelling suggests that PM_{10} may exceed the Interim Ontario 24-hour PM_{10} criteria of 50 μg/m^3 at Deepwood Estates, due to Haul Road activity alone, up to 2% of the time. With the addition of background, there were predicted exceedances of the 24-hour TSP and PM_{10} guidelines at Deepwood Estates (0.3% and 57% of the time, respectively), and 24-hour PM_{10} at 9 Beaver Dam Mines Road (13% of the time). There is a great deal of uncertainty in the presented background concentrations for both TSP and PM_{10}, which reduces the proposed significance of these findings. The overall significance of these exceedances is therefore also assessed as “not significant”, which is to be confirmed by a robust and longer-term air quality monitoring program for TSP and PM_{10}, in particular near the Deepwood Estates sensitive receptor, to confirm that there will be no adverse effects due to dust from the Haul Road

Table 6.2-19 Residual Environmental Effects for Air

Project - VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Beaver Dam Mine Site and Haul Road (Dust from haul trucks, Haul Road widening and construction, and on-site operations and material handling)	Equipment maintenance, best management practices, minimize blasting events.	A	N Does not exceed guidelines or threshold values	LAA Dust generated will likely extend beyond the PA	N/A VC is not expected to be affected by timing	MT Effects can occur beyond 12 months and up to 3 years	R Effects occur regularly in the construction phase of the Project	R VC will recover to baseline conditions	Increased ambient dust	Not significant
Operational – Beaver Dam Mine Site and Touquoy Mine Site at Property Lines (Dust from onsite activities, vehicle travel, material handling and the crushing of ore)	Equipment maintenance, dust suppression, hardened surface where practical, vehicle speed reduction, use of large haul vehicles to minimize trips, stabilization of stockpile slopes, covering of haul trucks, minimize blasts.	A	N Does not exceed guidelines or threshold values	LAA Dust generated will likely extend beyond the PA	N/A VC is not expected to be affected by timing	LT Effects may extend beyond 3 years	R Effects occur regularly in the construction phase of the Project	R VC will recover to baseline conditions	Increased ambient dust	Not Significant
Operational – Beaver Dam Mine Site and Touquoy Mine Site at Points of Reception (Dust from onsite activities, vehicle travel, material handling and the crushing of ore)	Equipment maintenance, dust suppression, hardened surface where practical, vehicle speed reduction, use of large haul vehicles to minimize trips, stabilization of stockpile slopes, covering of haul trucks, minimize blasts.	A	N Does not exceed guidelines or threshold values	LAA Dust generated will likely extend beyond the PA	N/A VC is not expected to be affected by timing	LT Effects may extend beyond 3 years	R Effects occur regularly in the operational phase of the Project	R VC will recover to baseline conditions	Increased ambient dust	Not Significant
Operational – Haul Road at Property Lines (Dust from haul trucks)	Haul truck operations < 24 hours per day to minimize road surface disturbance during nighttime hours, implementation of Road Dust Best Management Practices Plan (with 75% or greater targeted dust suppression efficiency).	A	H Exceeds guidelines or threshold values by more than 20%	LAA Dust generated will likely extend beyond the PA	N/A VC is not expected to be affected by timing	LT Effects may extend beyond 3 years	R Effects occur regularly in the operational phase of the Project	R VC will recover to baseline conditions	Increased ambient dust	Not Significant (to be confirmed through monitoring)
Operational – Haul Road at Points of Reception (Dust from haul trucks)	Haul truck operations < 24 hours per day to minimize road surface disturbance during nighttime hours, implementation of Road Dust Best Management Practices Plan (with 75% or greater targeted dust suppression efficiency).	A	L Marginally exceeds guidelines or threshold values	LAA Dust generated will likely extend beyond the PA	N/A VC is not expected to be affected by timing	LT Effects may extend beyond 3 years	R Effects occur regularly in the operational phase of the Project	R VC will recover to baseline conditions	Increased ambient dust	Not Significant (to be confirmed through monitoring)

Project - VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Reclamation – Beaver Dam Mine Site (heavy machinery operation for infilling of pit, reclaiming stockpiles, etc.)	Equipment maintenance, best management practices.	A	N Does not exceed guidelines or threshold values	LAA Dust generated will likely extend beyond the PA	N/A VC is not expected to be affected by timing	MT Effects can occur beyond 12 months and up to 3 years	R Effects occur regularly in the reclamation phase of the Project	R VC will recover to baseline conditions	Increased ambient dust	Not significant

Legend (refer to Table 5.10-1 for definitions)

Nature of Effect	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
A Adverse	N Negligible	PA Project Area	N/A Not Applicable	ST Short-Term	O Once	R Reversible
P Positive	L Low	LAA Local Assessment Area	A Applicable	MT Medium-Term	S Sporadic	IR Irreversible
	M Moderate	RAA Regional Assessment Area		LT Long-Term	R Regular	PR Partially Reversible
	H High			P Permanent	C Continuous	

A significant adverse environmental effect for air has been predicted for the Project for the following reasons, with consideration of the ecological and social context of the LAA surrounding the Project:

- During Construction: Dust will be elevated above baseline for periods and there is a reasonable likelihood of receptors being in close proximity to dust generation sites.
- During Operations: Dust will be elevated above baseline during this period and it is likely that receptors will be in close proximity to dust generation sites.
- During Closure: Dust will be elevated above baseline during closure activities involving mobile equipment and then drop to baseline for the post-closure period.

TSP and PM2.5 from Haul Road operations alone do not exceed the Nova Scotia or CCME guidelines at sensitive receptors identified and so the predicted particulate concentrations are not considered significant. Because cumulative values have the potential to exceed TSP guidelines at Deepwood Estates, and because some elevated concentrations of PM10 (which is not regulated at the provincial or federal level) were predicted at Deepwood Estates and 9 Beaver Dam Mines Road, monitoring will be carried out to confirm the assessment of non-significance provided by the definition above, and to determine if the proposed mitigation will be sufficient to ensure there are no adverse air quality effects as a result of Haul road operation.

6.2.9.1 Preferred Alternative Haul Road Residual Effects and Significance

Table 6.2-20 Residual Environmental Impacts of Air within the Preferred Alternative Haul Road

Project - VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Preferred Alternative Haul Road (Dust from haul trucks, Haul Road widening and construction)	Equipment maintenance, best management practices, minimize blasting events.	A	N Does not exceed guidelines or threshold values	LAA Dust generated will likely extend beyond the PA	N/A VC is not expected to be affected by timing	MT Effects can occur beyond 12 months and up to 3 years	R Effects occur regularly in the construction phase of the Project	R VC will recover to baseline conditions	Increased ambient dust	Not significant
Operational – Preferred Alternative Haul Road (Dust from haul trucks)	Haul truck operations < 24 hours per day to minimize road surface disturbance during nighttime hours, implementation of Road Dust Best Management Practices Plan (with 75% or greater targeted dust suppression efficiency).	A	H Anticipated levels above a threshold value.	LAA Dust generated will likely extend beyond the PA	N/A VC is not expected to be affected by timing	LT Effects may extend beyond 3 years	R Effects occur regularly in the operational phase of the Project	R VC will recover to baseline conditions	Increased dust	Not Significant (to be confirmed through monitoring)

Legend (refer to Table 5.10-1 for definitions)

Nature of Effect	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
A Adverse	N Negligible	PA Project Area	N/A Not Applicable	ST Short-Term	O Once	R Reversible
P Positive	L Low	LAA Local Assessment Area	A Applicable	MT Medium-Term	S Sporadic	IR Irreversible
	M Moderate	RAA Regional Assessment Area		LT Long-Term	R Regular	PR Partially Reversible
	H High			P Permanent	C Continuous	

Table 6.2-19 was reviewed, and it was determined that the construction and operation (dust from haul trucks) of the Haul Road were the only two VC interactions applicable to air associated with the Preferred Alternative Haul Road. There were no changes in the significance criteria or overall significance for either of these VC interactions (Table 6.2-20).

Mitigations presented in Table 6.2-18 will be established to reduce the impact of air from Project activities.

6.2.10 Proposed Compliance and Effects Monitoring Program

Prior to the start of construction, a baseline ambient air quality monitoring program will be undertaken at select locations on the Beaver Dam mine site and along the Haul Road. Air quality monitoring is currently ongoing at the Touquoy mine site and will continue throughout the construction and operations phase. The data collected will be used to better understand potential effects and refine mitigation and monitoring requirements prior to the processing of Beaver Dam ore.

Table 6.2-18 summarizes the mitigation activities that will be completed throughout the life of the Project. The details of the monitoring programs will be determined in consultation with regulatory agencies and will be described in the application for an IA for the site operations following the EA process. An Environmental Management System (EMS) and Environmental Protection Plan (EPP) will be developed as part of the Project implementation that will confirm the responsibility and system of accountability for the compliance and effects monitoring program.

The objectives of the atmospheric environment monitoring programs are to:

- Verify effects predicted in the EIS;
- Confirm the continuing effectiveness of mitigation measures;
- Identify the need for any new mitigation measures; and
- Confirm compliance with regulatory approvals and requirements.

Details of proposed air monitoring for the Beaver Dam Project are included in a Preliminary Environmental Effects Monitoring (EEM) Program, included as Appendix O.1. Refer to Appendix C.3 for the Dust Control Plan.

6.3 Light

6.3.1 Rationale for Valued Component Selection

Light level limits are not directly regulated through the provincial or federal regulatory regime. Changes (i.e. increases or changes to occurrence timing) to ambient light levels have the potential to adversely affect fauna and birds, as well as increase level of light ~~pollution~~ experienced by the general public or specific populations.

6.3.2 Baseline Program Methodology

A light impact assessment was conducted for the Touquoy facility in 2007, and for the Beaver Dam Mine Site in 2017. The impacts of the proposed lighting installations were quantified and compared with guidelines published by The Institution of Lighting Engineers (ILE) in the document entitled “Guidance Notes for the Reduction of Obtrusive Light”. A background light study was conducted at the Touquoy Mine Site in August 2007. Post curfew measurements (after 11 pm) were conducted utilizing a Skeonic L-358 flash meter. Measurements were taken in the EV mode and converted into LUX values.

6.3.3 Baseline Conditions

6.3.3.1 Ambient Light

The Beaver Dam Mine Site is in a remote, rural and mostly wooded, location. Ambient nighttime light conditions would be minimal and typical of an undeveloped rural area. The largest artificial light sources in the Project area are from the nearest residences (5+ km) ~~of~~ at the Beaver Lake Indian Reserve, and the occasional all-terrain vehicle.

Light monitoring was not completed during the baseline studies as ambient nighttime light conditions are not anticipated to cause any effects on the nearest residences. The Haul Road will not be active ~~at night~~ overnight and the Beaver Dam and Touquoy Mine Sites are located more than ~~5 km from the nearest residence.~~ 3 km from the nearest resident at the Beaver Lake IR; however, the Haul Road will pass in proximity to a permanent dwelling on Beaver Dam Mines Road and seasonal dwellings on the Cross Road. Furthermore, other than the hauling trucks, no other lighting sources will be present along the Haul Road (i.e. street lights, traffic lights).

As part of the 2007 Focus Report, a background light study was conducted at the Touquoy Mine Site. At all locations where measurements were taken, ambient light measurements were under exposed, indicating ambient light levels were too low to be measured.

6.3.4 Consideration of Consultation and Engagement Results

Key issues raised during public consultation and Mi’kmaq engagement relating to ambient light include light from mining operations at the Beaver Dam Mine Site and trucking along the Haul Road. The change to the Haul Road reduced these concerns with respect to passing by existing residences, especially concerns of Millbrook First Nation regarding its residents in Beaver Lake.

The results of the public consultation and Mi’kmaq engagement have been considered in the environmental effects assessment, including the Proponent’s commitments on mitigation and monitoring measures and proposed compliance and effects monitoring programs, as well as the Proponent’s broader commitment to ongoing public consultation and Mi’kmaq engagement. Specific to evaluating the effect of ambient light, these are found within the following environmental effects assessment.

6.3.5 Effects Assessment Methodology

6.3.5.1 Boundaries

Spatial Boundaries

The spatial boundary used for the assessment of effects of ambient light are discussed below: ~~the PA, LAA, and RAA.~~

The PA encompasses three primary components from Marinette to Moose River Gold Mines, Halifax County, NS. The Beaver Dam Mine Site will be located at the end of the Beaver Dam Mines Road and the Haul Road will span from the Beaver Dam Mine Site to Moose River Gold Mines, where the Touquoy Mine [processing and exhausted pit (to be used to dispose Beaver Dam tailings)] is located.

The LAA is variable based on 1 LUX threshold. Preliminary modelling and evaluation of light has determined this to be maximum distance of light propagation to a 1 LUX increase threshold (Figure 6.3-1).

The RAA encompasses an area 2 km in all directions surrounding the PA. Preliminary modelling and evaluation of light has determined this to be maximum extent of light propagation (Figure 6.3-1).

As the Project has the potential to cause direct and indirect effects of ambient light outside of the PA, ~~as well as cumulative effects compounded spatially and temporally from other Projects, the RAA and~~ the LAA ~~are~~ is the most appropriate spatial boundary.

Temporal Boundaries

The temporal boundaries used for the assessment of effects of ambient light are the construction phase, operational phase, and decommissioning and reclamation phase.

Technical Boundaries

Canada Occupational Health and Safety Regulations (SOR/86-304) direct the minimum illumination levels required at various workplace locations. To the extent that migrating birds may be affected by the Project, the federal *Migratory Birds Convention Act 1994* and the *Species at Risk Act* are applicable.

Administrative Boundaries

No administrative boundaries were identified for the effects assessment of ambient light.

6.3.5.2 Thresholds for Determination of Significance

The adverse effects of light trespass on human receptors are due both to an increase in general illuminance that may cause annoyance and may disrupt sleeping patterns, and from the direct view of the light source that can cause glare issues. The adverse effects of light trespass from exterior lighting are influenced by a number of factors:

- Light trespass is more likely to be perceived as obtrusive if the lighting installation is located above the observer. Lighting installations are usually directed towards the ground and an observer could hence have a direct view of the luminaire.
- The surrounding topography and site infrastructure, including distance, hills, trees, and buildings, generally have a positive effect by shielding the observer from the light source.
- Pre-existing lighting in the area. Light from a particular light source is seen as less obtrusive if it is located in, or perceived in, an area where the lighting levels are already high, e.g. along roads and near built up areas.
- The zoning of the area. A residential area is seen as more sensitive compared to commercial areas where high lighting levels are seen as more acceptable.
- Time of use. Clearly light will be seen as being more obtrusive during night time. This is generally considered to be between 11:00pm and 6:00 am.

A significant impact is defined as direct light trespass that according to the affected resident regularly interferes with the use and enjoyment of nearby residential properties on a permanent basis and/or evidence of unacceptable levels of bird mortality associated with Project lighting.

6.3.6 Project Activities and Light Interactions and Effects

The key sensitive receptor for light from the Beaver Dam Mine Site and Haul Road in the area is the Beaver Lake IR 17; a satellite community of the Millbrook First Nation located approximately 5 km south of the Beaver Dam Mine Site. A permanent resident, seasonal camps and cottages, are also located along the Beaver Dam Mines Road near Highway 224 and along the proposed Haul Road.

Camp Kidston, which operates only in the summer months, is located 3.5 km northeast of Touquoy. According to the Proponent, the nearest permanent full-time occupied residences are located approximately 5.8 km to the north of the open pit along Caribou Road. The Touquoy facility is currently in operation. The primary effect of the continued use of the Touquoy Mine Site is the continued lighting of facilities and vehicular traffic during the processing of Beaver Dam ore. There are no new or additional effects from light anticipated to be caused by the processing of ore and the management of tailings (exhausted pit) from the Beaver Dam Mine Site, as no new construction or disturbance is required at the Touquoy Mine Site related to the processing of Beaver Dam ore. The effects of light previously described for the Touquoy Mine Site in the EARD and Focus Report are presented in the sections below.

Table 6.3-1 Potential Ambient Light Interactions with Project Activities at Beaver Dam Mine Site

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Drilling and rock blasting in preparation of construction • Till and waste rock removal from site preparation transport and storage • Existing settling pond dewatering in preparation ~~of~~ for construction • Watercourse and wetland alteration in preparation ~~of~~ for construction • Mine Site road construction • Lighting of construction areas • Surface infrastructure installation and construction • Collection and settling ponds construction • General management of wastes derived from preparation and construction activities • ~~Accidents and malfunctions to include fuel and other spills, forest fires, slope failure, an unplanned explosive event, and a mobile equipment accident~~
Operation and Maintenance	3-4 years	• Rock blasting to access and extract ore • Management of waste rock produced from crushing and preparing ore for transport • Petroleum products management • Site maintenance and repairs • Lighting of facilities and Beaver Dam Mine Site roads • Environmental monitoring of the atmospheric environment • General management of wastes derived from operation and maintenance activities • ~~Accidents and malfunctions to include fuel and other spills, forest fires, slope failure, an unplanned explosive event, and a mobile equipment accident~~
Decommissioning and Reclamation	1-2 years	• Infrastructure Demolition • Site reclamation activities • ~~Environmental monitoring~~ • ~~Accidents and malfunctions to include fuel and other spills, slope failure, and forest fires~~

Table 6.3-2 Potential Ambient Light Interactions with Project Activities along Haul Road

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Drilling and rock blasting in preparation of construction • Till and waste rock from site preparation transport and storage • Watercourse and wetland alteration in preparation of construction • Haul road construction and upgrades • ~~Environmental monitoring of the atmospheric environment~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and a haul truck accident~~
Operation and Maintenance	3-4 years	• Ore transport • Road lighting • Haul road maintenance and repairs • ~~Environmental monitoring~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and a haul truck accident~~
Decommissioning and Reclamation		N/A[1]
1 Decommissioning and Reclamation of the Haul Road is not expected. The Haul Road will be returned to owner for forestry industry		

Table 6.3-3 Potential Ambient Light Interactions with Project Activities at ~~Touquoy Processing and Tailings Management Facility~~ Touquoy Mine Site

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Tailings pipeline, make-up water pipeline alteration, and relocation of reclaim infrastructure • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and mobile equipment accidents~~
Operation and Maintenance	3-4 years	• Ore management and processing • Lighting of facilities and Mine Site roads • ~~Environmental monitoring of the atmospheric environment~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and mobile equipment accidents~~
Decommissioning and Reclamation	1-2 years	• ~~Environmental monitoring~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and mobile equipment accidents~~

6.3.6.1.1 Beaver Dam Mine Site and Haul Road

A light impact assessment (Appendix D.1) was completed for the Beaver Dam Mine Project and included 5 points of reception – Beaver Lake IR, River Lake Residence, Hwy 224 Intersection Residence, Ferry Lake Seasonal Cottage, and Second Rocky Lake Seasonal Cottage (Figure 6.3-2). Based on the light impact assessment report (Appendix D.1), the calculated light levels at each sensitive receptor were significantly below the limits recommended by the ILE guidelines during both pre-curfew and post-curfew (curfew is typically considered to be 11:00 pm) conditions. Post-curfew illuminance values ranged from 8.18E-02 lux to 1.14E-02 lux, which are well below the Post-curfew value of 1 lux. This assessment was conducted prior to the change in the waste rock stockpile (WRSP) configuration and the introduction of the western WRSP. Given the distance from receptors, the topography, and proposed operational scenarios for WRSP construction, the assessment conclusions for the revised site are anticipated to be the same.

Lights will be installed in active construction and operational areas and at the Beaver Dam Mine Site, including Beaver Dam Mine Site roads. Lights will be operational at all times to provide for a safe working environment. Vehicle headlights moving around the site as well as entering and exiting the site will also be introduced. Temporary lighting systems (including portable lights) may be used during construction to illuminate specific areas and ensure the safety of staff.

Increased light may cause disturbance or displacement of species, while attracting other species, or general behavioral changes (DaSilva, Valcu and Kempenaers, 2015). For those species which may be attracted to lights, lights may increase potential for direct mortality of these species or may increase habitat suitability by supplementing their source of prey. Birds may become attracted to or disoriented by open pit lighting at night, particularly during periods of migration, which could lead to mortality (Jones and Francis, 2003). Light can also alter habitat quality and sleep/wake cycles for terrestrial fauna within the immediate vicinity of the PA. This may decrease efficiency of nocturnal hunters. Some opportunistic wild species may be attracted to the site as a result of increased access and available food sources (natural prey or anthropogenic food sources), potentially increasing interactions between site personnel and wildlife.

Ambient night-time (post-curfew) light levels at the Beaver Dam Mine Site are not anticipated to affect the Beaver Lake IR 17 community given the distance to the mine. The Beaver Lake IR 17 is located approximately 5 km south of the Beaver Dam Mine Site and is separated from the Beaver Dam Mine Site by forest and two topographic ridges. These ridges block direct views from the houses to all work areas. The pit is located in a topographic depression and the crusher is in a more elevated position; however, distance to any sensitive receptors would mitigate any effects. The lighting effects would have a lower impact although it could be more widely experienced, especially if moisture or particulate matter are present in the atmosphere. The resulting halo of light above the mine might be seen from many locations. Although evident and given the rural setting of the site, it is not considered that it would cause any significant visual impact, due to a combination of large viewing distance and the screening effects of topography and vegetative cover. The predicted illuminance levels represent the worst-case operating conditions of the Beaver Dam Mine Site. The assessment considers when all of the mobile equipment at the mine would be in use at the same time, illuminating towards receptors. The areas surrounding the site are wooded with varying topography and inhibit the spread of light. It was conservatively assumed for screening purposes that 50 percent of the light will not reach the receptors due to directionality and line of sight obstructions. In reality, the amount of light blocked by the surrounding woodland and topographic changes will likely be much greater than this (>90 percent), especially during the seasons when trees are in full bloom.

Sensitivity analysis was performed to determine the significance of a greater percentage of incident light reaching the nearest sensitive receptor during post curfew hours. If it were assumed that none of the light were obstructed and shining directly towards each receptor, the post curfew impact at the River Lake residence 6 km away remains less than 17 percent of the ILE standard, and the receptor at the Beaver Lake IR remains less than 17 percent of the ILE standard.

Ore will be hauled to the Touquoy Mine Site for approximately ~~12 to~~ 16 hours per day during the operational phase. Truck traffic will not generally be present on the Haul Road ~~during night-time hours~~ overnight. Illuminance from the Haul Road considers when two trucks are closest to each receptor and shining light towards each receptor, as a worst-case scenario. Because receptors along the Haul Road are not located on any road bends, with limited line of site to the travelling trucks, the assessed light impacts to these receptors are likely overestimated. ~~Ambient night-time light levels are not anticipated to increase along the Haul Road as a result of the Project.~~ The Proponent has indicated that trucking operations will occur mainly under daytime and pre-curfew conditions and thus light impacts from trucks along the Haul Road are expected to be insignificant when compared to baseline daylight illuminance and screening provided by trees along the Road.

6.3.6.1.2 **Touquoy Mine Site**

As part of the 2007 Focus Report, a light impact assessment was conducted for the Touquoy Mine Site and included three sensitive receptors – Camp Kidston, located approximately 3 km from the open pit, the nearest full time residence, approximately 5 km from the open pit, and the Scraggy Lake area. Based on the light impact assessment report, the calculated light levels at each sensitive receptor were significantly below the limits recommended by the ILE guidelines. Illuminance values ranged from 5.87 E-02 lux to 2.94 E-01 lux, which are well below the Post Curfew value of 1 lux.

Background ambient light was not measurable; therefore, project light sources during full-scale operations at the Touquoy Mine Site will have an impact on the existing environment. However, predicted Touquoy project sources will be well below ILE guidelines at all three sensitive receptors and in essence will have illuminance values less than that produced by a full moon. The surrounding forest area will further inhibit the spread of light. Impacts from proposed lighting sources will therefore not negatively impact migrating birds, native species, or other sensitive receptors. Additionally, during the processing of Beaver Dam ore, ambient light sources at the Touquoy Mine Site are anticipated to be less than those used during full-scale operations.

Although the light impacts from the Touquoy Mine Site and Beaver Dam Mine Site were not evaluated in combination, it is expected that the ILE limits at nearby receptors will not be exceeded from light trespass at both facilities. This is expected due to the low illuminance levels assessed at each receptor in both assessments (<30 percent of the ILE limits) and due to the large distances from the receptors to the sources of light at the other facilities.

6.3.7 Preferred Alternative Haul Road

6.3.7.1 Rationale for Valued Component Selection

The same rationale was used for the valued component selection as indicated in 6.3.1. This is appropriate based on the assessment of the route and baseline surveys.

6.3.7.2 Baseline Program Methodology

The same methodology was used for the baseline program for the Preferred Alternative Haul Road option as indicated in 6.3.2. No additional baseline studies were completed for this Haul Road option.

6.3.7.3 Baseline Conditions

The Project Area is in a remote, rural and mostly wooded, location. Ambient nighttime light conditions would be minimal and typical of an undeveloped rural area. Light monitoring was not completed during the baseline study program, as ambient nighttime light conditions are not anticipated to cause any effects on the nearest residences. The Preferred Alternative Haul Road will not be active overnight, and the Beaver Dam and Touquoy Mine Sites are located more than 5 km from the nearest residence. Furthermore, other than the ore haul trucks, no other lighting sources will be present along the Preferred Alternative Haul Road (e.g. street lights).

6.3.7.4 Consideration of Consultation and Engagement Results

The Preferred Alternative Haul Road is the result of consultation and engagement on the primary Haul road. The Preferred Alternative Haul Road is farther from human receptors located on the "Moose River Cross Road" so-called and from residents located on the Mooseland Road. Consultation and engagement results are presented in Section 6.3.4.

6.3.7.5 Effects Assessment Methodology

The effects assessment methodology of the Preferred Alternative Haul Road is as presented in Section 6.3.5. The spatial boundary of the PA for the Preferred Alternative Haul Road is confined only to this segment and assessed independently of the primary route. The LAA and RAA remain the same as indicated in Section 6.3.5.1.

As the Project has the potential to cause direct and indirect effects to light outside of the Preferred Alternative Haul Road PA, the LAA is the appropriate boundary for evaluation of this VC.

The same Temporal, Technical, and Administrative Boundaries are considered for the Preferred Alternative Haul Road as indicated in Section 6.3.5.

6.3.7.5.1 Thresholds for Determination of Significance

The thresholds for determination of significance regarding light within the Preferred Alternative Haul Road are identical to the thresholds for determination of significance for this VC, as presented within Section 6.3.5.2.

6.3.7.6 Project Activities and Light Interactions and Effects

The key sensitive receptor for light from the Beaver Dam Mine Site and Haul Road is in the area is the Beaver Lake IR 17; a satellite community of the Millbrook First Nation located approximately 5 km south of the Beaver Dam Mine Site. At its nearest point, the Preferred Alternative Haul Road is approximately 5.1 km southwest of Beaver Lake IR 17. Other receptors in the area include permanent residents and seasonal camps/cottages along the Beaver Dam Mines Road and Residences along Mooseland Road.

Potential interactions between Project activities and ambient light are outlined in Tables 6.3-1 to 6.3-3, located in Section 6.3.6. The Preferred Alternative Haul Road is located farther away from human receptors, such that there are no additional Project activities and ambient light interactions to discuss for this Haul Road option.

6.3.8 Mitigation ~~and Monitoring~~

The use of lights will be limited to the amount necessary to ensure safe operation, with the recognition that excessive lighting can be disruptive to wild species. Light pollution will be reduced by installing downward-facing lights on site infrastructure and Mine Site roads, as well as at the Touquoy Mine Site. Wherever possible, motion-sensing lights will be installed to ensure lights are not turned on when they are not necessary. Only direct and focused light will be used for worker safety.

Bird collisions with Project lighting and subsequent mortality are expected to be rare but if it occurs, it would not likely have significant effects on migrating bird populations. Efforts will be made to reduce the effect of lighting on migrating birds. Practices will be reviewed on an annual basis for BAPs, including illumination. No additional monitoring is recommended for the Project related to night-time light levels.

~~Ambient night-time light levels are not anticipated to increase along the Haul Road as a result of the Project; therefore, no additional mitigation or monitoring is required on the Haul Road.~~ Ore will be hauled to the Touquoy Mine Site for approximately ~~12 to~~ 16 hours per day during the operational phase. Ore hauling will generally not be occurring on the Haul Road during the post-curfew period. Maintenance activities may occur. ~~Highway truck traffic will not generally be present on the Haul Road during night-time hours.~~

Table 6.3-4 Mitigation for Light

VC	Project Phase	Mitigation Measure
Light	CON	Temporary lighting will be directly focused on work areas and shielded where practicable to avoid light trespass
	CON, OP, DEC	Use of only downward-facing lights on site infrastructure and Mine Site roads
	CON, OP, DEC	Install motion-sensing lights, where practicable
	CON, OP, DEC	Only use direct and focused light when needed for worker safety
	CON, OP, DEC	All floodlights will employ full horizontal cutoff, as appropriate
	CON, OP, DEC	Lighting not in use will be turned off, whenever practicable
	CON, OP, DEC	Site perimeter lighting will be directed to minimize light offsite light trespass
	CON, OP, DEC	Utilize efficient sources of light, such as LED, to reduce overall magnitude of light, wherever practicable
	CON, OP, DEC	A procedure, including a response plan, will be available for public to be able to register complaints regarding light concerns

6.3.9 Residual Effects and Significance

During the construction and operation of the Beaver Dam Mine Site and Haul Road, ambient lighting will increase, noticeably at first as an offset to the original undeveloped area. Increases in and the subsequent effects of light on potential receptors can be minimized through effective lighting design and operational schedule. Ongoing monitoring of site activity will inform on areas where light reductions are warranted.

Given the distance of the Beaver Dam Mine Site and Haul Road to surrounding properties/ residences, the natural topography and vegetation, it is unlikely that significant adverse effects due to light trespass from the site or vehicle headlights entering and exiting the site will be experienced.

The predicted residual environmental effects of Project development and production on ambient light are assessed to be adverse, but not significant. The overall residual effect of the Project on light is assessed as not likely to have significant adverse effects after proven mitigation measures have been implemented.

Table 6.3-5 Residual Environmental Effects for Light

Project - VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Beaver Dam Mine Site and Haul Road (Lights from haul trucks, site lighting)	Equipment maintenance, limited vegetation clearing.	A	N Negligible change from baseline conditions	LAA Lighting impacts may extend beyond the PA	A Seasonal aspects may affect VC (i.e. daylight hours)	MT Effects can occur beyond 12 months and up to 3 years	S Effects occur at irregular intervals throughout the Project	R VC will return to baseline conditions	Increased ambient light	Not significant
Operational – Beaver Dam Mine Site, Haul Road, Touquoy Mine Site (Lights from haul trucks, site lighting)	Equipment maintenance, haul truck operation <24 hours per day, minimize lighting (downward facing lighting, motion sensor lights, light positioning away from property boundaries were practical).	A	N Negligible change from baseline conditions	LAA Lighting impacts may extend beyond the PA	A Seasonal aspects may affect VC (i.e. daylight hours)	LT Effects may extend beyond 3 years	S Effects occur at irregular intervals throughout the Project	R VC will return to baseline conditions	Increased ambient light	Not significant
Operational – Beaver Dam Mine Site, Haul Road (Light at sensitive receptors)	Equipment maintenance, haul truck operation <24 hours per day, minimize lighting (downward facing lighting, motion sensor lights, light positioning away from property boundaries were practical).	A	N Negligible change from baseline conditions (Below ILE guidelines during post and pre curfew)	LAA Lighting impacts may extend beyond the PA	A Seasonal aspects may affect VC (i.e. daylight hours)	LT Effects may extend beyond 3 years	S Effects occur at irregular intervals throughout the Project	R VC will return to baseline conditions	Increased ambient light	Not significant
Operation – Touquoy Mine Site (site lighting)	Minimize lighting (downward facing lighting, motion sensor lights, light positioning away from property boundaries were practical).	A	N Negligible change from baseline conditions	LAA Lighting impacts may extend beyond the Touquoy Mine Site footprint	A Seasonal aspects may affect VC (i.e. daylight hours)	LT Effects may extend beyond 3 years	S Effects occur at irregular intervals throughout the Project	R VC will return to baseline conditions	Increased ambient light	Not significant
Reclamation – Beaver Dam Mine Site (Lights from haul trucks and site vehicles, site lighting)	Equipment maintenance, minimize lighting (downward facing lighting, motion sensor lights, light positioning away from property boundaries were practical).	A	N Negligible change from baseline conditions	LAA Lighting impacts may extend beyond the PA	A Seasonal aspects may affect VC (i.e. daylight hours)	MT Effects can occur beyond 12 months and up to 3 years	S Effects occur at irregular intervals throughout the Project	R VC will return to baseline conditions	Increased ambient light	Not significant

Project - VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
	Legend (refer to Table 5.10-1 for definitions)									

Nature of Effect	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
A Adverse	N Negligible	PA Project Area	N/A Not Applicable	ST Short-Term	O Once	R Reversible
P Positive	L Low	LAA Local Assessment Area	A Applicable	MT Medium-Term	S Sporadic	IR Irreversible
	M Moderate	RAA Regional Assessment Area		LT Long-Term	R Regular	PR Partially Reversible
	H High			P Permanent	C Continuous	

A significant adverse environmental effect for light has not been predicted for the Project for the following reasons, with consideration of the ecological and social context of the LAA surrounding the Project:

- During Construction : Light impacts are restricted to the mine site and Haul Road which are limited in extent and some distance to receptors.
- During Operations: Light will be elevated above baseline during this period, however the likelihood of receptors being in close proximity to light generation sites is very low.
- During Closure: Light will be elevated above baseline only during closure activities involving mobile equipment and then drop to baseline for the post-closure period.

6.3.9.1 Preferred Alternative Haul Road Residual Effects and Significance

Table 6.3-6 Residual Environmental Impacts of Light within the Preferred Alternative Haul Road

Project - VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Preferred Alternative Haul Road (Lights from equipment, site lighting)	Equipment maintenance, limit vegetation clearing.	A	N Negligible change from baseline conditions	LAA Lighting impacts may extend beyond the PA	A Seasonal aspects may affect VC (i.e. daylight hours and vegetation	MT Effects can occur beyond 12 months and up to 3 years	S Effects occur at irregular intervals throughout the period	R VC will return to baseline conditions	Increased ambient light	Not significant
Operational – Preferred Alternative Haul Road Site (Lights from haul trucks and road maintenance equipment)	Equipment maintenance, haul truck operation <24 hours per day, minimize lighting (downward facing lighting, motion sensor lights, light positioning away from property boundaries were practical).	A	N Negligible change from baseline conditions	LAA Lighting impacts may extend beyond the PA	A Seasonal aspects may affect VC (i.e. daylight hours and vegetation)	LT Effects may extend beyond 3 years	S Effects occur at irregular intervals throughout the Project	R VC will return to baseline conditions	Increased ambient light	Not significant

Legend (refer to Table 5.10-1 for definitions)

Nature of Effect	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
A Adverse P Positive	N Negligible L Low M Moderate H High	PA Project Area LAA Local Assessment Area RAA Regional Assessment Area	N/A Not Applicable A Applicable	ST Short-Term MT Medium-Term LT Long-Term P Permanent	O Once S Sporadic R Regular C Continuous	R Reversible IR Irreversible PR Partially Reversible

Table 6.3-5 was reviewed and it was determined that the construction and operation (lights from haul trucks) of the Haul Road were the only two VC interactions applicable to ambient light associated with the Preferred Alternative Haul Road. There were no changes in the significance criteria or overall significance for either of these VC interactions.

Mitigations presented in Table 6.3-4 will be established to reduce the impact of light from Project activities.

6.3.10 Proposed Compliance and Effects Monitoring Program

Light monitoring will be completed to verify the predicted environmental effects and the effectiveness of the mitigation measures outlined in Table 6.3-4. LA light monitoring program will occur pre-construction, to establish baseline conditions. A Complaints Protocol will be followed to provide a mechanism to register concerns and discuss them with Project representatives. Ambient light monitoring would occur if directed by regulators or as a result of a complaint.

The Preliminary Environmental Effects Monitoring Plan (EEM), located in Appendix O.1, outlines any proposed preliminary methods, timing, frequency, and locations for ambient light monitoring. This document will evolve through regulatory permitting, as well as public and Mi'kmaw engagement.

6.4 Greenhouse Gases

6.4.1 Rationale for Valued Component Selection

Climate change is known to be exacerbated by greenhouse gases (GHG), which will be created through the combustion of fuel during equipment operation, blasting within the pit, and vehicle use associated with project activities. GHG's are the focus of provincial policies and regulations for the electricity sector; however, there exists no province-wide standard for greenhouse gas emissions.

6.4.2 Baseline Program Methodology

No additional preliminary baseline monitoring was completed for greenhouse gases, separate from air quality. See Section 6.2 Air (6.2.2 Baseline Program Methodology and 6.2.3 Baseline Conditions) for baseline air quality monitoring results, as well as local and regional air quality.

6.4.3 Baseline Conditions

6.4.3.1 Provincial and Federal Greenhouse Gas Limits

The NPRI is Canada's legislated and publicly accessible inventory of pollutant releases to air, water, and land. The NPRI is managed by Environment and Climate Change Canada and currently tracks over 300 substances and groups of substances. Under the authority of CEPA, owners or operators of facilities that meet the NPRI reporting requirements published in the Canada Gazette, Part I are required to report to the NPRI.

Accurate tracking of GHG emissions is an important part of assessing Canada's overall environmental performance. In March 2004, the Government of Canada announced the introduction of the Greenhouse Gas Emissions Reporting Program. All facilities that emit the equivalent of 50 kilotonnes or more of GHG's in carbon dioxide equivalent units (CO_2 eq) per year are required to submit a report. Facilities with emissions falling below the reporting threshold of 50 kilotonnes per year can voluntarily report their GHG emissions.

In 2009, NSE released the Greenhouse Gas Emissions Regulations, made under Section 112 of the Environment Act, establishing GHG emission caps on the electricity sector. These regulations apply to any facility located in the province of Nova Scotia that emits greater than 10 kilotonnes of CO_2 eq greenhouse gases in a calendar year. The facility owner must submit an annual report no later than March 31 of the following year.

The Beaver Dam Mine Site is located in a relatively undeveloped rural region of Nova Scotia with infrequent industrial operations that would contribute to GHG emissions. Existing GHG emissions would be generated primarily through recreational vehicle usage, local traffic, and limited forestry operations.

The Environment and Climate Change Canada document, "National Inventory Report 1990-2014: Greenhouse Gas Sources and Sinks in Canada – Part 3" (ECCC 2016b), the total GHG emissions from Nova Scotia were identified to be 16,600 kilotonnes CO_2e during 2014.

6.4.4 Consideration of Consultation and Engagement Results

Key issues raised during public consultation and Mi’kmaq engagement relating to atmospheric environment include potential dust and noise from mining operations at the Project and trucking along the Haul Road. The change to the Haul Road alleviated these concerns with respect to passing by existing residences, especially concerns of Millbrook First Nation regarding its residents in Beaver Lake. Concerns about greenhouse gas emissions specifically associated with the trucking were also noted.

The results of the public consultation and Mi’kmaq engagement have been considered in the environmental effects assessment, including the Proponent’s commitments on mitigation and monitoring measures and proposed compliance and effects monitoring programs, as well as the Proponent’s broader commitment to ongoing public consultation and Mi’kmaq engagement. Specific to evaluating the effect on greenhouse gases, these are found within the following environmental effects assessment.

6.4.5 Effects Assessment Methodology

6.4.5.1 Boundaries

Spatial Boundaries

The spatial boundary used for greenhouse gases are described below:

The PA encompasses three primary components from Marinette to Moose River Gold Mines, Halifax County, NS. The Beaver Dam Mine Site will be located at the end of the Beaver Dam Mines Road, and the Haul Road will span from the Beaver Dam Mine Site to Moose River Gold Mines, where the Touquoy Mine [processing and exhausted pit (to be used to dispose Beaver Dam tailings)] is located.

The LAA encompass a 15 km zone in all directions from the PA, based on the expected maximum extent of potential ground level emissions (Figure 6.4-1).

The RAA encompasses the province of Nova Scotia. GHG emissions will be compared to Nova Scotia targets and totals (Figure 6.4-1).

As the Project has the potential to cause direct and indirect effects of greenhouse gases, as well as cumulative effects compounded spatially and temporally from other Projects, the RAA is the most appropriate spatial boundary.

Temporal Boundaries

The temporal boundaries used for the assessment of effects to greenhouse gases are the construction phase, operational phase, and decommissioning and reclamation phase.

Technical Boundaries

No technical boundaries were identified for the effects assessment of greenhouse gases.

Administrative Boundaries

In 2009, NSE released the Greenhouse Gas Emissions Regulations, made under Section 112 of the Environment Act, establishing GHG emission caps on the electricity sector. These regulations apply to any facility located in the province of Nova Scotia that emits greater than 10 kilotonnes of CO_2 eq greenhouse gases in a calendar year. The facility may be required to report to the NPRI an inventory of pollutant releases to air, water, and land. There exists no province-wide standard for greenhouse gas emissions.

There may be other requirements for monitoring of the atmospheric environment through provincial approvals to be obtained prior to the start of the Project, specifically the Industrial Approval.

6.4.5.2 Thresholds for Determination of Significance

The Nova Scotia Environmental Goals and Sustainable Prosperity Act (EGSPA), requires a reduction in provincial GHGs of at least 10% below 1990 levels by the year 2020. The electricity sector is responsible for about half of the provinces GHG emissions. Guidance for targets to that industry are specific in regulation both provincially and federally. To achieve these reductions, Nova Scotia has imposed emissions caps on electricity generation sector for 2025 and 2030 and is working to increase efficiency in the transportation sector. Reduction of the use of electricity from fossil fuels helps to meet these targets through use of energy efficient LED lighting and low-emission sourced renewable power (solar, wind, water).

The transportation sector generates about a quarter of the provinces GHG emissions. Reductions in GHG from onsite mining activity can be achieved implementing no idling policies, burning low-sulphur fuels, and regular equipment maintenance.

6.4.6 Project Activities and GHG Interactions and Effects

The key sensitive receptor in the area is the Beaver Lake IR 17; a satellite community of the Millbrook First Nation located approximately 5 km south of the Beaver Dam Mine Site. A permanent resident, seasonal camps and cottages are also located along the Beaver Dam Mines Road near Highway 224. Camp Kidston, which operates only in the summer months, is located 3.5 km northeast of the site. According to the Proponent, the nearest permanent full-time occupied residences are located approximately 5.8 km to the north of the Touquoy Mine Site open pit along Caribou Road.

The Touquoy Mine Site is currently in operation. The primary effect of the continued use of the Touquoy Mine Site is the continued generation of GHG emissions during the processing of Beaver Dam ore. There are no new or additional effects to greenhouses gases anticipated to be caused by the processing of ore and the management of tailings (exhausted pit) from the Project, as no new construction or disturbance is required at the Touquoy Mine Site related to the processing of Beaver Dam ore. The effects to greenhouse gases previously described for the Touquoy Mine Site in the EARD and Focus Report are presented in the sections below.

Table 6.4-1 Potential GHG Interactions with Project Activities at Beaver Dam Mine Site

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Drilling and rock blasting in preparation of construction • Till and waste rock from site preparation transport and storage • ~~Existing settling pond dewatering in preparation of construction~~ • Watercourse and wetland alteration in preparation of construction • Mine Site road construction • Haul road construction • Lighting of construction areas • Surface infrastructure installation and construction • Collection and settling pond construction • General management of wastes derived from preparation and construction activities • ~~Accidents and malfunctions to include fuel and other spills, forest fires, slope failure, an unplanned explosive event, and a mobile equipment accident~~
Operation and Maintenance	3-4 years	• Rock blasting to access and extract ore • Management of waste rock produced from crushing and preparing ore for transport • Petroleum products management • Site maintenance and repairs • Lighting of facilities and Mine Site roads • ~~Environmental monitoring of the atmospheric environment~~ • General management of wastes derived from operation and maintenance activities • ~~Accidents and malfunctions to include fuel and other spills, forest fires, slope failure, an unplanned explosive event, and a mobile equipment accident~~
Decommissioning and Reclamation	1-2 years	• Infrastructure Demolition • Site reclamation activities • ~~Environmental monitoring~~ • ~~Accidents and malfunctions to include fuel and other spills, slope failure, and forest fires~~

Table 6.4-2 Potential GHG Interactions with Project Activities along Haul Road

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Drilling and rock blasting in preparation of construction

Project Phase	Duration	Relevant Project Activity
		• Till and waste rock from site preparation transport and storage • Watercourse and wetland alteration in preparation of construction • Haul road construction and upgrades • ~~Environmental monitoring of the atmospheric environment~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and a haul truck accident~~
Operation and Maintenance	3-4 years	• Ore transport • Road lighting • Haul road maintenance and repairs • ~~Environmental monitoring~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and a haul truck accident~~
Decommissioning and Reclamation		N/A[1]

1 Decommissioning and Reclamation of the Haul Road is not expected. The Haul Road will be returned to owner for forestry industry

Table 6.4-3 Potential GHG Interactions with Project Activities at Touquoy Mine Site

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Tailings pipeline, make-up water pipeline alteration, and relocation of reclaim infrastructure • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and mobile equipment accidents~~
Operation and Maintenance	3-4 years	• Ore management and processing • Lighting of facilities and Mine Site roads • ~~Environmental monitoring of the atmospheric environment~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and mobile equipment accidents~~
Decommissioning and Reclamation	1-2 years	• Decommissioning and reclamation activities • ~~Environmental monitoring~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and mobile equipment accidents~~

The primary sources of GHG emissions were considered for each phase of the Project (construction, operation, and decommissioning). The primary sources of emissions from each work phase are stationary and mobile fuel combustion sources. These fuel combustion GHG-specific emissions include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). During the construction and operation phase of the Beaver Dam Mine Site, GHG emissions that would be generated from explosives used in rock blasting were also considered. For rock blasting, the explosive considered is emulsion (30% ANFO and 70% emulsion), which is an explosive used by the Proponent at other project sites. Under ideal conditions, the sole GHG emission from this explosive is CO_2, though small amounts of CH_4 and N_2O may also form as a result of the combustion. For the purposes of these emission estimates, it has been assumed the emulsion will be combusting under ideal conditions, with the primary CO_2 emissions being included only.

Other key assumptions used as part of the GHG emission estimates include:

- Sources of stationary and mobile combustion are operational 24 hours a day during the mine operation phase and during the construction and decommissioning phases would be limited to 16 hours. Down-time for equipment is assumed to occur up to 10 days out of a year due to weather conditions. This is a conservative estimate as additional downtime would be required for equipment maintenance/repair during this period.
- The energy ratings have been assumed for the equipment/vehicles that are proposed to be used for the Project at this time. As the Project details become more defined, these energy ratings can be better developed. The energy ratings have been used, along with projected hours of operation and number of equipment/vehicles, to project fuel use at the site. The exception to this is the hauling mobile combustion sources fuel use estimates, which are based on an assumed daily average number of trips from the Beaver Dam Mine Site to the Touquoy Mine Site and an assumed fuel efficiency for the hauling trucks.
- Projected fuel use totals have been increased an additional 20% to account for combustion inefficiencies in the mobile and stationary combustion sources.
- The emulsion use during the operation phases has been estimated by the Proponent based on prior mining experience at similar sites to be approximately 2000 tonnes/year.

6.4.6.1 <u>Beaver Dam Mine Site and Haul Road</u>

The projected GHG emission estimates for the life of the Project, based on the available information, are presented in Table 6.4-4. It is expected that as the phase milestone activities approach, the information driving the emissions estimates below can be refined based on known rather than projected data.

Table 6.4-4 Estimated GHG Emissions (Beaver Dam Mine Site and Haul Road)

Phase	Period	GHG	Phase Emissions	
			(tonnes)	Tonnes CO_2e
Primary Haul Road Construction	2021	CO2	3022.6	3078.5
		NH4	0.2	
		N20	0.2	
Mine Construction	2021	CO2	11,954.5	12,176.0
		CH4	0.7	
		N2O	0.7	

Phase	Period	GHG	Phase Emissions	
			(tonnes)	Tonnes CO_2e
Operation	2022-2026	CO2	121,634.2	124,178.7
		CH4	6.7	
		N2O	8.0	
Decommissioning	2027-2029	CO2	35,863.5	36,527.9
		CH4	2.1	
		N2O	2.1	
Note: CO2e – Carbon dioxide equivalents				

GHG emissions from Nova Scotia reported in 2014 were 16,600 kilotonnes CO_2e (ECCC 2016b). Based on the Project GHG assessment, in an average full year of operation of the Project (most GHG-intensive phase), the site would emit 30.34 kilotonnes CO_2e - approximately 0.18% of the reported 2014 GHG total for Nova Scotia. All phases for the life-of-Project would represent approximately 1% of the provincial one-year total.

6.4.6.2 Touquoy Mine Site

At the Touquoy Mine Site, GHG emissions will be generated from light and mobile fuel combustion sources, as well as emissions from the processing plant during the period of full-scale operations (2022 to 2026). The equipment used in the processing plant was not considered in the emissions estimates, as all other equipment are electricity based (indirect GHG emission sources). The projected GHG emission estimates for the life of the Project at the Touquoy Mine Site, based on the available information, are presented in Table 6.4-5 ~~6.1-13~~. It is expected that as Touquoy Mine Site begins processing Touquoy ore, the information driving the emissions estimates below can be refined based on known rather than projected data.

Table 6.4-5 Estimated GHG Emissions (Touquoy Mine Site)

Phase	Period	GHG	Phase Emissions	
			(tonnes)	Tonnes CO_2e
Operation	2022-2026	CO2	32,895.2	33,947.5
		CH4	1.2	
		N2O	3.4	
Note: CO2e – Carbon dioxide equivalents				

GHG emissions from Nova Scotia reported in 2014 were 16,600 kilotonnes CO_2e (ECCC 2016b). Based on the Project GHG assessment, in an average full year of processing of the Beaver Dam ore at the Touquoy Mine Site (most GHG-intensive phase), the Touquoy processing facility would emit 6.79

kilotonnes CO_2e - approximately 0.04% of the reported 2014 GHG total for Nova Scotia. All processing for the life-of-Project would represent approximately 0.20% of the provincial one-year total.

6.4.6.3 Overall Project

In an average full year of operation of the Project (most GHG-intensive phase), including operation of the Beaver Dam Mine Site, hauling of ore, and the processing of ore at the Touquoy facility, the Project facilities would emit 37.13 kilotonnes CO_2e - approximately 0.22% of the reported 2014 GHG total for Nova Scotia. All operation, hauling, and processing for the life-of-Project would represent approximately 1.25% of the provincial one-year total.

6.4.7 Preferred Alternative Haul Road

6.4.7.1 Rationale for Valued Component Selection

The same rationale was used for the valued component selection as indicated in 6.4.1.

6.4.7.2 Baseline Program Methodology

No additional preliminary baseline monitoring was completed for greenhouse gases, separate from air quality. See Section 6.2 Air (6.2.2 Baseline Program Methodology and 6.2.3 Baseline Conditions) for baseline air quality monitoring results, as well as local and regional air quality.

6.4.7.3 Baseline Conditions

The baseline greenhouse gas emissions of the Preferred Alternative Haul Road construction is as presented in Section 6.4.6 Project Activities and Interactions and Effects.

The Preferred Alternative Haul Road is located north of the primary Haul Road. The primary Haul Road will consist of approximately 15.4 km of upgraded road, and 4.0 km of new Haul Road construction, while the Preferred Alternative Haul Road will involve approximately 11.1 km of upgraded road, and 9.8 km of new Haul Road construction. The additional approximate 1.5 km of length of the Preferred Alternative Haul Road in comparison to the primary Haul Road, accounts for the additional CO2e emissions presented in Section 6.4.6.

6.4.7.4 Consideration of Consultation and Engagement Results

The Preferred Alternative Haul Road is the result of consultation and engagement on the primary Haul Road. The alternative Haul Road is further from human receptors located on the “Moose River Cross Road” so-called and form residents located on the Mooseland Road. Consultation and engagement results are presented in Section 6.4.4.

6.4.7.5 Effects Assessment Methodology

The effects assessment methodology of the Preferred Alternative Haul Road is as presented in Section 6.4.5. The spatial boundary of the PA for the Preferred Alternative Haul Road is confined only to this segment and assessed independently of the primary route. The LAA and RAA remain the same as indicated in 6.4.5.1.

As the Project has the potential to cause direct and indirect effects to GHGs outside of the Preferred Alternative Haul Road PA and the LAA, the RAA is the appropriate boundary for evaluation of this VC.

The same Temporal, Technical, and Administrative Boundaries are considered for the Preferred Alternative Haul Road as indicated in Section 6.4.5.

6.4.7.5.1 Thresholds for Determination of Significance

The thresholds for determination of significance regarding greenhouse gasses within the Preferred Alternative Haul Road are identical to the thresholds for determination of significance for this VC throughout the entire PA, as presented within Section 6.4.5.2.

6.4.7.6 Project Activities and Greenhouse Gases Interactions and Effects

Potential interactions between Project activities and greenhouse gas emissions are outlined in Tables 6.4-1 to 6.4-3 located in Section 6.4.6.

If the Preferred Alternative Haul Road alignment is chosen, the construction of this alternative option will result in 3323.2 tonnes CO_2e due to the additional 1.5 km of length of the Preferred Alternative Haul Road, in comparison to the primary Haul Road option.

6.4.8 Mitigation ~~and Monitoring~~

The Proponent will take steps to minimize GHG emissions associated with the Beaver Dam Mine Project, through activities such as reducing engine idling, where possible, and considering the use of more fuel-efficient vehicles and equipment. GHG emissions will also be minimized through the adoption of good maintenance practices, including undertaking regular maintenance as specified by suppliers. A review of emissions will be completed on an annual basis. The Proponent will seek to use Best Available Practices (BAP) that will evolve over time.

Mitigation measures at the Touquoy ~~processing facility~~ Mine Site are also described in the Air Quality Management Plan that was completed as part of the IA application for this facility. These mitigation measures include regular equipment maintenance, choosing more efficient equipment and vehicles, and reduction of vehicle travel distances and idling where possible. These mitigation measures are anticipated to continue throughout the life of the Beaver Dam Mine Project.

Table 6.4-6 Mitigation for GHG

VC	Project Phase	Mitigation Measure
Greenhouse Gases	CON, OP, DEC	Limit engine idling where practicable
	CON, OP, DEC	Implement fuel efficiencies where practicable
	CON, OP, DEC	Implement preventative maintenance plans for all mobile and stationary equipment
	CON, OP, DEC	Use renewable energy where reasonable – eg: solar-powered lights

6.4.9 Residual Effects and Significance

The predicted residual environmental effects of Project development and production on the atmospheric environment are assessed to be adverse, but not significant. The overall residual effect of the Project on greenhouse gases is assessed as not likely to have significant adverse effects after mitigation measures have been implemented.

Table 6.4-7 Residual Environmental Effects for GHG

Project - VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Beaver Dam Mine Site and Haul Road (Haul Road widening and construction, use of heavy machinery, haul trucks and site vehicle emissions)	Equipment maintenance, implementing fuel efficiencies, limited engine idling, use of more fuel efficient vehicles.	A	L Minor change from baseline conditions	RAA Atmospheric pollutants can travel beyond the LAA, and will be included in provincial emissions if it meets the thresholds for reporting	N/A VC is not expected to be affected by timing	MT Effects can occur beyond 12 months and up to 3 years	S Effects occur sporadically throughout the Project	IR VC will not recover to baseline conditions	Increased greenhouse gas emissions	Not significant
Operational – Beaver Dam Mine Site, Haul Road, Touquoy Mine Site (Emissions from haul trucks, site vehicles, heavy machinery, blasting and drilling of in-situ rocks)	Equipment maintenance, implementing fuel efficiencies, minimizing blasts, limited engine idling, use of more fuel efficient vehicles.	A	L Minor change from baseline conditions	RAA Atmospheric pollutants can travel beyond the LAA, and will be included in provincial emissions if it meets the thresholds for reporting	N/A VC is not expected to be affected by timing	LT Effects may extend beyond 3 years	S Effects occur sporadically throughout the Project	IR VC will not recover to baseline conditions	Increased greenhouse gas emissions	Not significant
Reclamation – Beaver Dam Mine Site (Emissions from haul trucks, site vehicles, heavy machinery,	Equipment maintenance, implementing fuel efficiencies, limited engine idling, use of more fuel efficient vehicles.	A	L Minor change from baseline conditions	RAA Atmospheric pollutants can travel beyond the LAA, and will be included in provincial emissions if it meets the thresholds for reporting	N/A VC is not expected to be affected by timing	MT Effects can occur beyond 12 months and up to 3 years	S Effects occur sporadically throughout the Project	IR VC will not recover to baseline conditions	Increased greenhouse gas emissions	Not significant

Legend (refer to Table 5.10-1 for definitions)

Nature of Effect	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
A Adverse	N Negligible	PA Project Area	N/A Not Applicable	ST Short-Term	O Once	R Reversible
P Positive	L Low	LAA Local Assessment Area	A Applicable	MT Medium-Term	S Sporadic	IR Irreversible
	M Moderate	RAA Regional Assessment Area		LT Long-Term	R Regular	PR Partially Reversible
	H High			P Permanent	C Continuous	

A significant adverse environmental effect for GHG has not been predicted for the Project for the following reasons, with consideration of the ecological and social context of the LAA surrounding the Project:

- During Construction: GHG will be elevated above baseline but not a significant contributor in the broader ecological and social context of the LAA.
- During Operations: GHG will be elevated above baseline during this period but not a significant contributor in the broader ecological and social context of the LAA.
- During Closure: GHG will be elevated above baseline during closure activities involving mobile equipment and then drop to baseline for the post-closure period.

6.4.9.1 Preferred Alternative Haul Road and Residual Effects and Significance

Table 6.4-8 Residual Environmental Effects of GHG within the Preferred Alternative Haul Road

Project - VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Preferred Alternative Haul Road (Haul Road widening and construction, use of heavy machinery, haul trucks and site vehicle emissions)	Equipment maintenance, implementing fuel efficiencies, limited engine idling, use of more fuel efficient vehicles.	A	L Minor change from baseline conditions	RAA Atmospheric pollutants can travel beyond the LAA, and will be included in provincial emissions if it meets the thresholds for reporting	N/A VC is not expected to be affected by timing	MT Effects can occur beyond 12 months and up to 3 years	S Effects occur sporadically throughout the Project	IR VC will not recover to baseline conditions	Increased greenhouse gas emissions	Not significant
Operational – Preferred Alternative Haul Road (Emissions from haul trucks, site vehicles)	Equipment maintenance, implementing fuel efficiencies, minimizing blasts, limited engine idling, use of more fuel efficient vehicles.	A	L Minor change from baseline conditions	RAA Atmospheric pollutants can travel beyond the LAA, and will be included in provincial emissions if it meets the thresholds for reporting	N/A VC is not expected to be affected by timing	LT Effects may extend beyond 3 years	S Effects occur sporadically throughout the Project	IR VC will not recover to baseline conditions	Increased greenhouse gas emissions	Not significant

Legend (refer to Table 5.10-1 for definitions)

Nature of Effect	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
A Adverse	N Negligible	PA Project Area	N/A Not Applicable	ST Short-Term	O Once	R Reversible
P Positive	L Low	LAA Local Assessment Area	A Applicable	MT Medium-Term	S Sporadic	IR Irreversible
	M Moderate	RAA Regional Assessment Area		LT Long-Term	R Regular	PR Partially Reversible
	H High			P Permanent	C Continuous	

Table 6.4-7 was reviewed and it was determined that the construction and operation of the Haul Road were the only two VC interactions applicable to GHGs associated with the Preferred Alternative Haul Road. There were no changes in the significance criteria or overall significance for either of these VC interactions.

Mitigations presented in Table 6.4-6 will be established to reduce the impact to GHGs from Project activities.

6.4.10 Proposed Compliance and Effects Monitoring Program

GHG monitoring will be completed to verify the predicted environmental effects and the effectiveness of the mitigation measures outlined in Table 6.4-6. Air quality and GHG monitoring programs will continue during baseline/pre-construction, to establish baseline conditions, construction and through the operational phase. An Air Quality Management Plan was established as part of the IA application for the Touquoy facility, and outlines mitigation measures that will continue throughout the life of the Beaver Dam Mine Project. In addition, GHG emissions will be reviewed on an annual basis throughout the operation of the Touquoy processing facility.

The Preliminary Environmental Effects Monitoring Plan (EEM), located in Appendix O.1, outlines the proposed preliminary methods, timing, frequency, and locations for greenhouse gas emissions monitoring. This document will evolve through regulatory permitting, as well as public and Mi'kmaw engagement.

6.5 Geology, Soil, and Sediment Quality

6.5.1 Rationale for Valued Component Selection

Geology, soil, and sediment as a VC is centered on: the potential for acid rock drainage (ARD) to be produced during exposure of Halifax Group or sulphide-bearing bedrock to oxygen and surface water runoff; and the potential for impacts to ~~contamination of~~ soil and sediment from the Project ~~mining activities~~. ARD is provincially regulated through the *Sulphide Bearing Material Disposal Regulations*.

Soil and sediment quality may facilitate exposure of birds, fauna, and fish to contaminants through ingestion. Exposure of soil from Project activities may increase the potential for siltation of watercourses from surface water runoff. Contaminated soil and sediment is provincially regulated via the *Contaminated Sites Regulations*.

6.5.2 Baseline Program Methodology

Discrete location sediment grab samples were collected on July 21, 2016 from nine locations throughout the Beaver Dam Mine Site to obtain baseline sediment quality data prior to site preparation and construction activities beginning (Figure 6.5-7). The rationale for each sample location is provided in Table 6.5-1 ~~Table 6.2-1~~.

Table 6.5-1 Baseline Sediment Locations for Beaver Dam Mine Site

Sample ID	Sample Location	Sample Location Rationale
SED1	Downstream of Cameron Flowage	To characterize sediment quality downstream and south of Project activities

Sample ID	Sample Location	Sample Location Rationale
SED2	Upstream of Cameron Flowage	To characterize sediment quality upstream and north of Project activities
SED3	Down-gradient of till stockpile and outflow from Crusher Lake	To characterize sediment quality downstream of Project activities
SED4	Down-gradient of till stockpile	To characterize sediment quality downstream of Project activities
SED5	Down-gradient of till stockpile into Wetland 20	To characterize sediment quality downstream of Project activities
SED6	Downstream of Cameron Flowage	To characterize sediment quality downstream and south of Project activities
SED7	Downstream of facilities, ore storage and crushing facilities	To characterize sediment quality downstream and south of Project activities
SED8	Downstream of waste rock pile	To characterize sediment quality downstream of waste rock storage
SED9	Downstream of waste rock pile	To characterize sediment quality downstream of waste rock storage

The purpose of this program was to establish a baseline ~~for comparison~~ of sediment quality before ~~and after~~ site activities commence. This data will be used for comparison with samples obtained as part of an annual sediment sampling program at the same locations as noted above in Table 6.5-1. The data will be used in assessing sediment quality variations during construction, operations, and decommissioning. Each sample was collected as a grab sample and analyzed for metals, including mercury (Hg).

Analytical results were compared to the CCME Sediment Quality Guidelines for the Protection of Aquatic Life (Freshwater Interim Sediment Quality Guidelines (ISQGs) and Probable Effect Level (PEL). The CCME PELs represent ~~guidelines represent~~ the maximum authorized concentrations in a grab sample above which adverse effects are expected to ~~occur~~ frequently occur. ISQGs represent the maximum total concentration in surficial sediments (i.e. top 5 centimeters). The analytical results were also compared to the Nova Scotia Tier 1 Environmental Quality Standards (NSEQs) for Freshwater Sediment.

Additional baseline soil sampling was completed along the Haul Road and Preferred Alternative Haul Road (1 sample) as part of the Country Foods Evaluation completed by Intrinsik in 2018. Soil samples for that program were selected based on proximity to the Haul Road and in areas where specific input data on near Haul Road soil quality was needed for the Country Foods Evaluation. The data for this program is found in Appendix C.2.

The Touquoy site was previously subjected to a sediment quality investigation that consisted of the collection of sediment samples from ten locations on the Touquoy site and surrounding area watercourses in January 2007. Three of these locations had organic substrate not suitable for chemical analysis for soils. The results of the previous Touquoy investigation are summarized below.

Historical till and soil geochemical regional data is available from the DNR. The documents entitled *Compilation of Seabright Resources Inc. Till and Soil Geochemical Data over the Meguma Terrane* (NSDNR 2006) and *Till Geochemical Survey over Mainland Nova Scotia* (NSDNR 2006a) were reviewed. Till samples were collected from 1986 to 1989 by Seabright Resources Inc. and Seabright Explorations Inc., and from 1977 to 1982 by the Department of Regional Economic Expansion and Nova Scotia Department of Mines, respectively. Samples were submitted for chemical analysis of select metals. The results of the historical till investigations are summarized below.

6.5.3 Baseline Conditions

6.5.3.1 Physiography, Geomorphology, and Topography

The Beaver Dam Mine Project is located in the Eastern Ecoregion of the Acadian Ecozone. Ecoregions express macroclimate as a distinctive ecological response to climate through soils and vegetation (Neily et al. 2005).

The Eastern Ecoregion is underlain by quartzite and slate of the Meguma Group with granitic intrusives. A variety of landforms are found in this ecoregion, including rolling till plains, drumlin fields, extensive rockland, and wetlands. The bedrock is highly visible in those areas where the glacial till is very thin, exposing the ridge topography.

Ecoregions are further subdivided into Ecodistricts, which reflect macro elements of the physical and biological attributes of ecosystems which will ultimately influence biodiversity. The three primary Project locations are spread across the further subdivided Eastern Interior and Eastern Drumlin Ecodistricts. The Eastern Interior Ecodistrict is generally characterized by highly visibly bedrock where glacial till is very thin, exposing the ridge topography. Where till is thicker, ridged topography is masked and thick softwood forests occur. There are a few drumlins and hills scattered throughout the Ecodistrict and fine textured soils are derived from slates. The Eastern Drumlin Ecodistrict is underlain by Meguma Group greywacke and slate, blanketed by fine-textured till derived from these underlying and adjacent rocks. Drumlins are derived from carboniferous rocks from the north, as well as material from the Cobequid Hills and Pictou-Antigonish Highlands. Figure 6.5-1 displays Ecodistricts in the area of the Project.

The Beaver Dam Mine Site is in an area of low topographic relief at 140 masl with scattered drumlins reaching 165 to 175 masl and Cameron Flowage channeling through a topographic low of 130 masl. Drainage is to the southeast along a number of poorly drained streams, shallow lakes, and wetlands.

6.5.3.2 Soils and Sediment

The soils of Halifax County have developed almost entirely from glacial drift and, in most cases, mirror the distribution of underlying rock formations. This is particularly true for coarse-textured materials derived from granite and quartzite. Finer-textured materials were transported more readily by glaciers and typically accumulated in drumlin or drumlin-like mound deposits (Hilchey et al. 1963).

Sediment is derived from the movement of soils and in some instances bedrock materials being transported by water to areas frequented by water. Soil and bedrock quality is therefore a good indicator of what sediment quality is in the absence of anthropogenic activities that could affect sediment directly. Sediment quality for the ~~Beaver Dam site~~ Beaver Dam Mine Site, Haul Road and ~~Touquoy site~~ Touquoy Mine Site are discussed below.

The Beaver Dam Mine Site is primarily composed of soils belonging to the Bridgewater and Halifax series. Surface soil and subsoils of the Bridgewater series are typically medium-textured brown shaley loam over yellowish-brown shaley loam with parent material consisting of olive shaley loam till derived from Precambrian slates. Surface soil and subsoils of the Halifax series are typically brown sandy loam over yellowish sandy loam with parent material consisting of olive to yellowish-brown stony sandy loam till derived from quartzite. These soils correlate to the NS Forest Soil Type – ST2, common in upland forests throughout the province. Soil depths to sea horizon are typically up to 18 inches. No mapping currently exists to depict soil depth by horizon.

These soils are suitable for reclamation in a forest environment at the site. Soils recovered from the area of the pit will be used elsewhere throughout the site.

The Haul Road is composed of a variety of soil types, but is dominated by the Danesville, Halifax, and Gibraltar series. Surface soil and subsoils of the Danesville series are typically dark grayish brown sandy loam over yellowish-brown sandy loam with parent material consisting of dark brown sandy loam till derived from quartzite. Surface and subsoils of the Gibraltar series are typically brown sandy loam over strong brown sandy loam with parent material consisting of pale brown coarse sandy loam till derived from granite.

The Touquoy Mine Site is primarily composed of soils belonging to the Danesville series.

Figure 6.5-2 displays regional soil cover as mapped by Hilchey (1963).

Regional till and soil data was reviewed and compared to CCME Soil Quality Guidelines (SQG) for the Protection of Environmental and Human Health for industrial property use. A review of the regional till samples collected by Seabright Resources Inc. and Seabright Exploration Inc. in the *Compilation of Seabright Resources Inc. Till and Soil Geochemical Data over the Meguma Terrane* identified that 98 samples were located in the vicinity of the PA. Results available for review included samples analyzed for arsenic, tungsten, gold, and antimony. Data was not provided for additional metals that may have been analyzed. The results indicate that arsenic concentrations were identified to be above the CCME soil quality guidelines of 12 mg/kg in 29 of the 98 samples, and antimony concentrations were identified to be below the CCME SQG of 40 mg/kg in all samples collected. Tungsten results were presented with negative concentrations; therefore they are not included in the discussion. There are no applicable guidelines for gold.

A review of the till samples collected by the Department of Regional Economic Expansion and Nova Scotia Department of Mines in the *Till Geochemical Survey over Mainland Nova Scotia* identified three soil samples in the vicinity of the PA. Samples were identified to have been collected from Lake Alma, MacGreggor Lake, and River Lake, located adjacent to the Haul Road. Results available for review included samples analyzed for silver, copper, lead, zinc, cadmium, nickel, cobalt, iron, manganese, calcium, magnesium, mercury, arsenic, molybdenum, uranium, tin, tungsten, and barium. Based on a review of the analytical results, copper was identified to exceed the CCME SQG of 91 mg/kg in one of three samples collected. No other parameters were identified to exceed the CCME SQGs, where they exist.

As noted above, soils samples were collected along the Primary Haul Road and Preferred Alternative Haul Road (1 sample) in 2018 as part of the Country Foods Evaluation program. A review of the data from this sampling program and the data from the Beaver Dam Mine Site evaluation of existing and new data for soils was completed. There is good correlation in the 2018 data with the historic data from public sources. The 2018 data and previous data was also used to do a review of the soils and till mapping for the Preferred Alternative Haul Road routing. All of the data suggests that there should be no major variation in the soils, and therefore the sediment as well would also be predicted to have low variation along the Preferred Alternative Haul Road. That route was subjected to ecological surveys and current and historic land use reviews with no activities noted that would vary the soils or sediment quality in comparison to those outlined along the Haul road. Appendix C.2 and Appendix E.1 display the historic and current 2018 data collected from the Country Foods Evaluation program, respectively.

6.5.3.2.1 Sediment Quality – Beaver Dam Mine Site

Single surficial sediment grab samples were collected on July 21, 2016 from nine locations throughout the Beaver Dam Mine Site and surrounding watercourses to obtain baseline sediment quality data prior to site preparation and construction activities beginning. A summary of parameters exceeding the CCME ISQGs and PELs, and NSEQSs for freshwater sediment (where they exist) is provided in Table 6.5-2. All concentrations of metals are total values. ~~freshwater sediment quality guidelines (where they exist) is provided in Table 6.2-2. All concentrations of metals are total values.~~

Arsenic levels above CCME ISQG, CCME PEL~~probable effects level (PEL) and interim sediment quality guidelines (ISQG)~~ and Tier 1 NSE EQS were identified at Sediment locations 1 to 7. Arsenic (As) is a naturally occurring element in the earth's crust and is found throughout the environment. In a gold mining area rich in arsenic mineralization (e.g. arsenopyrite), high As concentrations indicate naturally occurring arsenic. Arsenic concentrations in soils around Mine Sites have been reported as high as 4,700 ppm in areas where historic mining activity has concentrated As levels in mill waste.

Historical regional studies completed by Nova Scotia Department of Natural Resources (DNR) show areas sampled around Beaver Dam Mine Site are below CCME Soil Quality Guideline for Inorganic Arsenic. The Killag Historic Gold Mining area is located approximately 9 km to the southeast of the project site. Studies show areas with elevated arsenic values over the CCME SQG (12 mg/kg) despite no known historic mining activity or mineral occurrences, and therefore, it can be assumed that elevated values are attributed to background levels.

Regional studies of till samples show high levels of arsenic that have no mineral occurrences, and therefore it can be concluded that the elevated arsenic levels are attributed to natural background levels, or higher areas of mineral enrichment. High levels of As in the hundreds of mg/kg in sediments indicate that further monitoring is warranted. It is noted that the action of movement in water concentrates many higher density materials including metals such as the naturally occurring arsenic.

The mercury concentration in sediment location 3 was above the CCME ISQG, but did not exceed the CCME PEL or Tier 1 NSE EQS. Mercury (Hg) occurs in all types of rocks and is present in the atmosphere as metallic mercury vapours and as volatized organic mercury compounds. Mercury is used in the chlor-alkali industry, pulp and paper manufacturing, thermometers, electrical equipment, dental amalgams, and some medicinal compounds. Mercury-based pesticides are no longer used and no mining of mercury in Canada has occurred since 1975. Mercury was detected at all sites between concentrations of 0.014 to 0.31 mg/kg. These concentrations make further monitoring warranted, but there are no indications of historic tailings at the Beaver Dam Mine Site and no indications that mercury was used in any of the historic stamp mills or other crude processing of ore.

Cadmium and copper concentrations above the CCME ISQGs were identified at sediment location 5. The sample did not exceed CCME PELs or Tier 1 NSE EQS for cadmium or copper. The selenium concentration at sediment location 5 also exceeded the Tier 1 NSEQS for freshwater sediments.

~~Cadmium and copper concentrations above CCME ISQG were identified at Sediment location 5. The sample did not exceed CCME PEL for cadmium or copper.~~

~~Mercury concentrations above CCME ISQG were identified at Sediment location 3. The sample did not exceed CCME PEL. Mercury (Hg) occurs in all types of rocks and is present in the atmosphere as metallic mercury vapours and as volatized organic mercury compounds. Mercury is used in the chlor-alkali industry, pulp and paper manufacture, thermometers, electrical equipment, dental amalgams and some medicinal compounds. Mercury-based pesticides are no longer used and no mining of mercury in Canada has occurred since 1975. Mercury was detected at all sites between concentrations of 0.014 to 0.31 mg/kg. These concentrations make further monitoring warranted but there are no indications of historic tailings at the Beaver Dam site and no indications that mercury was used in any of the historic stamp mill or other crude processing of ore.~~

Table 6.5-2 Summary of Sediment Quality for Beaver Dam Mine Site

Sample ID	Sample Location	Parameters Exceeding CCME Freshwater ISQGs	Parameters Exceeding CCME Freshwater PELs	Parameters Exceeding NSEQSs for Freshwater Sediment
SED1	Downstream of Cameron Flowage	Arsenic	Arsenic	Arsenic
SED2	Upstream of Cameron Flowage	Arsenic	Arsenic	Arsenic
SED3	Down-gradient of till stockpile and outflow from Crusher Lake	Arsenic, Mercury	Arsenic	Arsenic
SED4	Down-gradient of till stockpile	Arsenic	Arsenic	Arsenic, Selenium
SED5	Down-gradient of till stockpile into Wetland 20	Arsenic, Cadmium, Copper	Arsenic	Arsenic
SED6	Downstream of Cameron Flowage	Arsenic	Arsenic	Arsenic
SED7	Downstream of facilities, ore storage and crushing facilities	Arsenic	Arsenic	Arsenic
SED8	Downstream of waste rock pile	N/A	N/A	N/A

Sample ID	Sample Location	Parameters Exceeding CCME Freshwater ISQGs	Parameters Exceeding CCME Freshwater PELs	Parameters Exceeding NSEQSs for Freshwater Sediment
SED9	Downstream of waste rock pile	N/A	N/A	N/A

Full analytical results compared to CCME Freshwater Sediment Quality Guidelines and Tier 1 NSE EQS are included in Appendix E.1.

The existing topsoil and overburden are considered suitable for use in the rehabilitation of disturbed areas. Topsoil will be stockpiled in two locations during construction and used to facilitate re-vegetation at the end of the mine life and, when practical, during operation. Plant material and vegetation that was able to grow on the overburden and topsoil prior to disturbance is assumed to be able to grow on the area post reclamation. Organic debris (roots, stumps, brush) will also be stockpiled and mulched to provide biomass for reclamation. All disturbed areas, most notably the waste rock and till storage piles, will be reclaimed with topsoil and growing medium to a depth matching the native surroundings.

6.5.3.2.2 **Sediment Quality - Touquoy Site**

A sediment quality investigation at the Touquoy site consisted of the collection of ten sediment samples from the site and surrounding area watercourses in January 2007. Three of these locations had organic substrate not suitable for chemical analysis for soils. A summary of the analytical results from the Touquoy site is presented below. Arsenic levels above the CCME probable effects level (PEL) and Tier 1 NSE EQS were found at Sediment Sites 1, 2, 3, 5, 6, 7 and 8. Sites 1, 6, 7 and 8 are above the existing open pit or in a different catchment. All the locations exceed the CCME interim sediment quality guideline (ISQG).

Only Station 5 (0.81 mg/kg) exceeds the ISGQ (0.6 mg/kg) but not the PEL (3.5 mg/kg) limits for cadmium. Station 9 along the shore of Scraggy Lake is close to the ISGQ at 0.58 mg/kg.

Sediment at Site 3, 5, 6 and 10 exceed the ISQG limit (35 mg/kg Pb) for lead but not the PEL limit (91.3 mg/kg Pb). Sediment from the shore at Scraggy Lake far exceeded both limits at 1100 mg/kg Pb. Such a high concentration in a relatively pristine area appears to be anomalous and suggests that the lake requires further investigation.

Mercury was found at Sites 3 and 9 at concentrations above the ISQG limit (0.17 mg/kg), and at Site 2 (0.52 mg/kg) above the PEL (0.48 mg/kg). It was detected at all sites between concentrations of 0.02 to 0.16 mg/kg.

The concentration of zinc was relatively consistent across all sites. Site 9 at 150 mg/kg was elevated above the ISQG limit of 123.0 mg/kg, but well below the PEL of 315.0 mg/kg.

Cyanide was included in the analysis to monitor for its presence once the mine is operating. Cyanide is naturally present in some foods and in certain plants and seeds such as peach pits. Cyanide is contained in over 800 plant species, some foods and a great number of microorganisms, cigarette smoke and the combustion products of synthetic materials such as plastics. In manufacturing, cyanide is used to make paper, textiles, and plastics. It is present in the chemicals used to develop photographs. Cyanide salts are used in metallurgy for electroplating, metal cleaning, and removing gold from its ore. Cyanide gas is used to exterminate pests and vermin in ships and buildings. If accidentally ingested (swallowed), chemicals found in acetonitrile-based products that are used to remove artificial nails can produce cyanide. Cyanide was not used in the previous milling operations.

Cyanide was detected at low levels in Sites 5, 9 and 10, all sites that are well removed from the open pit. It was below the detection limit of 0.5 mg/kg at all other sites.

6.5.3.3 Surficial Geology

Surficial geology in the area is described on geology maps (Stea et al., 1992) as consisting of stony till plains and drumlins with minor organic deposits. Till is typically 2-20 m thick and primarily comprised of a stony and sandy matrix material derived from local bedrock sources, while drumlin facies are typically 4-30 m thick and siltier due to erosion and incorporation of older till units by glaciers. Figure 6.5-3 displays regional surficial geology.

6.5.3.4 Bedrock Geology

Nova Scotia can be divided into two distinct metallogenic terranes; the Avalon Terrane to the north and the Meguma Terrane to the south (Keppie et. al., 2000). These two terranes developed independently until they were juxtaposed along the Cobequid-Chedabucto Fault Zone during the mid-Devonian Acadian Orogeny. Figure 6.5-4 displays the regional bedrock geology.

The Beaver Dam gold deposit is located in an area of Nova Scotia dominated by the Meguma Supergroup, which is divided into the 5,600 m thick basal greywacke Goldenville Group and the 4,400 m thick overlying, finer grained, argillite Halifax Group. These sediments were uplifted and deformed into a series of tightly folded subparallel northeast trending anticlines and synclines during the Acadian Orogeny. The Meguma Group rocks are metamorphosed from greenschist to amphibolite (staurolite) facies and were intruded by granites and minor mafic intrusions by circa 370 Ma (Smith and Kontak, 1996). Mineralization at the Beaver Dam Property occurs in the north-dipping southern limb of an overturned anticline with gold hosted both within quartz veins and disseminated through the intervening inter-bedded argillite and greywacke. It is the quartz vein hosted gold mineralization augmented by disseminated style mineralization in or near anticline hinges that forms the basis of a geological model associated with the ongoing exploration and development of the Beaver Dam gold deposit.

Regional and site specific drilling has encountered bedrock materials that consist mainly of metamorphosed sedimentary rocks of the Goldenville Group. The Proponent reviewed the historic drill core from within the deposit and has recently supplemented this with additional resource delineation drilling and core sample analysis of in situ ore and waste rock.

An ML/ARD assessment of the Beaver Dam mine rock has recently been completed and includes static testing for a dataset of 70 samples from the main geologic units encountered at the project. Acid-base accounting (ABA) was completed for all samples, while 30 samples were analyzed for solid phase elements. The ABA results were used to calculate the acid generating potential and the neutralization potential of the samples (Table 6.5-3). These parameters are then used to calculate the net potential ratio (NPR) which can be used as an indicator for the likelihood of a given sample to generate net acid upon exposure to the atmosphere. Approximately 40% of the Beaver Dam samples were classified as potentially acid generating (PAG) based on having an NPR-threshold of 2, where samples with an NPR of < 2 are considered PAG, while samples with a NPR of ≥ 2 are non-acid generating (NAG). This NPR value is consistent with the criteria proposed in Price (2009). Generally, argillitic samples have a higher proportion of PAG samples than the greywacke sample population.

During construction and operations, regular testing of rock will be conducted for acid generating potential. A sampling frequency of 8 to 10 samples per 100,000 tonnes of rock generated is recommended based on the guidelines in Price (2009). Parameters of potential concern identified by the solid phase elemental analysis include As, Cu, Mn and Pb. Of these, As is considered the species with the greatest potential for deleterious effects on mine contact water.

To understand sulphide oxidation and metal leaching rates from Beaver dam mine-specific materials, eight humidity cells (one PAG cells and one NAG cell four each of the four major waste rock types) were initiated using representative samples from this dataset to represent a range of sulphur values from the main geologic units. XRD and petrographic analyses were completed on the humidity cell samples. The main sulphide mineral identified by petrography was pyrrhotite (<1% to 3%). Humidity cell testing are currently underway. After 20 weeks of testing, the leachates from all humidity cells show neutral pH. These preliminary results indicate that As is the main parameter of concern. The majority of PAG samples are expected to take several years to become acid producing.

In addition to the ML/ARD assessment of the mine rock, five overburden samples and five Haul Road samples were also analyzed. The overburden samples were collected from within the proposed Beaver Dam pit. These samples have low sulphur content; however, they lack any significant neutralization potential. The samples along the Beaver Dam Haul Road were collected from bedrock outcrops. The results indicate that the bedrock along the Haul Road is not potentially acid generating; however, additional samples will likely be required depending on the Haul Road design and blast depth.

Refer to Appendix E.2 and Appendix E.3 for the ML/ARD Assessment Report and the Geochemical Source Term Predictions for Waste Rock, Low-Grade Ore, Tailings and Overburden.

Table 6.5-3 Acid-Base Accounting Summary

Sample ID	Paste pH	Total S (%)	Sulphate S (%)	Sulphide S (%)	Total C (%)	CaNP (kg $CaCO_3$/t)	Modified NP (kg $CaCO_3$/t)	NPR (ModNP/AP)
ARGILLITE (AR) n = 10								
Min	8.2	0.020	0.010	0.020	<0.05	<4.5	6.0	0.27
Median	9.0	0.44	0.020	0.44	<0.05	<4.5	8.5	0.64
Max	9.5	1.0	0.060	0.94	<0.05	<4.5	37	17
ARGILLITE-GREYWACKE (AG) n =11								
Min	7.9	0.010	<0.01	0.010	<0.05	<4.5	7.0	0.23
Median	9.1	0.12	0.020	0.12	<0.05	<4.5	8.0	8.0
Max	9.5	1.1	0.060	1.1	0.17	14	177	47
GREYWACKE-ARGILLITE (GA) n = 14								
Min	7.9	0.010	0.010	0.010	<0.05	<4.5	5.0	0.40

Sample ID	Paste pH	Total S (%)	Sulphate S (%)	Sulphide S (%)	Total C (%)	CaNP (kg $CaCO_3$/t)	Modified NP (kg $CaCO_3$/t)	NPR (ModNP/AP)
Median	9.0	0.16	0.020	0.14	0.11	9.1	9.0	2.5
Max	9.5	1.7	0.060	1.5	0.57	48	58	46
GREYWACKE (GW) n = 24								
Min	8.9	*<0.01*	*<0.01*	*<0.01*	*<0.05*	*<4.5*	6.0	0.16
Median	9.2	0.025	0.020	0.030	0.10	9.1	14	22
Max	9.5	1.2	0.060	1.2	0.60	50	160	512
QUARTZ VEIN (QTZV) n = 3								
BD157-070	9.2	0.160	0.020	0.140	-	-	145	33
BD156-108	9.3	0.060	0.010	0.050	-	-	10	6.4
BD160-089	8.9	0.040	0.010	0.040	-	-	30	24

Notes: n = number of samples used in statistical distribution
A hyphen indicates the parameter was not analyzed.
Values in grey italics are below the analytical detection limit. Values were set at the detection limit for calculation of NP, AP and NPR values.
Sulphate S is calculated using the HCl method.
AP (acid potential) calculated using sulphide sulphur (% non-sulphate sulphur x 31.25);
CaNP (carbonate neutralization potential) calculated using total inorganic carbon (% TIC x (100.09/12.01) x 10);
Modified NP is obtained by the modified Sobek method.
NPR = neutralization potential ratio; calculated as Modified NP / AP.

6.5.3.5 Seismic Activity

The North American Plate has a stable interior but along the edges more seismic activity is likely to occur. Eastern Canada is part of the stable interior; however; unlike the subduction zone on the west coast of North American where plates are colliding, crustal stresses on the east coast are more difficult to explain and likely depend on their local tectonic context.

Although seismic activity is unpredictable, all of Nova Scotia is in a moderately low hazard zone. The southern Bay of Fundy is a moderate hazard zone. The Laurentian Slope is a moderate to high hazard zone (NRCAN 2015). Figure 6.5-5 (below) displays the relative earthquake hazards across Canada as determined by the Geological Survey of Canada (NRCAN 2015).

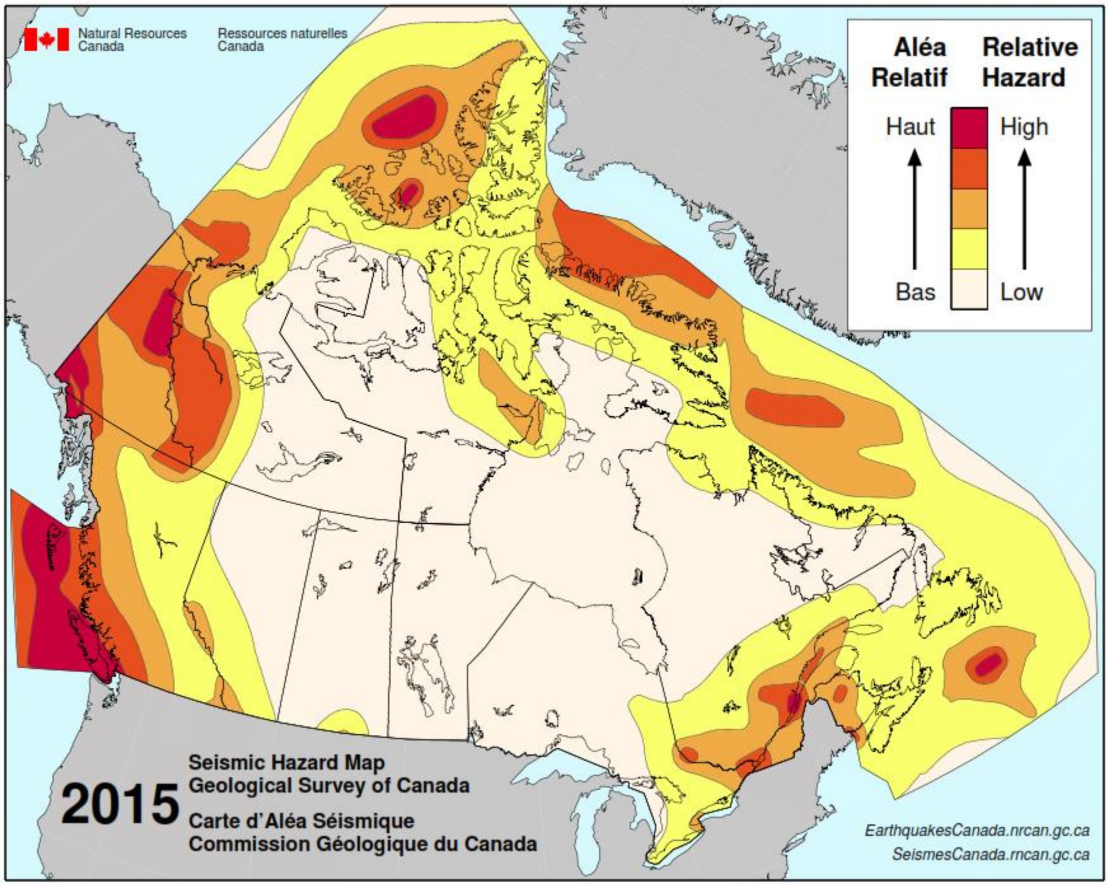


Figure 6.5-5 Relative Earthquake Hazard Map of Canada

Each year, approximately 450 earthquakes occur in eastern Canada, of which four will exceed magnitude 4, 30 will exceed magnitude 3, and 25 events will be reported as felt. A decade will likely include three events greater than magnitude 5. Nova Scotia, in particular, has low seismic activity with records (since 1925) showing a max magnitude of 3.5 (Yarmouth - 2015) and most of the activity occurring in SW Nova Scotia. Figure 6.5-6 displays the distribution and magnitude of earthquakes recorded in eastern Canada over 400 years.

The Northern Appalachians Seismic Zone is located in southwest Nova Scotia. The Beaver Dam Mine Project is located east of this zone. The nearest earthquake to Marinette, Nova Scotia was recorded with a magnitude of 2.7 in 1999 and was located northeast approximately 20 km north of the Project area. Magnitudes of intensity less than 3.0 are not felt by people except under especially favourable conditions and cause no damage to buildings. The global frequency of earthquakes with magnitude 2.0 to 2.9 is over one million per year.

If an earthquake occurs, seismic activity may affect the Beaver Dam Mine Project through primary impacts such as infrastructure damage facilitated by ground vibrations and secondary impacts such as fires facilitated by damaged infrastructure. Tsunami's, should they be created by offshore earthquakes, are unlikely to impact the Project. The Project is located approximately 30 km from the coast and at an elevation of 140 masl.

Given that Nova Scotia is located in a low hazard zone and the limited extent and duration of the Project, the potential risk of seismic activity affecting the Project is very low and not significant.

6.5.3.6 Isostatic Uplift and Subsidence

During the most recent major advance of the North American ice sheet complex, known as the Wisconsinan Glaciation, the Appalachian Glacier Complex covered the Maritimes. These glaciers formed and grew locally, independent of the Laurentide Ice Sheet due to a combination of increased snowfall, cold temperatures, and isolation from continental glaciers by deep ocean channels and the Appalachian mountain range. The glaciers were centred in the Maritimes, and advanced and retreated at least four times. During each of these cycles, glaciers were centered on land masses and flowed towards the Scotian Shelf and Laurentian Channel or radiated from central Nova Scotia and New Brunswick (NSDNR 2014).

The enormous weight of the Appalachian Glacier Complex caused the surface of the Earth's crust to deform and warp downward, forcing the viscoelastic mantle material beneath to flow away from the central loading region. This caused the central land masses in Nova Scotia and New Brunswick to depress and the outer regions at the limits of the glacier complex to flux upward. Following retreat of the glacier complex, the central land masses in Nova Scotia began to rise to their pre-glaciation position, while the outer regions began to subside. This concept is called isostatic rebound and exacerbates the effects of global sea level rise.

Given the Beaver Dam Mine Project is located approximately 30 km from the coast and average elevation is 140 masl, it is unlikely the effects of isostatic rebound will impact the Project, nor will the Beaver Dam Mine Project impact isostatic rebound.

6.5.3.7 Landslides, Slope Erosion, and Subsidence Following Project Activities

Geotechnical work has been completed at the Touquoy site and the expertise gained from working with these materials will be applied to the final design of the Beaver Dam disturbed areas using actual geotechnical data collected at Beaver Dam to supplement the abundant public information available. Features constructed from site materials such as waste rock stockpiles and overburden stockpiles will use the collected data for final design to produce features with appropriate safety factors to reduce the possibility of landslides, slope erosion and subsidence. With many stockpiles it is common to have subsidence in the short term creating a landscape that is varied in topography. This is in line with ~~NSDNR~~ NSL&F objectives for reclamation to have surfaces that are not uniform but offer safe long term landscapes with a variety of features. General reclamation goals to have heterogeneous landscapes that offer habitat features greater than simply a hydro seeded mat are important and can be assisted by some variation in the topography through subsidence.

6.5.4 Consideration of Consultation and Engagement Results

Key issues raised during public consultation and Mi'kmaq engagement relating to geology, soil and sediment include potential ARD, suspended solids and leaching of metals from the rock at the Beaver Dam Mine Site which may affect receiving water and its fish habitat, specifically Cameron Flowage, the closest watercourse to the Site.

The results of the public consultation and Mi'kmaq engagement have been considered in the environmental effects assessment, including the Proponent's commitments on mitigation and monitoring measures and proposed compliance and effects monitoring programs, as well as the Proponent's broader commitment to ongoing public consultation and Mi'kmaq engagement. Specific to evaluating the effect on geology, soil and sediment, these are found within the following environmental effects assessment.

6.5.5 Effects Assessment Methodology

6.5.5.1 Boundaries

Spatial Boundaries

The spatial boundary used for the assessment of effects to geology, soil, and sediment is the ~~LAA~~ PA. As the Project has the potential to cause direct and indirect effects to geology, soil, and sediment within and immediately adjacent to but not outside the Project Area, the ~~LAA~~ PA is the most appropriate spatial boundary.

The PA encompasses three primary components from Marinette to Moose River Gold Mines, Halifax County, NS. The Beaver Dam Mine Site will be located at the end of the Beaver Dam Mines Road and the Haul Road will span from the Beaver Dam Mine Site to Moose River Gold Mines, where the Touquoy Mine [processing and exhausted pit (to be used to dispose Beaver Dam tailings)] is located.

The evaluation of effects was completed at the PA level ~~LAA is equivalent to the PA~~, as direct and indirect impacts to geology, soils, and sediment are expected only within the PA boundaries (Figure 5.4-1).

No RAA was necessary for geology, soil, and sediment as a footprint analysis was completed on this VC, and impacts were only expected within the PA.

Temporal Boundaries

The temporal boundaries used for the assessment of effects to geology, soil, and sediment are the construction phase, operational phase, and decommissioning and reclamation phase.

Technical Boundaries

No technical boundaries were identified for the effects assessment of geology, soils and sediments.

Administrative Boundaries

ARD is provincially regulated through the *Sulphide Bearing Material Disposal Regulations*. Contaminated soil and sediment is provincially regulated via the *Contaminated Sites Regulations*. Sediment quality is compared to the CCME ISQGs and PELs, and the NSEQSs for freshwater sediment. ~~Sediment Quality Guidelines for the Protection of Aquatic Life (Freshwater Interim Sediment Quality Guidelines (ISQG)/ and Probable Effect Level (PEL)).~~

6.5.5.2 Thresholds for Determination of Significance

There are no regulated or proposed thresholds for geology ~~and soils effects~~ for this site and Project. Both sediment and soils that become mobilized have a linkage with surface water and quality that have regulated thresholds and can be quantified through the monitoring program proposed. Sediment and soil ~~has~~ have regulated thresholds that are well understood by the proponent and can be quantified through the monitoring program proposed. Tier I NSE and CCME Soil and Sediment Criteria in conjunction with background considerations and percent change, in context with NSE policy and guidance documents are the thresholds.

6.5.6 Project Activities Interactions and Effects

Table 6.5-4 Potential Soil and Sediment Interactions with Project Activities at Beaver Dam Mine Site

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Rock blasting in preparation of construction • Till and waste rock from site preparation transport and storage • Existing settling pond dewatering in preparation of construction • Watercourse and wetland alteration in preparation of construction • Mine Site road construction • Surface infrastructure installation and construction • Collection and settling pond construction ~~• Environmental monitoring~~ ~~• General management of wastes derived from preparation and construction activities~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, settling pond overflow, slope failure, an unplanned explosive event, and a mobile equipment accident~~
Operation and Maintenance	3-4 years	• Rock blasting to access and extract ore • Mine dewatering to facilitate access to and extraction of ore • Management of waste rock produced from crushing and preparing ore for transport • Surface Water Management ~~• Petroleum products management~~ ~~• Environmental monitoring of surface water discharges~~ ~~• General management of wastes derived from operation and maintenance activities~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, settling pond overflow, slope failure, an unplanned explosive event, and a mobile equipment accident~~
Decommissioning and Reclamation	1-2 years	• Infrastructure Demolition • Site reclamation activities ~~• Environmental monitoring~~ ~~• General management of wastes derived from decommissioning and reclamation activities~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, slope failure, and a mobile equipment accident~~

The Beaver Dam Mine Site is currently an advanced exploration site with existing conditions as described in other Sections. Effects to geology, soil, and sediment caused by project activities will include the blasting in geology, materials movement of soil and geology, and changing sediment. Any anticipated effects are outlined and further discussed in related VC Sections including, groundwater, surface water, and wetlands, with further residual effects from Project activities on geology, soil, and sediment described in Section 6.5.9. All site areas used for storage of natural materials such as the Till Stockpile, Waste Rock stockpiles, LGO would be monitored throughout the life of the Beaver Dam facility as per any approval relative to operation and any approval relative to closure and reclamation plan for the Beaver Dam Mine Project. Surface water and groundwater monitoring programs would include locations in proximity to areas where soils, sediment and geology (rock materials) would be disturbed so these programs would outline effects and compare them to applicable guidelines.

Table 6.5-5 Potential Soil and Sediment Interactions with Project Activities along Haul Road

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Rock blasting in preparation of construction • Till and waste rock from site preparation transport and storage • Watercourse and wetland alteration in preparation of construction • Haul road construction and upgrades • ~~Environmental monitoring of surface water~~ • ~~General management of wastes derived from preparation and construction activities~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and a haul truck accident~~
Operation and Maintenance	3-4 years	• Ore transport • Haul road maintenance and repairs • ~~Environmental monitoring~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and a haul truck accident~~
Decommissioning and Reclamation		N/A[1]

1 Decommissioning and Reclamation of the Haul Road or the Preferred Alternative Haul Road is not expected as it would be ~~The Haul Road will be~~ returned to owners ~~for~~ of forestry industry activities.

The baseline conditions along the Haul Road and Preferred Alternative Haul Road have been previously described and consist of existing forestry type roads of varying widths, surfaces and conditions. With the development of the Haul Road or Preferred Alternative Haul Road, there are anticipated activities that have the potential to affect geology, soil, and sediment anticipated to be caused through activities as outlined on the table above. Surface water and sediment monitoring programs would include locations in proximity to areas where soils, sediment and geology (rock materials) would be disturbed as part of road development so these programs would outline effects and compare them to applicable guidelines. As Decommissioning and Reclamation of the Haul Road or Preferred Alternative Haul Road is not expected as either option would be returned to the owner (s) for forestry industry activities.

Table 6.5-6 Potential Soil and Sediment Interactions with Project Activities at Touquoy Mine Site

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Tailings pipeline, make-up water pipeline alteration, and relocation of reclaim infrastructure • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and mobile equipment accidents~~
Operation and Maintenance	3-4 years	• ~~Environmental monitoring of surface water discharges~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and mobile equipment accidents~~
Decommissioning and Reclamation	1-2 years	• Decommissioning and reclamation activities • ~~Environmental monitoring~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and mobile equipment accidents~~

The Touquoy facility is currently ~~under construction~~ in operation. There are no effects to geology, soil, and sediment anticipated to be caused by the processing of ore and the management of tailings (exhausted pit) from the Beaver Dam Mine Project at the Touquoy Mine Site. The use of the Touquoy facility for the processing of Beaver Dam ore will not involve construction or operation at the Touquoy Mine Site or use of the Tailings Management Facility; therefore, no effects are anticipated at the Touquoy facility related to the processing of Beaver Dam ore, with the exception of the continued potential for accidents and malfunctions and continued environmental monitoring. The waste rock stockpile will continue to be monitored throughout the life of the Touquoy Mine Site as per the approved closure and reclamation plan for the Touquoy Gold Mine; this facility will not be used as part of the Beaver Dam Mine Project.

6.5.7 Preferred Alternative Haul Road

6.5.7.1 Rationale for Valued Component Selection

The same rationale was used for the valued component selection as indicated in 6.5.1.

6.5.7.2 Baseline Program Methodology

The same methodology was used for the baseline program for the Preferred Alternative Haul Road option as indicated in 6.5.2. No additional baseline studies were completed for this Haul Road option except for the aforementioned sediment sample location.

6.5.7.3 Baseline Conditions

Soil, sediment and geology baseline conditions are presented in Section 6.5.3. Sediment was sampled at several representative locations around the Beaver Dam Mine Site, Haul Road and one sample along the Preferred Alternative Haul Road route (Sediment #11). Table 6.5-2 presents the sediment quality results and exceedances from the Beaver Dam Mine Site. Sediment values from the 2018 program are found in Appendix E.1 and have been discussed previously.

6.5.7.4 Consideration of Consultation and Engagement Results

The Preferred Alternative Haul Road is the direct result of public consultation and Mi'kmaq engagement on the primary Haul Road and preferences stated that the route should be farthest from residential clusters as possible. The Preferred Alternative Haul Road is further from human receptors located on the "Moose River Cross Road" so-called and from residents located on the Mooseland Road. Consultation and engagement results are presented in Section 6.5.4.

6.5.7.5 Effects Assessment Methodology

The effects assessment methodology of the Preferred Alternative Haul Road is as presented in Section 6.5.5. The spatial boundary of the PA for the Preferred Alternative Haul Road is confined only to this segment and assessed independently of the Haul Road. The LAA remains the same as indicated in Section 6.5.5.1.

Potential direct and indirect effects to geology, soil, and sediment quality are expected to be confined to the Preferred Alternative Haul Road PA, therefore, the PA is the appropriate boundary for evaluation of this VC.

6.5.7.5.1 Thresholds for Determination of Significance

The thresholds for determination of significance regarding geology, soil, and sediment quality within the Preferred Alternative Haul Road are identical to the thresholds for determination of significance for this VC throughout the entire PA, as presented within Section 6.5.5.2.

6.5.7.6 Project Activities and Geology, Soil, and Sediment Quality Interactions and Effects

Potential interactions between Project activities and geology, soil, and sediment quality are outlined in Tables 6.5-4 to 6.5-6, in Section 6.5.6. The Preferred Alternative Haul Road is located farther away from human receptors, such that there are no additional Project activities and noise interactions to discuss for this option.

6.5.8 Mitigation

Geology, soils and sediment quality baseline is well established and at the ~~Beaver Dam site~~ Beaver Dam Mine Site, ~~and~~ Touquoy Mine Site, and Haul Road as outlined in the above sections. Baseline quality has limited issues but there is a need for mitigation measures to limit the mobilization of materials to areas of the sites that could results in impacts occurring (wetlands, watercourses and habitats). In general, the mitigation measures relate to limiting sediment and erosion from occurring through management practices outlined in other sections. Geology and soils outside the disturbed areas at the sites have no potential for generating impacts and are therefore not part of any mitigation or monitoring program.

Soils are being moved on-site at Beaver Dam Mine Site but are being re-used for reclamation purposes to the greatest extent possible, resulting in no net loss. Therefore, there is no need for mitigation or compensation measures, or for monitoring of site soils.

Sediment is a valued part of aquatic habitats and needs to be afforded the protection from new inputs of potential impacts (suspended solids, elevated metals) that can affect invertebrates and other aspects of the aquatic environments dependent on invertebrates such as fish species for example. The measures outlined below will aid in limiting or eliminating impacts but there remains a possibility of impacts and monitoring is therefore prudent. Programs are outlined below as well.

Table 6.5-7 Mitigation for Geology, Soil, and Sediment Quality

VC	Mitigation Category	Project Phase	Mitigation Measure
Geology, Soils, and Sediment	**Sediment and Erosion Control**	CON, OP	Use of the following routine controls, as needed: • Silt fences • Silt curtains • Riprap • Check dams
		CON, OP	Implement Erosion and Sediment Control Plan
		CON, OP	Secure overburden stockpiles using a combination of mulching, hydroseeding, and slope stabilization
		CON, OP, DEC	Limit exposed soil
		DEC, REC	Use soil and organics stockpiles for final capping and stabilization. Hydroseed as required

6.5.9 Residual Effects and Significance

Residual effects for geology, soils and sediment are not anticipated at any of the PA components (Beaver Dam Mine Site, Touquoy Mine Site – as a result of the Beaver Dam Mine Site ore processing. Haul Road or Preferred Alternative Haul Road. The geology of the Beaver Dam Mine Site, some areas of the Haul Road and Preferred Alternative Haul Road ~~site~~ and the soils are currently disturbed in many areas as well ~~of the site~~. Overburden and soils will be stored temporarily for future reclamation use and some overburden will be reclaimed in its stored location at the Beaver Dam Mine Site. Soils and materials not used in construction along any Haul Road option would be stored and remediated in a manner that is permanent with no residual impacts predicted. Sediment has the potential for changes that have possible effects in the short term~~. The~~ mitigation and monitoring programs have been designed to outline (if they actually occur) and avoid and monitor any identified ~~the potential~~ long-term residual impacts.

Table 6.5-8 Residual Environmental Effects for Geology, Soil, and Sediment Quality

Project - VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction and Operational – Beaver Dam Mine Site (exposure of acid generating material, impacted soil/sediment through migration of contaminants, downstream sediment quality, and sediment quality impacts)	Select removal of impacted materials, wet dust suppression controls, hardened surfaces where practical, covering of haul trucks to reduce dust during transportation, vehicle speed reduction to minimize dust, spill preparedness.	A	L Minor changes from baseline conditions	LAA Potential adverse effects to soil/sediment quality and quantity outside the PA	A Seasonal aspects may affect VC (i.e. wind)	LT Effects may extend beyond 3 years	S Effects occur at irregular intervals throughout the Project	IR VC will not recover to baseline conditions	Soil and sediment quality, increased dust impact (i.e. flora and fauna/habitat, human health, etc.)	Not significant
Construction and Operational – Haul Road (Haul Road widening and construction, trucking activity, and sediment quality impacts)	Slope stabilization, sediment and erosion control, best management practices, spill preparedness.	A	L Minor changes from baseline conditions	PA Potential adverse effects confined to the PA	N/A VC is not expected to be affected by timing	MT Effects can occur beyond 12 months and up to 3 years	O Potential effects to occur once during the construction phase	IR VC will not recover to baseline conditions	Erosion, soil and sediment quality	Not significant
Operational – Touquoy Mine Site (soil/sediment quality)	Covering of haul trucks to reduce dust during transportation onsite, vehicle speed reduction to minimize dust onsite.	A	L Minor changes from baseline conditions	LAA Potential adverse effects to soil/sediment quality and quantity outside the PA	A Seasonal aspects may affect VC (i.e. wind)	LT Effects may extend beyond 3 years	S Effects occur at irregular intervals throughout the Project	IR VC will not recover to baseline conditions	Soil and sediment quality, increased dust impact (i.e. flora and fauna/habitat, human health, etc.)	Not significant
Reclamation – Beaver Dam Mine Site (reclaiming/spreading stockpiles, soil/sediment quality, accidents/malfunctions)	Select removal of impacted sediments, best management practices, and spill preparedness.	A	L Minor changes from baseline conditions	LAA Potential adverse effects to soil/sediment quality and quantity outside the PA	A Seasonal aspects may affect VC (i.e. wind)	MT Effects can occur beyond 12 months and up to 3 years	S Effects occur at irregular intervals throughout the Project	IR VC will not recover to baseline conditions	Impact soil and sediment quality, increased dust impact (i.e. flora and fauna/habitat, human health, etc.)	Not significant

Legend (refer to Table 5.10-1 for definitions)

Nature of Effect	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
A Adverse	N Negligible	PA Project Area	N/A Not Applicable	ST Short-Term	O Once	R Reversible
P Positive	L Low	LAA Local Assessment Area	A Applicable	MT Medium-Term	S Sporadic	IR Irreversible
	M Moderate	RAA Regional Assessment Area		LT Long-Term	R Regular	PR Partially Reversible
	H High			P Permanent	C Continuous	

A significant adverse environmental effect for Geology, Soils and Sediment has not been predicted for the Project for the following reasons, with consideration of the ecological and social context of the LAA surrounding the Project:

- During Construction: Changes are restricted to a small footprint in the broader ecological and social context of the LAA.
- During Operations: Changes are restricted to a small footprint in the broader ecological and social context of the LAA.
- During Closure: Changes are limited in footprint and the landscape returns to near baseline conditions after physical works are complete such as revegetation and contouring.

6.5.9.1 Preferred Alternative Haul Road Residual Effects and Significance

Table 6.5-9 Residual Environmental Effects of Geology, Soil, and Sediment Quality within the Preferred Alternative Haul Road

Project - VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction and Operational – Preferred Alternative Haul Road (Haul Road widening and construction, trucking activity, and sediment quality impacts)	Slope stabilization, sediment and erosion control, best management practices, spill preparedness.	A	L Minor changes from baseline conditions	PA Potential adverse effects confined to the PA	N/A VC is not expected to be affected by timing	MT Effects can occur beyond 12 months and up to 3 years	O Potential effects to occur once during the construction phase	IR VC will not recover to baseline conditions	Erosion, soil and sediment quality	Not significant

Legend (refer to Table 5.10-1 for definitions)

Nature of Effect	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
A Adverse	N Negligible	PA Project Area	N/A Not Applicable	ST Short-Term	O Once	R Reversible
P Positive	L Low	LAA Local Assessment Area	A Applicable	MT Medium-Term	S Sporadic	IR Irreversible
	M Moderate	RAA Regional Assessment Area		LT Long-Term	R Regular	PR Partially Reversible
	H High			P Permanent	C Continuous	

Table 6.5-8 was reviewed and it was determined that the construction and operation of the Haul Road was the only VC interaction applicable to geology, soil, and sediment quality associated with the Preferred Alternative Haul Road. There were no changes in the significance criteria or overall significance for this VC interaction.

Mitigations presented in Table 6.5-7 will be established to reduce the impact to geology, soil, and sediment quality from Project activities.

6.5.10 Proposed Compliance and Effects Monitoring Program

Geology and soils monitoring will be completed to verify the accuracy of the predicted environmental effects and the effectiveness of the mitigation measures outlined in Table 6.5-7. There is no determined need for geology and soils to have compliance or effects monitoring programs. An Erosion Sediment Control Plan will be implemented to aid in sediment and erosion control.

The Preliminary Environmental Effects Monitoring Plan (EEM), located in Appendix O.1, outlines the proposed preliminary methods, timing, frequency, and locations for geology, sediment, and soil quality monitoring. This document will develop through regulatory permitting, as well as public and Mi'kmaw engagement.

6.6 Groundwater Quality and Quantity

6.6.1 Rationale for Valued Component Selection

Groundwater quality and quantity is Provincially regulated via many legislative avenues within the *Environmental Act* and protects ecological components, as well as the health of the general public.

Groundwater quality and quantity as a VC is centered on its potential ecological value in recharging surface water and wetlands. From a hydrological and hydrogeological perspective, the potential disconnection between bedrock aquifers and surface water in the project area may limit groundwater recharging, or being recharged, by surface water. In a mine dewatering scenario, groundwater may experience drawdown and subsequently adversely affect surface water quantity in Cameron Flowage or adjacent watercourses or wetlands. Groundwater as a VC is also included in this EIS relative to the Touquoy Mine Site operation as that pit is being used for Beaver Dam Mine Site tailings deposition.

Groundwater quality and quantity also has a socio-economic importance due to its potential to provide potable water through drilled and dug wells. The nearest domestic well is approximately 5.5 km southwest of the Beaver Dam Mine Site.

6.6.2 Baseline Program Methodology

Baseline conditions at the Beaver Dam and Touquoy Mine Sites were assessed and developed as follows:

- Publicly available data including well records, reports and groundwater quality and quantity data were reviewed and compiled;
- Site-specific reports, and geologic cross-sections and maps developed from past drilling programs were reviewed and compiled;
- A groundwater monitoring network was installed at both the Touquoy and Beaver Dam Mine Sites to collect groundwater quality/quantity information to establish baseline conditions and to provide ongoing monitoring; and,

- A numerical groundwater flow model was developed for both the Touquoy and Beaver Dam Mine Sites. The numerical models were applied to simulate current baseline groundwater quantity conditions, which form the basis of comparison for predicted groundwater quantity conditions under future mining conditions.

The assembled data and groundwater monitoring networks installed at the Touquoy and Beaver Dam Mine Sites are described in Section 6.6.2.1 and Section 6.6.2.2, respectively.

6.6.2.1 Beaver Dam Mine Site Baseline Program Methodology

The Beaver Dam Mine Site is in an area of Nova Scotia that has been well studied from a geologic and hydrogeologic perspective. Publicly available information is abundant including important studies such as Lin (1970). The Nova Scotia Well Log Database (NS Well Log Database) that contains thousands of records of wells drilled and dug in Nova Scotia was reviewed to determine the proximity and construction details for domestic wells in the area of the Beaver Dam Mine Site. Data was reviewed for applicability to the Beaver Dam Mine Site geology and hydrogeology and was used in the assessment of this VC. Hydrogeological maps and cross-sections for the mine area are well characterized from past drilling programs. The stratigraphy and general hydrogeological conditions have been described in this document in Section 6.5.

Peter Clifton & Associates (PCA) completed a hydrogeological assessment of the Beaver Dam Mine Site (PCA, 2015). The report provides an assessment of potential groundwater inflows to the proposed open pit at the Beaver Dam Mine Site and includes a review of previous hydrogeological investigations completed at the Mine Site by Jacques Whitford and Associates Ltd. (JWA) in 1986 (JWA, 1986a) and Stantec Consulting, Ltd. (Stantec) in 2014 (Stantec, 2014). The PCA (2015) and JWA (1986a) reports are included in Appendix F.1 and Appendix F.2, respectively. Additional reports reviewed for background information such as fault mapping, previous hydrogeologic evaluations, and geologic interpretations include *Assessment Report on 1987 Exploration Programme on Development License 0078* (Duncan, 1987) and *Environmental Assessment of Gold Mining Exploration, Beaver Dam, Nova Scotia –* (JWA, 1986b).

To further define baseline conditions at the Beaver Dam Mine Site, a monitoring well drilling, installation and hydrogeologic investigation program was conducted from March 29, 2018 to May 7, 2018. In total, 49 nested monitoring wells were installed (Figure 6.6-1). At each nested location, one shallow well was drilled to intercept the water table, or the first occurrence of saturated conditions, typically encountered within the overburden above bedrock. A second monitoring well was also installed at every monitoring well nest, typically screened within shallow competent bedrock. A series of deeper bedrock wells (approximately 30 metres [m] below ground surface [bgs]) were installed at 12 locations, designed to assess more regional groundwater flow patterns in the deeper bedrock and determine the relationship between shallow and deep bedrock groundwater flow conditions. Finally, three additional wells were installed at depths of approximately 60 m bgs to evaluate bedrock groundwater flow conditions at this greater depth in the immediate vicinity of the proposed open pit mine. The drilling program is documented in Appendix F.3 Field activities Report Beaver Dam Mine Site including the location of wells, boreholes logs, and associated hydraulic testing conducted to assess the hydraulic properties of the overburden and bedrock.

Following drilling, packer and slug tests were conducted at selected well locations to determine the hydraulic conductivity of the overburden and bedrock. Biweekly synoptic monitoring of groundwater and surface water elevations began July 5, 2018. Two rounds of water quality sampling from all newly installed monitoring wells were completed in June 2018 and September 2018. Hydraulic conductivity testing, groundwater/surface water elevation measurements, and water quality sampling results are discussed in Section 6.7.2.3.

Previous drilling programs and recent monitoring support that the Beaver Dam Mine Site hydrogeologic conditions are very similar in nature to those at the Touquoy Mine Site. This is expected as the Touquoy Mine Site is located in the same geologic formation as the Beaver Dam Mine Site. The understanding of the groundwater system at Beaver Dam Mine Site will therefore grow with the collection and analysis of data from the compliance monitoring program at the Touquoy Mine Site that has been ongoing since the spring of 2016. Data collected at the Touquoy Mine Site will be used to supplement the ongoing data collection at the Beaver Dam Mine Site. Relationships between surface water and groundwater systems at the Touquoy Mine Site will be better understood in these intervening years and this knowledge will be applied to the monitoring and data collection programs for the Beaver Dam Mine Site throughout the construction, operation, and reclamation phases. Empirical data has significant value in this situation and will be used to the fullest extent, and preferentially over modelling.

The historic and recent data from the Beaver Dam Mine Site, supplemented by data collected at the Touquoy Mine Site provides thorough picture of the physical hydrogeology of the Beaver Dam Mine Site as well as possible interactions that were examined as part of the groundwater VC. Based on the observed hydrogeologic conditions at the Beaver Dam Mine Site, a hydrogeologic conceptual site model (CSM) was developed to describe observed geologic, hydrogeologic, and hydraulic condition, including groundwater and surface water interactions. The Beaver Dam Mine Site CSM is presented in Appendix F.5 Beaver Dam Hydrogeologic Model Development and Application.

Based on the CSM, a three-dimensional (3D) numerical groundwater flow model was developed for the Beaver Dam Mine Site in accordance with British Columbia Ministry of the Environment guidelines (Wels et al., 2012). The Beaver Dam Mine Site 3D numerical groundwater flow model (Beaver Dam Model) was applied to simulated baseline groundwater quantity conditions, which provides a basis of comparison for predicted groundwater quantity conditions at end of mine life and post-closure. The Beaver Dam Model is also applied to improve understanding of hydrogeologic interactions and to simulate transport of constituents of concern (COCs) at the Beaver Dam Mine Site. Detailed documentation of the Beaver Dam Model, including background information, CSM development, model construction, model calibration, and model application is included in Appendix F.5 Beaver Dam Hydrogeologic Model Development and Application.

6.6.2.2 Touquoy Mine Site Baseline Program Methodology

PCA also completed a hydrogeological assessment of the Touquoy Mine Site (PCA, 2007). The report provides an assessment of potential groundwater inflows to the proposed open pit at the Touquoy Mine Site. This assessment used a series of geotechnical/hydrogeological drill holes that were also sampled for groundwater quality. The holes were purged using an airlift method and then sampled after fully developing and purging the wells to obtain a representative groundwater sample. The water obtained from the drill holes represents groundwater from bedrock at the site. Samples were analyzed for general chemistry and metals. Test pits were also excavated in June 2006 to evaluate groundwater flow in the till between the open pit and Moose River. Additional assessment work completed in September 2006 included a temperature survey of surface water to determine possible areas of upwelling groundwater.

JWA (2008) prepared a Groundwater Monitoring Plan as part of the Industrial Approval application for the Touquoy Mine Site. The series of 32 multi-level well pairs, proposed in the plan were installed by GHD at the Touquoy Mine Site (GHD, 2016a,b), and groundwater monitoring has been ongoing at the Touquoy Mine Site to characterize the groundwater conditions in the overburden and bedrock (water levels and chemistry). The baseline groundwater conditions are described in the 2017 Annual Report of Surface Water and Groundwater Monitoring (Stantec, 2018).

The historic and recent data from the site provided a thorough picture of the physical hydrogeology of the Touquoy Mine Site as well as possible interactions that were examined as part of the groundwater VC. Based on the observed hydrogeologic conditions at the Touquoy Mine Site, a hydrogeologic CSM was developed to describe groundwater and surface water interactions at the site. The CSM for the Touquoy Mine Site is presented in Appendix F.6 Groundwater Flow and Solute Transport Modelling to Evaluate Disposal of Beaver Dam Tailings in Touquoy Open Pit – Beaver Dam Gold Project.

A three-dimensional groundwater flow model was developed based on the CSM in accordance with the BC Guidelines for Groundwater Modelling to Assess Impacts of Proposed Resource Development Activities (Wels et al. 2012). The Touquoy Mine Site numerical groundwater flow model (Touquoy Model) was applied to simulate baseline groundwater quantity conditions for the disposal of the Beaver Dam tailings into the Touquoy pit. Baseline conditions correspond to the fully dewatered conditions at the end of mine life, which provide a basis of comparison for predicted groundwater quantity conditions during closure (i.e., as the Touquoy pit is filling) and post closure (i.e., after the groundwater conditions have stabilized following the filling of the Touquoy pit). The Touquoy Model is also applied to improve understanding of hydrogeologic interactions and to simulate transport of constituents of concern at the Touquoy Mine Site. Detailed documentation of the Touquoy Model, including background information, CS development, model construction, model calibration and model application is included in Appendix F.6 Groundwater Flow and Solute Transport Modelling to Evaluate Disposal of Beaver Dam Tailings in Touquoy Open Pit – Beaver Dam Gold Project.

6.6.3 Baseline Conditions

Baseline conditions in terms of geology, hydrogeology, and groundwater quality are described in this section on a regional basis, for the PA surrounding both the Beaver Dam and Touquoy Mine Sites, and then locally for each of the Beaver Dam and Touquoy Mine Sites.

6.6.3.1 Regional Baseline Conditions

The Beaver Dam Mine Site is located in a rural, sparsely populated area of Halifax County. The nearest domestic well is 5.5 kilometers southwest from and up gradient of the Beaver Dam Mine Site at a residence along Hwy 224. Domestic wells located along Hwy 224 are a mix of drilled and dug wells based on a review of the NS Well Log Database. Some of the drilled wells in the NS Well Log Database are reported as completed in granite. Granite was encountered at one well location during the monitoring well drilling program at the Beaver Dam Mine Site, consistent with the location of granite mapped by Nova Scotia Department of Natural Resources (NSDNR). Based on this mapping, the granite intrusion is expected to terminate approximately 100 m southwest of the proposed west waste rock pile location and granite bedrock not anticipated beneath mine features. Therefore, regional wells completed in granite may not be representative of the hydrogeologic conditions in the fractured slate~~s~~ and quartzite bedrock present beneath the Beaver Dam Mine Site. Drilled wells over 60 m bgs typically intersect only one or two sets of discrete water-bearing fractures and have relatively low yields~~,~~ (typically 5 to 10 litres per minute [L/min]). Static groundwater levels measured at the Beaver Dam Mine Site range from 3 to 12 m bgs.

Domestic water supplies in the area are typically vulnerable to surface water entry and associated coliform bacteria issues, and have elevated iron and manganese concentrations (Lin, 1970). Tables 6.6-1 and 6.6-2 below summarize the water quality identified in nearby drilled and dug wells.

Table 6.6-1 Till Groundwater Analysis for dug well in area of Beaver Dam Mine Site

Parameter	NSE Tier 1 EQS	CDWQ Guidelines	CDWQ Source	Units	Dug Well
Sodium		200	AO	mg/L	2.0
Potassium				mg/L	0.3
Calcium				mg/L	21.0
Magnesium				mg/L	3.5
Hardness (CaCO3)				mg/L	67.0
Alkalinity (CaCO3)				mg/L	40.7
Sulfate		500	AO	mg/L	22.0
Chloride		250	AO	mg/L	6.4
Silica				mg/L	3.9
Orthophosphate				mg/L	<0.01
Nitrate + Nitrite				mg/L	0.12
Ammonia				mg/L	<0.5
Arsenic	0.01	0.01	MAC	mg/L	**0.04**
Iron		0.3	AO	mg/L	2.3
Manganese		0.05	AO	mg/L	0.25
Lead	0.01	0.01	MAC	mg/L	0.009
Copper		1	AO	mg/L	0.01
Zinc	5	5	AO	mg/L	0.03
Total Dissolved Solids		500	AO	mg/L	84.0
Suspended Solids				mg/L	382
Colour		15	AO	TCU	12.5

Parameter	NSE Tier 1 EQS	CDWQ Guidelines	CDWQ Source	Units	Dug Well
Turbidity				NTU	87
Conductivity				umho/cm	149.0
pH		7.0 - 10.5	AO	S.U.	6.8

Notes:

The Dug well was partially constructed of waste rock and the sample was turbid so it may not be representative of metals in the overburden groundwater.

NSE Tier 1 EQS – Nova Scotia Environment Tier 1 Environmental Quality Standards for Potable Groundwater (Coarse Grained Soil), Agricultural/Residential

CDWQ Health Canada's Guidelines for Canadian Drinking Water Quality, October 2014

AO Aesthetic Objective

MAC Maximum Acceptable Concentration

Red Denotes guideline exceedance of CDWQG

Bold Denotes guideline exceedance of NSE Tier1 EQS

Table 6.6-2 Bedrock Groundwater Analysis for drilled wells in area of Beaver Dam Mine Site

Parameter	NSE Tier 1 EQS	CDWQ Guidelines	CDWQ Source	Units	Austin Shaft 7m	Austin Shaft 17m	DDH86-47 (flowing)1
Sodium		200	AO	mg/L	2.1	2.3	4.4
Potassium				mg/L	0.9	0.8	1.4
Calcium				mg/L	8.3	9.5	24.3
Magnesium				mg/L	1.0	1.1	2.0
Hardness (CaCO3)				mg/L	25.0	28.3	69.0
Alkalinity (CaCO3)				mg/L	20.3	23.5	69.0
Sulfate		500	AO	mg/L	8.0	8.0	7.5
Chloride	250	250	AO	mg/L	3.3	3.1	4.6

Parameter	NSE Tier 1 EQS	CDWQ Guidelines	CDWQ Source	Units	Austin Shaft 7m	Austin Shaft 17m	DDH86-47 (flowing)1
Silica				mg/L	4.8	5.2	12.0
Orthophosphate				mg/L	0.02	<0.01	0.01
Nitrate + Nitrite				mg/L	0.18	0.13	<0.5
Ammonia				mg/L	<0.05	<0.05	<0.5
Arsenic	0.01	0.01	MAC	mg/L	**0.04**	**0.04**	**0.04**
Iron		0.3	AO	mg/L	0.3	0.32	0.5
Manganese		0.05	AO	mg/L	<0.01	0.03	0.31
Lead	0.01	0.010	MAC	mg/L	<0.002	<0.002	<0.002
Copper		1	AO	mg/L	<0.01	<0.01	<0.01
Zinc	5	5	AO	mg/L	<0.01	<0.01	<0.01
Total Dissolved Solids		500	AO	mg/L	35.0	43.0	94.0
Suspended Solids				mg/L	<0.3	<0.3	0.8
Colour		15	AO	TCU	5.0	5.0	20
Turbidity				NTU	1.5	2.3	0.4
Conductivity				umho/cm	69.00	76.00	161.0
pH		7.0 - 10.5	AO	S.U.	6.30	6.40	7.4
Aluminum		0.1	AO	mg/L	<0.05	<0.05	- -
Boron	5	5	MAC	mg/L	<0.02	<0.02	- -
Barium	1	1	MAC	mg/L	<0.005	<0.005	- -
Beryllium	0.004			mg/L	<0.005	<0.005	- -
Chromium	0.05	0.05	MAC	mg/L	<0.01	<0.01	- -
Cobalt	0.01			mg/L	<0.01	<0.01	- -

Parameter	NSE Tier 1 EQS	CDWQ Guidelines	CDWQ Source	Units	Austin Shaft 7m	Austin Shaft 17m	DDH86-47 (flowing)1
Nickel	0.1			mg/L	<0.02	<0.02	- -
Antimony	0.006	0.006	MAC	mg/L	<0.05	<0.05	- -
Selenium	0.01	0.05	MAC	mg/L	<0.1	<0.1	- -
Tin	4.4			mg/L	<0.03	<0.03	- -
Vanadium	0.0062			mg/L	<0.01	<0.01	- -
Mercury	0.001	0.001	MAC	mg/L	<0.05	<0.05	- -
Cadmium	0.005	0.005	MAC	mg/L	<0.01	<0.01	- -

Notes:

(1) Sample taken from exploration borehole but representative of typical bedrock groundwater of site area.

NSE Tier 1 EQS NSE Tier 1 EQS – Nova Scotia Environment Tier 1 Environmental Quality Standards for Potable Groundwater (Coarse Grained Soil), Agricultural/Residential

CDWQ Health Canada's Guidelines for Canadian Drinking Water Quality, October 2014

AO Aesthetic Objective

MAC Maximum Acceptable Concentration

Red Denotes guideline exceedance

Bold Denotes guideline exceedance of NSE Tier1 EQS

It should be noted that the rock at the bulk of the Beaver Dam Mine Site was determined through testing to be net acid consuming. The likelihood of acidic runoff being generated with associated metals-enriched content is therefore very limited. Groundwater in contact with the net acid consuming materials will not generate acidic groundwater that may enter the surface water system. Areas where the rock is net acid producing are well understood and the available data to properly manage this material will increase during mining while testing is completed as the project advances.

In relation to the Touquoy Mine Site, Camp Kidston, that operates only in the summer months, is located 3.5 km northeast of the Touquoy Mine Site. According to the Proponent, the nearest permanent full-time occupied residences are located approximately 5.8 km to the north of the Touquoy Mine Site along Caribou Road. The next closest permanent residences to the Touquoy Mine Site are approximately 7.4 km to the northwest and 11.7 km to the southeast.

A review of the Nova Scotia Groundwater Observation Well Network 2015 report identifies that there are two regional observation wells located in the general vicinity of the PA: one, in Sheet Harbour, and the other in Musquodoboit Harbour. This is the most recent report completed under this program. The report identifies that in general across the Province, aquifers have higher groundwater levels in the spring months and lower levels in the summer months. The typical seasonal variation in groundwater levels in

Nova Scotia aquifers is usually less than about 3 m. Lower groundwater levels may also be observed in February, depending on winter conditions including snowfall amounts and frost, which can limit recharge. Similar seasonal changes in groundwater levels have been observed at the Touquoy Mine Site where groundwater elevation monitoring has been ongoing since 2016. Trend analysis has not been conducted on the two nearest regional observation wells in this network due to insufficient data collected to date (less than 10 years of usable data). In general, groundwater levels have remained relatively consistent at the Musquodoboit Harbour observation well since its installation in 2008, and groundwater levels have increased by approximately 1 m in the Sheet Harbour observation well since its installation in 1987. Figures 6.6-2 and 6.6-3 below provide a summary of the groundwater elevations observed in these two regional observation wells.

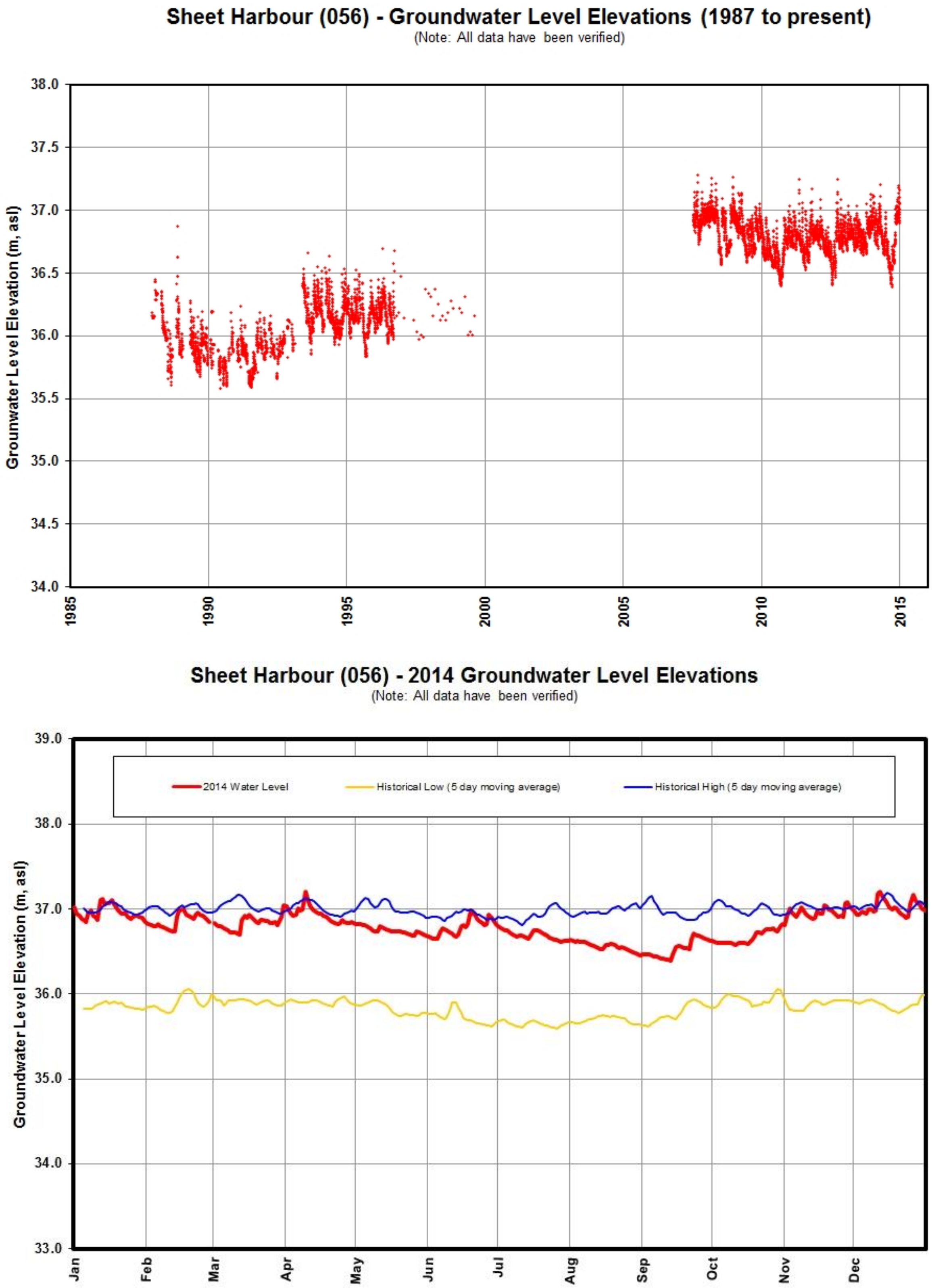
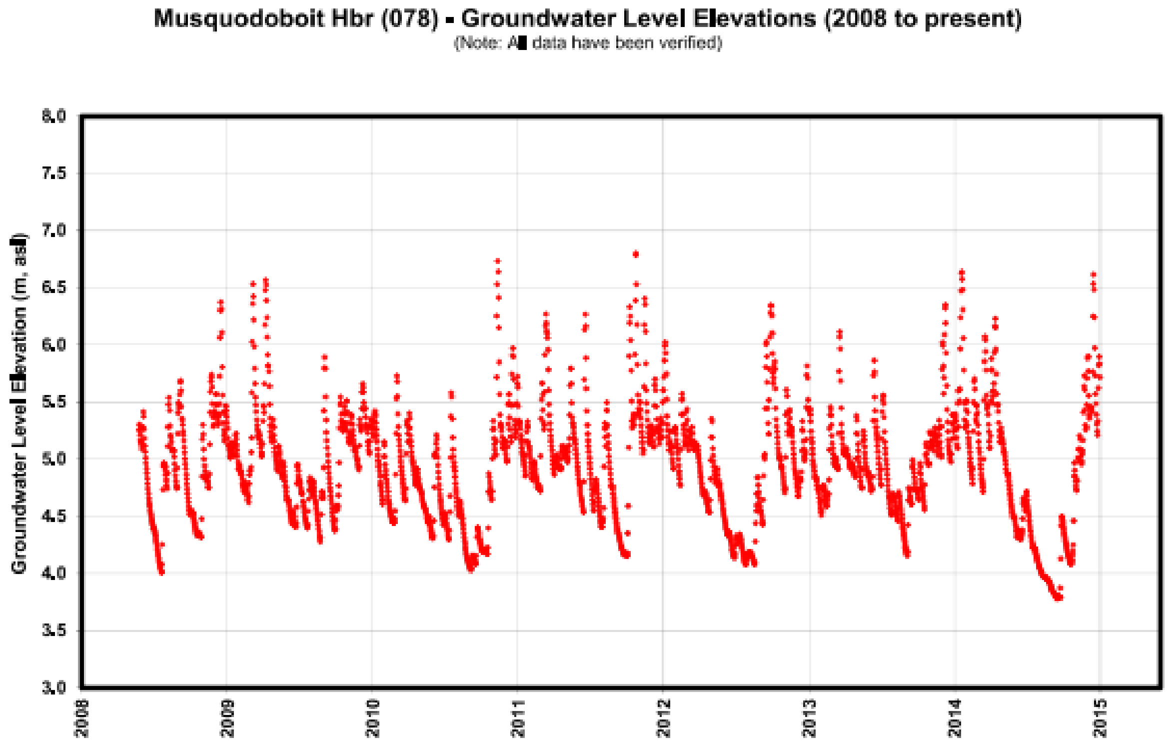


Figure 6.6-2 Summary of Groundwater Elevations Observed in Sheet Harbour Observation Well (NSE 2015c))



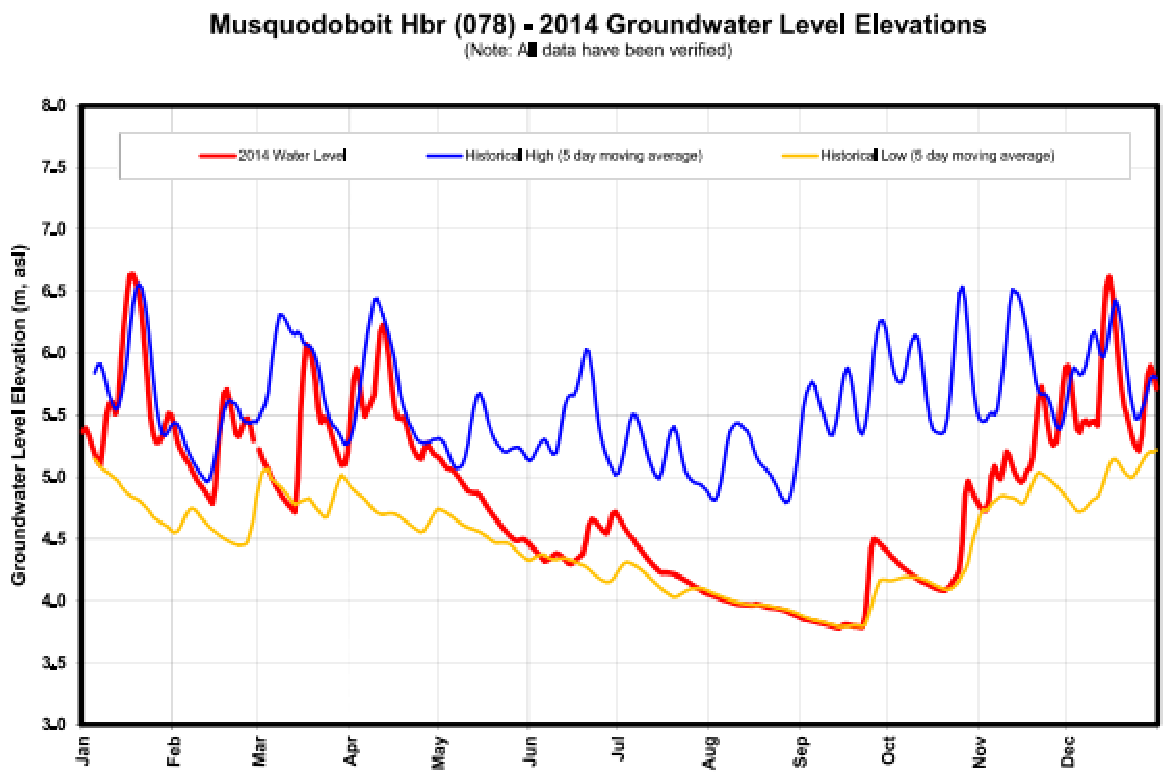


Figure 6.6-3 Summary of Groundwater Elevations Observed in Musquodoboit Harbour Observation Well (NSE 2015c)

6.6.3.2 PA Baseline Conditions

In general, the hydrogeology for the PA surrounding the Beaver Dam and Touquoy Mine Sites consists of a fractured rock aquifer system that is overlain by a thin till overburden layer. These two hydrogeologic units are present on a regional scale and extend beyond the limits of the Mine Sites. The bedrock can be subdivided into a shallow weathered fractured zone and deep fractured zone. Prior to 2018, most of the site-specific hydrogeologic data collected were focused on determining the rate of groundwater flow in bedrock for the purpose of determining pit dewatering requirements.

The till within the PA is orange brown to olive brown silty sand and gravel. It contains quartzite and slate cobbles and boulders up to one (1) m in diameter. Grain size analysis indicates the till averages approximately 60 percent gravel, 25 percent sand, 15 percent silt, and 1 percent clay. Topography throughout the PA is relatively flat. Till thickness is controlled by the depth to the undulating bedrock surface and the glacial depositional environment which has left scattered drumlins located throughout the region. Till thickness ranges from 0.5 m to 22 m, but typically ranges from 3 m to 5 m thick.

The degree of groundwater saturation within the till varies. A series of test pits installed at the Beaver Dam Mine Site encountered groundwater at a depth of 0.6 m bgs but this was close to a bog area and may have indicated a perched water table condition. The water table was encountered at depths of 1.5 to 1.8 m bgs in several test pits, while others were terminated at bedrock at depths of up to 4 m bgs without encountering groundwater. Groundwater levels observed for the Beaver Dam Mine Site monitoring network typically vary between 2 and 5 m bgs. Groundwater flow in the till mimics the topography, with recharge occurring in elevated areas and groundwater flowing towards and discharging into surface water bodies in low-lying areas.

The till, as well as bedrock, have temporal variations in flow and static groundwater levels based on the amount of rainfall and infiltration. Groundwater levels in monitoring well locations are observed to respond quickly to precipitation events, consistent with what would be expected for systems consisting of shallow till overburden overlaying fractured bedrock. Rainfall and infiltration can be highly variable due to the local and regional weather patterns. Infiltration can be limited by both periods of frozen ground conditions and dry periods. Seepage discharge rates from the till are expected to be greatest following the spring thaw and during the early summer months.

6.6.3.3 Beaver Dam Mine Site Baseline Conditions

Results from the ongoing groundwater monitoring program at the Beaver Dam Mine Site indicate that the groundwater has an approximately neutral acidity (pH ranges from 5.64 to 8.24, average of 7.1) and has an elevated hardness (2.2 to 290 mg/L, average of 41 mg/L). Certain metals such as aluminum, silver, arsenic, cadmium, copper, iron, and zinc are naturally elevated relative to CCME FWAL and/or PSS Tier 2 guidelines. However, these metals are within ranges typically found in groundwater throughout Nova Scotia. Groundwater analytical results for the Beaver Dam Mine Site are presented in Appendix F.3 (GHD Field Activities Report). The actual volume of groundwater stored in the bedrock aquifer is small, and this reflects the relatively small primary porosity of these rocks.

JWA conducted a hydrogeological investigation at the Beaver Dam Mine Site in 1986 (JWA, 1986a) and Stantec conducted a hydrogeological investigation in 2014 (Stantec, 2014). Based on the results of pumping tests and packer tests, the geometric mean (approximate median) of the hydraulic conductivity values obtained by JWA (1986a) and Stantec (2014) is relatively low at 4.5×10^{-8} metres per second (m/s). The results of extensive packer testing within bedrock drill holes at the Beaver Dam Mine Site did not identify any large-scale permeable zones from which high rates of groundwater seepage into an open pit could be expected. As discussed further in this section, the packer tests specifically targeted the Mud Lake Fault Zone and results indicate that the Mud Lake Fault has a hydraulic conductivity similar to the surrounding bedrock.

GHD (2018) (GHD Field activities Report) conducted further packer testing in summer 2018 at three deep drill holes installed surrounding the proposed pit location. These packer tests were conducted to better define hydraulic conductivity values surrounding the pit and better support pit inflow calculations. Each deep drill hole was tested at 10 depth intervals for a total of 30 packer tests. Hydraulic conductivity results from the packer tests range from 2.1×10^{-6} to 7.2×10^{-10} m/s with a geometric mean of 3.2×10^{-8} m/s, consistent with the previous packer test results summarized by PCA (2015). The packer test results indicate the bedrock has a low hydraulic conductivity, which is consistent with the lithology observed in diamond drillhole cores drilled at the Beaver Dam Mine Site.

GHD (2018) (GHD Field activities Report) also complete slug tests in all newly installed monitoring wells, with the exception of two deep wells, which recovered at rates too slow to complete the tests. The slow recovery of the deep wells further supports that the deep bedrock is of low permeability. For the overburden, hydraulic conductivity values estimated from slug tests ranged from 6×10^{-7} m/s to 3.8×10^{-4} m/s, with a geometric mean of 1×10^{-5} m/s. For the bedrock, hydraulic conductivity values estimated from the slug tests ranged from 10×10^{-10} m/s to 1.6×10^{-4} m/s, with a geometric mean of 1.2×10^{-6} m/s. The geometric mean hydraulic conductivity in bedrock is greater than that obtained from packer test results since the majority of slug tests were conducted in the shallow more permeable bedrock zone.

The bedrock hydraulic conductivity at the Beaver Dam Mine Site generally decreases with depth. The shallow bedrock zone (referred to as the top 22 m of bedrock by JWA, 1986a) has a geometric mean hydraulic conductivity (across all packer and slug tests) of 5.6×10^{-7} m/s, while the geometric mean hydraulic conductivity of bedrock below 22 m is 2.9×10^{-8} m/s. Therefore, the amount of groundwater flow is expected to be greater in the shallow bedrock relative to the deep less permeable bedrock.

JWA (1986a) reported that during drilling completed in the 1980s at the Beaver Dam Mine Site, most of the diamond drill holes had static groundwater levels within 0.3 m of ground surface. Drill holes that penetrated the Mud Lake Fault Zone were often flowing, albeit at very low rates (less than 5 L/min). -This indicates an area where bedrock groundwater is discharging upward into the overlying wetland systems in the vicinity of the proposed open pit mine. The same observation was made by GHD (2018) (GHD Field activities Report) during recent fieldwork completed to evaluate groundwater/surface water interaction, which included the installation of well points at select locations where groundwater discharge was suspected.

Table 6.6-3 Groundwater-Surface Water Interactions

Location ID	Description	GPS Coordinates	Rationale for Location	Results Summary	Notes
Location #1 Well point and SED1	Downstream of site on Cameron Flowage	523247 4990039	To assess interaction between Cameron Flowage and local groundwater system down gradient of site	Delta of 4 cm indicates slight downward gradient from stream to groundwater system. Cameron Flowage has minor contribution to local groundwater system at this location.	Inspection completed of stream bank to 100 metres from well point site up-gradient and down-gradient with no seepage points noted or up-welling in stream bed obvious. Stream has bedrock exposed and cobbles with coarse sand bottom.
Location #2 Well point and SED2	Upstream of site, west bank of Cameron Flowage	521989 4990921	To assess interaction between Cameron Flowage and groundwater system at this location up-stream of mine area	No delta in levels inside and outside well point at this location indicating no groundwater and surface water interaction	Inspection completed of stream bank to 100 metres from well point site up-gradient and down-gradient with no seepage points noted or up-welling in stream bed obvious. Stream has coarse sand and cobble substrate with minor sands.
Location #3 Well point and SED3	Down-gradient from planned Waste Rock Pile	521560 4990242	To assess interaction between groundwater and surface water at this location.	No delta in levels inside and outside well point at this location indicating no groundwater and surface water interaction	No visible areas of discharge noted within 50 metres of site up-gradient and down-gradient. Stream has gravelly cobble substrate with some silt and boulders.
Location #4 Well point and SED4	Down-gradient from planned Waste Rock Pile	521941 4990172	To assess interaction between groundwater and surface water at this location.	Delta of 6 cm indicates slight downward gradient from stream to groundwater at this location.	No visible areas of discharge noted within 40 metres of site up-gradient and down-gradient. Stream has an organic substrate underlain by silty sand with some cobbles.

Location ID	Description	GPS Coordinates	Rationale for Location	Results Summary	Notes
Location #5 Well point and SED5	Down-gradient from planned Waste Rock Pile	521829 4990207	To assess interaction between groundwater and surface water at this location.	No delta in levels inside and outside well point at this location indicating no groundwater and surface water interaction	No visible areas of discharge noted within 50 metres of site up-gradient and down-gradient. Stream has an organic substrate underlain by silty sand with some cobbles.
Location #6 Well point and SED6	Down-gradient from Cameron Flowage	522960 4990277	To assess interaction between groundwater and surface water at this location.	Delta of 3 cm indicates slight downward gradient from stream to groundwater at this location.	No visible areas of discharge noted within 50 metres of site up-gradient and down-gradient. Stream has a silt substrate with organics and some boulders.
Location #7 Well point and SED7	Downstream of planned facilities, ore storage, and crushing facilities	522730 4990130	To assess interaction between groundwater and surface water at this location.	No delta in levels inside and outside well point at this location indicating no groundwater and surface water interaction	No visible areas of discharge noted within 60 metres of site up-gradient and down-gradient. Stream has a silt substrate with minor organics and some boulders and cobbles.
Location #8 Well point and SED8	Downstream of planned Waste Rock Pile	522658 4989053	To assess interaction between groundwater and surface water at this location.	No delta in levels inside and outside well point at this location indicating no groundwater and surface water interaction	No visible areas of discharge noted within 40 metres of site up-gradient and down-gradient. Stream has a silt substrate with heavy organics and boulders, minor cobbles.
Location #9 Well point and SED9	Downstream of planned Waste Rock Pile	521841 4989133	To assess interaction between groundwater and surface water at this location.	No delta in levels inside and outside well point at this location indicating no groundwater and surface water interaction	No visible areas of discharge noted within 50 metres of site up-gradient and down-gradient. Stream has a silt substrate with organics.

Based on previous studies of the hydrogeology of the bedrock formation at the Beaver Dam Mine Site and surrounding the area, the degree of hydraulic connection between smaller bedrock fracture zones is likely poor to moderate. The water table is close to the surface (typically within 2 to 5 m of ground surface) across the Beaver Dam Mine Site, reflecting flat lying terrain, low permeability bedrock, and an excess of annual rainfall beyond evapotranspiration rates. Thus, a portion of the overlying tills will be saturated with groundwater under ambient conditions.

The bedrock at the Beaver Dam Mine Site consists of three sub-parallel anticlines. The gold deposit is associated with beds that dip to the north at between 75° and 90°. The Mud Lake Fault and the Cameron Flowage Fault trend northwest near the Beaver Dam Mine Site. The Mud Lake Fault is described from drill cores as a 2 m to 3 m zone of gouge within a 10 m to 20 m wide brecciated zone. Locally, bedrock groundwater flows predominantly southeast along the fault trends, with flows to the northeast and east directions caused by secondary structural features. The fractures that were encountered displayed evidence of groundwater flow (iron staining) but were infrequently spaced with variable orientations. Fracture orientation depended on location relative to the anticline (i.e., which side of the anticline) and proximity to the Mud Lake Fault.

Considering all packer testes conducted in bedrock drill holes at the Beaver Dam Mine Site [JWA (1986a), Stantec (2014), and GHD (2018) (GHD Field activities Report)], bedrock hydraulic conductivity values ranged from 1.0×10^{-10} m/s to 2.1×10^{-6} m/s with a geometric mean of 3.4×10^{-8} m/s. Six packer tests were conducted at drill hole intervals that intersected the Mud Lake Fault. Hydraulic conductivity results determined from these tests ranged from 1.2×10^{-9} m/s to 1.9×10^{-6} m/s with a geometric mean of 1.2×10^{-8} m/s, which is only slightly less than the geometric mean hydraulic conductivity calculated for all packer test results. This indicates that the Mud Lake Fault is likely of similar permeability or lower permeability than the surrounding bedrock. This is consistent with the observation by JWA (1986a) that the Mud Lake Fault is infilled with clay-like gouge.

The vertical and horizontal extents of the Mud Lake Fault, defined based on exploratory drill hole records and regional fault mapping, were incorporated into the Beaver Dam Model. Through model calibration, it was determined that the best match to observed groundwater elevations was obtained by assigning a hydraulic conductivity value to the Mud Lake Fault that was lower than, or similar to, that of the surrounding bedrock. This further supports that the Mud Lake Fault has a similar hydraulic conductivity value to that of the surrounding bedrock and does not act as preferential flow path at the Beaver Dam Mine Site.

Groundwater flow at the Beaver Dam Mine Site occurs primarily in the till overburden and the shallow bedrock zone, with less flow expected within the deeper less permeable bedrock. Groundwater flow in the till overburden typically follows topographic relief, and is expected to mirror the topographic surface, with recharge occurring on the basin boundaries and uplands and discharge occurring to low-lying areas containing wetland areas and tributaries of the Killag River Watershed. Figure 6.6-4 in shows a groundwater elevation contour map based on groundwater elevations measured in the overburden on July 18, 2018. Figure 6.6-4 further demonstrates that shallow groundwater flow mirrors topographic relief and that groundwater recharge in areas of topographic highs and discharges to low-lying surface water bodies. PCA (2015) further states that groundwater occurs at shallow depths at the Beaver Dam Mine Site and that Cameron Flowage is a likely area of groundwater discharge.

Groundwater flow in the shallow weathered bedrock is controlled by secondary permeability caused by fracturing. Locally, groundwater flow in shallow bedrock is directed predominantly to the south-east along the direction of dominant fault trends, with a smaller component of groundwater flow towards the northeast and east.

The degree of hydraulic connection amongst the shallow bedrock fractures is likely poor to moderate. The volume of groundwater stored in the shallow bedrock aquifer is probably small, and this reflects the relatively small primary porosity of these rocks. Some of the larger bedrock-fractures may be hydraulically connected to surface water bodies, which may become sources of aquifer recharge under a mine dewatering scenario.

Groundwater can be expected to seep into the open pit developed at the Beaver Dam Mine Site largely through the surficial glacial till, and through fractures in the shallow bedrock. The more competent deep bedrock is not expected to contribute significant groundwater inflow to the open pit. As the pit dewatering progresses and groundwater levels in the vicinity of the open pit are lowered, a reduction in baseflow (i.e., the groundwater contribution to stream flow) may be observed in nearby water bodies (i.e., some surface water bodies ,which are presently groundwater discharge areas, may receive reduced groundwater discharge or become areas of groundwater recharge).

Both total stream flow and baseflow were estimated for Cameron Flowage through analysis and review of stream flow data collected at nearby hydrometric stations. The nearest four hydrometric stations are Pembroke River at Glenbervie, Musquodoboit River Near Upper Musquodoboit, Musquodoboit River Near Middle Musquodoboit, and Musquodoboit River at Crawford Falls, which have drainage areas of 7,330 hectares (ha), 14,100 ha, 33,400 ha, and 65,000 ha, respectively. A baseflow value was estimated for each drainage area using a recursive digital filter (Eckhardt, 2005) and scaled to the total drainage area of approximately 3,871 ha for Cameron Flowage. The estimated total average annual flow in Cameron Flowage is 103,881 m^3/d. The estimated average annual baseflow for Cameron Flowage is 23,426 m^3/d, which is approximately 23 percent of the total average annual flow. The estimated average annual baseflow in Cameron Flowage provides a baseline condition against which to compare predicted baseflow at the end of mine life and post-closure.

6.6.3.4 Touquoy Gold Mine Site Baseline Conditions

As identified in the 2007 Focus Report, the Touquoy Mine Site is located within a metamorphic bedrock hydrostratigraphic unit, cross cut by structural features (faults, anticlinal axes) that may represent separate hydrostratigraphic units. Groundwater inflows and outflows will be controlled by these relatively low permeability and fracture-controlled bedrock units. Given the high water table in the study area and combined with the high water surplus and general low permeability of the area, the groundwater flow system can be characterized as a “local” system, with topographic highs representing recharge zones that would discharge into the adjacent topographic lows. The till overburden hydrostratigraphic unit acts as a confining unit that creates non-flowing artesian conditions within the bedrock, Groundwater-surface water interaction is limited by the presence of this confining till, with flow rates controlled by the thickness, continuity and permeability of the till.

Single-well response tests conducted on wells across the Touquoy Mine Site including all of the monitoring wells installed as part of the groundwater monitoring plan (GHD, 2017a,b). The hydraulic conductivity estimates were fairly consistent across the site, in both the silty-sand till overburden (geometric mean of 1.8×10^{-6} m/s), and in the relatively shallow bedrock (geometric mean of 1.0×10^{-6} m/s). No differentiation of hydraulic conductivity in the bedrock was observed in wells constructed in the two dominant rock lithologies: argillite; and greywacke.

Seepage into the open pit at Touquoy from the till and bedrock was expected to range from 550 cubic metres per day (m^3/d) to 1,450 m^3/d (PCA, 2006). An additional assessment completed as part of the Touquoy Gold Project Focus Report to determine the potential linkage between Moose River and the local groundwater system identified that groundwater upwelling was not measured from temperature profiling conducted through the portion of Moose River that lies adjacent to the proposed Touquoy open pit. The poor linkage between the Moose River and Touquoy Pit is has been confirmed to date (2017 and 2018) by ongoing flow monitoring at the site during operations under the Industrial Approval.

Under ambient conditions, surface water contribution to groundwater would be very limited given the thickness, continuity and permeability of the confining till and the relative impermeability of the bedrock.

Groundwater Quality at the Touquoy Mine Site

Baseline groundwater quality at the Touquoy Mine Site indicate that the groundwater is slightly basic (pH range 7.02 to 8.08) and an elevated hardness (45 to 160 mg/L). Groundwater quality results from samples collected in the vicinity of the open pit at the Touquoy Mine Site (i.e., the OPM-series wells) are summarized on Figures 6.6-5 and 6.6-6. As shown on these figures, the groundwater quality generally meets the NSE Tier 2 PSS for groundwater > 10 m from surface water criteria. The GCDWQ and the CCME FAL guidelines are also presented on Figures 6.6-5 and 6.6-6 for illustrative purposes, but are not discussed, as groundwater at the Touquoy Mine Site is not used as a potable water supply, and the NSE Tier 2 PSS already account for groundwater discharging to surface water bodies. The Touquoy groundwater monitoring program results (for OPM-series wells) are reported annually to NSE based on the requirements of the Industrial Approval which regulates operational activities and monitoring at the Touquoy Mine Site (reference required for 2018 annual report).

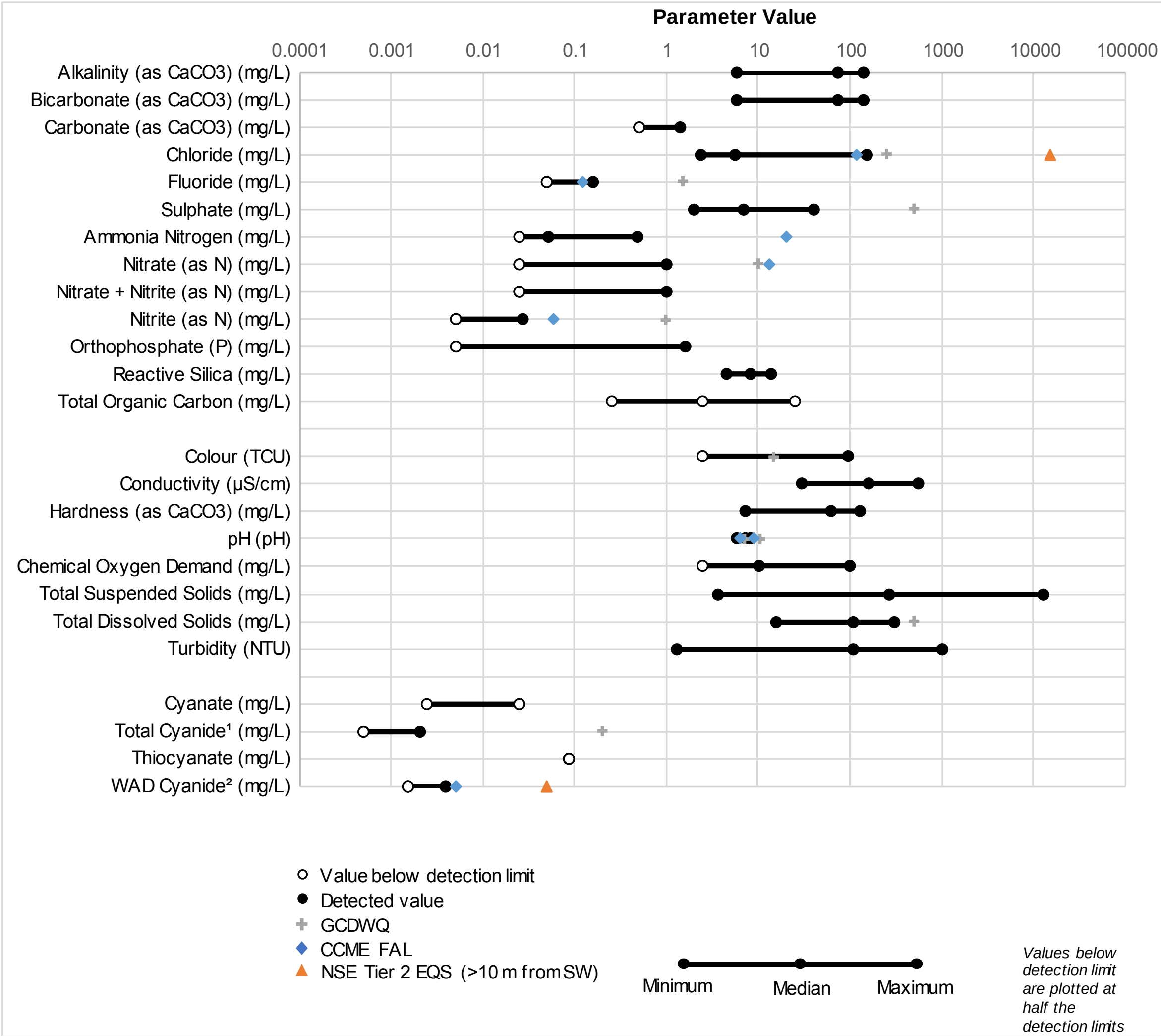


Figure 6.6-5 Summary of Groundwater Quality in the Vicinity of the Open Pit at the Touquoy Mine Site – General Chemistry and Cyanide-Related Parameters

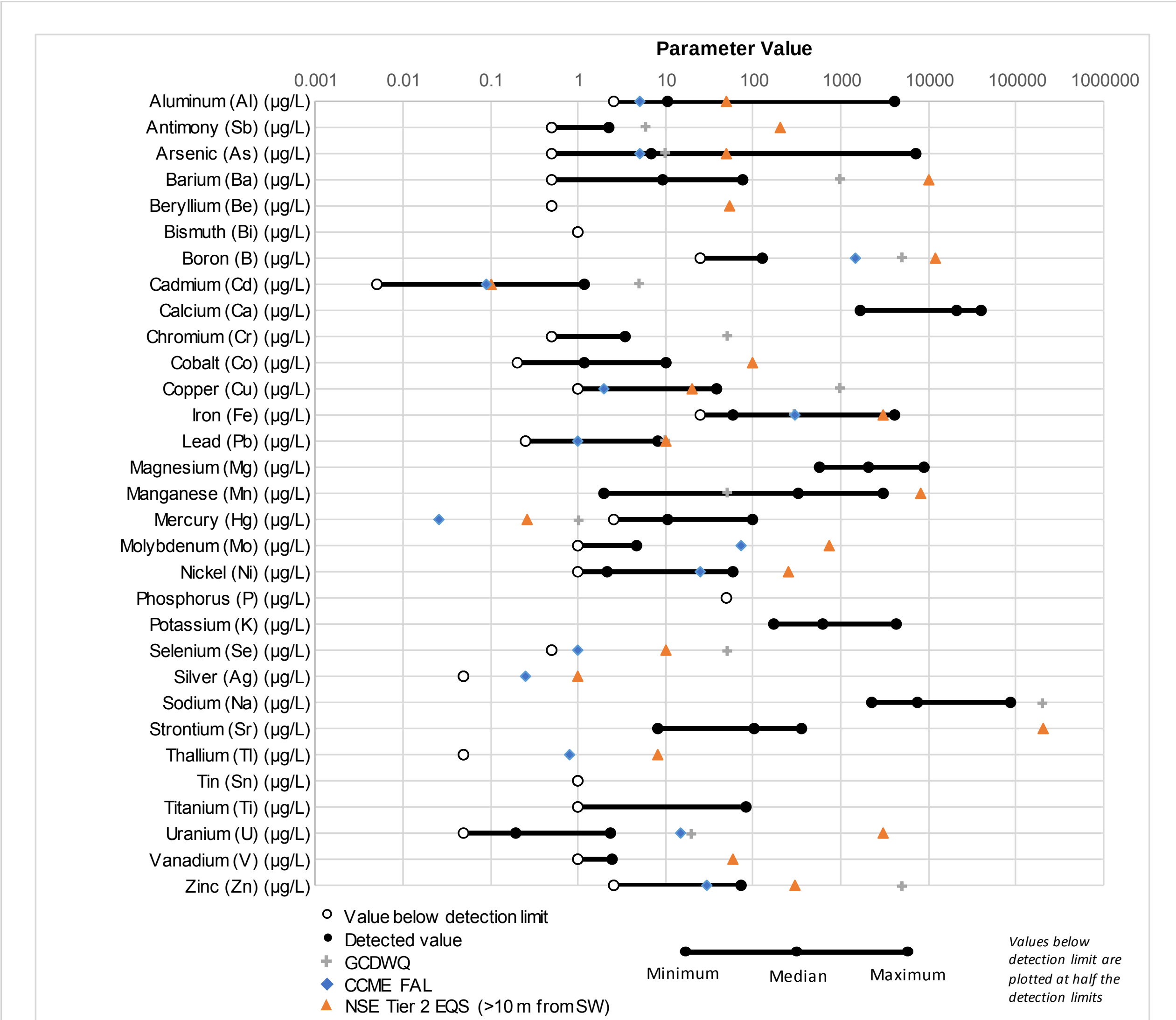


Figure 6.6-6 Summary of Groundwater Quality in the Vicinity of the Open Pit at the Touquoy Mine Site – Dissolved Metals

Groundwater quality exceedances of the NSE Tier 2 PSS were noted in 2017 for aluminum, arsenic, cadmium, copper, iron, mercury, silver, and organics that were common in the 2016 baseline period, and therefore were not attributed to the operation of the mine. The development of site-specific criteria for the Mine Site should be considered to determine thresholds for water quality that consider the elevated concentrations of parameters under baseline conditions. Until such time as site-specific criteria are developed, the evaluation of potential water quality effects from the operation of the mine is based on long-term upward or downward trends in comparison to the baseline levels, and not exclusively on any exceedances of NSE EQS or PSS criteria. The current monitoring record representing operation is too short to distinguish any potential effects of the mine water quality compared to the natural variability, as operation only began in October 2017.

Arsenic was noted to consistently exceed the Tier 2 PSS at OPM-1A/B in both 2016 and 2017. These elevated arsenic concentrations are not attributed to operation and may be from historical tailing piles and/or the Touquoy ore body itself. A remedial action plan is currently underway by the Proponent that involves the delineation, removal, and management of these historical tailing piles around the open pit area.

The Groundwater Contingency Plan (Stantec 2017b) presents contingency action levels for groundwater quality around the mine for indicators of operation-related effluent impacts to groundwater compared to the baseline water quality record. However, the monitoring record for the baseline period is relatively short, therefore, as observed for the upstream surface water quality, the natural variability of groundwater quality may not have been captured in the baseline period, and therefore the action levels defined in the groundwater contingency plan may be overly conservative for evaluating potential mine effects on groundwater quality.

Single, discontinuous groundwater quality results above action levels were identified in the 2016 baseline and 2017 operating data, however, these were not attributed to mine operations, but may be the result of natural variability not captured during the baseline period. Groundwater quality will continue to be monitored closely in 2018 to identify potential indicators of groundwater seepage from mine operations.

6.6.4 Consideration of Consultation and Engagement Results

Key issues raised during public consultation and Mi'kmaq engagement relating to groundwater included potential effects on groundwater levels from open pit mining at the Beaver Dam Mine Site and potential groundwater quality impacts associated with Project activities at the both the Beaver Dam and the Touquoy Mine Sites. Concerns were specifically expressed by the Millbrook First Nation regarding effects on groundwater quality and quantity in terms of potable water wells and the health of its residents in Beaver Lake IR 17. These concerns were identified in relation to potential effects on groundwater quality from unplanned releases due to accidents and malfunctions, specifically during mine operations.

The results of the public consultation and Mi'kmaq engagement have been considered in the environmental effects assessment, including the Proponent's commitments to mitigation and monitoring measures and proposed compliance and effects monitoring programs, as well as the Proponent's broader commitment to ongoing public consultation and Mi'kmaq engagement. Specific evaluations of the potential effects on groundwater quality and quantity are presented within the following environmental effects assessment.

6.6.5 Effects Assessment Methodology

6.6.5.1 Boundaries

Spatial Boundaries

The spatial boundaries used for the assessment of effects to groundwater quality and quantity are defined below:

The PA encompasses three primary components from Marinette to Moose River Gold Mines, Halifax County, NS. The Beaver Dam Mine Site will be located at the end of the Beaver Dam Mines Road and the Haul Road will span from the Beaver Dam Mine Site to Moose River Gold Mines, where the Touquoy Mine Site [processing and exhausted pit (to be used to dispose Beaver Dam Mine Site tailings)] is located.

The LAA encompasses an 800 m buffer from the Beaver Dam Mine Site PA, 800 m buffer along the portion of the Haul Road that will be upgraded where receptors are present, and the portion of down-gradient habitat from the Touquoy Mine Site. As Nova Scotia requires, the LAA is defined as an 800 m radius with respect to blasting for mining and construction projects, to ensure structural and groundwater quality and quantity continuity, and maximum expected extent of project direct and indirect impacts to groundwater at the Touquoy Mine Site (Figure 6.6-7).

The RAA in the context of groundwater quality and quantity encompasses Tertiary Watersheds intersecting the PA (includes an approximate 6 km buffer around the PA). The RAA aims to account for the maximum zone of influence and corresponds roughly to the extent of the groundwater flow model domain (Figure 6.6-8).

As the Project has the potential to cause direct and indirect effects to groundwater outside of the PA, the LAA is the appropriate boundary for evaluation of this VC.

Temporal Boundaries

The temporal boundaries used for the assessment of effects to groundwater quality and quantity are the construction phase, operational phase, reclamation and decommissioning, and post-closure phases.

Technical Boundaries

No technical boundaries were identified for the effects assessment of groundwater quality and quantity.

Administrative Boundaries

Groundwater quality at the Beaver Dam Mine Site, the Touquoy Mine Site, and along the Haul Road will be compared to criteria from CCME FWAL guidelines and Nova Scotia Environment (NSE) Tier 1 EQS groundwater quality criteria, and baseline conditions/background groundwater concentrations. The NSE Tier 2 Pathway Specific Standards (PSS) for groundwater discharging to surface water will be applied, as the current and future use of the site will be non-potable for groundwater. Applicable Tier 1 EQS groundwater quality criteria do not specify concentration limits for the constituents of concern at the Beaver Dam and Touquoy Mine Sites. There may be other requirements for monitoring of groundwater through provincial approvals to be obtained prior to the start of Project activities.

6.6.5.2 Beaver Dam Mine Site Groundwater Modelling Methodology

A 3D groundwater flow model for the Beaver Dam Mine Site (Beaver Dam Model) was developed by GHD for the following purposes:

- To enhance the understanding of groundwater flow conditions at and surrounding the Beaver Dam Mine Site to facilitate developing a hydrogeologic CSM to use as the basis for developing the numerical groundwater flow model
- To construct and calibrate the numerical groundwater flow model consistent with the CSM to represent observed Beaver Dam Mine Site conditions
- To apply the calibrated groundwater flow model to evaluate potential changes in groundwater quality and quantity with respect to groundwater flow and groundwater interactions with surface water at the Beaver Dam Mine Site under EOM and PC conditions

The Beaver Dam Model was based on site-specific and available regional data including surface water features, topography, water well records and geologic information. The scope of work completed by GHD to develop the Beaver Dam Model and apply the model to evaluate potential impacts to groundwater and surface water flow regimes included the following:

- Compilation, review, and interpretation of the geologic, groundwater flow, and surface water flow data available for the Beaver Dam Mine Site and surrounding area

- Development of a 3D geologic model, a CSM, and a 3D groundwater flow model of the Beaver Dam Mine Site and surrounding area based on available regional and site-specific data. The Beaver Dam Model was calibrated under steady-state conditions and the sensitivity of the model calibration was evaluated with reference to model input parameters such as measured groundwater elevations, groundwater flow directions, and estimated baseflow.
- Application of the calibrated Beaver Dam Model to evaluate potential changes in groundwater quality and quantity with respect to groundwater flow and groundwater interactions with surface water at the Beaver Dam Mine Site under End of Mine (EOM) and Post-Closure (PC) conditions.

The detailed methodology and results of the Beaver Dam Model are documented in a report presented in Appendix F.1.

6.6.5.3 Touquoy Mine Site Groundwater Modelling Methodology

A groundwater flow and solute transport model has been developed to evaluate:

- the dewatering rate from the Touquoy open pit and changes in groundwater flow conditions and discharges as the baseline conditions.
- the groundwater seepage rates to the Touquoy open pit as it is filled with Beaver Dam tailings.
- the identification of areas where water in contact with the Beaver Dam tailings disposed in the Touquoy open pit are discharged to the receiving environment, and the potential for surface and groundwater interactions.

The groundwater flow model was based on site-specific and available regional data including surface water features, topography, water well records and geologic information. The scope of work completed by Stantec to develop the groundwater flow model and apply the model to evaluate potential impacts to groundwater and surface water flow regimes included the following:

- Compilation, review, and interpretation of the geologic, groundwater flow, and surface water flow data available for the Touquoy Mine Site and surrounding area
- Development of a CSM and steady-state 3D groundwater flow model of the Touquoy Mine Site and surrounding area. The groundwater flow model was calibrated under steady-state conditions and the sensitivity of the model calibration was evaluated with reference to model input parameters such as measured groundwater elevations, groundwater flow directions, and estimated baseflow.
- Application of the calibrated groundwater flow model to evaluate potential changes in groundwater quality and quantity with respect to groundwater flow and groundwater interactions with surface water at the Touquoy Mine Site under Baseline (conditions prior to the deposition of Beaver Dam tailings at the Touquoy Mine Site, in the exhausted pit), end of Operations (conditions at the end of deposition of Beaver Dam tailings at the Touquoy Mine Site, in the exhausted pit), and Post-Closure conditions.

The detailed methodology and results of the groundwater flow model for the Touquoy Mine Site were documented in a report presented in Appendix F.6.

6.6.5.4 Thresholds for Determination of Significance

A significant adverse effect from the Project on groundwater is defined as an effect that creates an effect on groundwater quality exceeding the applicable CCME water quality criteria and NSE EQS for groundwater (i.e., Tier 1 EQS groundwater quality criteria and/or Tier 2 PSS guidelines for groundwater discharging to surface water). Groundwater quantity impacts are evaluated through surface water and wetlands.

6.6.6 Project Activities and Groundwater Quality and Quantity Interactions and Effects

Potential interaction between Project activities and groundwater quality and quantity within the PA is outlined in Tables 6.6-4 to 6.6-6 below and in Table 6.6-3 provided above for Surface Water and Groundwater Interaction.

Table 6.6-4 Potential Groundwater Interactions with Project Activities at Beaver Dam Mine Site

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Rock blasting and crushing to support construction activities • Watercourse and wetland alteration in preparation for construction • Mine Site road construction
Operation and Maintenance	3-4 years	• Rock blasting to access and extract ore • Surface mine dewatering to facilitate access to and extraction of ore • Effluent treatment as required of site surface water runoff and surface mine pumped water
Decommissioning and Reclamation	1-2 years	• Site Reclamation • Effluent treatment as required of site surface water runoff and surface mine pumped water
Post-Closure	3 years +	• Water treatment as required • Water quality and quantity monitoring

Table 6.6-5 Potential Groundwater Interactions with Project Activities along Haul Road

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Rock blasting to support construction activities • Watercourse and wetland alteration in preparation for construction • Haul road construction and upgrades
Operation and Maintenance	3-4 years	N/A[1]
Decommissioning and Reclamation		N/A[2]

Project Phase	Duration	Relevant Project Activity
Note: (1) No impacts to groundwater are expected during operation of the Haul Road (2) Decommissioning and Reclamation of the Haul Road is not expected. The Haul Road will be returned to owner for forestry uses as owner determines.		

Table 6.6-6 Potential Groundwater Interactions with Project Activities at Touquoy Mine Site

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Tailings pipeline, make-up water pipeline alteration, and relocation of reclaim infrastructure
Decommissioning and Reclamation	1-2 years	• Tailings from processing the Beaver Dam Mine ore within the Touquoy Mine Site pit lake
Operation and Maintenance	3-4 years	• Disposal of tailings from processing the Beaver Dam Mine ore at Touquoy Mine Site into the exhausted Touquoy Pit
Post-Closure	3 years +	• Water treatment as required • Water quality and quantity monitoring

6.6.6.1 Beaver Dam Mine Site

Groundwater and surface water at the Beaver Dam Mine Site interact in many areas with the main controls including: topography, bedrock permeability, and surface water bodies. Areas of recharge are typically the elevated areas with discharge occurring in the low-lying areas. Evidence of groundwater discharge to the surface water systems are abundant and mainly appear in the form of seeps and wetlands. Abundant groundwater/surface water interactions are supported by high levels of precipitation (an average of approximately 1,357 mm/yr), undulating topography, and relatively low permeable shallow bedrock overlain by permeable soil and till units. As discussed in Section 6.6.5.1 the most appropriate spatial boundary at which to evaluate projected impacts is the LAA. Effects will range from locally significant to insignificant. No adverse groundwater impacts from the Beaver Dam Mine Site are predicted beyond the boundary of the RAA, and in general, the majority of impacts do no extend beyond the LAA.

Potential impacts of Project activities on groundwater quantity/quality at the Beaver Dam Mine Site were predicted through the application of the Beaver Dam Model. The Beaver Dam Model was applied to predict pit inflow rates, groundwater elevation drawdowns, COC transport, and changes in baseflow within the PA, LAA, and RAA, where appropriate.

Simulated inflow rates to the open pit at the Beaver Dam Mine Site range from 631 to 676 m^3/d for average dry and average wet conditions, respectively. A sensitivity analysis was conducted to examine the impact of both the Mud Lake Fault and Cameron Flowage Fault on pit inflow rates. The sensitivity analysis was conducted in accordance with British Columbia Ministry of the Environment guidelines (Wels et al., 2012) and consistent with the fault representation and analysis method presented in BGC

Engineering Inc. (2015) for groundwater modelling in support of the environmental impact statement developed for the Ajax project near Kamloops, British Columbia. The sensitivity analysis presented in Table 7.6 of Appendix F.1 (Beaver Dam Model Report) shows that simulated inflow rates increase by 22 percent to 824 m^3/d when the hydraulic conductivity of the Mud Lake Fault Zone is increased by two orders of magnitude above the calibrated hydraulic conductivity value. Pit inflow rates are insensitive to changes in the hydraulic conductivity of the Cameron Flowage Fault Zone as it does not intersect the proposed pit.

The sensitivity analysis of simulated pit inflow rates also included testing variations in bedrock hydraulic conductivity. As shown in Table 7.6 of Appendix F.1 (Beaver Dam Model Report), the simulated pit inflow rates range from 677 to 1,628 m^3/d for all pit inflow sensitivity simulations. However, the maximum inflow rate of 1,628 m^3/d corresponds to a significant deterioration in model calibration statistics, and thus, is not supported by observed groundwater elevations. As a result, the expected range in simulated pit inflow rates obtained through the sensitivity analysis is 677 to 854 m^3/d, which compares well with the range estimate pit inflow rates of 550 to 1,450 m^3/d presented in PCA (2015).

The Beaver Dam Model was applied to assess changes in groundwater flow and groundwater/surface water interactions under end of mine life conditions (open pit excavated to maximum proposed depth) and post-closure conditions (open pit infilled with water to an elevation of 127 masl). Specifically, drawdown (i.e., the degree to which groundwater levels decrease) and changes in baseflow were evaluated. Figures 6.6-9 and 6.6-10 show simulated drawdown under base case conditions for EOM and PC, respectively, Figures 6.6-9 and 6.6-10 show simulated drawdown under dry conditions for EOM and PC, respectively, and Figures 6.6-11 and 6.6-12 show simulated drawdown contours under wet conditions for EOM and PC, respectively. The greatest extent of simulated drawdown is shown on Figure 6.6-13, corresponding to simulated dry conditions at end of mine life. Figure 6.6-13 shows that a maximum drawdown of 0.5 m is simulated adjacent to Cameron Flowage within the PA. Simulated drawdown is generally less than 10 cm outside of the PA, and simulated drawdown is negligible beyond the LAA. Simulated water levels recover slightly under post-closure conditions, as demonstrated by a reduction in drawdown shown on Figures 6.6-10, 6.6-12, and 6.6-14, but remain depressed relative to baseline conditions.

The maximum radius of groundwater drawdown influence under dry (conservative) conditions has been simulated at 1 km (in a southerly direction) and less in all other directions from the pit. At the horizontal extent of this radius of influence, there is a predicted drawdown of 10cm. Beyond this radius of influence, there is little to no potential impact from the Beaver Dam Mine Site development on groundwater quantity interactions with surface water features or potable wells.

The simulated change in baseflow throughout the Cameron Flowage watershed is presented in Table 7.4 of Appendix F.1 (Beaver Dam Model Report). The simulated baseflow reduction ranges from 1,414 to 1,634 m^3/d at end of mine life and from 1,287 to 1508 m^3/d at post-closure. The range in baseflow reduction represents 5 to 7 percent of total baseflow in the Cameron Flowage watershed and is under 2 percent of the total average annual flow in Cameron Flowage. Approximately 85 percent of the total baseflow reduction is simulated to occur within the PA, and the remaining 15 percent of total baseflow reduction is simulated to occur between the PA and the LAA, indicating that Beaver Dam Mine Site operations will not impact the baseflow contribution to Cameron Flowage beyond the LAA. Further analysis of the potential effects of this baseflow reduction to Cameron Flowage are discussed in Section 6.7(Surface Water Section).

GHD also applied the Beaver Dam Model to simulate the transport of COCs from potential source zones (e.g., waste rock piles, low grade ore stock pit, and pit lake) to surface water bodies. COC concentrations discharging to surface water were estimated for both base case and upper case source term concentrations developed by Lorax (2018) for end of mine life and post-closure conditions. A conservative tracer (i.e., considering the solute transport processes of advection and dispersion only) at a unit concentration was applied to simulate COC migration from each source. The maximum tracer concentration simulated at each receptor location was scaled based on the source term concentrations developed by Lorax (2018) to estimate the COC concentrations discharging from groundwater to surface water. The COC transport simulations are described in detail in Section 7.1.5 of Appendix F.1 (Beaver Dam Model Report).

As shown on Figures 6.6-15 through 6.6-25, the maximum simulated COC concentrations discharge to east end of Crusher Lake. Table 7.5a of Appendix F.1 (Beaver Dam Model Report – End of Mine Table) presents the maximum simulated COC concentrations for groundwater discharge to surface water under end of mine life conditions for the base case and upper case source term conditions. All COC concentrations in the simulated groundwater discharge are below Tier 2 PSS guidelines under end of mine life conditions, with the exception of arsenic that exceeds its Tier 2 PSS guideline, but is within the range of background arsenic concentrations observed in groundwater. Therefore, COC concentrations are not predicted to have a significant impact to groundwater discharge under end of mine life conditions.

Table 7.5b of Appendix F.1 (Beaver Dam Model Report – Post Closure Table) presents maximum simulated COC concentrations that discharge to surface water under post-closure conditions for the base case and upper case source term concentrations. Applying the base case source concentrations, under post-closure conditions, aluminum, arsenic, and cadmium are simulated to exceed Tier 2 PSS guidelines, but remain within the range of background concentrations observed in groundwater at the Beaver Dam Mine Site. Silver and copper concentrations exceed both observed background groundwater concentrations and Tier 2 PSS guidelines. Using the base case source term concentrations under post-closure conditions, simulated COC exceedances in groundwater discharge only occur at the east end of Crusher Lake within the PA.

Applying upper case source term concentrations under post-closure conditions, aluminum, silver, arsenic, cadmium, and copper are simulated to exceed both Tier 2 PSS guidelines and observed background groundwater concentrations. Again, the simulated COC exceedances occur primarily at the east end of Crusher Lake within the PA. Two exceptions to this occur for aluminum and copper that have simulated exceedances of Tier 2 PSS guidelines in groundwater discharge towards the west end of Mud Lake, and to the tributary immediately adjacent to the west waste rock pile.

An exceedance of Tier 2 PSS in groundwater discharge to Cameron Flowage was also simulated from the low grade ore stock pile. However, since this assessment was completed, the mining plan was modified to include the removal of the low grade ore stockpile from the Beaver Dam Mine Site. All low grade ore will be transported to Touquoy for processing and therefore, this modelled prediction does not require further discussion as the low grade ore pile has been removed as a potential COC source.

As shown on Figure 6.6-15 through 6.6-25, maximum concentrations that potentially exceed Tier 2 PSS guidelines are simulated at the east end of Crusher Lake within the PA. Simulated concentrations discharging to surface water bodies are below Tier 2 PSS guidelines outside the LAA, supporting that any significant impact to groundwater quality is confined to within the LAA. Analysis of the combined impact of groundwater and surface water COC loadings to the Cameron Flowage watershed and potential mitigation measures is discussed in Section 6.7.

The key sensitive receptor in the area of the Beaver Dam Mine Site is the Beaver Lake IR 17. The Beaver Lake IR 17 is a satellite community of the Millbrook First Nation located approximately 5 km south of the Beaver Dam Mine Site and beyond the LAA boundary. No significant impacts to groundwater quality or quantity are predicted outside of LAA boundary, and thus, no impacts are predicted at the Beaver Lake IR 17.

The nearest domestic well is approximately 5 km southwest from the Beaver Dam Mine Site, at a residence along Hwy 224 that is located beyond the LAA boundary. No significant impacts to groundwater quality or quantity are predicted outside of the LAA boundary, and thus, no impacts are predicted at the domestic wells from the Beaver Dam Mine Site.

6.6.6.2 Haul Road

The nearest identified potable water supplies are located at a permanent residence near the intersection of Beaver Dam Mines Road and Hwy 224, at the Beaver Lake IR 17 approximately 3 km from the primary Haul Road, and approximately 1 km from the nearest residences located on the Mooseland Road.

Clearing, grubbing and grading of the Haul Road surface in preparation for construction has the potential to affect the groundwater flow regime. Also, there will be limited wetland alteration required to facilitate Haul Road construction. In consideration of the overall small linear extent of the disturbed area, this disturbance is a low to negligible potential for interaction and affect to the groundwater flow regime.

Localized rock blasting will occur along the Haul Road to support construction activities. Blasting has the potential to impact nearby shallow potable water wells by fracturing the aquifer and introducing changes to the groundwater flow regime. In addition, there is the potential for the release of blasting residues to groundwater via surface water pathways. Both interactions have the potential to affect to groundwater quantity and groundwater quality, but such affects would be highly localized and limited in extent.

During operations, there will be maintenance activities that would include grading and repairs to the road as well as the application of magnesium chloride. These interactions are predicted to be limited in extent.

There is the potential for a groundwater interaction from Haul Road activity in the event of an accident or malfunction (i.e. potential spill). Accidents and Malfunctions are identified and described in Section 6.18.

6.6.6.3 Touquoy Mine Site

In relation to the Touquoy Mine Site, Camp Kidston, which operates only in the summer months, is located 3.5 km northeast of the Touquoy facility. According to the Proponent, the nearest permanent full-time occupied residences are located approximately 5.8 km to the north of the Touquoy open pit along Caribou Road. The next closest permanent residences to the Touquoy Mine Site are approximately 7.4 km to the northwest and 11.7 km to the southeast.

The deposition of the Beaver Dam tailings into the open pit at the Touquoy Mine Site has the potential to interact with groundwater quality around the open pit, and the water quality in Moose River from groundwater seepage into the river.

The tailings will be deposited into the exhausted pit, which will have been dewatered as part of the Touquoy Gold Project. Therefore, the dewatering of the open pit will be the initial condition. This condition was simulated during the Touquoy groundwater modelling exercise, as described in Appendix F.6. The dewatering of the open pit, prior to tailings deposition, is predicted to occur at a rate of 475 m^3/d, and will result in drawdowns around the open pit, as shown on Figure 6.6-26 (below). The extent of the drawdown cone, as delineated by the 0.5 m drawdown contour, extends approximately 350 m south of the site and about 50 m west of the site toward Moose River. Compared to the existing conditions, the dewatering of the open pit is anticipated to reduce the flow in Moose River by 282 m^3/d. This accounts for approximately 0.2% of the mean annual flow at Moose River, as estimated 23,348 m^3/d at SW-2.

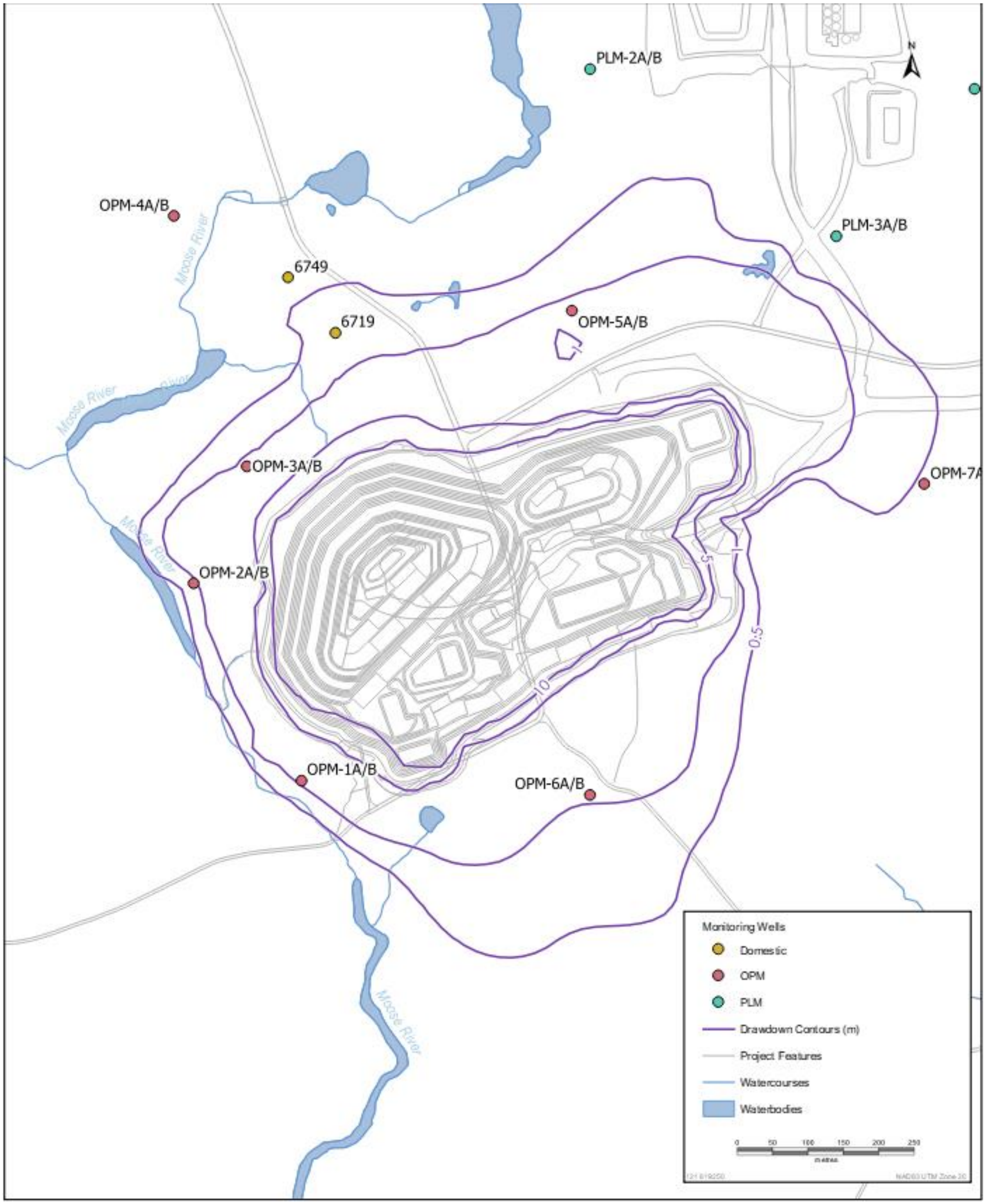


Figure 6.6-26: Predicted drawdown contours from fully dewatered open pit at Touquoy Mine Site prior to deposition of Beaver Dam tailings

The groundwater inflow rates to the open pit during the filling of the pit were predicted with the groundwater flow model. As described in the Touquoy groundwater model report (Appendix F.6), the filling of the pit was simulated by adding tailings to the model, and then predicting the inflow rates to the pit lake above the tailings over time. The predicted inflow rates compared to the pit lake stage are presented on Figure 6.6-27 (below). As shown, the inflow rates decrease from 475 m^3/d when the pit stage is at -25 masl, to 251 m^3/d at a pit stage of 108 masl, at which point the pit lake will overflow to Moose River through a spillway.

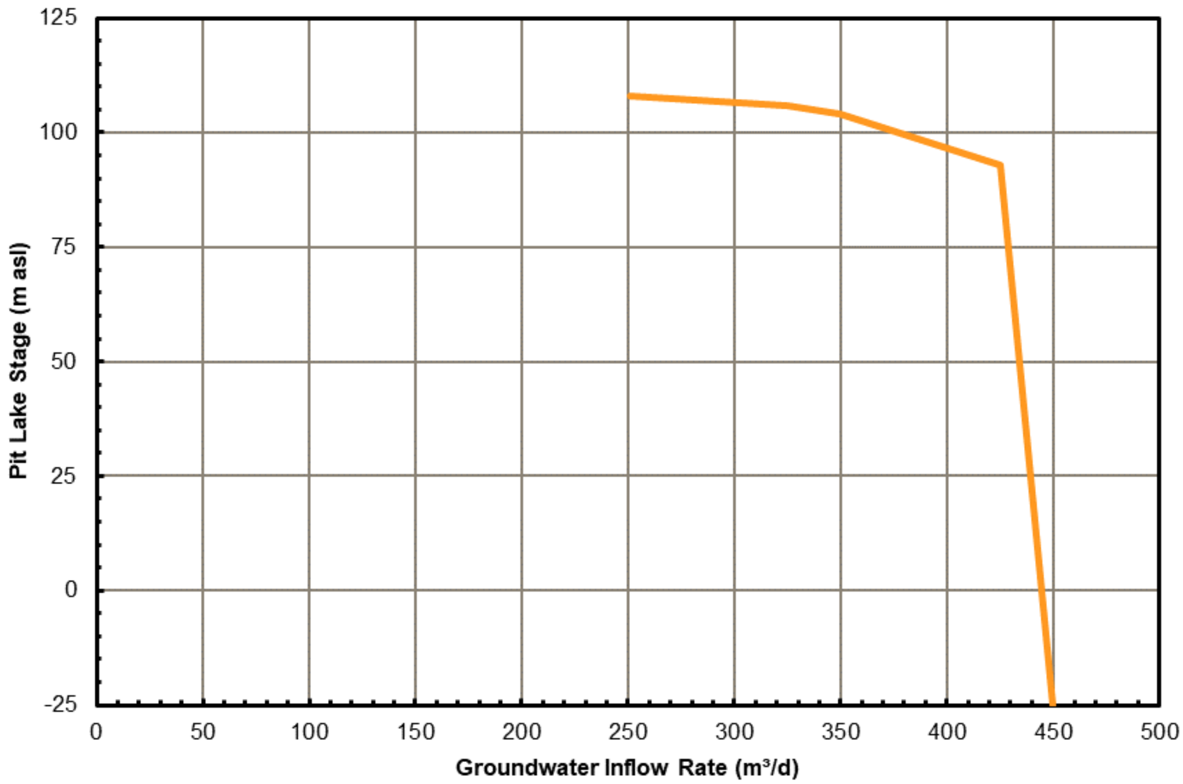


Figure 6.6-27 Groundwater inflow rates to the open pit during the filling of the open pit

The drawdown at the end of pit filling (i.e., when the pit lake stage is 108 masl) was simulated using the Touquoy groundwater model and is shown on Figure 6.6-28 (below). As presented on Figure 6.6-27 (above), the groundwater flow to the open pit remains at 251 m^3/d because the 108 masl level is below the natural groundwater elevation within the footprint of the open pit. However, at this elevation, there are both groundwater inflows to and outflows from the open pit that are not observed with the fully dewatered open pit where no outflows are observed.

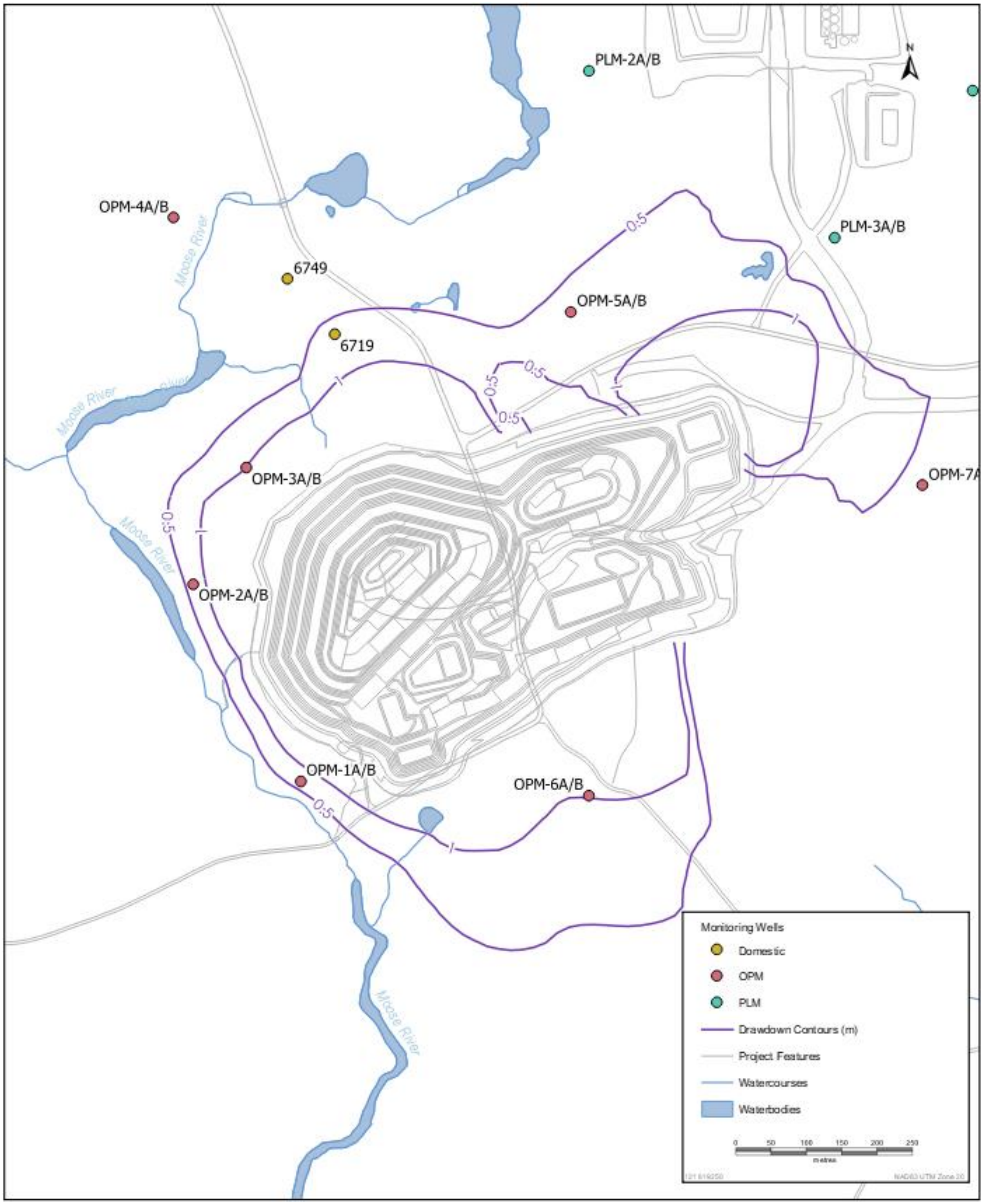


Figure 6.6-28 Predicted drawdown contours from filled open pit at Touquoy Mine Site following deposition of Beaver Dam tailings

The deposition of Beaver Dam tailings in the open pit at the Touquoy Mine Site will degrade the water quality in the pit, including the pore water quality in the tailings within the open pit. This lower quality water has the potential to migrate toward Moose River via groundwater. The Touquoy groundwater model was used to simulate the migration of solutes from the open pit to Moose River. As described in Appendix F.6, the model simulated the release of water from the pore spaces in the deposited tailings, and the pit lake quality based on a relative contribution basis. This process simulates the transport of a conservative solute with a concentration of 1 mg/L through the groundwater to the receiving environment over time. The relative concentrations are multiplied by the source term concentrations (refer to Section 6.5 and Appendix E.3 for geochemical source term derivation) for the contaminants of primary concern (COC) in the open pit to predict the concentrations and mass loadings to the receiving environment over time. The distributions of the concentrations after 60 years are shown on Figure 6.6-29 (below), and after 500 years on Figure 6.6-30 (below). The average concentrations of arsenic discharged to Moose River over the 500-year simulation period are shown on Figure 6.6-31 (below). As shown on Figure 6.6-31 (below), the average concentrations in the discharge to the river stabilize after about 150 years. Refer to the 6.7 for a further discussion and effects assessment of the modelled COC in surface water that originates from groundwater seepage.

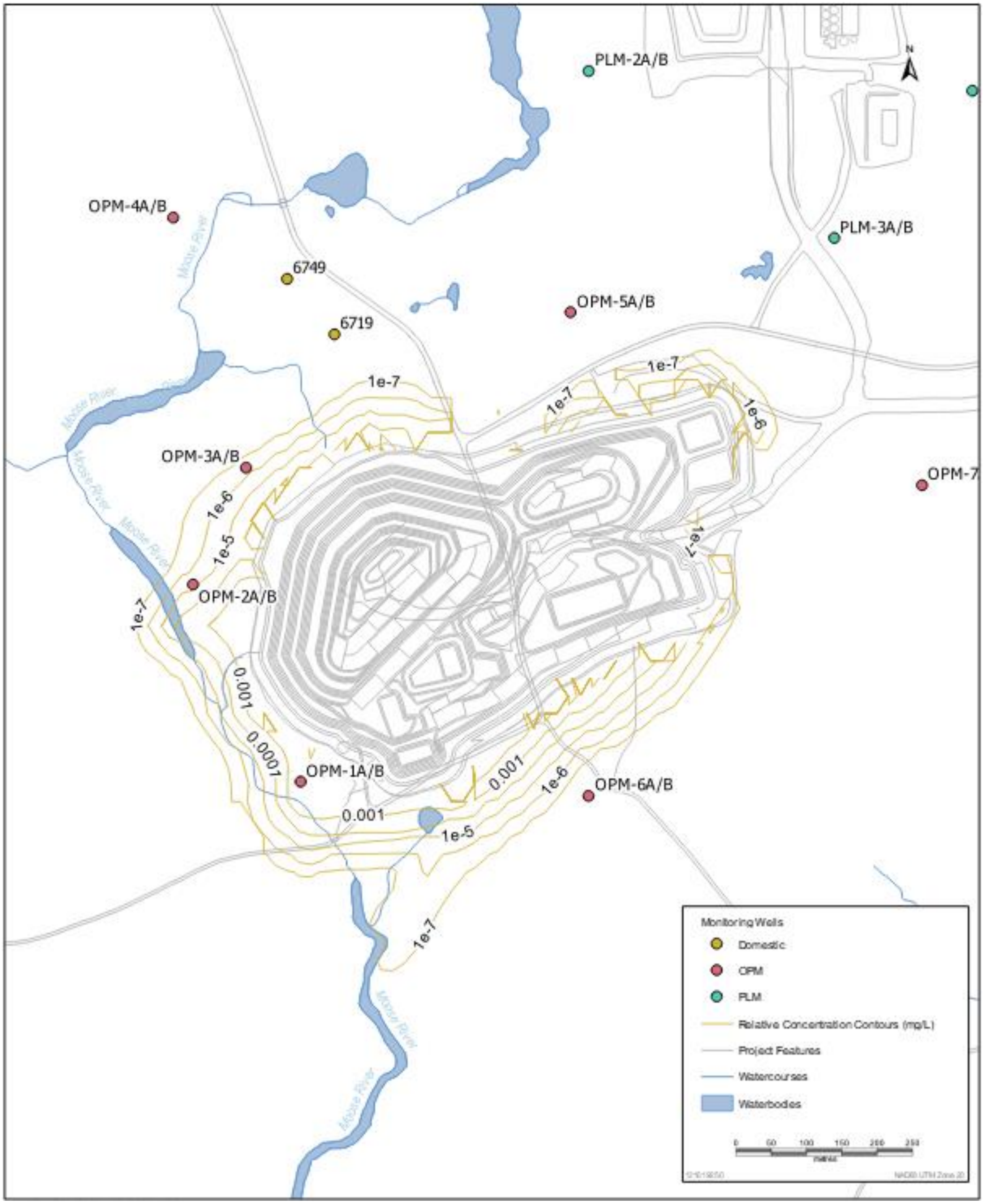


Figure 6.6-29 Relative solute concentrations in groundwater (mg/L) after 60 years of travel based on concentrations in open pit of 1 mg/L.

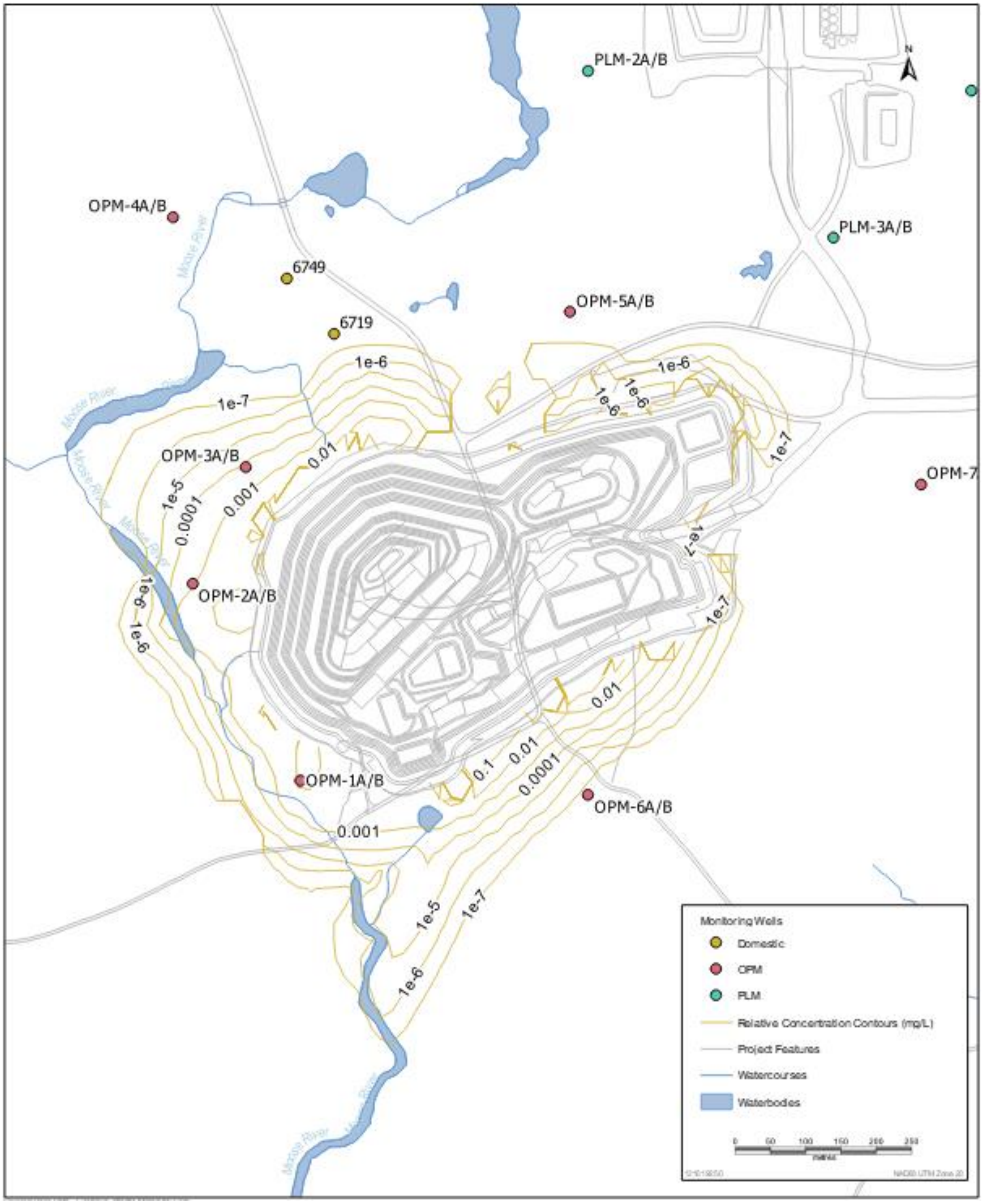


Figure 6.6.30 Relative solute concentrations in groundwater (mg/L) after 500 years of travel based on concentrations in open pit of 1 mg/L.

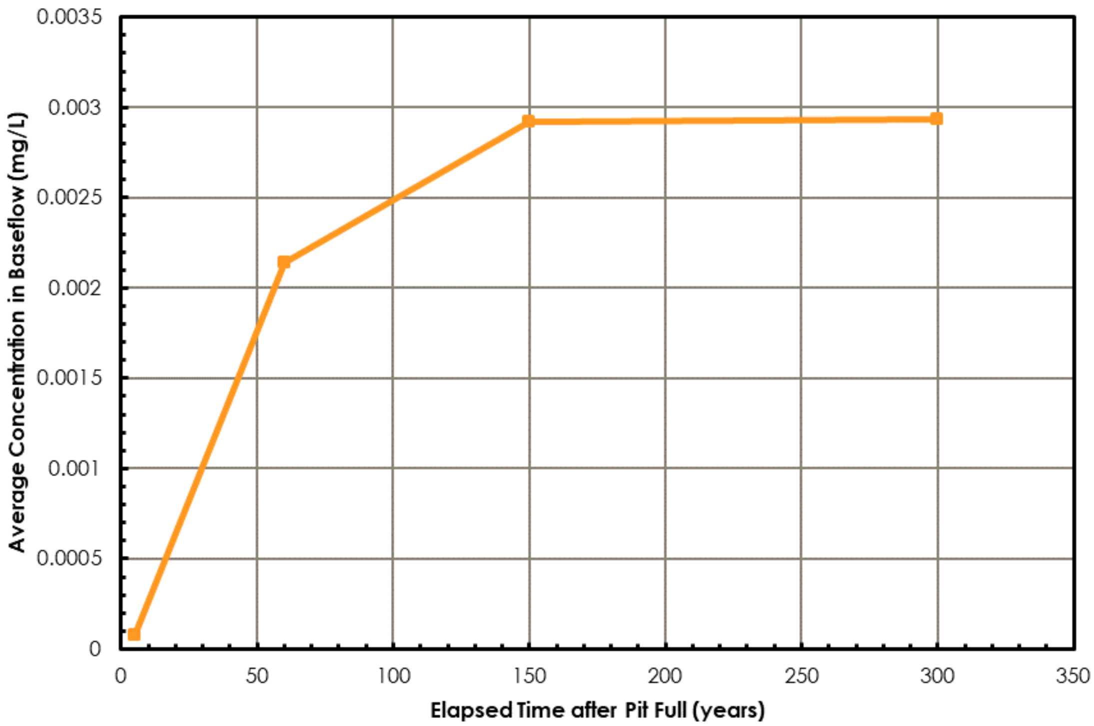


Figure 6.6-31 Simulated average concentrations of arsenic discharged to Moose River in groundwater seepage

6.6.6.4 Groundwater Project Effects Summary

The following summaries are provided for each Mine Site specific to pre-mitigation project interactions, based on results of predictive modelling completed at each Mine Site.

Beaver Dam Mine Site

- The range of potential groundwater inflow rates into the Beaver Dam open pit is approximately 631 to 854 m^3/d.
- The maximum radius of groundwater drawdown influence under dry (conservative) conditions has been simulated at 1 km (in a southerly direction) and less than 1 km in all other directions from the Beaver Dam open pit. Beyond 1 km, simulated drawdown decreases below 10cm and there is little to no potential impact from the Beaver Dam Mine Site development on groundwater quantity interactions with surface water or domestic wells.
- The range in simulated baseflow reduction to the Cameron Flowage watershed is from 5 to 7 percent of average annual baseflow and is under 2 percent of total average annual flow. Potential effects of this baseflow reduction to Cameron Flowage are discussed in Section 6.7.
- Simulated COC concentrations for groundwater discharge to surface exceed Tier 2 PSS guidelines under post-closure conditions for aluminum, silver, arsenic, cadmium and copper. Simulated groundwater COC loadings were incorporated into the predictive water quality model to assess the combined impact of groundwater and surface water COC loadings as discussed in Section 6.7.
- Potential impacts to groundwater quality and quantity are generally confined to within the PA and LAA. No impacts to groundwater quality and quantity are predicted approaching the RAA or at key receptors including Beaver Lake IR 17 or the nearest domestic well located along Hwy 224.

Touquoy Mine Site

- Water levels in the vicinity of the Touquoy Mine Site open pit will be depressed at the beginning of Beaver Dam operations. The Touquoy open pit will be dewatered at a rate of approximately 475 m^3/d.
- Water levels in the vicinity of the Touquoy will recover slightly at the end of Beaver Dam operations but will continue to be depressed relative to existing conditions as the final water level in the Touquoy open pit will be at 108 masl. At this stage, there will be both groundwater inflows to and outflows from the filled open pit, with a net groundwater discharge of 251 m^3/d.
- Groundwater in the filled Touquoy open pit will seep to Moose River during Post Closure. The mass loading of the primary compounds of concern are predicted to be low and are not anticipated to adversely affect the water quality in Moose River.

6.6.7 Preferred Alternative Haul Road

6.6.7.1 Rationale for Valued Component Selection

The same rationale was used for the valued component selection as indicated in 6.7.1.

6.6.7.2 Baseline Program Methodology

The same methodology was used for the baseline program for the preferred alternative Haul Road option as indicated in 6.7.2. No additional baseline studies were required for this Haul Road option.

6.6.7.3 Baseline Conditions

Groundwater quality and quantity was examined at the Beaver Dam Mine Site and the Touquoy Mine Site. The site is located in a rural, sparsely populated area of Halifax County. Further information on groundwater quality and quantity for the Beaver Dam Mine Site can be found in Section 6.6.3.2, and for the Touquoy Mine Site in 6.6.3.3.

The geological and hydrogeological characteristics of the Beaver Dam Mine Site and Touquoy Mine Site have been extensively examined. Publicly available studies including Lin, 1970, have been reviewed.

The Preferred Alternative Haul Road option is 1.5 km from the nearest receptor on the primary Haul Road and is located between the Touquoy Mine Site and Beaver Dam Mine Site. Given the proximity of the preferred Haul Road to the primary Haul Road, and between the Touquoy and Beaver Dam sites, there are similarities in the hydrogeological features of groundwater quality and quantity, as a result no additional baseline studies for groundwater were warranted.

6.6.7.4 Consideration of Consultation and Engagement Results

The Preferred Alternative Haul Road is the result of consultation and engagement with stakeholders and property owners that have interests in the primary haul route. The alternative Haul Road is situated further from human receptors located on the "Moose River Cross Road" so-called and from residents located on the Mooseland Road. Consultation and engagement results are presented in Section 6.6.4.

6.6.7.5 Effects Assessment Methodology

The effects assessment methodology of the Preferred Alternative Haul Road is as presented in Section 6.6.5. The spatial boundary of the PA for the Preferred Alternative Haul Road is confined only to this segment and assessed independently of the primary route. The LAA and RAA remain the same as indicated in Section 6.6.5.1.

As the Project has the potential to cause direct and indirect effects to groundwater outside of the Preferred Alternative Haul Road PA, the LAA is the appropriate boundary for evaluation of this VC.

The same Temporal, Technical, and Administrative Boundaries are considered for the Preferred Alternative Haul Road as indicated in Section 6.6.5.

6.6.7.5.1 Threshold for Determination of Significance

The same thresholds for determination of significance as used for the primary Haul Road are utilized for the Preferred Alternative Haul Road.

6.6.7.6 Project Activities and Groundwater Interactions and Effects

Development of the Preferred Alternative Haul Road can affect groundwater directly during the construction and operation phase of the Project, through activities such as clearing, grubbing, and construction. The groundwater interactions and effects associated with the construction of the Preferred Alternative Haul Road are similar to the primary Haul Road and are likely to occur during construction from clearing, grubbing and grading, limited rock blasting, watercourse and wetland alteration. The Preferred Alternative Haul Road is located farther away from the nearest residential receptor and associated potable well (1.5 km away along the primary Haul Road). As a result, the magnitude of any potential impacts on this potable well from construction/blasting would be lower.

During the Operational Phase, interactions would be limited to Haul Road maintenance and repairs. The potential for accident and malfunctions such as fuel and other spills, forest fires, and haul truck accidents remains similar for both Construction and Operational Phases.

Potential interactions between Project activities and groundwater quality and quantity are outlined in Tables 6.6-4 to 6.6-6, in Section 6.6.6.

6.6.8 Mitigation

Groundwater modelling was completed for the Beaver Dam Mine Site and included an assessment of the geographic extent for changes to the quantity and quality of groundwater for the site, Haul Road, and Preferred Alternative Haul Road. No current water supplies will be affected by the project as designed and proposed in this EIS document. Therefore, a mitigation plan is not necessary, however the Proponent has stated in public and Mi'kmaq engagement sessions that prudent project planning means that monitoring of the water supplies at Beaver Lake IR and any identified water supplies along the selected final Haul Road would be completed.

Nova Scotia Environment has guidance documents on after supply monitoring and mitigation so plans that would be used to develop plans prior to the project construction and submitted as part of the Industrial Approval application. Based on the fact that the project construction is not set to begin until 2021, it is prudent to do survey work to identify water supplies closer to the construction period to ensure the right supplies are included in the mitigation and monitoring plans. The Proponent would review the most current NSE guidance documents and prepare a document according to the requirements of the time of the application and submit for approval.

Mitigation measures are identified in the table below. The Touquoy facility is currently operational.

Table 6.6-7 Mitigation for Groundwater Quality and Quantity

VC	Mitigation Category	Project Phase	Mitigation Measure
Groundwater	**Quality**	PC	Conduct pre-construction well survey at Beaver Lake IR
		CON, OP	Use above ground fuel storage tanks that meet applicable regulatory standards
		CON, OP	Select appropriate type of explosive that will minimize nitrogen release to surface water and groundwater
		OP, DEC, REC	Sub-aqueous deposition of mine tailings to reduce/prevent oxides and leaching
		DEC, REC	In the event of acid rock drainage and metal leaching, implement mitigative measures that will manage the source material and drainage effectively utilizing methods such as segregation and encapsulation
		PC	Based on evaluation of predicted aquatic risk, pump and treatment of groundwater (if required based on monitoring results) from installed groundwater wells at Beaver Dam Mine Site including those at Crusher Lake, Mud Lake, outlet from Mud Lake to the Killag, and Cameron Flowage, and existing groundwater wells at Touquoy between the open pit and the Moose River. The purpose of this groundwater treatment is to intersect groundwater seepage impacted with COCs above Tier II pathway specific guidelines or groundwater baseline/background prior to seepage discharging into surface water bodies.
	Quantity	CON, OP	Use blasting and pit construction techniques that minimize the potential for negatively interacting the adjacent groundwater table and nearby surface water
		CON, OP	Implement water conservation program for onsite facilities
		CON, OP	Recycle site water for reuse wherever practical to reduce water withdrawal from lakes or streams
		CON, OP	Recycled water must meet acceptable water quality criteria for its intended use

6.6.9 Residual Effects and Significance

The predicted residual environmental effects of Project development and production on groundwater are assessed to be adverse, but not significant, beyond the LAA. There is the potential for residual groundwater quality effects within the PA and LAA.

The overall residual effect of the Project on groundwater is assessed as not significant after mitigation measures have been implemented. Effects to groundwater supplies used for domestic purposes are not anticipated due to distance from site activities. The reclamation plan for both sites includes a refilling of each pit to attain steady state groundwater flow conditions so that post-mining groundwater conditions are stable (i.e., inflow is equal to outflow)

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Table 6.6-8 Residual Environmental Effects for Groundwater

Project - VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Beaver Dam Mine Site and Haul Road (Surface Water Alteration resulting in reduction of recharge to groundwater, blasting effects on GW, elevated nitrogen in GW from blasting residue)	Sediment and erosion control, pre-blast surveys within 800m of potable wells, watercourse alteration permitting, inclusion of use of pit dewatering water and collected surface water instead of groundwater for dust control in the project design	A	M Mitigation strategies and best management practices reduce the magnitude of impact	PA VC confined to the Mine Site	N/A VC interaction is not affected by timing considerations	LT VC interaction effects extend beyond three years	R VC interaction will occur regularly during construction phase	PR Mitigation can not guarantee a return to baseline conditions	Reduction in Water Quantity	Not Significant
Post-Closure – Beaver Dam Mine Site (Groundwater seepage from stockpiles discharge to surface water (Mud Lake, outlet watercourse from Mud Lake, Crusher Lake))	Installation of groundwater wells at the shores of these locations; periodic sampling to evaluate this prediction; modelling updates to include updated source term data/water quality inputs; groundwater will be intercepted upstream of wells and treatment will be considered to meet regulatory requirements prior to discharge into receiving environment.	A	L Mitigation strategies and best management practices reduce the magnitude of impact	PA VC confined to the Mine Site	N/A VC interaction is not affected by timing considerations	LT Effects will extend beyond three years	R Effects will occur at regular intervals during post closure phase of project	PR Mitigation can not guarantee a return to baseline conditions	Reduction in Water Quality	Not Significant

Legend (refer to Table 5.10-1 for definitions)

Nature of Effect	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
A Adverse	N Negligible	PA Project Area	N/A Not Applicable	ST Short-Term	O Once	R Reversible
P Positive	L Low	LAA Local Assessment Area	A Applicable	MT Medium-Term	S Sporadic	IR Irreversible
	M Moderate	RAA Regional Assessment Area		LT Long-Term	R Regular	PR Partially Reversible
	H High			P Permanent	C Continuous	

A significant adverse environmental effect for Groundwater has not been predicted for the Project for the following reasons, with consideration of the ecological and social context of the LAA surrounding the Project:

- During Construction: Effects are limited to the mine site and there is limited interaction with receptors.
- During Operations: Effects are limited to the mine site and there is limited interaction with receptors.
- During Closure: Effects are limited to the mine site, there is limited interaction with receptors and conditions return to baseline.

6.6.9.1 Preferred Alternative Haul Road Residual Effects and Significance

Table 6.6-9 Residual Environmental Effects of Groundwater within the Preferred Alternative Haul Road

Project - VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Preferred Alternative Haul Road (Surface Water Alteration resulting in reduction of recharge to groundwater, blasting effects on GW, elevated nitrogen in GW from blasting residue)	Sediment and erosion control, pre-blast surveys if within 800m of potable wells, watercourse alteration permitting, inclusion of use of pit dewatering water and collected surface water instead of groundwater for dust control in the project design	A	M Mitigation strategies and best management practices reduce the magnitude of impact	PA VC confined to the Mine Site	N/A VC interaction is not affected by timing considerations	LT VC interaction effects extend beyond three years	R VC interaction will occur regularly during construction phase	PR Mitigation can not guarantee a return to baseline conditions	Reduction in Water Quantity	Not Significant

Legend (refer to Table 5.10-1 for definitions)

Nature of Effect	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
A Adverse	N Negligible	PA Project Area	N/A Not Applicable	ST Short-Term	O Once	R Reversible
P Positive	L Low	LAA Local Assessment Area	A Applicable	MT Medium-Term	S Sporadic	IR Irreversible
	M Moderate	RAA Regional Assessment Area		LT Long-Term	R Regular	PR Partially Reversible
	H High			P Permanent	C Continuous	

Table 6.6-8 was reviewed and it was determined that the construction of the Haul Road was the only VC interaction applicable to groundwater quality and quantity associated with the Preferred Alternative Haul Road. There were no changes in the significance criteria or overall significance for this VC interaction.

Mitigations presented in Table 6.6-7 will be established to reduce the impact on groundwater from Project activities.

6.6.10 Proposed Compliance and Effects Monitoring Program

Groundwater monitoring will be completed to verify the accuracy of the predicted environmental effects and the effectiveness of the mitigation measure groundwater quality. Mitigations are outlined in Table 6.6-7. Groundwater monitoring programs will continue during baseline/pre-construction, to establish groundwater baseline conditions, construction and through the operational phase to validate the predictions presented in this chapter for groundwater. A groundwater monitoring program will be developed in association with requirements of wetland and watercourse alteration permits issued for direct wetland and watercourse alterations associated with the Project.

The Preliminary Environmental Effects Monitoring Plan (EEM), located in Appendix O.1, outlines the proposed preliminary methods, timing, frequency, and locations for groundwater monitoring. This document will evolve through regulatory permitting, as well as public and Mi'kmaq engagement.

6.7 Surface Water Quality and Quantity

6.7.1 Rationale for Valued Component Selection

Surface water (quality and quantity) was selected as a Valued Component for its significance to hydrological, ecological, and socio-economic systems. Hydrologically and hydrogeologically, surface water consists of stormwater runoff that feeds into various water systems (i.e., rivers, lakes, oceans) including groundwater through recharge. Aquatic species find habitats in water and terrestrial species rely on accessible water sources for their survival. Socially and economically, surface water resources are essential to municipal, agricultural, industrial and recreational sectors, among others.

Surface water quality and quantity are provincially regulated through many legislative avenues within the *Environment Act*. The regulations help protect ecological components, as well as the health of the general public. In summary, surface water was selected as a Valued Component for the following reasons:

- Its ecological value in providing habitat for aquatic species;
- The importance of surface water in the daily lives of terrestrial species;
- Its potential to convey storm water;
- The socio-economic importance of surface water from a recreational and resource perspective; and
- Its potential to interact with Project activities

6.7.2 Baseline Program Methodology

6.7.2.1 Project Watersheds

6.7.2.1.1 Beaver Dam Mine Site and Haul Road

An inventory of surface water features was taken of the Beaver Dam Mine Project components to identify those water features that may be impacted directly or indirectly by the proposed mine and Haul Road construction and operations.

The Beaver Dam Mine Site lies within the West River Sheet Harbour drainage basin, which is directly east of the important Musquodoboit River Valley system. The watershed occupies an area of roughly 576 km^2, a moderately sized watershed in the Province. The area is characterized by rolling till plains, drumlin fields, extensive rockland, and numerous freshwater lakes, streams, bogs and wetlands having relatively low relief, hummocky type terrain. Forests are predominantly coniferous of red and black spruce. According to DNR, the site is in the Eastern Ecoregion of the Acadian Ecozone, the only ecozone in Nova Scotia. The Eastern Ecoregion is underlain by quartzite and slate of the Meguma Super Group with granitic intrusives. A variety of landforms are found in this ecoregion, including rolling till plains, drumlin fields, extensive rockland, and wetlands. The bedrock is highly visible in those areas where the glacial till is very thin, exposing the ridge topography.

This inland area is somewhat removed from the immediate climatic influence of the Atlantic Ocean and is characterized by warmer summers and cooler winters.

The West River Sheet Harbour drainage basin discharges to the West River and its tributaries, from north to south. Elevations within the catchment vary from approximately 135 to 165 masl in the headwater areas and gradually decrease to sea level at the final outlet located at Sheet Harbour. The headwaters of the drainage basin are located along the topographic divide separating the Musquodoboit River Valley to the northwest. The Killag River and Cameron Flowage are the main mapped linear watercourses of the Beaver Dam Mine Site, and Crusher Lake and Mud Lake are the major mapped lakes. The complex system of streams, lakes, bogs and wetlands is a direct result of the underlying bedrock geology of greywacke and slate found in the region. These relatively impermeable and poorly jointed rocks result in slow groundwater recharge and most of the excess surface water is retained on the surface, often called a ‘deranged’ drainage pattern. The basin ultimately drains to the south via the West River Sheet Harbour, and discharge peaks are likely attenuated to a large extent by the numerous lakes and wetlands through which runoff is routed. Catchment areas are shown on Figure 6.7-1 and 6.7-2.

The West River Sheet Harbour and Tangier River Secondary boundary runs through the center of the PA along the Haul Road. Tertiary basins affected by the Project include three within the Beaver Dam Mine Site (Cameron Flowage, Tent Lake and Kent Lake) and six along the Haul Road footprint (Brandon Lake, Rocky Brook Lake, Rocky Lake, Lake Alma, Middle Beaver Lake, and Eagle’s Nest Basin Tertiary watersheds).

Available databases were evaluated to identify mapped waterbodies and watercourses within the Beaver Dam Mine Site and the Haul Road. A field evaluation followed in the spring and summer of 2015 to confirm the presence of the identified water features within and surrounding the. No mapped waterbodies were identified within the Haul Road. Given the linear nature of the Haul Road, mapped watercourses were grouped into watercourse systems 1-7 based on their tertiary watershed affiliations to aid in field identification. Field evaluation followed in fall 2015 and spring 2016 to confirm the presence of mapped watercourses along the Haul Road and the identification of additional watercourses within the Haul Road corridor.

Watercourses were documented using an SXBlue II Global Positioning System (GPS) receiver unit capable of sub-meter accuracy with a handheld SXPad field computer. Blue flagging tape was used to mark the locations of all watercourses. Watercourses were mapped to the edge of the PA within the Beaver Dam Mine Site and Haul Road and provided a specific watercourse identification number. Each watercourse, when identified in the footprint, was described for physical parameters including: bank full width, wetted width, water depth, structure (pool, riffle, run, flat, others), fish habitat potential, overhanging and in-stream vegetation, substrate, potential to support species at risk (SAR) and species of conservation interest (SOCI) and bank stability. Waterbodies observed at the Beaver Dam Mine Site were described for physical characteristics including width and overall size, depth, littoral zone description, potential to support species at risk (SAR) and species of conservation interest (SOCI), shoreline characterization, and substrate.

6.7.2.1.2 **Touquoy Mine Site**

The Touquoy Mine Site is part of the Moose River drainage basin, which is directly east of the Musquodoboit River Valley system. As described in the Environmental Assessment Registration Document (CRA 2007), the Moose River watershed can be characterized by rolling till plains, drumlin fields, extensive rock land, and numerous freshwater lakes, streams, bogs and wetlands in the headwaters and the relatively low relief hummocky terrain. The basin ultimately drains to the south via Moose River, and runoff through the catchment to Moose River is likely attenuated by the many lakes and wetlands in the catchment thus reducing the peak flow. This inland area is removed from the immediate climatic influence of the Atlantic Ocean and is characterized by warmer summers and cooler winters.

The regional bedrock-controlled topography is undulating to rolling, with local land forms dominated by northeast to southwest trending glacial drumlin hills with intervening wetlands or watercourses. Forests are predominantly coniferous of red and black spruce (CRA 2007). Local ground surface elevations at the Touquoy Mine Site range from 102 to 145 metres (m) above mean sea level.

The Touquoy Mine Site is approximately 10 km northwest of the Tangier Grand Lake Wilderness Area. This protected area consists of 16,000 ha of predominantly coniferous forest and has abundant lakes, wetlands, and waterways. The waterbodies within the Wilderness Area are contained within a separate watershed from that of the Touquoy Mine Site, which lies in the Fish River Watershed.

The Touquoy Mine Site is an active Mine Site that commenced operation on October 11, 2017, subject to an Industrial Approval to operate issued by NSE. A Class I Environmental Assessment under the *Nova Scotia Environment Act* and Environmental Assessment Regulations for the Project was reviewed and approved in 2008, subject to Approval conditions. Existing conditions with respect to surface water for the watershed was based on the available data collected as part of the 2007 submission (CRA), 2013 Lidar (Leading Edge), and Water Management Plan (Stantec 2017a) for operation, the Reclamation Plan (Stantec 2017b) for reclamation and closure, and the 2017 surface water quality/quantity monitoring reports (Stantec 2018b).

6.7.2.2 Surface Water Quality

6.7.2.2.1 Beaver Dam Mine Site and Haul Road

Baseline surface water monitoring was conducted at nine locations around the Beaver Dam Mine Site and 29 locations along the Haul Road to obtain water quality data. The rationale for each sample location is provided in Table 6.7-1 and Table 6.7-2.

Table 6.7-1 Baseline Surface Water Locations for Beaver Dam Mine Site

Sample ID	Sample Location	Sample Location Rationale
SW-1	Killag River	To characterize surface water quality downstream and east of Project activities
SW-2A	Upstream of Cameron Flowage	To characterize surface water quality upstream and north of Project activities
SW-4A	Wetland downstream of Mud Lake	To characterize surface water quality downstream and north of Project activities
SW-5	Existing settling pond outlet	To characterize surface water quality exiting the existing settling pond into Cameron Flowage and near Project activities
SW-6A	Unnamed stream between Crusher Lake and Mud Lake (WC-5)	To characterize surface water quality downstream and west of Project activities
SW-9	West River Sheet Harbour	To characterize surface water quality in a different watershed for reference
SW-10	Upstream of existing settling pond	To characterize surface water quality entering the existing settling pond
SW-11	Tent Lake	To characterize surface water quality downstream and south of Project activities
SW-12	Unnamed lake/wetland – headwaters of Paul Brook	To characterize surface water quality downstream and southwest of Project activities

Table 6.7-2 Baseline Surface Water Locations for Haul Road

Sample ID	Sample Location	Sample Location Rationale
WC-2 WC-3 WC-7 to WC-17	Watercourses along Beaver Dam Mines Road portion of the Haul Road	To characterize surface water quality in watercourses upstream of the Beaver Dam Mines Road portion of the Haul Road
SW-41 SW-42	Watercourses along new construction through greenfield environment	To characterize surface water quality in watercourses upstream of the new construction portion of the Haul Road
WC-23 to WC-31	Watercourses along Moose River Cross Road portion of Haul Road	To characterize surface water quality in watercourses upstream of Moose River Cross Road portion of the Haul Road
SW-43 to SW-47	Watercourses along the Mooseland Road portion of the Haul Road	To characterize surface water quality in watercourses upstream of the Mooseland Road portion of the Haul Road

Surface water monitoring data was collected around the Beaver Dam Mine Site to be representative of the site conditions and considers stream water rather than lake water. Kent Lake is outside of the study boundary. Kent Lake is upstream of the water flow direction in an adjacent watershed. Kent and Tent may be hydraulically connected upstream by the wetlands in the headwaters. Both lakes drain to the West River Sheet Harbour. The watercourse (WC-5) leading from Crusher Lake to Mud Lake was sampled during baseline studies. The outflow from Mud Lake was sampled for baseline conditions. Mud Lake consists of two water bodies that are connected by the watercourse from Crusher Lake and are surrounded by a large wetland complex. Sampling from Mud Lake was conducted on the outflow from the NW section of Mud Lake. An unnamed lake is located SW of the logging road and is an open water bog.

The 2017 surface water samples collected from Mud Lake and the stream from Crusher Lake provide ample baseline SW data for these sites. Kent Lake would provide no additional data. A monitoring location here prior to construction and during operation may be warranted. Tent Lake and the SW unnamed lake were sampled (SW-11 and SW-12) in October 2017 to provide additional surface water baseline conditions surrounding the Beaver Dam Mine Site to the southeast and southwest respectively. Surface water sample results for are found in Appendix G.1 – Surface Water Data Tables.

The purpose of this program was to establish a baseline for comparison of surface water quality before site activities commence. Each sample was collected as a grab sample and analyzed for general chemistry and metals (RCAp-MS (dissolved)), mercury (Hg), and/or total suspended solids (TSS). TSS analysis was limited to the Haul Road due to the potential for haul truck traffic to suspend particulate matter for deposition into watercourses adjacent to the Haul Road. The potential for this interaction at the Beaver Dam Mine Site is low, due to the planned sediment and erosion control measures and nature of the pit design. Field measurements were recorded for dissolved oxygen (DO), temperature, total dissolved solids (TDS), conductivity, pH, and/or flow rate. Flow rate and water levels at sample locations along the Haul Road did not allow for consistent field parameter data collection.

Sampling at the Beaver Dam Mine Site began in October 2014 and was conducted monthly until August 2015. Nine sampling events were completed for four of the sampling locations and eight sampling events were completed for two of the sampling locations. A seventh sampling location was added in June 2015 and was included in three sampling events. Two additional sampling locations were added in October 2017, with one sampling event completed at these locations. Sampling activities were not conducted at any of the sampling locations during the months of February and March 2015 due to winter conditions (i.e., freezing/dry conditions). One sampling event was completed in June 2015 for the 29 sampling locations along the Haul road. Analytical results were compared to the CCME FWAL guidelines, updated to 2014; the MDMER guidelines (formerly MMER) updated to 2018; and the NSEQSs for Surface Water, updated to 2013. The guidelines represent the maximum authorized concentrations in a grab sample. The surface water sampling locations are provided on Figures 6.7-3 and 6.7-3A to 6.7-3L.

6.7.2.2.2 **Touquoy Mine Site**

As required under the Industrial Approval for operation of the Touquoy Mine Site, surface water quality monitoring is conducted at thirteen surface water monitoring locations applicable to the Beaver Dam ore processing and tailings deposition (exhausted pit), as shown in Figure 6.7.-4 (below). There are additional monitoring stations in the seepage collection ditch around the TMF that are not presented in the Beaver Dam Project EIS. As summarized in Table 6.7-3, surface water monitoring locations SW-1, SW-11, SW-12, and SW-23 are identified as “background” as they are located upstream from the Touquoy Mine Site and are not expected to be affected by the Project. Surface water quality monitoring stations SW-2, SW-3, SW-13, SW-15, SW-19, and SW-21 are grouped as “downstream” sites since they are located adjacent and/or downstream to the Touquoy Mine Site. Surface water is monitored on a monthly basis to characterize the water quality. Surface water monitoring station SW-14 is the existing final liquid effluent discharge point under the MDMER, located at the outfall from Polishing Pond. Under the proposed reclamation plan (Stantec 2017b) for the Touquoy site, a second MDMER discharge point is planned for drainage from the existing open pit once filled with water through a constructed ditch or channel to Moose River.

Surface water quality results both in 2016 and 2017 were compared to Nova Scotia Environment Contaminated Sites Regulation 2013 Tier 1 Environmental Quality Standards (EQS) as per a requirement of the Industrial Approval to operate (NSE 2017), in addition to the Canadian Council of Ministers of the Environment (CCME) Freshwater Aquatic Life (FAL) Guidelines, and MDMER.

For operation of the Touquoy Mine Site, a baseline environmental effects monitoring program was conducted in 2017/2018 to establish existing conditions in what was designed to be the future aquatic receiving environment for effluent in Scraggy Lake. The program was designed to meet the MDMER. Near surface and near bottom surface water quality samples were collected at each location on Scraggy Lake (SGL-001, -002, -003, -004 and -008) for laboratory analysis which included general chemistry, dissolved metals, total metals, strong acid dissociated cyanide and chlorophyll a. Results are provided in the Baseline Environmental Effects Monitoring Program (Stantec 2018c).

Table 6.7-3 Surface Water Monitoring Locations at Touquoy Mine Site

Site	Location	Rationale	Location Description
SW1	504325E, 4981604N	Background	Moose River – adjacent to site and upstream of Moose River road culvert and open pit

Site	Location	Rationale	Location Description
SW2	504378E, 4980703N	Downstream – Near-field	Moose River – downstream of Facility and upstream of Bridge, just below the open pit
SW3	505587E, 4980396N	Downstream – Near-field	Watercourse No.4 (unnamed tributary to Moose River) downstream of Site, east of the Tailings pond
SW11	504140E, 4982529N	Background	Moose River – upstream of the Site to represent relatively un-impacted conditions upstream of the facility
SW12	506060E, 4982420N	Background	Outlet from Square Lake
SW13	507950E, 4976355N	Downstream – Far-field	Outlet from Scraggy Lake at Dam
SW14	506380E, 4980022N	Final Discharge Point	Final liquid effluent discharge point (*MDMER*) located at outfall from Polishing Pond
SW15	506397E, 49798321N	Downstream – Near-field	Outlet of unnamed Tributary to Scraggy Lake, at confluence with Scraggy Lake
SW18	501475E, 4974281N	Downstream – Far-field	Fish River north of pughole and upstream of bridge
SW19	505333E, 4981589N	Downstream – Near-field	Watercourse No.4 (unnamed tributary to Moose River) – upstream of the tailings pond, adjacent to the waste rock storage area
SW20	506931E, 4980433N	Downstream – Near-field	East of the tailing's impoundment on an unnamed tributary to Scraggy Lake
SW21	506349E, 4979823N	Downstream – Near-field	In Scraggy Lake, at outlet of polishing pond emergency spillway
SW23	505369E, 4982094N	Background	Watercourse No.4 (unnamed tributary to Moose River) upstream of Site to represent relatively un-impacted upstream conditions

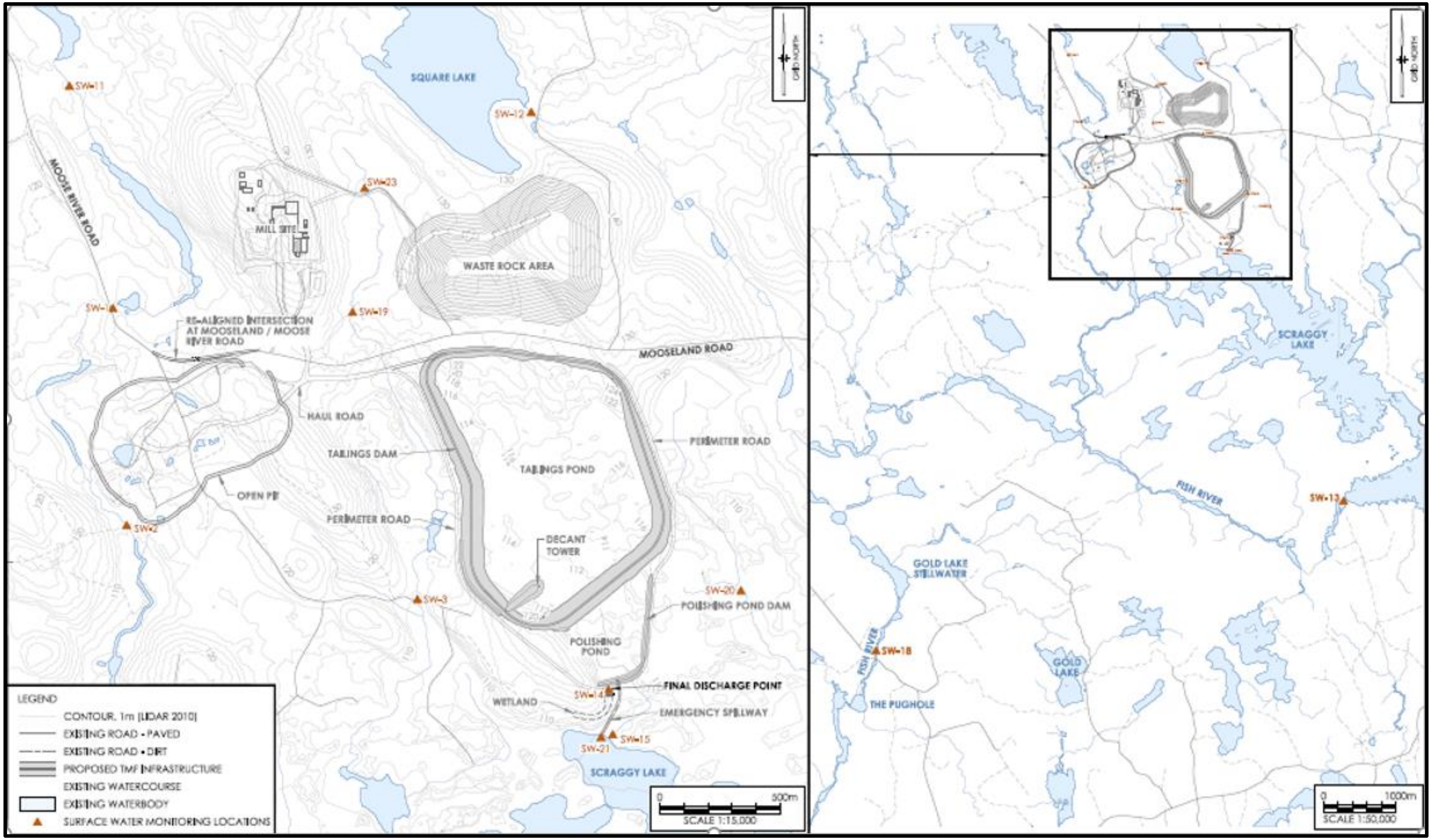

Figure 6.7-4 Touquoy Surface Water Compliance Monitoring Locations

6.7.2.3 Surface Water Quantity

6.7.2.3.1 Beaver Dam Mine Site

A water balance for the Beaver Dam Mine Site was calculated to determine the amount of surface water runoff generated by the site catchment areas under baseline conditions. The results will be compared to the runoff volumes generated under operational and post-closure conditions, after the site catchment areas have been altered in size and cover material as a result of the Project. The water balance will be used to assist in the evaluation of options to manage the change in runoff volume discharged to the receiving environment.

Climate data for historical precipitation and temperature were obtained from Environment Canada Middle Musquodoboit climate station (8203535) that is located approximately 25 km from the PA. Potential evapotranspiration was calculated using the Hamon equation (1961) that requires average temperature and hours of daylight as input. Average hours of daylight were calculated using the Sunrise and Sunset Calculator (https://www.timeanddate.com/sun/, last accessed 6 November 2018).

Under baseline conditions, the Australian water balance model (AWBM) was used to calculate runoff volumes based on the surplus of rainfall/snowmelt depths from the soil storage multiplied by the contributing drainage area.

Catchment area sizes representing primary, secondary and tertiary basins were estimated utilizing GIS.

6.7.2.3.2 Touquoy Mine Site

In operation of the existing Touquoy Mine Site, the exhausted Touquoy open pit model was developed to simulate the quantity of runoff at the existing mine facilities under existing conditions and various climate scenarios. Results of the monthly water balance model will assist in the evaluation of operational water management of Beaver Dam ore processing at Touquoy, presented in the water and tailings management (exhausted pit) plan (Stantec 2018d) included in Appendix G.2 Touquoy Integrated Water and Tailings Management Plan. Model inputs accounted for groundwater inflows, surface runoff, direct precipitation, and open pit dewatering for Touquoy ore processing. Touquoy climate data is represented consistently with the Beaver Dam water balance model. Groundwater inflows were based on results of a groundwater flow model (Stantec 2018e), as presented in Section 6.6. The water balance model was originally built to support design of Mine Site facilities at Touquoy and is continually being refined/calibrated as monitoring data becomes available during operation. Effluent discharge from the polishing pond at the final discharge point is monitored to estimate the monthly volume that is released to the constructed wetland and the downstream receiving environment.

Flow in Moose River is represented by a stage-discharge curve derived based on an annual hydrometric monitoring program at stations SW-2 and SW-11. Flow statistics on Moose River were generated based on a regional analysis of thirteen representative Environment and Climate Change Canada (ECCC 2018) hydrometric stations, prorated to the Moose River catchment area at SW-2. The record of daily average flow for each station was fitted to the Log Pearson Type III distribution and prorated to the site based on catchment area. The log relationship of catchment area and flow was graphically plotted to establish a relationship between the catchment area and the average spring flow (April), summer flow (June/July/August), and low flow (July).

6.7.3 Baseline Conditions

6.7.3.1 Surface Water Features

6.7.3.1.1 Beaver Dam Mine Site

Within the Beaver Dam Mine Site, four waterbodies: Crusher Lake, Mud Lake, Cameron Flowage, and an unnamed waterbody in the southwest corner of the PA, were identified through a desktop review of available mapping. Five linear watercourses were similarly identified at the Beaver Dam Mine Site:

- in the south-central portion of the Beaver Dam Mine Site and draining north into Crusher Lake. It continues north from Crusher Lake into Mud Lake in the northwest corner of the Beaver Dam Mine Site;
- in the southwest corner of the Beaver Dam Mine Site, draining southwest, outside of the Beaver Dam Mine Site and into an unnamed open waterbody along the southwestern edge of this component of the PA;
- in the southeast corner of the Beaver Dam Mine Site that drains southeast, outside of the PA boundary;
- in the northwest section of the Beaver Dam Mine Site and drains north into Mud Lake;
- in the northeast section of the Beaver Dam Mine Site draining from a mapped unnamed waterbody inside the PA, into Cameron Flowage in the northeast corner of the Beaver Dam Mine Site; and,
- in the northwest extent of the Beaver Dam Mine Site draining north, outside of the PA, and into the Killag River.

During field evaluations within the Beaver Dam Mine Site, each watercourse location was evaluated. Some watercourses extended beyond the original mapped footprint while others were removed as they were not found in the field. Some watercourses were shortened or adjusted to reflect headwater wetland habitat and were identified as draining in and out of the corresponding wetland habitat across the PA. A total of 14 watercourses were confirmed within the Beaver Dam Mine Site. All identified watercourses are described in Table 6.7-4 and shown on Figure 6.7-3. Details of fish habitat potential and fish presence are provided in Section 6.9.

Watercourses within the Beaver Dam Mine Site are first order streams originating within headwater wetland habitat inside of the PA. The most significant stream (WC-5) drains northward from Wetland 48 through Crusher Lake and continues through Wetlands 14 and 17 into Mud Lake. Other streams across the Beaver Dam Mine Site are generally small with minimal pool/riffle structure and consist of mucky organic substrate. Many of these streams would be ephemeral in nature, with little water present at dry times of the year.

There are four waterbodies located within the Beaver Dam Mine Site. Crusher Lake is located in the western section of the PA, Mud Lake is located in the northwestern corner, and Cameron Flowage is located within the northeast corner, near the location of the proposed open pit. The fourth mapped waterbody (unnamed) is located in the southwest corner of the PA. During the field evaluation, however, this waterbody was confirmed as wetland habitat, and as a result, is described in Section 6.8. The three confirmed waterbodies within the Beaver Dam Mine Site are described in Table 6.7-4 below.

Table 6.7-4 Mine Site – Physical Characteristics of Watercourses

Watercourse	Tertiary Watershed	UTM East	UTM North	Section Length (m)	Velocity	Gradient	Wetted Width (cm)	Bank full Width (cm)	Average Depth (cm)	Bank Height (cm)	Substrate (%)	Habitat Type (%)	In-stream Vegetation (%)	Overhanging Vegetation (%)	Coarse Woody Debris
1	Tent Lake	522631	4989087	60	L	M-L	45	60	10	20	SB=80 Gr=20	Run= 100	20	80	M
2	Cameron Flowage	522050	4990014	70	L	M	70	80	15	10	Gr=20 MC=80	Run= 100	40	80	H
3	Cameron Flowage	522024	4989866	50	L	M-L	30	30	5	5	Ru=70 Sa=30	Riffle=80 Pool=20	40	80	L
4	Cameron Flowage	521450	4990084	40	L	L	10	80	5	1	Co=80 Gr=20	Flat=100	40	>95	H
5 (top near WL2)	Cameron Flowage	521808	4989574	100	M	M	60	75	5	15	Si=20 MC=15 SB=20 Ru=30 Pe=15	Run=40 Flat= 60	15	100	M
5 (lower near WL14)	Cameron Flowage	521555	4990209	266	M	M	50-200	100-300	20-60	60	SB=80 Ru=10 Co=10	Run= 70 Riffle=30	20	100	H
6	Cameron Flowage	521379	4990527	30	M	M	20	30	5	10	Ru=60 Co=20 Pe=20	Run=100	10	100	M
7	Cameron Flowage	521438	4990346	100	L	M-L	40	50	3	20	SB=5 Ru=20 Co=20 Pe=20 Gr=10 MC=15	Riffle=15 Pool=15 Glide=70	25	100	M
8	Cameron Flowage	521343	4990272	30	L	L	50	300	10	250	SB=10 Ru=15 MC=35 Si=40	Glide=100	70	75	L

Watercourse	Tertiary Watershed	UTM East	UTM North	Section Length (m)	Velocity	Gradient	Wetted Width (cm)	Bank full Width (cm)	Average Depth (cm)	Bank Height (cm)	Substrate (%)	Habitat Type (%)	In-stream Vegetation (%)	Overhanging Vegetation (%)	Coarse Woody Debris
9	Cameron Flowage	521536	4990206	100	H	H	50	200	8	20	SB=50 Ru=30 Co=10 Pe=3 MC=7	Riffle=15 Pool=25 Glide=50 Cascade=10	30	100	M
10	Kent Lake	521394	4989508	100	L	L	60	70	10	40	Gr=50 Si-50	Run=100	20	70	M
11	Kent Lake	521166	4989752	250	L	L	150	150	40	150	Ru=5 SB=5 MC=90	Run=100	40	70	H
12	Cameron Flowage	522202	4990328	40	M	L	50-400	100-400	10	10	Gr=40 Si=60	Run=100	15	80	L
13	Cameron Flowage	522689	4990224	60	L	L	300	500	10	20	SB=20 Ru=60 Si=20	Riffle=25 Pool=20 Run=55	80	100	L
14	Cameron Flowage	522734	4990027	150	M	M	100	120	50	10	Co=60 Gr=40	Run=100	0	100	M

Note: Coarse Woody Debris: H:10+ woody debris per 20m reach, M: 10-5 woody debris per 20m reach, L: less than 5 woody debris per 20m section

Velocity: H: flows at a speed at which the water is visually rough and irregular, creates eddies M: flows at a speed which creates smooth riffles L: flows so slowly that the water is smooth and fine sediments are not held in suspension

Substrate: SB: Small Boulder, Ru: Rubble, Co: Cobble, Pe: Pebbles, Gr: Gravel, Sa: Sand, MC: Mud/Clay, Si: Siltation

Gradient: H:>5% slope, M: 2-5% slope L: <2% slope (estimated only)

Habitat Type: **Run**: Swiftly flowing water with some surface agitation but no major flow obstructions, coarser substrate (gravel, cobble, and boulders). **Riffle**: Shallower section with swiftly flowing, turbulent water with some partially exposed substrate (usually cobble or gravel dominated **Flat**: Water surface is smooth and substrate is made up of organic matter, sand, mud, and fine gravel. This habitat differs from a pool due to the length, associated with low gradient. This habitat type generally has a flat bottom. **Pool**: Deeper area comprising full or partial width of stream, due to the depth or width flow velocity is reduced. Pool has rounded surface on bottom. **Cascade**: Areas of steeper gradient with irregular and rapid flows, often with turbulent white water. Rapids are primarily associated with larger stream sections and rivers. In larger rivers it is recommended that the survey crew not attempt to conduct cross sections in these types of habitat. **Glide**: Wide, shallow pool flowing smoothly and gently, with low to moderate velocities and little or no surface turbulence. Substrate usually consists of cobble, gravel and sand.

Table 6.7-5 Waterbodies within the Beaver Dam Mine Site

Watershed	Size (ha)	Depth (m)	Shoreline Characteristics	Littoral Zone Characteristics	Substrate
Crusher Lake	4.5	4 to 10	Organic peatland surrounds approximately 50% of the lake; moderately sloped mineral soil surrounds the remaining margins of the lake. The majority of the lake is unshaded, with only thin bands of shaded areas present along the margins. Mature, discrete, undisturbed forest surrounds the entire lake. Floating peatlands are present along the margins (Wetlands 8 and 10), particularly along the eastern end. A beaver lodge is also present in the eastern end of the waterbody within WL 8.	Organic substrate is present. Floating peatland extends into the waterbody in the eastern and western edges. These lacustrine wetlands support a community of submergent and emergent wetland vegetation. Near discrete upland habitat, the littoral zone is abrupt and generally lacking vegetation. Littoral zone is shaded by adjacent upland forest. Marsh St. John's Wort, Leatherleaf and a variety of sedges are emergent in both of these wetlands.	Muck and organic, with some gravel and cobble
Mud Lake	4.1	2	Entire shoreline is comprised of wetland habitat (WL17). Adjacent to open water, the wetland consists of low ericaceous shrubs and graminoids, with tall shrubs dominant at the wetland/upland edge. Gentle slopes surround the waterbody.	The littoral zone is gently sloped with some evidence of fluctuating water levels. Littoral zone is unshaded by any forest canopy cover, but some shade is provided by emergent and floating wetland vegetation (primarily Leatherleaf and White Water-lily, respectively).	Muck and organic

Watershed	Size (ha)	Depth (m)	Shoreline Characteristics	Littoral Zone Characteristics	Substrate
Cameron Flowage	11	5	Organic peatland surrounds 25% of the waterbody. Sparsely vegetated cobble and rubble shores encompass approximately 35% of the waterbody's shoreline, while mature, undisturbed forest encompasses approximately 40% of the boundary.	Emergent and floating wetland vegetation is present in the littoral zone adjacent to wetland habitat. White Water-lily is the dominant floating species, but emergent Royal Fern and Leatherleaf are also present. Where the shoreline is dominated by cobble and rubble habitat, emergent vegetation is sparse, and habitat diversity is provided primarily by structural features (i.e. cobble, rubble, small boulders). The littoral zone adjacent to upland forest is shaded, generally lacks emergent vegetation, and is comprised of sand, gravel and cobble substrate.	Majority of the substrate is rubble to small boulder, with some areas dominated by gravel and organic material.

6.7.3.1.2 Haul Road

Sixteen (16) mapped watercourses, including two major rivers, West River Sheet Harbour and Morgan River, intersect the Haul Road. Five smaller waterbodies are mapped west of Lake Alma. During field assessments, however, these five waterbodies were confirmed to be wetland habitat. The wetlands are described in Section 6.8.

Main West River, Sheet Harbour (WRSH)

The West River Sheet Harbour crosses the Haul Road just north of the intersection of the Haul Road with Highway 224. There is a current bridge crossing at this location that will require upgrading to support road widening and increased truck traffic. The Atlantic Salmon Conservation Centre has completed recent liming programs (2009, 2010) on the West River Sheet Harbour with a goal to maintain a pH of 5.5 at the river mouth to support quality salmon habitat in the river (Nova Scotia Salmon Federation http://salmonconservation.ca/en/projects/west_river_sheet_harbour_project_lime_doser_support).

The West River Sheet Harbour commences at headwater lakes including Sand Lake and West Lake just southeast of the community of Pleasant Valley near Upper Musquodoboit. The river drains in the southeast direction, parallel to Highway 224, across the Haul Road and into the Atlantic Ocean at Sheet Harbour, NS. The Killag River commences north of Cameron Flowage (Tait Lake) that is located directly northeast of the Beaver Dam Mine Site. The Killag River joins the main West River Sheet Harbour southeast of the Haul Road. Halfyard and Ferguson (June 2009) described the habitat within the West River Sheet Harbour and its main tributary, the Killag River below.

The Main branch of the West River Sheet Harbour (WRSH) originates from Upper Fisher Lake, at the head of the WRSH Secondary Watershed. The WRSH has three primary tributaries (West River Main branch, Killag River, and Little River), and it flows into the Atlantic Ocean at Sheet Harbour. The watershed is largely undeveloped, though extensive timber harvesting is present. Water within the WRSH is naturally high in tannins and flash prone. There are two, large lake-like pools on the system, the uppermost being River Lake at roughly 0.5 km^2 and the lower, Sheet Harbour lake, at roughly 1.2 km^2. A waterfall forms a natural barrier to fish passage approximately 30 km upstream of the head of tide (9.5 km upstream of Beaver Dam Mines Road, where the proposed Haul Road will cross the WRSH).

The WRSH has experienced acidification, reducing the habitat quality for spawning Atlantic salmon (Southern Upland population). In an effort to improve the quality of fish habitat, the Nova Scotia Salmon Federation installed and operates a continuous lime dosing station in 2005. Its purpose is to increase the pH of the water into a range that is more suitable for juvenile salmon (approximate pH levels of 5.5). This dosing station is located approximately 500 m upstream of the natural barrier to fish passage (10 km upstream of the Beaver Dam Mines Road). According to the Nova Scotia Salmon Federation, the implementation of the lime dosing program has resulted in a significant increase in Atlantic salmon smolt population within the WRSH and is considered to be one of the most effective salmon habitat restoration programs in the province.

Based on its success, the Nova Scotia Salmon Federation has installed a second lime dosing station on the Killag River, approximately 400 m downstream of the Beaver Dam Mine Site.

The Killag River

The Killag River is one major tributary to the WRSH. The Killag has a rather long and narrow drainage basin, with a main channel length of approximately 27 km. This system is also organic-acid stained, similar to the WRSH. Land-use within this tertiary watershed is similar to the overall secondary watershed, with sparse development and abundant timber harvesting. The Killag River system has several associated waterbodies, such as Tait Lake and Cameron Flowage. West Lake, Mud Lake and Crusher Lake are associated with sub-tertiary basins that are tributaries to the Killag River. According to local knowledge, the majority of salmon (as well as brook trout, white suckers, American eel and lake chub) spawned in this part of the system. As previously discussed, the Nova Scotia Salmon Federation has installed a second lime dosing station along the Killag River to try to replicate successful salmon habitat rehabilitation that was accomplished in the WRSH.

The Morgan River

The Morgan River is one major tributary to the Tangier River that originates at the headwater lakes (including First and Second Essen Lakes) and south of the community of Pleasant Valley, near Upper Musquodoboit. The river drains south/southeast across the Haul Road and into River Lake, east of the Haul Road, and then joins the main Tangier River to the southeast of the PA. The Tangier River drains from Tangier Grand Lake to the Atlantic Ocean at Tangier, Nova Scotia.

During field assessments in spring and summer 2016, 34 watercourses were mapped and evaluated within the Haul Road corridor. These watercourses straddle seven tertiary watersheds, and many are classified as first order streams, in high positions within the tertiary basins. Others, however, are second and third order streams, positioned lower in the tertiary watersheds and broader secondary watersheds, and offer more substantial aquatic and fish habitat. All watercourses observed within the Haul Road are described in Table 6.7-6 and shown on Figure 6.7-3A to 6.7-3L.

Table 6.7-6 Haul Road – Physical Characteristics of Watercourses

Watercourse	Tertiary Watershed	Crossing Coordinates		Section Length (m)	Velocity	Gradient	Wetted Width (cm)	Bankfull Width (cm)	Average Depth (cm)	Bank Height (cm)	Substrate (%)	Habitat Type (%)	In-stream Vegetation (%)	Overhanging Vegetation (%)	Coarse Woody Debris	Wetland Habitat associated with crossing
		UTM East	UTM North													
A	Tent Lake	522628	4988891	26	L	L	20-400	20-400	10-25	1-20	MC=100	Flat= 100	20	65	L	WL120
B	Tent Lake	522705	4988568	40	L	L	20-400	20-400	10-20	1-20	Co=10 MC=90	Glide=80 Riffle=10 Run=10	10	95	M	WL117
C	Tent Lake	522752	4988169	50	L	L	35-80	35-80	5-25	5-40	Ru=10 Co=20 Gr=15 Si=25 MC=30	Flat= 100	10	50	M	WL119, WL118
D	Tent Lake	522828	4987773	25	M	M	25-65	25-80	5-20	5-20	SB=40 Co=50 MC=10	Run=45 Riffle=35 Pocket= 20	0	45	L	WL121
E	Brandon Lake	522907	4987152	75	M	L	25-170	35-180	1-20	10-40	SB=5 Co=50 Pe=30 Gr=15	Run=50 Riffle=5 Glide=30 Pool=15	5	80	H	N/A
F	Brandon Lake	522841	4986566	83	M	L	60-150	70-170	10-30	5-30	Gr=25 MC=75	Run=50 Pool=50	20	70	M	N/A
G	Brandon Lake	522621	4986101	71	L	L	40-350	50-350	5-30	1-10	Co=5 Pe=10 Gr=25 MC=50	Glide=75 Run=25	75	10	M	WL76
H	Brandon Lake	522562	4985938	100	H	M	100-500	120-500	2-40	10-30	SB=30 Ru=30 Co=30 Pe=10	Run=40 Cascade=25 Riffle=10 Pool=25	0	60	M	N/A

Watercourse	Tertiary Watershed	Crossing Coordinates		Section Length (m)	Velocity	Gradient	Wetted Width (cm)	Bankfull Width (cm)	Average Depth (cm)	Bank Height (cm)	Substrate (%)	Habitat Type (%)	In-stream Vegetation (%)	Overhanging Vegetation (%)	Coarse Woody Debris	Wetland Habitat associated with crossing
		UTM East	**UTM North**													
I	Brandon Lake	522547	4985881	64	L	L	30-150	30-150	5-15	1-50	SB=15 Ru=20 Co=60 Gr=5	Pool=20 Riffle=40 Run=40	5	65	L	N/A
J	Brandon Lake	522554	4985838	80	M	M	50-200	60-200	5-23	5-50	Co=15 Pe=15 Gr=15 MC=40	Pool=30 Riffle=30 Run=40	0	70	M	N/A
K	Brandon Lake	522306	4984470	55	M	M	30	40	15	10	SB=40 Gr=20 Sa=40	Riffle=60 Pool=40	5	100	L	N/A
L	Brandon Lake	522312	4984339	47	L-M	M	30	50	10-30	10-20	Pe=50 Gr=50	Run=75 Riffle=20 Pool=5	0	90	l	N/A
M	Brandon Lake	522234	4984150	50	L	L	35-100	50-110	2-45		Gr=10 MC=90	Run=100	5	95	H	N/A
N- West River Sheet Harbour	Brandon Lake / Rocky Brook Lake	521887	4983922	113	H	M	1200	1200	100	100-200	LB=5 SB=10 Ru=25 Pe=30 Gr=30	Cascade=10 Glide=25 Riffle=25 Run=40	10	40	L	N/A
O	Lake Alma	521193	4983426	30	L	L	40-400	60-430	15	17-23	SB=10 Ru=15 Co=10 MC=65	Riffle=20 Pool=10 Glide=70	7	30	M	Wl95 & WL96
P	Lake Alma	520111	4982977	30	M	M	20-120	20-150	10-35	10-40	LB=10 SB=30 Ru=20	Riffle=30 Pocket= 20 Run=50	0	0	L	N/A

Watercourse	Tertiary Watershed	Crossing Coordinates		Section Length (m)	Velocity	Gradient	Wetted Width (cm)	Bankfull Width (cm)	Average Depth (cm)	Bank Height (cm)	Substrate (%)	Habitat Type (%)	In-stream Vegetation (%)	Overhanging Vegetation (%)	Coarse Woody Debris	Wetland Habitat associated with crossing
		UTM East	**UTM North**													
											Co=20 Pe=10 Gr=10					
Q	Lake Alma	518454	4982878	35	L	L	60-160	60-160	10-20	30	SB=30 Co=30 Gr=35 MC=5	Glide=80 Riffle=20	0	10	M	N/A
R	Lake Alma	518335	4982893	100	L	L	80-150	100-180	15	20-45	SB=5 Co=5 MC=90	Glide=10 Pool=85 Riffle=5	30	50	M	
S	Lake Alma	518117	4983044	68	L	L	100-200	100-200	10-20	20-40	Ru=15 Pe=25 Gr=40 MC=20	Glide=50 Run=25 Riffle=25	0	90	I	N/A
T	Lake Alma	517873	4982824	52	M	L	100-260	100-260	1-19	15-30	MC=20 Gr=10 Pe=20 Co=20 Ru=20 SB=10	Run=85 Riffle=5 Pool=10	N/A	80	m	N/A
U	Lake Alma	517441	4982674	56	L-M	L-M	50-100	50-100	6-40	5-30	MC=50 Co=10 Gr=40	Run=70 Riffle=20 Pool=10	0	90	L	N/A
V	Lake Alma	517395	4982554	65	H	M	80-140	130-150	2-17	5-60	Gr=30 LB=20 Co=30 SB=20	Riffle=5 Run=65 Cascades=30	5	90	L	N/A

Watercourse	Tertiary Watershed	Crossing Coordinates		Section Length (m)	Velocity	Gradient	Wetted Width (cm)	Bankfull Width (cm)	Average Depth (cm)	Bank Height (cm)	Substrate (%)	Habitat Type (%)	In-stream Vegetation (%)	Overhanging Vegetation (%)	Coarse Woody Debris	Wetland Habitat associated with crossing
		UTM East	**UTM North**													
W	Lake Alma	517500	4982275	44	M	M	20-150	20-200	5-22	5-20	MC=90 Ru=10	Run=79 Pool=20 Riffle=1	0	90	L	N/A
X	Lake Alma	517549	4982187	70	M	M	25-80	30-100	5-45	5-50	MC=60 Co=20 Pe=20	Riffle=40 Flat= 60	0	40	M	WL114
Y	Lake Alma	517595	4982084	70	M	M	25-80	30-100	5-45	5-50	MC=60 Co=20 Pe=20	Riffle=40 Flat=60	0	40	M	WL115
Z	Lake Alma	517675	4981893	90	L	L	30-200 (downstream), 2500 (upstream)	30-200 (downstream), 2500 (upstream)	12->40	2	Gr=65 Pe=5 MC=30	Run=25 Riffle=5 Pool=70	70	30	L	WL9
AA	Eagles Nest	516527	4979693	105	M	L	50-350	50-350	20	5-15	MC=30 Gr=25 Pe=25 Co=15 Ru=5	Run=100	10	80	20	WL5
AB	Eagles Nest	516303	4979597	40	M	M	20	25	10	5	Sa=100	Run=70 Pocket= 30	40	100	L	WL86
AC	Eagles Nest	515091	4979240	60	L	L	50-400	50-600	5-20	5-10	SB=40 Ru=30 Sa=30	Flat=70 Riffle=10 Pool=20	10	50	L	WL76
AD	Eagles Nest	514588	4978868	130	M	L	~1200-1600	1300-1700	100+	25	Too deep to see substrate; Co, Ru, LB, SB	Run=100	1	10	0	N/A
AE	Rocky Lake	514402	4978588	80	M	L	30-120	50-150	10	20	Gr=40 Pe=40 Co=15 Ru=5	Run=80 Riffle=10 Pool=10	10	50	L	WET2

Watercourse	Tertiary Watershed	Crossing Coordinates		Section Length (m)	Velocity	Gradient	Wetted Width (cm)	Bankfull Width (cm)	Average Depth (cm)	Bank Height (cm)	Substrate (%)	Habitat Type (%)	In-stream Vegetation (%)	Overhanging Vegetation (%)	Coarse Woody Debris	Wetland Habitat associated with crossing
		UTM East	**UTM North**													
AF	Rocky Lake	514346	4978527	70	L	L	50-180	50-180	20-30	30-35	Ru=25 Co=45 Gr=30	Pool=40 Flat=50 Riffle=10	40	70	M	WL70
AG	Rocky Lake	514286	4978468	65	M	L	40-90	40-110	20-45	30-50	SB=30 Ru-40 Co=30	Run=50 Cascade=15 Riffle=35	10	55	M	WL68
AH	Rocky Lake	514249	4978518	100	M	L	200-650	200-700	50-80	60-90	SB=10 Ru=30 Co=40 Gr=20	Riffle= 80 Pool=20	30	30	L	N/A

Note: Coarse Woody Debris: H:10+ woody debris per 20m reach, M: 10-5 woody debris per 20m reach, L: less than 5 woody debris per 20m section

Velocity: H: flows at a speed at which the water is visually rough and irregular, creates eddies, heavier riffles to light rapids M: flows at a speed which creates smooth to moderate riffles L: flows so slowly that the water is smooth and fine sediments are not held in suspension

Substrate: LB; Large Boulder, SB: Small Boulder, Ru: Rubble, Co: Cobble, Pe: Pebbles, Gr: Gravel, Sa: Sand, MC: Mud/Clay, Si: Siltation

Gradient: H:>5% slope M: 2-5% slope L: <2% slope (estimated only)

Habitat Type: Run: Swiftly flowing water with some surface agitation but no major flow obstructions, coarser substrate (gravel, cobble, and boulders). Riffle: Shallower section with swiftly flowing, turbulent water with some partially exposed substrate (usually cobble or gravel dominated). Pocket: Turbulence increased greatly by numerous emergent boulders which create eddies or scour holes (pockets) behind the obstructions. Flat: Water surface is smooth and substrate is made up of organic matter, sand, mud, and fine gravel. This habitat differs from a pool due to the length, associated with low gradient. This habitat type generally has a flat bottom. Pool: Deeper area comprising full or partial width of stream, due to the depth or width flow velocity is reduced. Pool has rounded surface on bottom. Cascade: Areas of steeper gradient with irregular and rapid flows, often with turbulent white water. Rapids are primarily associated with larger stream sections and rivers. In larger rivers it is recommended that the survey crew not attempt to conduct cross sections in these types of habitat. Glide: Wide, shallow pool flowing smoothly and gently, with low to moderate velocities and little or no surface turbulence. Substrate usually consists of cobble, gravel and sand.

6.7.3.1.3 Touquoy Mine Site

As shown in Figure 6.7-5 (below), the Touquoy Mine Site comprises approximately 176 ha; of that area the existing open pit is approximately 40 ha. The open pit is located between Moose River on the west and Watercourse No. 4 on the east that each flow north to south adjacent to the limits of the open pit. The existing open pit is 70 m from Moose River channel bank at the nearest location. The catchment area of Moose River is 3904 ha at surface water monitoring station SW-2 draining from topographical highs of 180 m to 110 m in elevation (CGVD 2013) at the banks of Moose River. Moose River flows south approximately 2.3 km downstream of SW-2 where it joins the Fish River. Watercourse No. 4 has a catchment area of 136.3 ha at surface water monitoring station SW- 3 and flows south between the existing open pit and TMF to Moose River and eventually to the Fish River. Additional watercourse and wetlands field identified by MEL at the Touquoy Mine Site are identified on Figure 6.8-4.

The existing Touquoy open pit is actively dewatered and pumped to the TMF. Based on the groundwater flow model (Stantec 2018e), the open pit acts as a groundwater sink resulting in groundwater inflows at an average rate of 450 m³/d. Water in the TMF is decanted to the effluent treatment plant for treatment. Effluent then drains to the polishing pond through a series of geobags, then to a constructed wetland where water infiltrates through the berm and finger drains to Scraggy Lake, the receiving water body for the Mine Site. The approved Touquoy Environmental Assessment stated that the exhausted open pit would be allowed to fill naturally with water over a period of time through the collection of direct precipitation, surface flow and groundwater inflow. No change to this method is planned for the deposition of Beaver Dam tailings, except that the time frame for refilling will be shorter given the decrease in available volume taken by the tailings.

Scraggy Lake is part of the Moose River drainage system. It has an area of 6.4 km² (Stantec 2018c) and forms two major basins which are separated by islands and peninsulas. Scraggy Lake is the freshwater make-up supply for the active Touquoy mill process. Water flows into Scraggy Lake from approximately twenty-two inlets consisting of mapped watercourses or adjacent waterbodies. Water flows out of Scraggy Lake over the Fish River Dam and into the Fish River. The Fish River drains Square Lake located north of the existing Touquoy waste rock area to Scraggy Lake. Both lakes are part of the Fish River Watershed which flows west and then south into Lake Charlotte, eventually emptying into the Atlantic Ocean at Ship Harbour.

As per the Reclamation Plan for Touquoy (Stantec 2017b), Moose River is proposed as a second point of final discharge under closure of the exhausted Touquoy open pit. At SW-2, Moose River is a 3rd order watercourse with an approximately 12.5 m bankfull width as measured in the 2017 hydrometric program. The substrate was noted in the 2017 hydrometric monitoring report (Atlantis 2017) as characteristically muddy consisting predominantly of cobbles and small boulders, silt/sand with gravel. Figure 6.7-6 (below) presents a bathymetric cross section of Moose River at SW-2 measured from west to east as part of the ongoing hydrometric monitoring program for operation of the Touquoy Mine Site. This cross section was presented to represent the physical characteristics of Moose River near the final discharge point. As part of the hydrometric monitoring program, water levels (stage) and river flows (discharge) were measured. The data was plotted and the best fit regression was fitted to the data. Figure 6.7-7 (below) presents the 2017 stage discharge curve at SW-2.

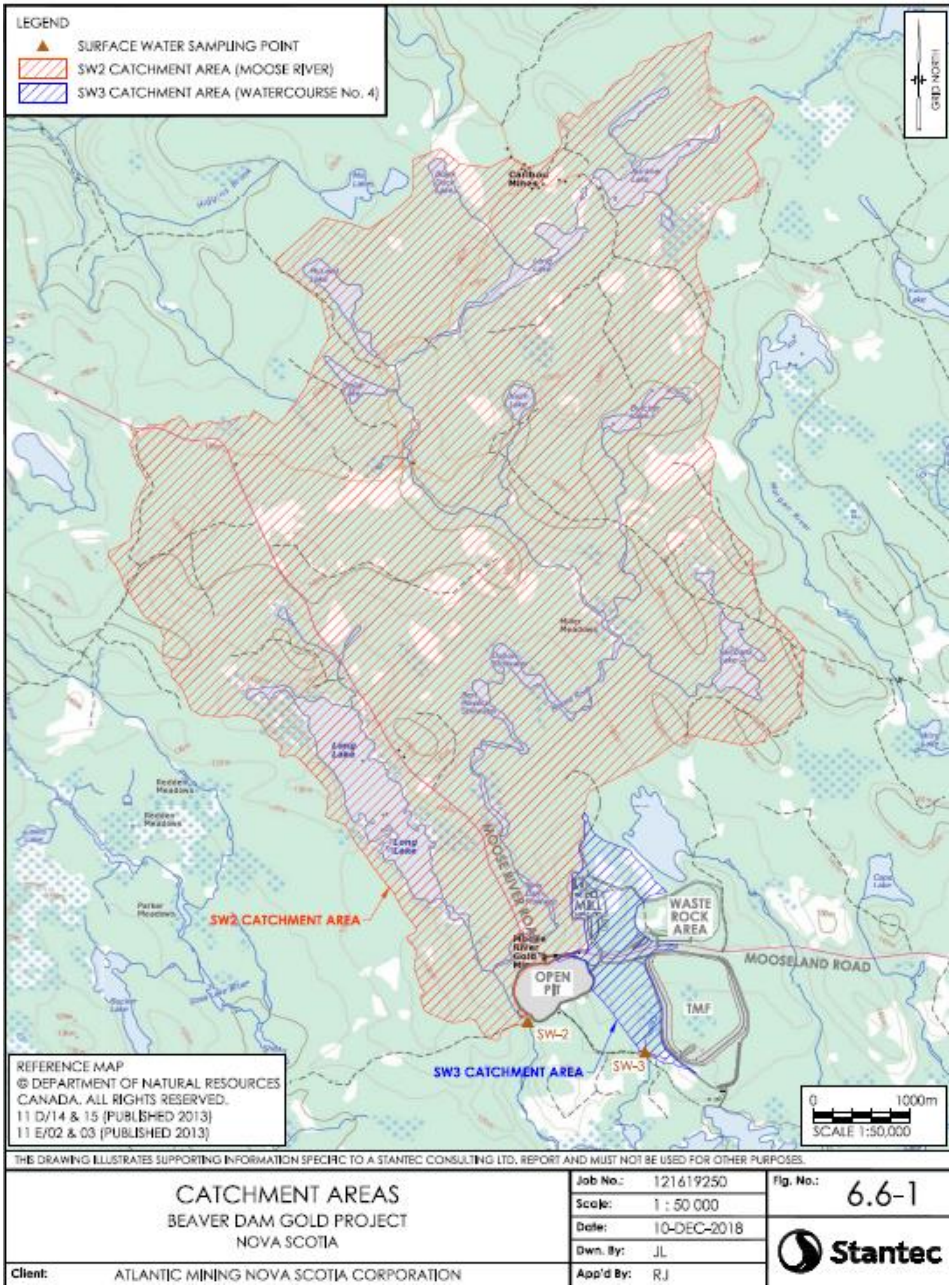

Figure 6.7-5 Touquoy Mine Site Catchment Areas

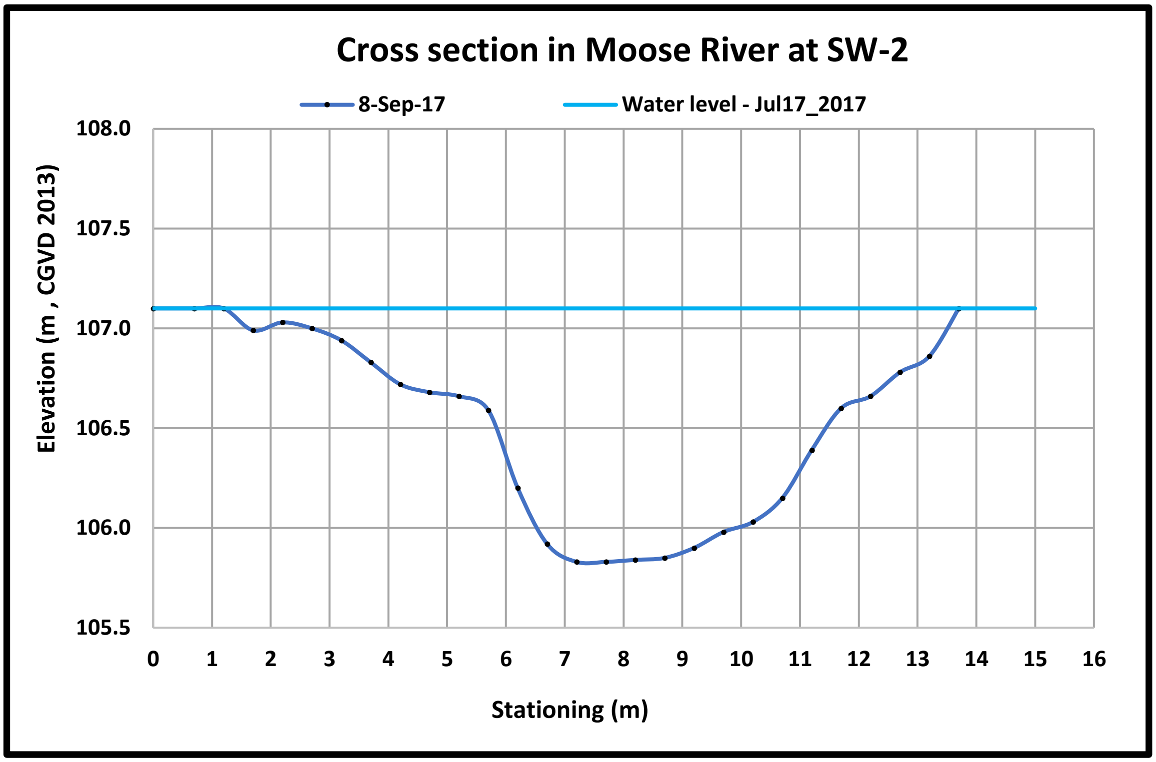

Figure 6.7-6 Cross section in Moose River at SW-2

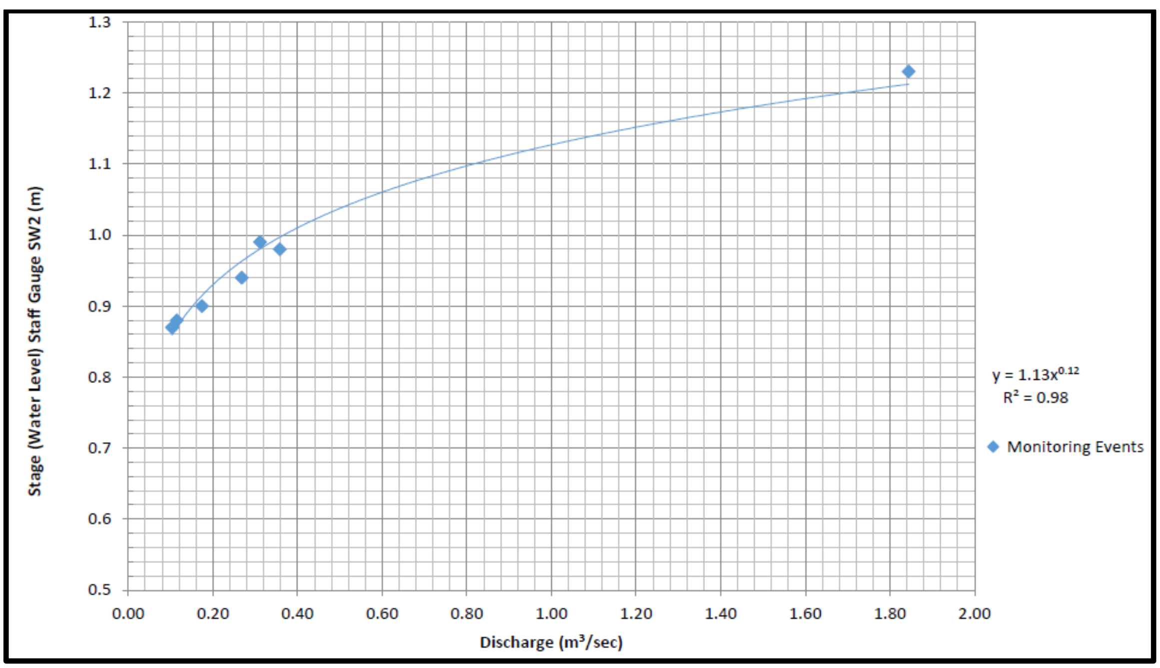

Figure 6.7-7 Stage Discharge Relationship at Moose River Hydrometric Station SW-2

6.7.3.2 Surface Water Quality

6.7.3.2.1 Beaver Dam Mine Site

Water quality at the Beaver Dam Mine Site is characterized as relatively pristine, with very little influence from past mining activities, local industry, road salting, or local residents. Some localized influences from road work (culverts, ditching) or forestry use would have occurred historically (suspended solids for example) but these would be localized and short term variations. Portions of the Haul Road where NSTIR had a role in winter maintenance may have experienced salt and/or sanding, but there is little publicly available information on this.

The majority of nutrients were below or slightly above detectable concentrations, indicating little to no influence from agricultural operations in the area. Dissolved ions were low and the water was very soft, indicating little mineral content and influence from weathered rock. The watersheds have been logged extensively, yet turbidity is low, indicating a lack of silt in the soils and/or little erosion from logging practices. The Haul Roads have been used to haul timber as well; however, TSS levels were low, which may be attributable to existing road conditions and allowable speeds.

The majority of metal concentrations were below detectable levels. At the Beaver Dam Mine Site, aluminum and iron exceeded the CCME FWAL guidelines and NSEQSs at all sampling locations during most sampling events; however, this is a common feature of surface water in Nova Scotia. Mercury was identified above the CCME FWAL guidelines and NSEQSs at all sampling locations during the last sampling event in August 2015, and arsenic concentrations were identified above the CCME FWAL guidelines and NSEQSs at SW-4A, SW-5, SW-6A, and SW-10 during various sampling events. Arsenic concentrations were variable at all sampling locations but were generally elevated in the summer months. Arsenopyrite, an iron arsenic sulfide compound, is common in the surficial and bedrock geology of the area. Lead, cadmium, and copper fluctuates in surface water at most sampling locations and at times slightly exceeded the CCME FWAL guidelines and NSEQSs at SW-6A (copper) and SW-10 (copper and lead). The NSEQS for cadmium, which is lower than the CCME FWAL guideline, was exceeded at most sampling locations during most sampling events. The CCME FWAL guideline for cadmium was only exceeded at five sampling locations, SW-4A, SW-6A, SW-10, SW-11 and SW-12, throughout the sampling program.

Along the Haul Road, aluminum exceeded the CCME FWAL guideline and NSEQS at all sampling locations, and iron exceeded both guidelines at all but three sampling locations. Arsenic, copper, and lead concentrations were identified to exceed the CCME FWAL guidelines and NSEQSs at several sampling locations (SW-43, SW-45, and/or SW-47). Cadmium exceeded the NSEQS at all but one of the sampling locations but did not exceed the CCME FWAL guideline at any location.

Alkalinity was low at all sampling locations throughout the PA. This is anticipated due to the surficial geology being resistant to weathering and containing little carbonate. Lime applied to lawns and gardens increases alkalinity, but this practice is not evident by the water quality data. pH was generally low in all sampling locations and outside the range identified in the CCME and MDMER guidelines; however, this a common feature of surface water in Nova Scotia being influenced by acidic precipitation originating in the northeast United States. At the Touquoy Mine Site, pH measures were highly variable, in particular on Moose River, where on several sampling events at two sampling stations, the pH varies by two orders of magnitude. DO concentrations measured in the field were identified above the CCME FWAL guidelines at the majority of sampling locations. A summary of parameters exceeding the CCME FWAL and MDMER Guidelines is provided in Table 6.7-7 and Table 6.7-8.

Significant differences between the field and laboratory pH measurements (Appendix G.1) were noted. Field pH values will generally be higher or lower than laboratory pH values by as much as +/- 1 pH unit or more. Temperature may be a factor, with lower pH associated with higher temperatures and vice versa than when pH values are measured in the field. However, field values are commonly lower than laboratory values because collection, transport, and or storage causes a release of dissolved carbon dioxide from the water into the head space of the sample and a release to the atmosphere when the sample is opened (Pyne, 1994). In addition, the difference in field and laboratory pH measurements have been attributed to microbial metabolism of organic acids and breakdown of particulate matter resulting in delayed neutralization of acid contributing species (Latysh, N. and Gordon, J., 2002).

Latysh and Gordon's (2002) study investigating pH difference in precipitation water measured in the field and lab shows that in post 1994 data, the laboratory pH values were higher for 67% of all samples. Other literature indicates that laboratory pH is, ideally, slightly lower than field measurements of pH (McKean & Huggins, 1989). But his predates the 1994 change in laboratory procedures to eliminate differences in the pH measurement through improved sample collection and testing methods.

Factors including temperature and exposure to atmospheric CO_2 influence pH after sampling. Where the pH data in the EIS generally shows field pH to be lower than laboratory pH, a reassessment of the data may not be necessary.

Table 6.7-7 Summary of Surface Water Quality for Beaver Dam Mine Site

Sample ID	Sample Location	Parameters Exceeding CCME FWAL	Parameters Exceeding MDMER	Parameters Exceeding NSEQS for Freshwater
SW-1	Killag River	pH, DO, Aluminum, Iron, Mercury	pH	Aluminum, Cadmium, Iron, Mercury
SW-2A	Upstream of Cameron Flowage	pH, DO, Aluminum, Iron, Mercury	pH	Aluminum, Cadmium, Iron, Mercury
SW-4A	Wetland downstream of Mud Lake	pH, DO, Aluminum, Arsenic, Cadmium, Iron, Mercury	pH	Aluminum, Arsenic, Cadmium, Iron, Mercury
SW-5	Existing settling pond outlet	pH, DO, Aluminum, Arsenic, Iron, Mercury	pH	Aluminum, Arsenic, Cadmium, Iron, Mercury

Sample ID	Sample Location	Parameters Exceeding CCME FWAL	Parameters Exceeding MDMER	Parameters Exceeding NSEQS for Freshwater
SW-6A	Unnamed stream between Crusher Lake and Mud Lake	pH, DO, Aluminum, Arsenic, Cadmium, Copper, Iron, Mercury	pH	Aluminum, Arsenic, Cadmium, Copper, Iron, Mercury
SW-9	West River Sheet Harbour	pH, DO, Aluminum, Iron, Mercury	pH	Aluminum, Cadmium, Iron, Mercury
SW-10	Upstream of existing settling pond	pH, DO, Aluminum, Arsenic, Cadmium, Copper, Iron, Lead, Mercury	pH	Aluminum, Arsenic, Copper, Iron, Lead, Mercury
SW-11	Tent Lake	pH, Aluminum, Cadmium, Iron	pH	Aluminum, Cadmium, Iron
SW-12	Unnamed lake/wetland – headwaters of Paul Brook	pH, Aluminum, Cadmium, Iron	pH	Aluminum, Cadmium, Iron

Table 6.7-8 Summary of Surface Water Quality for Haul Road

Sample ID	Sample Location	Parameters Exceeding CCME FWAL	Parameters Exceeding MDMER	Parameters Exceeding NSEQS for Freshwater
WC-2, WC-7 to WC-17	Watercourses along Beaver Dam Mines Road portion of the Haul Road	Aluminum, iron, pH	pH	Aluminum, cadmium, iron
WC-3	Watercourses along Beaver Dam Mines Road portion of the Haul Road	Aluminum, iron, pH	pH	Aluminum, iron

Sample ID	Sample Location	Parameters Exceeding CCME FWAL	Parameters Exceeding MDMER	Parameters Exceeding NSEQS for Freshwater
SW-41	Watercourse along new construction through greenfield environment	Aluminum, pH	pH	Aluminum, cadmium, iron
SW-42	Watercourse along new construction through greenfield environment	Aluminum, iron, pH	pH	Aluminum, cadmium, iron
W-23 to WC-28	Watercourses along the Moose River Cross Road portion of Haul Road	Aluminum, iron, pH	pH	Aluminum, cadmium, iron
WC-29	Watercourse along the Moose River Cross Road portion of Haul Road	Aluminum, pH	pH	Aluminum, cadmium
WC-30, WC-31	Watercourses along the Moose River Cross Road portion of Haul Road	Aluminum, iron, pH	pH	Aluminum, cadmium, iron
SW-43	Watercourse along the Mooseland Road portion of the Haul Road	Aluminum, copper, iron, lead, pH	pH	Aluminum, cadmium, copper, iron, lead
SW-44	Watercourse along the Mooseland Road portion of the Haul Road	Aluminum, iron, pH	pH	Aluminum, cadmium, iron
SW-45	Watercourse along the Mooseland Road portion of the Haul Road	Aluminum, arsenic, iron, pH	pH	Aluminum, arsenic, cadmium, iron
SW-46	Watercourse along the Mooseland Road portion of the Haul Road	Aluminum, iron, pH	pH	Aluminum, cadmium, iron

Sample ID	Sample Location	Parameters Exceeding CCME FWAL	Parameters Exceeding MDMER	Parameters Exceeding NSEQS for Freshwater
SW-47	Watercourse along the Mooseland Road portion of the Haul Road	Aluminum, iron, lead, pH	pH	Aluminum, cadmium, iron, lead

Full analytical results compared to the CCME FWAL guidelines, MDMER guidelines, and NSEQSs for all surface water sampling locations and events are included in Appendix G.1.

6.7.3.2.2 **Haul Road**

An initial assessment of the Haul Road identified 23 watercourse crossings: 20 culverts (smaller watercourses) and 3 timber bridges (watercourses 6 to 13 m in width). The bridges were considered to be in good condition. A large number of the culverts were poorly installed (i.e., buried, caved in, plugged, hung, not present, water flowing through the road base and not the culvert). The overall poor culvert conditions have contributed to obstructed fish passage.

There is a potential for all surface water systems along the Haul Road to be impacted by the proposed works. There is also an opportunity for improvement of the existing surface water conditions through proper sediment and erosion control measures during construction and maintenance and properly designed and installed culverts.

6.7.3.2.3 **Touquoy Mine Site**

The geology at the Touquoy Mine Site is situated in the Meguma Super Group Goldenville Formation. This formation is closely related to historical and current gold production and exploration operations. This formation is also known to be high in natural concentrations of arsenopyrite which is found associated with gold deposits in Nova Scotia. As a result, natural concentrations of arsenic in groundwater in this formation have been found to naturally exceed Nova Scotia Tier 1 Guidelines for arsenic. As groundwater is a pathway to surface water, these elevated concentrations of arsenic will also be common in local watercourses.

The Touquoy Mine Site is in an area of historic gold mining activity, with a network of small underground workings and bottle pits dating from as far back as 1866. Gold production from Moose River Gold Mines, near the Mine Site, commenced around 1877. A field sampling plan of the Mine Site area identified historical tailings at the mines to have elevated concentrations of arsenic and mercury. Due to the wide distribution of historical tailings in the area, and the length of time the tailings have been in place, they have the potential to have a negative impact on surface water quality.

Water management at the currently operating Touquoy Mine Site includes directing all waste water and surface runoff that comes in contact with the ore to the existing tailings management facility (TMF) for treatment. Treatment includes the addition of ferric sulphate to the effluent to precipitate arsenic, hydrated lime to adjust pH, and coagulant polymer to facilitate the removal of colloidal sized suspended matter. The treated effluent is then directed into the polishing pond where additional settling will occur before being released into a constructed wetland for subsequent discharge into the northwestern end of Scraggy Lake. At the point of final discharge, the effluent meets MDMER water quality criteria.

Based on a review of the 2017 baseline surface water quality results (Stantec 2017b), surface water at the monitoring stations upstream and downstream of the Touquoy Mine Site had elevated baseline concentrations of arsenic, aluminum, iron, cadmium, copper, lead, zinc, and manganese that exceeded Nova Scotia Environment Tier 1 EQS. Table 6.7-9 summarizes parameter exceedances by monitoring locations. In addition, cobalt, manganese, silver and mercury exceeded the Canadian Council of Ministers of the Environment (CCME 2018) guideline for the protection of freshwater aquatic life. These exceedances are considered to be naturally occurring, or the result of historical anthropogenic (i.e., non-Project related) activities, varying seasonally and representing baseline conditions at the Touquoy Mine Site. Site-specific standards have been developed for both the Beaver Dam Mine and the Touquoy Mine Site to establish thresholds for surface water quality that include the elevated concentrations of parameters under baseline conditions (Appendix G.4 Evaluation of Potential for Aquatic Effects as a Result of Effluent Releases Related to Beaver Dam Mine).

As reported in the 2017 groundwater and surface water monitoring report (Stantec 2018b), spatial trends were not apparent between conductivity and the observed Tier 1 EQS exceedances, or between background and downstream monitoring locations to indicate an effect of a specific mine facility (i.e., TMF, waste rock pile, open pit) on surface water resources during construction. Arsenic was noted to consistently exceed the Tier 1 EQS at SW-2 downstream of the open pit in both 2016 and 2017. As no trends in water quantity or quality were identified between baseline and operation, these elevated arsenic concentrations are not attributed to operation and may be from historical tailing piles and/or the Touquoy ore body itself. A remedial action plan is currently underway by the Proponent that involves the delineation, removal, and management of these historical tailings piles around the open pit area.

Table 6.7-9 Summary of Baseline 2016/2017 Surface Water Quality for Touquoy Mine Site Parameter Exceedance

Water Quality Parameter	SW-1	SW-2	SW-3	SW-11	SW-12	SW-13	SW-15	SW-18	SW-19	SW-20	SW-21	SW-23	No. of Stations with Parameter Exceedance
Exceedance of MDMER													
pH	9	10	2	13	11	13	10	13	7	7	7	7	10
Exceedance of Tier 1 EQS													
pH	20	20	6	22	20	20	10	19	18	16	16	9	10
Total Aluminium (Al)	21	22	20	22	21	20	19	21	21	19	19	9	10
Total Arsenic (As)	20	18	14	22	0	2	9	11	8	2	0	3	8
Total Cadmium (Cd)	12	14	11	15	13	11	17	13	20	17	14	9	10
Total Cobolt (Co)*	0	0	0	0	0	0	0	0	1	0	0	0	1
Total Copper (Cu)	0	0	3	1	0	0	6	0	3	2	0	0	5
Total Iron (Fe)	17	17	14	16	1	2	18	14	17	18	6	7	10

Water Quality Parameter	SW-1	SW-2	SW-3	SW-11	SW-12	SW-13	SW-15	SW-18	SW-19	SW-20	SW-21	SW-23	No. of Stations with Parameter Exceedance
Total Lead (Pb)	0	0	5	0	0	1	12	0	2	4	2	0	5
Total Manganese (Mn)*	0	0	1	0	0	0	1	0	2	0	0	0	3
Total Mercury (Hg)	0	0	0	0	0	1	3	0	0	1	0	0	1
Total Silver (Ag)*	0	0	0	0	0	0	0	0	1	0	0	0	1
Total Vanadium (V)	0	0	0	0	0	0	0	0	1	1	0	0	1
Total Zinc (Zn)	0	0	0	0	1	2	2	0	1	1	0	0	3
No. of Monitoring Events per Station	21	22	20	22	21	20	19	21	21	19	19	19	12
Note: Surface water quality parameter is listed if there is at least 1 exceedance in 20162017 monitoring. *= Indicates exceedance of CCME guideline													

Figures 6.7-8 to 6.7-11 (below) present box plots that summarize the surface water quality for both the background and downstream locations at the Touquoy Mine Site. These represent the baseline conditions for the use of the Touquoy Mine Site for the processing of the ore for the Beaver Dam Mine Project. The minimum, mean, and maximum concentration or value for the parameters are presented on a logarithmic scale. Values below the detection limits are flagged in the plots, as are the relevant guidelines or discharge limits. For example, in Figure 6.7-10 (below), all values for total bismuth in the background data set (i.e., SW-1, SW-11 SW-12, and SW-23) are below the detection limit. In Figure 6.7-10 (below) for the background data set, the minimum cadmium value is below the detection limit, the mean and maximum value is above Tier 1 EQS and CCME FWAL guideline.

Overall, the water quality is similar between background and downstream surface water quality presented in the 2017 monitoring report (Stantec 2018b). All applicable parameters meet *MDMER* discharge limits, with the exception of pH which is slightly acidic in background water quality conditions. Organic sampling parameters related to hydrocarbons as well as cyanide related parameters were all below the detection limits for all 2016/2017 sampling locations, thus no exceedances are reported under the Tier 1 EQS for freshwater. There were no detections of radium 226 at the locations sampled (i.e., SW-2, SW-21). Conductivity is generally stable at each location by month in 2016/2017 and is generally low (<43 µS/cm) at most sampling locations. The pH in surface water was noted to be slightly acidic and generally at or below 6.0 at both background and downstream locations with the exception of SW-3, SW-16 and SW-17 where more neutral values (i.e., pH generally between 6 and 7) were observed. Total suspended solids (TSS) were generally less than 10 mg/L. Turbidity was generally low at less than 5.5 NTU at background locations but were slightly elevated in downstream locations at the site. Ammonia nitrogen concentrations were typically not detected or were less than 0.1 mg/L. There were no Tier 1 EQS surface water guideline exceedances noted for antimony, barium, beryllium, boron, molybdenum, mercury, nickel, selenium, strontium, thallium, uranium, benzene, toluene, ethylbenzene, total xylenes and total cyanide (i.e., strong acid dissociated cyanide). The surface water sampling locations are provided on Figures 6.7-4 (above). Complete water quality results are presented in the 2017 Annual Report – Surface Water & Groundwater Monitoring (Stantec 2018b).

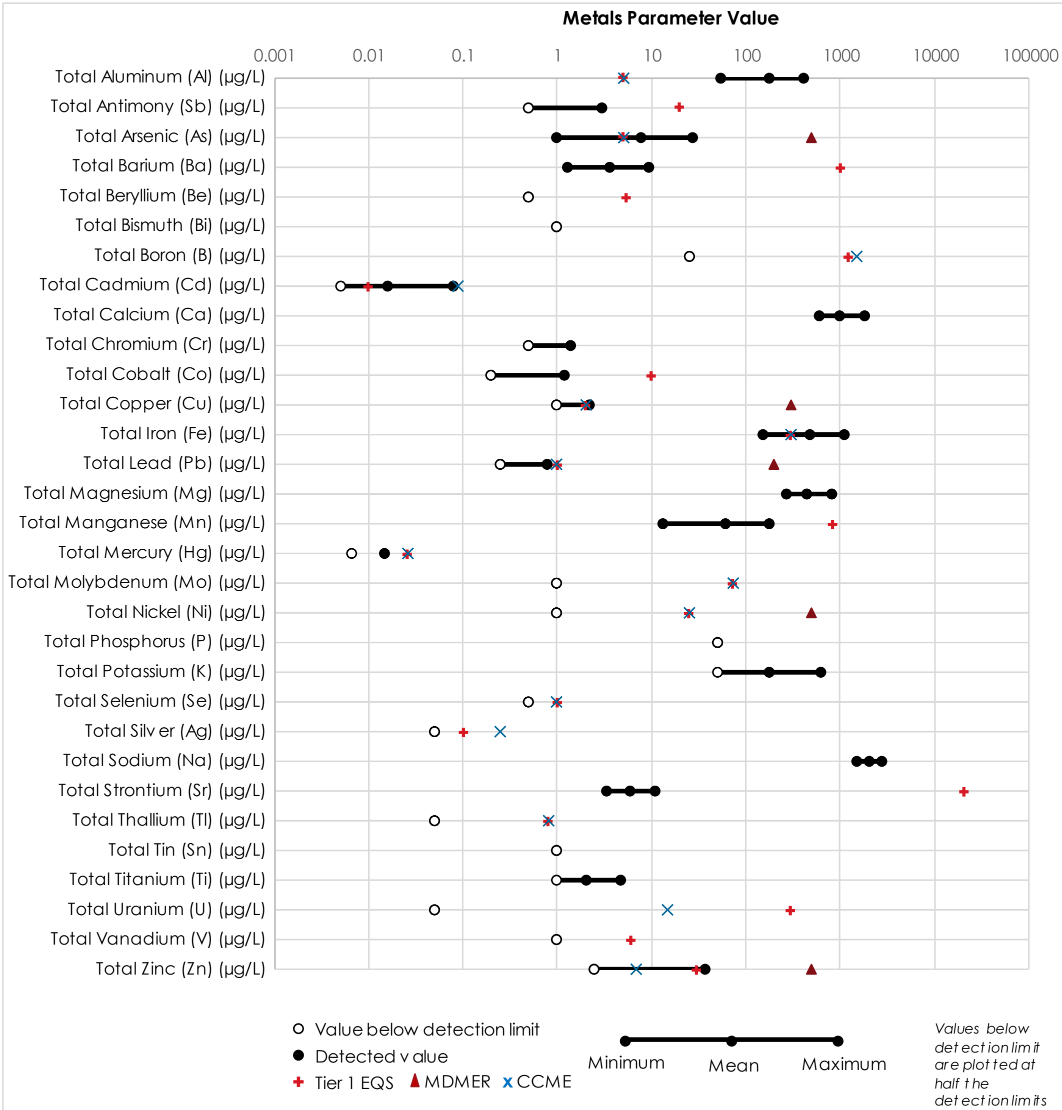

Figure 6.7-8 Background Water Quality at Touquoy - Metal Parameters

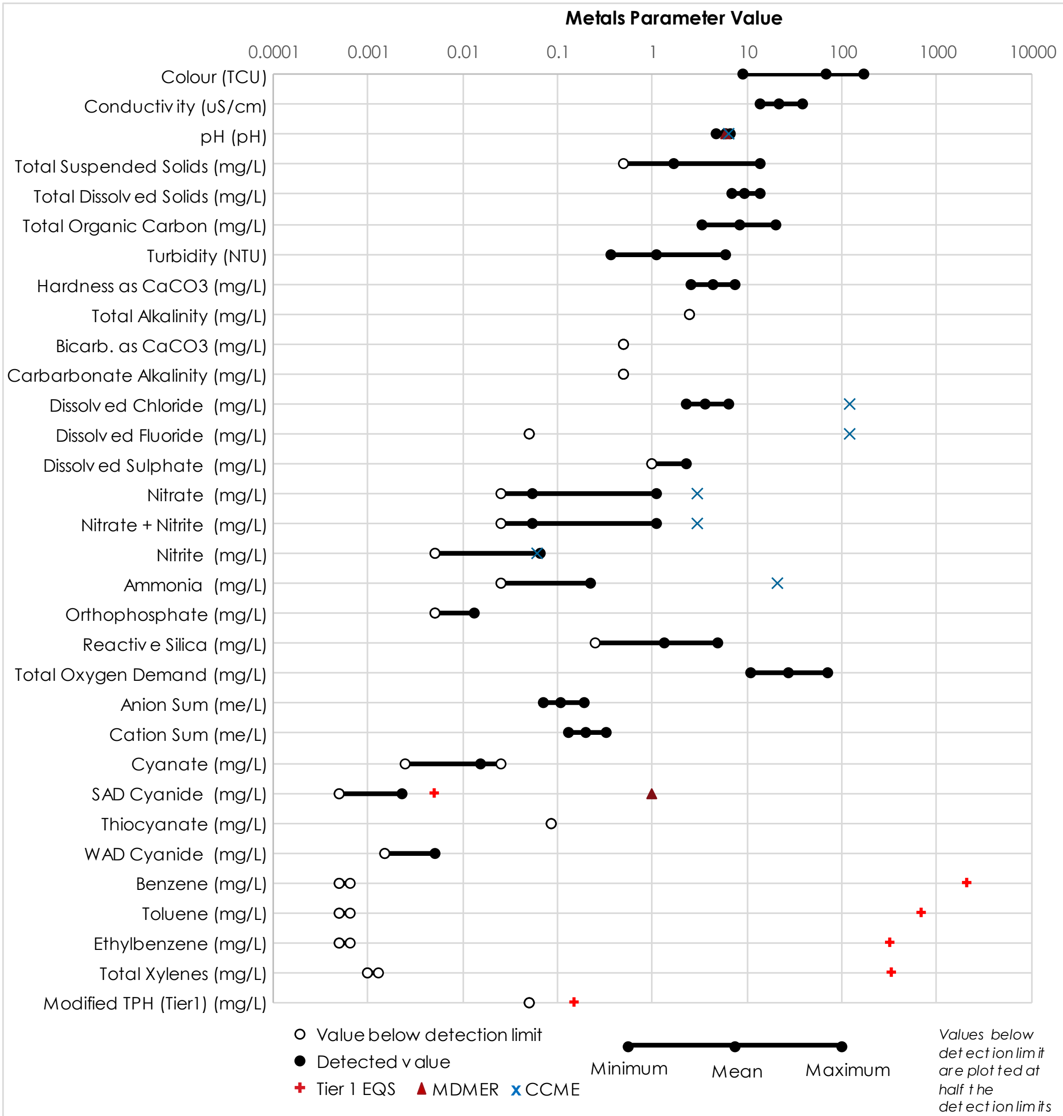

Figure 6.7-9 Background Water Quality at Touquoy – General Chemistry, Cyanide & Petroleum Hydrocarbons

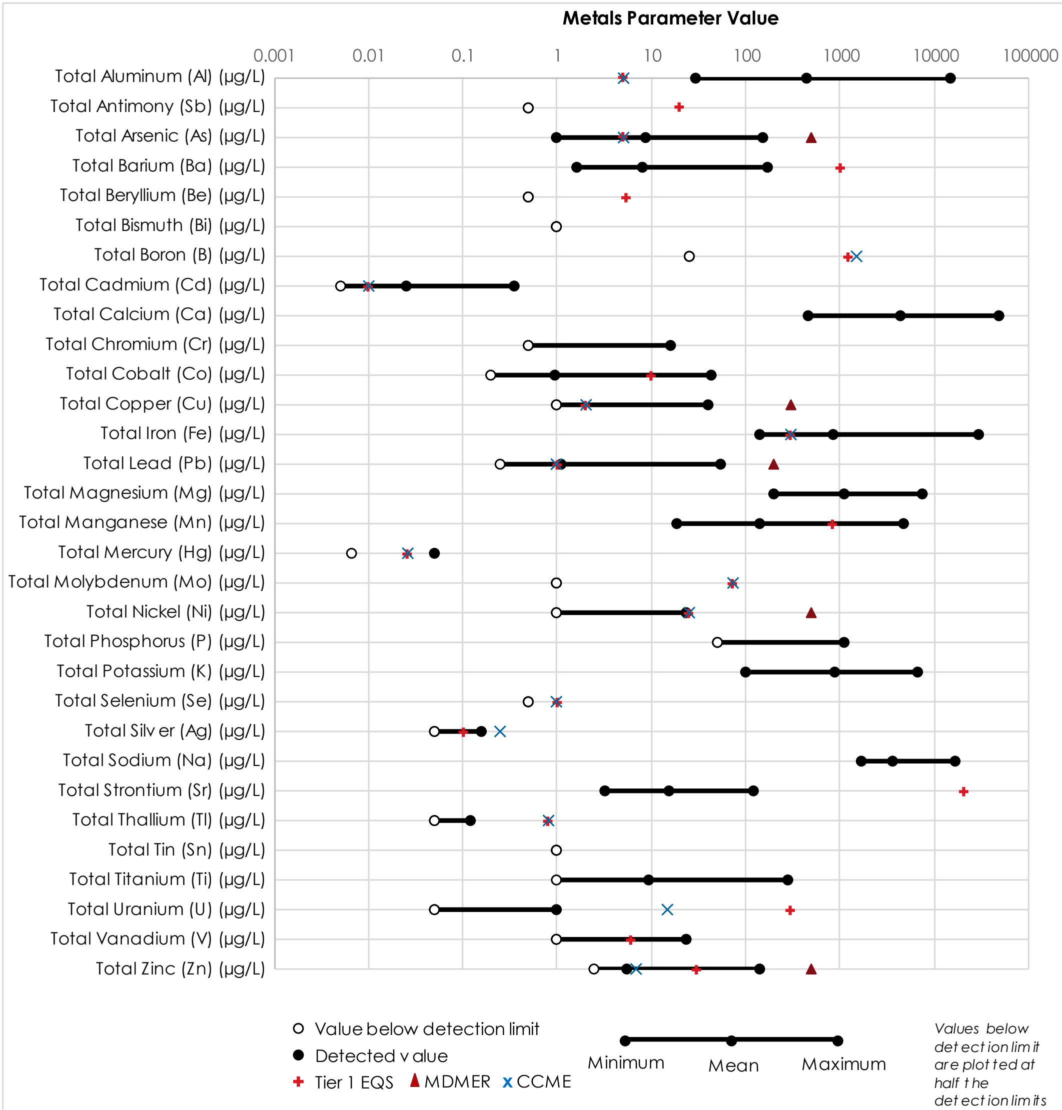

Figure 6.7-10 Downstream Water Quality at Touquoy – Metal Parameters

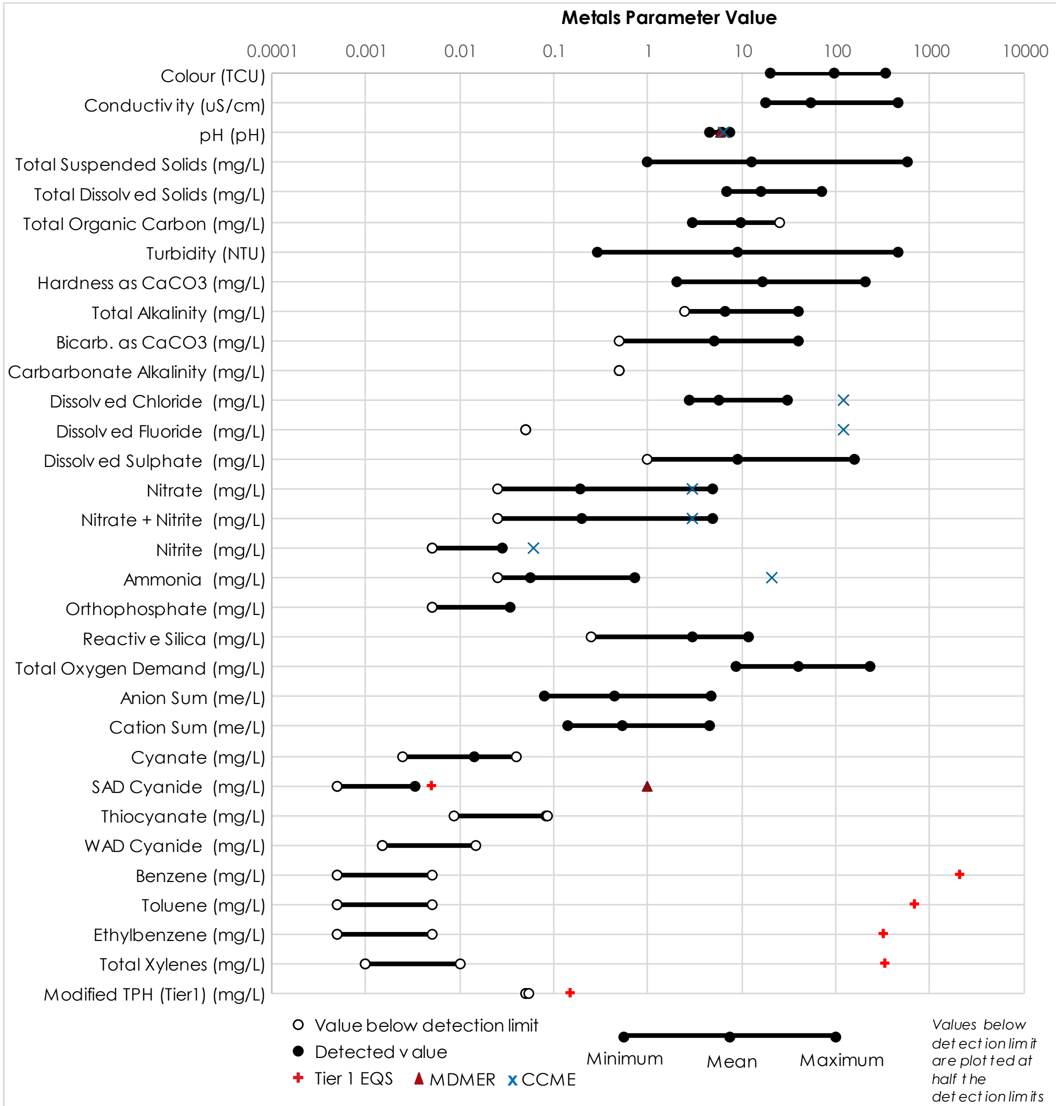

Figure 6.7-11 Downstream Surface Water Quality at Touquoy – General Chemistry, Metals and Petroleum Hydrocarbons

6.7.3.3 Surface Water Quantity

6.7.3.3.1 Beaver Dam Mine Site

The primary surface water drainage system through the Beaver Dam Mine Site flows northward from Crusher Lake to Mud Lake and then northeastward into Cameron Flowage that forms part of the Killag River. West Lake and Tait Lake, located northwest of the site, discharge into a series of tributaries that flow southward into Cameron Flowage. Several small, ephemeral tributaries of this water system are also present.

In addition to the major water system, a 16 ha headwater bog is located south/southeast of the Mine Site. The bog discharges south into streams, another wetland system, and into Tent Lake. There is also a surface water system that originates at an unnamed lake/wetland located south/southwest of the Mine Site that continues to flow south through Paul Brook and discharge into the West River Sheet Harbour.

A man-made pond with naturalized wetland habitat, was created when the previously blasted exploration decline was allowed to fill in. Approximately 80% of this pond is located in the proposed pit of the Mine Site. The pond discharges to Cameron Flowage through an open channel. There is potential for all surface water in this system to be impacted by the proposed works either directly or indirectly through facilitated pathways.

A water balance was undertaken to determine the amount of water surplus generated on the Mine Site in its existing, pre-development, conditions. The results can assist in the evaluation of water management options for site design by comparing pre to post-development water surplus values. Catchment area, precipitation and evaporation data and storage capacity for the Mine Site were acquired to complete the water balance calculations.

Catchment Delineations

The Mine Site was divided into three sub-catchment areas for the purpose of calculating the water balance. The Beaver Dam Mine Site ultimately discharges to two major water features including Cameron Flowage and Tent Lake. The baseline contributing drainage areas to Cameron Flowage and Tent Lake are approximately 3870 ha and 28 ha, respectively, at the outfalls of the Mine Site. The Mine Site and contributing drainage area to Cameron Flowage also encompasses the Mud Lake catchment area that is approximately 175 ha under baseline conditions. The Mine Site represents approximately 5% of the contributing drainage area to Cameron Flowage downstream of the PA.

The contributing drainage area to Mud Lake (approximately 175 ha) can be divided into two separate drainage areas. The larger of the two encompasses the flow (WC-5) to Mud Lake originating from Crusher Lake and its contributing drainage area (approximately 150 ha). The second drainage area (approximately 25 ha) encompasses the area adjacent to Cameron Flowage that flows north into the southeast corner of Mud Lake.

The contributing drainage areas were delineated using ArcHydro. ArcHydro is a geospatial and temporal data model for water resources, designed to operate within ArcGIS. The ArcHydro model is used to extract topological variables from a digital elevation model (DEM) such as flow direction, flow accumulation, stream definition, stream segmentation and as final result watershed delineation. The DEM for the Site was generated based on LiDAR data that was flown by Leading Edge Geomatics. The catchment areas were refined manually using contours generated from the LiDAR dataset.

Climate Data

Climate data for the water balance analysis was obtained from the Environment Canada Middle Musquodoboit climate station that is located approximately 25 km from the Mine Site. The station was selected for its long, continuous record that was collected between 1961 and 2010. Thirty year average climate conditions (climate normals) calculated for the 1981 to 2010 time period are provided in Table 6.7-10 to demonstrate the average climate characteristics of the site.

Table 6.7-10 Summary of Climate Norms for Station 8203535, Middle Musquodoboit, Nova Scotia (1981-2010)

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
Mean Temp (°C)	-6.2	-5.2	-1.3	4.4	9.9	14.8	18.5	18.4	14.2	8.5	3.5	-2.4	6.4
Mean Max Temp (°C)	-0.9	0.2	3.9	9.6	16.1	21.3	24.7	24.6	20.3	14	7.8	2.2	12.0
Mean Min Temp (°C)	-11.4	-10.6	-6.4	-0.9	3.7	8.3	12.2	12.2	7.9	2.9	-1	-7.1	0.8
Extreme Max Temp (°C)	16.5	17	26	28	33.3	33.9	34.5	35.6	33	26.7	23.5	15.6	-
Extreme Min Temp (°C)	-34	-33	-31	-15	-7.8	-3	1.1	-1.5	-4.5	-10.6	-21	-34	-

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Average Total Rain (mm)	80.4	62.1	92.8	99.5	104.9	99.8	103.8	91.9	110.7	116.7	128.6	97.2	1188.3
Average Total Snow (cm)	49.4	41.3	31.4	9.5	0.5	0	0	0	0	0	8.2	31.9	172.2
Average Total Precipitation (mm)	129.8	100.5	124.2	109	105.4	99.8	103.8	91.9	110.7	116.7	136.8	129.1	1357.6

Being somewhat inland, the Musquodoboit Valley's climate is still highly influenced by the Atlantic Ocean. Although winters are generally mild and summers are generally cool, the inland position of the region still creates some extreme temperature ranges within seasons. As shown in Table 6.7-10, the Middle Musquodoboit climate station recoded an average annual total precipitation of approximately 1350 mm over a 30 year period from 1981 to 2010; approximately 1,188 mm fell as rain, while 172 cm fell as snow.

Table 6.7-11 presents Depth Duration Frequency (DDF) rainfall data that is used to represent the design rainfall events at the Mine Site, which is taken from the Truro station (Climate ID 8205990) from Environment and Climate Change Canada Short Duration Rainfall Intensity-Duration–Frequency Data.

This station was selected based on its relative proximity to the site (approximately 38 km) and the long data record used for the estimation of the DDF data (21 years). The data in Table 6.7-11 represents the probability that a given average rainfall depth will occur within a given time period. This data is typically used for engineering design purposes.

Climate data for the Beaver Dam Mine Site also applies to the Haul Road and the Touquoy Mine Site.

Table 6.7-11 Depth Duration Frequency (DDF) Rainfall

Duration	Rainfall Depth (mm) and Frequency					
	1:2 Years	1:5 Years	1:10 Years	1:25 Years	1:50 Years	1:100 Years
5 minutes	5.2	6.8	7.8	9.2	10.2	11.2
10 minutes	8.2	10.7	12.3	14.4	16	17.5
15 minutes	10.1	13	14.9	17.4	19.2	21
30 minutes	13.8	18.5	21.7	25.6	28.5	31.5
1 hour	18.6	24.3	28	32.7	36.2	39.7
2 hours	25.2	33.2	38.6	45.3	50.3	55.2
6 hours	41.2	51.4	58.2	66.7	73	79.3
12 hours	48.8	60.2	67.8	77.3	84.4	91.4
24 hours	58.5	73.8	83.9	96.7	106.1	115.5

Evapotranspiration Potential

Evaporation describes the process of the return of moisture to the atmosphere from open water and land surfaces. Evaporation from plant surfaces is called evapotranspiration. The magnitude of evaporation or evapotranspiration over time is a function of the climate, soil, and the vegetation in the area. Evaporation rates tend to peak in the summer months when temperatures are highest, daylight hours are longest, sun intensity is greatest, and the growing season is at its peak. Potential evapotranspiration was calculated using the Hamon equation (1961), which requires average temperature and average hours of daylight as input. Average hours of daylight were calculated for Halifax, Nova Scotia using the Sunrise and Sunset Calculator (https://www.timeanddate.com/sun/, last accessed 6 November 2018). Average temperature values were obtained from the Middle Musquodoboit climate station. Table 6.7-12 provides a summary of the potential evapotranspiration rates used as a water loss parameter in the water balance assessment.

Table 6.7-12 Average Potential Evaporation per Year

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Potential Evapotranspiration (mm/day)	0	0	0	33	59	87	109	90	54	31	15	0	477

Runoff Volumes

Under baseline conditions, runoff volumes were calculated using the AWBM at a daily time step. The AWBM is used to calculate runoff depths based on the surplus of rainfall/snowmelt depths from the soil storage multiplied by the contributing drainage area. Rainfall and snowmelt depths are added to the soil storage as inputs, and potential evapotranspiration depths are subtracted from the soil storage as output. Actual evapotranspiration is equal to potential evapotranspiration when the available moisture within the soil store is sufficient to meet the evapotranspiration/energy demand. Otherwise, actual evapotranspiration is equal to the depth of water available in the soil storage.

Surplus, or runoff depth, is calculated as the excess water from the soil storage, after the capacity of the soil storage has been exceeded. Surplus is subsequently partitioned into surface runoff and baseflow recharge using a baseflow index (BFI). The BFI represents the fraction of surplus that recharges the baseflow storage, and (1-BFI) represents the fraction of the surplus that discharges as surface runoff. Baseflow is calculated using the baseflow recession constant (Kb). Baseflow is equal to (1-Kb) multiplied by the available water within the baseflow storage. Runoff depth is calculated as the sum of surface runoff and baseflow runoff. Runoff volumes are calculated for each catchment by multiplying the runoff depth by the corresponding contributing drainage area. Daily runoff volumes are summed into monthly and annual totals.

Mean Annual Runoff

Table 6.7-13 Average Evaporation Runoff Volume per Year

Catchment	Flows To	Definition of Qualitative Categories	
		Area (ha)	Mean Annual Runoff (m^3)
1	Cameron Flowage	3870	33,772,789
2	Mud Lake	175	1,535,244
3	Tent Lake	28	247,733

6.7.3.3.2 **Haul Road**

An initial assessment of the existing Haul Road identified 23 watercourse crossings: 20 culverts (smaller watercourses) and 3 timber bridges (watercourses 6 to 13 m in width). The bridges were considered to be in good condition. A large number of the culverts were poorly installed (i.e., buried, caved in, plugged, hung, not present, water flowing through the road base and not the culvert). The overall poor culvert conditions have contributed to localized poor surface water hydrology and obstructed fish passage.

There is a potential for all surface water systems along the Haul Road to be impacted by the proposed works. There is also an opportunity for improvement of the existing surface water conditions through proper sediment and erosion control measures during construction and maintenance, and properly designed, sized and installed culverts.

6.7.3.3.3 **Touquoy Mine Site**

As was completed for the Beaver Dam Mine Site, a water balance model of the exhausted Touquoy open pit was developed to simulate the quantity of runoff at the Touquoy Mine Site under existing conditions. The water balance model was developed through multiple iteration and revisions during design, construction, commissioning, and operation of the Touquoy Mine Site to improve accuracy. Model inputs accounted for groundwater inflows, surface runoff, direct precipitation, and open pit dewatering for Touquoy ore processing.

As described in more detail in Section 6.6.5 and the technical report (Stantec, 2018d), the water balance was refined to simulate the existing conditions (water quantity and water quality) at the end of Touquoy mine life and the start of processing Beaver dam ore. Model assumptions include:

- the TMF dam is at the maximum elevation of 130 m with an emergency spillway at 128.5 m in elevation
- the maximum tailings capacity in the Touquoy TMF is reached in April/May 2022 and the pond water level is at normal operating water level
- the Touquoy open pit is exhausted and empty
- the waste rock storage area is fully developed and reached the maximum capacity

The Touquoy Mine Site was divided into five sub-catchment areas based on the available LiDAR topography (Leading Edge 2013) and the water management at the site. The catchment areas for each of the mine facilities include the mill site (13.8 ha), TMF (94.0 ha), open pit (40.4 ha), waste rock area (55.1 ha), and polishing pond (16.9 ha).

Touquoy climate data is represented consistently with the Beaver Dam water balance model. As presented in Section 6.7.2, precipitation was based on the Environment and Climate Change Canada Middle Musquodoboit climate station (ID 8205990) and evaporation based on the Truro climate station (ID 8205990). The proportion of the precipitation that contributes to runoff collected in the open pit was estimated in the model through a runoff coefficient, with 100% of direct precipitation on the pond and 85% of precipitation as runoff on natural ground. Runoff from the waste rock storage area captured in the collection ponds is assumed to increase from 5% to 30% of precipitation by the end of Touquoy mine life.

The tailings pond is operated to manage water in the facility such that the tailings facility has adequate capacity at all times to store, route, or otherwise handle runoff from extreme precipitation events. Water enters the tailings pond as process water in the tailing's slurry, direct precipitation, and runoff from surrounding un-diverted catchments. Some of the water is lost in the tailings deposit as pore water in the tailings voids, and to evaporation and seepage. Water is recycled to the plant for reclaim use in the mill process. Water is discharged from the TMF to the effluent treatment pond at a maximum rate of 400 m^3/hr. Seepage from the TMF was assumed at 1336 m^3/d of that 200 m^3/d is captured in the polishing pond and 736 m^3/d is re-circulated to the TMF from the seepage collection ponds in the non-frozen months. Process and tailings parameters assumed for the tailings pond water balance are presented in Table 6.7-14.

The existing Touquoy open pit is dewatered from a pond constructed in the pit and pumped to the TMF. Process water is reclaimed through a floating barge and associated pipeline from the TMF to the mill of operation, as required. Freshwater make-up is pumped from Scraggy Lake under an existing surface water withdrawal permit, which is also the receiving waterbody for the mine effluent discharge. Based on the results of the water balance model under climate normal conditions, the TMF is decant in the wet months of April and May at a total volume of 500,000 m3 and finally to Scraggy Lake.

Table 6.7-14 Process and Tailings Parameters

Item	Value	Unit
Process		
Milling rate	6,400	t/d
Resources mass (ore to mill)	9,300,000	t
Ore/tailings ratio [1]	1	-
Tailings mass	9,300,000	t
Deposition method	Sub-aerial spigot/end spill	-
Slurry discharge rate (water volume)	9,022	m^3/d
Tailings water reclaim rate	8,379	m^3/d
Mill freshwater make-up	521.5	m^3/d
Tailings[2]		
Slurry solids fraction of tailings discharged	41	%
Specific gravity (ore) (density of water/density of ore)	2.83	-
Void ratio (Volume of voids/volume of solids)	0.90-0.96	-
Deposited dry density (historical results)	1.49	T/m^3

Note:

1 Concentration of gold ore is negligible in comparison to the resultant tailings volume.

2 Tailings values may change by stage and the values presented reflect a conservative estimate.

This section has described baseline conditions for the Beaver Dam Project, including water quality and quantity pre-development (baseline) conditions for the Beaver Dam Mine Site, the Haul Road, and the Touquoy Mine Site.

6.7.4 Consideration of Consultation and Engagement Results

Key issues raised during public consultation and Mi'kmaq engagement relating to surface water quality and quantity include potential effect from ARD, suspended solids and leached metals from the Beaver Dam Mine Site activities. Potential effects on the quantity of surface water near the Beaver Dam pit were noted, specifically potential effects on water levels in Cameron Flowage. Concerns were identified related to effects on surface waters along the Haul Road, specifically during construction activities, including River Lake, a segment of the West River Sheet Harbour, near the Beaver Lake IR 17. At the Touquoy Mine Site, questions arose about potential effects on Moose River from placement of tailings in the mined out pit.

Questions were identified on potential effects on receiving waters in the event of unplanned releases due to accidents and malfunctions, specifically during operations. Potential effects on traditional uses of land and resources by the Mi'kmaq were noted, including importance of clean water to support the natural environment, including fish, flora, fauna and drinking water.

The results of the public consultation and Mi'kmaq engagement have been considered in the environmental effects assessment, including the Proponent's commitments to mitigation and monitoring measures and proposed compliance and effects monitoring programs, as well as the Proponent's broader commitment to ongoing public consultation and Mi'kmaq engagement. Specific to evaluating the effect on surface water quality and quantity, these commitments are described within the following environmental effects assessment.

6.7.5 Effects Assessment Methodology

This section describes the boundaries of the effects assessment, the quantitative modelling methods for both surface water quality and quantity predictions for the Beaver Dam Mine Site, and the Touquoy Mine Site, and the thresholds for determination of significance for both surface water quality potential effects and surface water quantity potential effects of the Project.

6.7.5.1 Boundaries

Spatial Boundaries

The spatial boundaries used for the assessment of effects to surface water quality and quantity are defined below:

The PA encompasses three primary components from Marinette to Moose River Gold Mines, Halifax County, NS. The Beaver Dam Mine Site will be located at the end of the Beaver Dam Mines Road and the Haul Road will span from the Beaver Dam Mine Site to Moose River Gold Mines, where the Touquoy Mine Site [processing and exhausted pit (to be used to dispose Beaver Dam tailings)] is located.

The LAA encompasses portions of downstream aquatic habitats and headwaters where appropriate, depending on project activities, up to the maximum size of the tertiary watershed(s). The LAA is defined as such, as this includes the maximum expected extent of project direct and indirect impacts to the aquatic environment, considering project activities across all three components of the Beaver Dam Project (Figure 6.7-12).

The RAA in the context of surface water quality and quantity encompasses Secondary Watersheds (West River Sheet Harbour, Tangier River, and Fish River). The RAA aims to account for broader than expected project impacts; considering other project boundaries as per cumulative effects methodology (Figure 6.7-13).

As the Project has the potential to cause direct and indirect effects to surface water quality and quantity outside of the PA, the LAA is the appropriate boundary for evaluation of this VC.

Temporal Boundaries

The temporal boundaries used for the assessment of effects to surface water quality and quantity are the construction phase, operational phase, reclamation and decommissioning, and post closure phases.

Technical Boundaries

No technical boundaries were identified for the effects assessment of surface water quality and quantity.

Administrative Boundaries

The Beaver Dam Mine Project is subject to the MDMER criteria at the point(s) of discharge. For this project, three discharge points are planned that are expected to be subject to MDMER:

- During operations, discharge from the North Settling Pond to the Cameron Flowage (Killag River) at the Beaver Dam Mine Site;
- During closure, discharge from the pit to the Cameron Flowage (Killag River) at the Beaver Dam Mine Site; and,
- During closure, discharge from the pit to the Moose River at the Touquoy Mine Site.

CCME FWAL guidelines, NSE Tier I criteria and established background concentrations for each river will be applied in the receiving environment (Cameron Flowage and Moose River) and watercourses along the Haul Road, such that aquatic habitat is maintained. Furthermore, the site specific criteria established by Intrinsik (Appendix G.4) will also be applied for Arsenic in both the Killag and Moose Rivers.

Water quantity effects will be evaluated against current established baseline flow conditions in the receiving environments.

There may be other criteria for surface water discharges through provincial approvals to be obtained prior to the start of the Project.

Administrative boundaries that must be considered with respect to surface water quantity component of the Project include: (i) the *Fisheries Act* (DFO); and (ii) Activities Designation Regulations of the *Environment Act* (NSE). Any physical activities in wetlands, watercourses or waterbodies may require authorization in accordance with the *Fisheries Act*. The Activities Designation Regulations section of the Environment Act requires water approvals and/or notification of water withdrawal, alteration of waterbodies, watercourses and/or wetlands.

Other guidelines regarding surface water quantity that should be considered for Site design, construction, operation and reclamation phases are:

- Erosion Sediment Control Handbook for Construction Sites (NSE, 1988)
- Guide to Altering Watercourses (NSE, 2015a)
- Nova Scotia Watercourse Alterations (NSE, 2015b)
- Storm Drainage Works Approval Policy (NSE, 2002a)

There are several existing Touquoy management plans that can also be reviewed and utilized to support operations for the Beaver Dam Project including:

- Erosion and Sedimentation Control Plan
- Surface Water Management Plan
- Operation, Maintenance, Surveillance Manual
- Emergency Preparedness Plan

6.7.5.2 Surface Water Modelling at Beaver Dam Mine Site

6.7.5.2.1 Surface Water Quality at Beaver Dam Mine Site

A predictive water quality assessment was developed for two life cycle stages of the Beaver Dam Mine Site development, including End-Of-Mine (EOM) and Post-Closure (PC). For each life cycle stage, the potential effects of mine contact water to the water quality in the Killag River was assessed under base case (median) and upper case (90th percentile) concentration scenarios. The objective of the Beaver Dam water quality model is to predict the water treatment requirements prior to effluent discharge to the Killag River.

The predictive water quality assessment was calculated on a monthly basis for the average year climatic conditions. Performing the water quality assessment on a monthly basis allows for the prediction of the seasonality characteristics of water quality in the Killag River. This allows for the assessment of the wet and dry months to determine the month with the highest potential impacts on the water quality in the Killag River and will assist with the design of water quality treatment options at the Project Site. A detailed summary of the predictive water quality assessment is provided in Appendix G.3.

To determine the concentration of each constituent of concern in the site effluent, the geochemistry of each stockpile (till, waste rock, low grade ore) and the pit wall rock were assessed individually by Lorax Environmental (Lorax Environmental, 2018). This assessment established both the base case and the upper case scenarios of constituent concentrations for EOM and PC mine life cycle conditions. Base case conditions represent the most likely concentration scenario (median) while upper case conditions represent the likely worst-case (90th percentile) concentration scenario.

For the EOM conditions, the source term model assumed the following:

- The waste rock piles have reached their maximum height but remain uncovered and unrestored
- The low grade ore stockpiles have an area of 25,000 m2 and remain uncovered and unrestored
- The pit is constantly being dewatered and discharged into the North Settling Pond
- Standard erosion and sediment control measures have been implemented on the soil and till piles

For the PC conditions, the source term model assumed the following:

- Waste rock stockpiles have been covered with soil and seeded
- The low grade ore stockpile has been removed from the Project Site and processed at the Touquoy site
- The pit has been allowed to naturally fill with water to an elevation of 127 m
- All site water will drain to the pit prior to discharge into the river
- Other than what is mentioned above no other reclamation activities have been implemented at the Project Site

The predictive water quality assessment incorporated mine impacted groundwater recharge into the surface water ditches and the Killag River. Concentrations of constituents of concern and discharge volumes were taken from GHD’s groundwater model for the Beaver Dam Mine Site (GHD, 2019b).

During the operational phase of the open pit, dewatering will have to occur since the natural groundwater table is above the mining elevation. During EOM conditions, the precipitation that fell into the pit was assumed to contact the freshly exposed pit walls causing the release of the weathering products, in particular those related to sulphide oxidation (Lorax Environmental, 2018). Groundwater inflows are expected to contain constituents of concern equal to the background groundwater monitoring concentration levels. Average measured groundwater concentrations were used for the base case scenario while maximum measured groundwater concentrations were used for the upper case scenario. During PC conditions, the direct precipitation into the pit is assumed clean as it will fall directly onto the lake, which has formed in the pit. Groundwater inputs are assumed to remain at background concentrations during PC.

6.7.5.2.2 Surface Water Quantity at Beaver Dam Mine Site

A water balance analysis for three life-cycle stages of the Beaver Dam Mine development including baseline, End-of-Mine (EOM), and Post-Closure (PC) stages was completed to estimate the potential impacts to the receiving water bodies. The objective of the water balance analysis is to assess the short and long-term impacts of the Project on the receiving environment. Monthly and annual total runoff volumes are compared between the three mine life-cycle stages (baseline, EOM and PC) at two discharge points including Tent Lake, and the Killag River.

The WBM was developed using the GoldSim software. GoldSim is a highly graphical program used for carrying out dynamic, probabilistic simulations to support decision making. GoldSim is especially well-suited to simulating dynamic, computationally intensive, but well-defined network models such as a water balance. GoldSim permits inputs to be entered as probability distributions, performs Monte Carlo simulations, tracks outputs from those simulations, and provides a graphic interface to facilitate the review and identification of interactions between system components.

Average daily temperature values and daily precipitation totals were obtained from the Environment Canada Middle Musquodoboit Climate Station (Climate ID 8203535) from 1961 to 2017. The station was selected based on its proximity to the Project Site, and relatively long and current record. Total monthly precipitation and monthly average temperatures were derived from the daily records and used in the analysis. Average daily temperature and total daily precipitation are modelled stochastically. Temperature data is included in the WBM to partition precipitation into rainfall and snowfall, and to simulate the snowmelt process. Precipitation data is included in the WBM as a key water balance input. Average daily temperatures are modelled using a normal distribution.

Monthly lake evaporation normals were obtained from the Environment Canada Truro Station (Climate ID 8205990). The Truro station is the closest climate station to the Project Site that collects lake evaporation data. Monthly potential evapotranspiration normals were calculated using the Hamon equation (1961). The Hamon equation requires monthly average hours of daylight and monthly average temperature as input. Monthly average hours of daylight were calculated for Halifax, Nova Scotia using the Sunrise and Sunset Calculator (https://www.timeanddate.com/sun/, last accessed 6 November 2018). Monthly average temperature values were obtained from the Environment Canada Middle Musquodoboit Station. Lake evaporation and potential evapotranspiration normals are input as constant and discrete values to the WBM.

6.7.5.3 Surface Water Modelling at Touquoy

6.7.5.3.1 Surface Water Quality at Touquoy

Monthly water quality model (Stantec 2018d) in the exhausted Touquoy open pit was developed to simulate the overall water quality of metal parameters and nitrogen species including cyanide, ammonia, nitrate, and nitrite in operation and post closure. The objectives of the Touquoy water quality model are to predict the period of time that water treatment will be required prior to the pit lake effluent discharge to

Moose River, and the water quality of effluent discharge to Moose River at biological monitoring stations in place to assess environmental effects.

Water quality modelling considered the pore water quality in the tailings and the groundwater inflow quality in the pit floor/ walls, dilution from surface runoff, direct precipitation, and process water surplus, and the geochemistry of the individual water quality parameters. As discussed in source terms memo (Lorax 2018), the pore water quality in the tailings and pit walls/floor was based on geochemical source term predictions that were derived from upscaling of kinetic tests and Touquoy monitoring data. The kinetic test and Touquoy monitoring data are considered representative for Beaver Dam ore processing as the Beaver Dam and Touquoy pits mine ore from the same geologic formation with similar sulphur content and Beaver Dam ore processing and cyanide detoxification in the Touquoy mill will follow the same general approach as the Touquoy ore processing. These source terms were coupled with the inflow rates for the various components of inflow to the Touquoy pit and mixed to predict the water quality in the pit over time. The volume in the pit increased until discharge was predicted to occur in Beaver Dam Mine Year 7. Further details of the modelling can be found in the water and tailings management plan (Appendix G.2, Stantec 2018d).

As summarized in the assimilative capacity study of Moose River (Appendix G.6, Stantec 2018f), a CORMIX (Doneker & Jirka 2017) mixing zone model was run in to predict the length of Moose River until full mixing is achieved. Based on mass balance, water quality in Moose River is a result of the climate-driven effluent discharge and the continuous seepage input from the pit lake at the post closure phase. Several climate statistics were run to identify the worst-case dilution ratio between effluent discharge and flow volume in Moose River that would result in the highest metal and nitrogen species concentrations at the MDMER biological monitoring stations located at 100 m and 200 m downstream of the effluent discharge point. As full mixing of discharge effluent in Moose River is achieved in less than 30 m downstream of the discharge point, water quality was predicted for only 100 m downstream, assuming 200 m downstream has similar or better water quality. Effluent discharge water quality from the pit lake was assumed to meet MDMER discharge criteria for an existing mine in 2021 prior to discharge to Moose River. Operational plans are in place so that effluent not meeting criteria would either be further treated or pumped to the existing Touquoy effluent treatment plant for treatment prior to discharge to the downstream Touquoy discharge facilities and finally Scraggy Lake.

6.7.5.3.2 **Surface Water Quantity at Touquoy**

The existing conditions water balance model at Touquoy was extended to simulate the overall operational water management of Beaver Dam ore processing at Touquoy, as part of a water and tailings management (exhausted pit) plan. The Touquoy water balance model simulates the water surplus in the open pit from both groundwater inflows, surface runoff, direct precipitation and slurry discharge and the estimated time to fill the pit under various climate scenarios. Water quality was assigned to each of the inputs to simulate the monthly water quality and the gradual improvement overtime until effluent discharge from the pit lake. The main objective of the water balance model is to assess the water quantity changes associated with PA activities during operation, reclamation, and closure of the Beaver Dam ore processing.

Model inputs are consistent with the Touquoy operation with the exception of the following changes to the existing Touquoy water model scenario to account for Beaver Dam ore processing:

- processing Beaver dam ore at the existing Touquoy mill
- the exhausted open pit used as a tailing’s management facility assuming an average deposited dry density of 1.3 t/m³ for subaqueous tailings deposition

- process water decant from the existing Touquoy TMF during start-up until pond volumes are depleted
- existing decant barge relocated to exhausted open pit for reclaim throughout the remainder of operation
- natural filling of the open pit over time to create a pit lake overtop of the tailings
- groundwater inflow to the pit consistent at 450 m³/day but decreasing to 250 m³/d when water elev. is at 104 m or higher
- an emergency spillway in the open pit at the crest elevation of 108 m to prevent overtopping and a conveyance channel to Moose River
- effluent treatment as a batch reactor in the open pit
- effluent further treated or pumped and treated at the existing effluent treatment plant for treatment and discharged to the downstream treatment facilities and Scraggy Lake receiving environment

6.7.5.4 Aquatic Effects Assessment

Receiving Environment Characterization

To conduct the aquatic effects assessment, the receiving environment was characterized, based on available baseline data and descriptive text characterizing the receiving environments.

Exposure Assessment

To conduct the exposure assessment related to possible future concentrations of metals and other substances in the receiving environment, the predictive water quality modelling conducted by GHD (2019a) and Stantec (2018a) were used to characterize potential future receiving environment chemistry, as a result of mine-related emissions to either of the two environments, over various time frames.

Toxicity Assessment

Water quality guidelines used in the assessment are selected from the CCME water quality guidelines for the protection of aquatic life (CCME 2018) and the Nova Scotia Tier 1 surface water guidelines for use in freshwater (NSE 2014; many of which are based on CCME). For the selection of guidelines, the Nova Scotia Tier 1 surface water guidelines were given precedent over the CCME water quality guidelines, with the exception of the following cases:

- the Nova Scotia Tier 1 guidelines have not accounted for site-specific toxicity modifying factors (i.e., pH, hardness); or,
- the CCME provides a more updated water quality guideline.

In these cases, the CCME guideline was selected over the Nova Scotia Tier 1 guideline.

Table 6.7-15 presents the CCME and Nova Scotia Tier 1 water quality guidelines along with the selected guideline for each chemical. Where water quality varies between the Killag River and Moose River, the modified guidelines for each site are presented. The chemicals presented in Table 6.7-15 are based on the metals or substances considered in the predictive modelling for the Killag River (GHD, 2019a) or Moose River (Stantec, 2018a). Not all chemicals are assessed in both receiving environments. Only those chemicals considered in each of the modelling efforts are carried into the assessment of potential for aquatic effects. For example, cyanide treatment is only conducted at the Touquoy site, and hence, cyanide did not merit assessment in Killag River, but was assessed in Moose River. For the specific compounds assessed in the two receiving environments, see Section 3.0 (Killag River) and Section 4.0 (Moose River) of the Appendix G.4.

Table 6.7-15 Selected Water Quality Guidelines for Use in the Aquatic Effects Assessment

Chemical	CCME (µg/L)	Nova Scotia Tier 1 (µg/L)	Selected Guideline	Regulation
Silver	0.25	0.1	0.25	CCME
Aluminium	5/100[a]	5	5	Nova Scotia Tier 1
Antimony	NV	20	20	Nova Scotia Tier 1
Arsenic	5	5	5	Nova Scotia Tier 1
Cadmium	0.04/0.09[b]	0.01	0.04	CCME
Chromium	8.9[c]	1[d]	8.9	CCME
Cobalt	NV	10	10	Nova Scotia Tier 1
Copper	2/4[e]	2	2	Nova Scotia Tier 1
Iron	300	300	300	Nova Scotia Tier 1
Mercury	0.026	0.026	0.026	Nova Scotia Tier 1
Manganese	NV	820	820	Nova Scotia Tier 1
Molybdenum	73	73	73	Nova Scotia Tier 1
Nickel	25	25	25	Nova Scotia Tier 1
Lead	1/7[f]	1	1	Nova Scotia Tier 1
Selenium	1	1	1	Nova Scotia Tier 1
Sulphate	NG	NG	128,000[g]	BC MOE
Thallium	0.8	0.8	0.8	Nova Scotia Tier 1
Uranium	15	300	15	CCME
Zinc	7	30	7	CCME
WAD Cyanide	5	5	5	Nova Scotia Tier 1
Total Cyanide (based on Strong Acid Dissociated)	NG	NG	5[h]	CCME
Nitrite (as N)	NG	60	60	CCME

Chemical	CCME (µg/L)	Nova Scotia Tier 1 (µg/L)	Selected Guideline	Regulation
Total Ammonia - N	NG	Varies with pH and temperature	Varies with pH and temperature	CCME

Notes: NG = No guideline available from that agency

a The CCME water quality guideline for aluminum of 5 µg/L is for pH<6.5, and 100 µg/L is for pH ≥6.5. The background pH of the Killag River is 4.59 and 6; and mean pH of Moose River is 6.05; therefore, the guideline of 5 µg/L is appropriate for use at both sites.

b The CCME water quality guideline for cadmium of 0.04 µg/L is for water hardness >0 to <17 mg/L, and 0.09 µg/L is for water of 50 mg/L hardness. The background water hardness of the Killag River is between 1.6 and 5.5 mg/L $CaCO_3$; and the mean hardness of Moose River is 5.0 mg/L; therefore, the guideline of 0.04 µg/L is appropriate for use at both sites.

c Based on Cr^{3+}; this value was selected as $Cr^{6=}$ is unlikely to be present in the receiving environment

d Based on Cr^{6+}

e The CCME water quality guideline for copper of 2 µg/L is for water hardness of 0 to <82 mg/L or when the hardness is unknown. When the hardness is >82 to ≤180 mg/L, the following equation is used to calculate the guideline: CWQG (µg/L) = 0.2 * $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$, and at a hardness >180 mg/L, the guideline is 4 µg/L. The background water hardness of the Killag River is between 1.6 and 5.5 mg/L $CaCO_3$ and the mean hardness of Moose River is 5.0 mg/L; therefore, the guideline of 2 µg/L is appropriate for use at both sites.

f The CCME water quality guideline for lead of 1 µg/L is for water hardness of 0 to ≤60 mg/L or when the hardness is unknown. When the hardness is >60 to ≤180 mg/L, the following equation is used to calculate the guideline: CWQG (µg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$, and at a hardness >180 mg/L, the guideline is 7 µg/L. The background water hardness of the Killag River is between 1.6 and 5.5 mg/L $CaCO_3$ and the mean hardness in Moose River is 5.0 mg/L; therefore, the guideline of 1 µg/L is appropriate for use at both sites.

g No CCME or NS Tier 1 guideline is available; therefore a guideline from BC Moe was used (https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/approved-wqgs/wqg_summary_aquaticlife_wildlife_agri.pdf)

h This guideline is for free CN, and hence does not apply to Total CN. It is used to provide perspective only in the effects assessment.

Where substances were found to exceed the selected guideline, and the 75th percentile of baseline, consideration was given to developing a Site Specific Water Quality Objective (SSWQO), following CCME guidance (CCME, 2007). The typical starting points for assessment of surface water data are Canadian Water Quality Guidelines for Protection of Freshwater Aquatic Life (WQGI - FWAL), established by the Canadian Council of Ministers of the Environment (CCME). These guidelines are generic, national recommendations which reflect the most current scientific data at the time they were developed. They are intended to provide protection to all forms of aquatic life and aquatic life cycles, including the most sensitive life stages, at all locations across Canada (CCME, 2007). Since they are generic and do not always account for site-specific factors that can alter toxicity, these national guidelines can be modified using widely accepted procedures, to derive site-adapted or SSWQOs for a given project or location (CCME, 2003). Modifications to the generic guidelines allow for protection of aquatic species accounting for specific conditions in the receiving environment, primarily due to the following reasons (CCME, 2003):

- There may be naturally-occurring levels of substances that are above the generic guidelines. This is commonplace for metals and metalloids near areas of natural enrichment, such as mines.
- There may be certain characteristics of the water at a specific location or site which modify the toxicity of the substance, such that the generic guideline is unnecessarily conservative (protective). These characteristics are known as exposure and toxicity modifying factors (ETMFs), and can include parameters such as pH, temperature, hardness, and organic matter, amongst others (CCME, 2007).
- There may be certain sensitive species considered in the development of the generic guideline which are not present in the area under assessment (e.g., warm water species which are absent from northern environments), and removal of these data allows for a more site-specific guideline to be developed, without compromising protection. In addition, information on toxicity of the substance in

question to resident species in the area of interest may be lacking in the existing database, and therefore, there may be interest in expanding the database to include site-specific toxicity data. Or, the existing CCME guideline may be dated and hence, application of more advanced protocols and available data can result in a revised guideline, which is more representative of current scientific practice and available toxicity data.

Based on consideration of all the available information, a revised SSWQO was derived for arsenic, following CCME protocols (CCME, 2007). A SSWQO consistent with CCME (2007) guidance, using a species sensitivity distribution (SSD) approach was used to derive the SSWQO. The SSD approach was comprised of identifying chronic toxicity data for species, analyzing the data using a regression approach and selecting the final chronic effects benchmark. The HC5 (i.e., the concentration that is hazardous to no more than 5% of a species in the community) was selected as the final chronic effects benchmark as per CCME (2007) guidance. The resultant guideline using the protocol is 30 µg/L. The details related to the SSWQO for arsenic are provided in Appendix G-4.

6.7.5.5 Thresholds for Determination of Significance

Surface Water Quality

A significant adverse effect to surface water quality within the Beaver Dam and Touquoy Mine Sites is defined as a repeated or sustained exceedance of the MDMER criteria at the point of discharge from each Mine Site, and the CCME FWAL criteria, confirmed background concentrations, or site specific established criteria for TSS, and metals (especially Arsenic), in surface water samples collected in situ from the receiving environments (Killag or Moose River).

BTEX/TPH will also be monitored in case of accidental events. CCME FWAL guidelines for BTEX/TPH are as follows; Benzene – 370 µg/L, Toulene – 2.0 µg/L, Ethylbenzene – 90 µg/L. Surface water quality within the mine sites will also consider pH, which should fall between 6.5 – 9.0 according to the CCME FWAL water quality guidelines. In terms of the Touquoy Mine Site, surface water quality will consider all substances in processing that are defined in the current, and any future, IA.

Schedule 4 consists of limits for existing mining operations and new mining operations (as of June 1, 2021). Table 6.7-16 and Table 6.7-17 list these limits.

Table 6.7-16 2021 Schedule 4 Limits of the Metal and Diamond Mining Effluent Regulations (existing mines)

Deleterious Substance	Maximum Authorized Monthly Mean Concentration	Maximum Authorized Concentration in a Composite Sample	Maximum Authorized Concentration in a Grab Sample
Arsenic	0.30 mg/L	0.45 mg/L	0.60 mg/L
Copper	0.30 mg/L	0.45 mg/L	0.60 mg/L
Cyanide	0.5 mg/L	0.75 mg/L	1.00 mg/L
Lead	0.10 mg/L	0.15mg/L	0.20 mg/L
Nickel	0.50 mg/L	0.75 mg/L	1.00 mg/L
Zinc	0.50 mg/L	0.75 mg/L	1.00 mg/L

Deleterious Substance	Maximum Authorized Monthly Mean Concentration	Maximum Authorized Concentration in a Composite Sample	Maximum Authorized Concentration in a Grab Sample
Total Suspended Solids	15.00 mg/L	22.50 mg/L	30.00 mg/L
Radium 226	0.37 Bq/L	0.74 Bq/L	1.11 Bq/L
Un-ionized ammonia, as Nitrogen	0.50 mg/L	NA	1.00 mg/L

Table 6.7-17 2021 Schedule 4 Limits of the Metal and Diamond Mining Effluent Regulations for a new Mine Site (at Beaver Dam)

Deleterious Substance	Maximum Authorized Monthly Mean Concentration	Maximum Authorized Concentration in a Composite Sample	Maximum Authorized Concentration in a Grab Sample
Arsenic	0.10 mg/L	0.15 mg/L	0.20 mg/L
Copper	0.10 mg/L	0.15 mg/L	0.20 mg/L
Cyanide	0.50 mg/L	0.75 mg/L	1.00 mg/L
Lead	0.08 mg/L	0.12mg/L	0.16 mg/L
Nickel	0.25 mg/L	0.38 mg/L	0.50 mg/L
Zinc	0.40 mg/L	0.60 mg/L	0.80 mg/L
Total Suspended Solids	15.00 mg/L	22.50 mg/L	30.00 mg/L
Radium 226	0.37 Bq/L	0.74 Bq/L	1.11 Bq/L
Un-ionized ammonia, as Nitrogen	0.50 mg/L	NA	1.00 mg/L

A significant adverse effect to surface water quality along the Haul Road is defined as a repeated or sustained exceedance of the CCME FWAL criteria for Total Suspended Solids (TSS) in surface water samples collected in situ. In addition, surface water quality along the Haul Road will also consider BTEX/TPH, in case of trucking accidents or malfunctions. The CCME FWAL criteria for TSS are as follows:

- Clear Flow: maximum increase of 25 mg/L from background levels for any short-term exposure (e.g. 24-hour period). Maximum average increase of 5 mg/L from background levels for longer term exposure (e.g. inputs lasting between 24 hours and 30 days);
- High Flow: maximum increase of 25 mg/L from background levels at any time when background levels are between 25 and 250 mg/L should not increase more than 10% of background levels when background is ≥ 250 mg/L.

Should a release resulting in contamination to surface water occur, the Nova Scotia Contaminated Sites Regulations – Tier 1 Environmental Quality Standards for the Protection of Freshwater Aquatic Life in Surface Water (NSE 2014), Section 1, Table 3 is applicable.

Surface Water Quantity

During site development, the Cameron Flowage, Mud Lake, and Tent Lake catchment areas will be altered, impacting the runoff volume discharging to these water bodies on an annual basis. A significant impact to water quantity is defined as a major adjustment in river geomorphology or increased risk to downstream key infrastructure (Lime Dosing Station, bridges, culverts, structures etc).

6.7.6 Project Activities and Surface Water Interactions and Effects

Potential interaction between Project activities and surface water quality and quantity within the PA is outlined in Tables 6.7-18 to 6.7-20 below. Potential effects, as predicted through quantitative modelling, are described in detail in associated sub-sections of this section for the Beaver Dam Mine Site, the Haul Road and the Touquoy Mine Site.

Table 6.7-18 Potential Surface Water Interactions with Project Activities at Beaver Dam Mine Site

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Rock blasting in preparation of construction • Till and waste rock from site preparation transport and storage • Existing settling pond dewatering in preparation of construction • Watercourse and wetland alteration in preparation of construction • Mine Site road construction • Surface infrastructure installation and construction • Collection and settling pond construction
Operation and Maintenance	3-4 years	• Rock blasting to access and extract ore • Surface mine dewatering to facilitate access to and extraction of ore • Management of waste rock produced from crushing and preparing ore for transport • Treatment of site surface water runoff and surface mine pumped water • Petroleum products management • Site maintenance and repairs
Decommissioning and Reclamation	1-2 years	• Infrastructure demolition • Site reclamation activities

Table 6.7-19 Potential Surface Water Interactions with Project Activities along Haul Road

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Rock blasting in preparation of construction • Till and waste rock from site preparation transport and storage • Watercourse and wetland alteration in preparation of construction • Haul road construction and upgrades
Operation and Maintenance	3-4 years	• Ore transport • Haul road maintenance and repairs
Decommissioning and Reclamation		N/A[1]
1 Decommissioning and Reclamation of the Haul Road is not expected. The Haul Road will be returned to owner for forestry industry		

Table 6.7-20 Potential Surface Water Interactions with Project Activities at Touquoy Mine Site

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Tailings pipeline, make-up water pipeline alteration, and relocation of reclaim infrastructure
Operation and Maintenance	3-4 years	• Ore management (drilling, blasting, loading and hauling of ore and waste rock) • Ore processing (ore crushing and conveyance, ore milling) • Management of tailings produced from processing ore (Sub-aqueous deposition in Touquoy open pit) • Environmental monitoring of surface water • General management of waste derived from processing activities • Water treatment as a batch reactor as pit is filling
Decommissioning and Reclamation	1-2 years	• Water treatment of Touquoy pit lake surplus at water treatment plan until water quality meets MDMER criteria • Effluent Discharge from Touquoy pit lake to Moose River

6.7.6.1 Beaver Dam Mine Site

6.7.6.1.1 Surface Water Quality Modelling Results

There are three discharge points proposed during EOM conditions and PC conditions. During EOM conditions, site water from the waste rock, low grade ore stockpiles and the pit will be routed through the North Settling Pond prior to discharge into the Killag River. Additionally, clean water from the site will be diverted and discharged directly to Crusher Lake. There will also be clean discharge from the eastern till stockpiles to the Killag River and from the crusher pad south to Tent Lake. During PC conditions, site water from the waste rock stockpiles will be routed through the pit prior to discharge directly from the pit into the Killag River. This discharge point is approximately 200 m downstream of the EOM discharge point from the North Settling Pond. The North Settling Pond will likely be decommissioned for the PC scenario. Clean water from the site (including the removed low grade ore stockpile area during PC condition) will continue to be diverted to Crusher Lake. Clean runoff from the eastern till stockpiles will continue to be discharged to the Killag River. The crusher pad will also be decommissioned for the PC scenario and clean runoff will continue to discharge south to Tent Lake.

With the expectation that the composition of the material within the till stockpiles will be at or below background constituent levels, it is likely there will be no additional loadings of constituents, from background condition, into the Killag River. In addition, it is anticipated that the till stockpiles will have low infiltration rate and high absorption rate. Immediately after the till stockpiles are constructed, they will be vegetated and standard erosion protection measures will be implemented. Therefore, there is likely little to no significant effluent containing higher than background constituents expected to be discharged into the Killag River from this discharge point. The only discharge points with potential for discharge of impacted mine effluent into the Killag River system are the North Settling Pond (EOM) and the pit (PC).

Based on previous experience with mixing models in rivers of similar size to the Killag River and the results of the Touquoy Moose River mixing model (30 m distance to fully mixed) (Stantec, 2018f), it was assumed that full mixing would occur in a relatively short distance from the discharge point. In addition, based on the biological monitoring requirements set out in MDMER Part 2, 9 (1) (b) in order to assess the effect on the benthic invertebrate community, the concentrations of constituents of concern must be determined at a location that is 100 m from the point at which the effluent enters that watercourse from the final discharge point. Therefore, constituent concentrations in the receiving water body were calculated at near-field (100 m downstream of each discharge point with the potential for constituent transport) and far-field (approximately 1 km downstream of Near Field – Pit – PC discharge point in the Killag River) locations for both EOM and PC conditions.

The quantitative surface water modelling exercise predicted the following conclusions for the Beaver Dam Mine Site.

End of Mine (EOM) Predictions- North Settling Pond to Killag River: Beaver Dam Mine Site

The North Settling Pond is the only discharge point with potential for elevated constituent concentrations into the Killag River during EOM conditions. To assess the anticipated level of water quality treatment needed to meet the regulatory guidelines (MDMER, CCME, established background concentrations, or Site Specific Water Quality Objective) a water quality assessment was completed at the end of pipe (with comparisons of predicted discharge concentrations to MDMER limits) and at the EOM near-field point [with comparisons of predicted receiving environment concentrations at 100 m downstream of point of discharge, as well as 1.2 km downstream of point of discharge to either CCME freshwater aquatic life guidelines, established background concentrations (where background concentrations naturally exceeded

CCME guidelines, such as in the case of iron and aluminum], and Site-Specific Water Quality Objective (in the case of arsenic)]. A site specific water quality objective was developed for arsenic in the receiving environment, following CCME (2007) protocols, using a species sensitivity distribution (SSD) approach. The resultant Site Specific Water Quality Objective (SSWQO) can be found in Appendix G.4. The water quality assessments can be found in Appendix G.1 and G.3. The initial analysis assumed no treatment of mine contact water in the North Settling Pond and only analyzed the results from a mass balance (dilution) calculation at the extent of the predicted mixing zone. The results from the analysis conclude that effluent from the North Settling Pond does not exceed MDMER objectives during both base case and upper case scenarios. At the near-field mixing zone, the results from the base case scenario suggest there is no exceedances of either CCME, established background concentrations or Site-Specific criteria. However, during the upper case scenario there is potential requirements for water quality treatment for Iron as it has been predicted to slightly exceed background levels at the near-field mixing zone location.

Mine rock materials are not expected to turn acidic during the mine operational phase. Based on the geochemical and modelling completed to date (Appendices E.2 and E.3, respectively) which was based on conservative assumptions, there is a potential for some of the mine rock to turn acidic over the long term during the post-closure phase. This effect is mitigated naturally due to the alkaline groundwater inflows into the open pit and, as required, by the adoption of closure measures such as water treatment and/or the installation of a cover on the waste rock pile. All mine contact water released from the site must meet the stringent MDMER limits for pH which ranges from 6.0 to 9.5. If on-site water treatment is required for mine contact water, lime is introduced into the process which will raise pH to around the neutral range and above background pH for the Killag River of 5.4.

Post Closure (PC) Predictions- Pit to Killag River: Beaver Dam Mine Site

During PC conditions the pit lake discharges into the Killag River directly. To assess the anticipated level of water quality treatment needed to meet the regulatory guidelines (MDMER, CCME, established background concentrations, or Site Specific Water Quality Objective) a water quality assessment was completed in the pit lake (MDMER) and at the PC near-field point (CCME, established background concentrations, and Site-Specific Criteria). The initial analysis assumed no treatment of mine contact water in the pit lake and only analyzed the results from a mass balance (dilution) calculation at the extent of the predicted mixing zone. The results from the analysis conclude that effluent from the pit lake does not exceed MDMER objectives during base case scenario. However, during the upper case scenarios it has been predicted that the MDMER objectives will be exceeded for Copper (in May only) and Arsenic (majority of the year). At the near-field mixing zone the results from the base case scenario suggest there is potential for exceedances of the CCME objectives of Copper (half the year) and Zinc (three months of the year). At the near-field mixing zone the results from the upper case scenario suggest there is potential for exceedances of the Site Specific Water Quality Objectives of Arsenic (August only), as well as the CCME guideline for Copper (all year) and Zinc (five months of the year). While cadmium is not in exceedance when the CCME guideline is applied based on hardness of 50 mg/L, adjusting the guideline for site specific hardness in the Killag River (< 10 mg/L) does indicate that the guideline is predicted to be exceeded over several months.

In summary, under the EOM scenarios, predicted near-field (100 m downstream of the Northern Settling Pond discharge) and far-field chemical concentrations in the base case and upper case are consistently below selected water quality benchmarks without water treatment. While iron exceeds mean baseline surface water concentrations in the EOM Upper case scenario within the Killag River during some months, these exceedances are considered marginal, relative to mean baseline and are unlikely to present a risk to aquatic life. Under the PC scenarios, there is little difference between predicted chemical concentrations at near-field (pit lake discharge) and far-field locations for each assessment each case. In base case PC scenarios, copper and zinc concentrations are predicted to exceed selected water quality benchmarks at both locations without water treatment during some months. In the upper case PC scenarios, arsenic is predicted to exceed the selected water quality benchmark in August, cadmium is predicted to exceed in January and from May to September, copper is predicted to exceed year-round, and zinc is predicted to exceed guidelines for 5 months, without water treatment. Zinc and arsenic exceedances are concluded to have a low potential for toxicity, based on the marginal degree of exceedance, relative to the guidelines for these substances. Cadmium may be associated with some potential for toxicity, but the highest exceedances are within two-fold of the guideline (when adjusted for site specific hardness in the Killag River), and hence, may have limited toxic potential, depending on baseline water quality characteristics, particularly hardness. Copper predictions are more noticeably elevated, relative to the guideline, and hence, have a higher potential for toxicity.

Possible Water Treatment: EOM and PC: Beaver Dam Mine Site

During both EOM and PC there is likely to be a need for some form of water quality treatment (Figure 6.7-14). Treatment requirements will be determined following re-evaluation of source terms, additional water quality modelling and gathering of additional baseline data, to further confirm existing conditions, and potential future conditions, based on additional refinement of data. The treatment system, if required, will be designed to ensure that all site effluent water meets MDMER and CCME, established background concentrations, or Site Specific objectives. During EOM conditions the treatment system will be placed adjacent to the North Settling Pond. The treatment system during PC conditions will likely be moved to the proposed discharge point from the pit lake. Water quality will be continuously measured in the North Settling Pond, during EOM conditions, and the pit lake, during PC conditions, so that the treatment system can be scaled as needed to meet effluent discharge guidelines. Sufficient freeboard will be provided in both the North Settling Pond and the pit lake to allow for adequate timing to adjust the treatment process as needed. A conceptual treatment approach is provided in Appendix G.7.

Possible Onset of ARD from Waste Rock: Beaver Dam Mine Site

Lorax Environmental has provided predictions relating to ARD potential from the waste rock pile at the Beaver Dam Mine Site. Initial predictions indicate that it will take around 30 years for half of the Beaver Dam PAG waste rock to turn acidic.

For the PAG humidity cells that are expected to become acidic, the time to NP depletion theoretically corresponds to the time to onset of acid generating conditions, although the grain liberation is an important factor. Note that for the purposes of calculating NP depletion rates and the time for complete depletion of NP, the initial sulphate production rates, which reflect the flushing of non-acid generating surface oxidation products such as gypsum, were not incorporated in the calculation. Rather the relatively stable NP depletion rates in later cycles of the tests more appropriately reflect depletion based on sulphate produced by sulphide oxidation. This will prevent underestimating the amount of available NP and the lag time to the onset of acidic conditions. The model results suggest that will be depleted between around 7 to 10 years for the PAG humidity cells. To provide a more realistic estimate that considers the slowing of sulphide oxidation at the Beaver Dam site in response to colder temperatures and/or freezing of parts of the waste rock, the sulphate leaching rate was corrected by a factor of 0.3. This value is consistent with the temperature-dependent sulphide oxidation rate and sulphate release rate observed around 10°C (Dockrey and Mattson, 2016), which is somewhat higher than the mean annual temperature measured at the Beaver Dam site. Note that this approximation is only applicable for waste rock exposed to ambient air temperatures such as pit walls, since waste rock piles may have a different temperature profile. Plotting humidity cell total sulphur (S_T)

contents against the respective temperature-corrected NP depletion rates shows a positive correlation (Figure 4-11a; Appendix E.2) that can be written as:

$$\text{NP depletion rate} = 0.0013 \times \ln [S_T] + 0.0064$$

This function was then applied to the PAG samples within the Beaver Dam static test population to quantify a range of lag times that can be expected until these PAG samples release net acidic drainage. The results of this exercise are shown in Figure 4-11b within Appendix E.2 and show that it will take around 20 years for 10% of all PAG samples and 28 years for 50% of all PAG samples to turn acidic. For additional details refer to ML/ARD Report in Appendix E.2.

There is no expectation for acidic conditions during Beaver Dam operations based on an assessment of the geochemical characteristics of the mine rock (refer to Appendices F.2 and F.3). However, during the closure phase, current studies suggest that acidic conditions may occur. The Proponent will develop and implement a Geochemistry Characterization and Monitoring Plan that will inform the scope of the ML/ARD monitoring and mitigation measures to be adopted during the operational and closure phases of the Project. The Plan will outline geochemical test work to be conducted during the pre-mining and the operational mining phases.

The scope of the Plan for the pre-mining phase will fill in gaps and reduce uncertainties identified in the initial geochemical characterization work as presented in Appendix F.2 and F.3. The results from this Plan will further be used to inform the submission of the NSE Industrial Approval Application. The scope of work addressed in this Plan will comprise (but may not be limited to) the following:

- Tailings testing consisting of static characterization of Beaver Dam tailings samples as part of an overall metallurgical testing program when undertaken. This work will be used to assess whether the use of Touquoy tailings as a geochemical surrogate for Beaver Dam tailings is valid.
- Based on the results of the above, kinetic testwork including humidity cells and/or saturated columns may be conducted on Beaver Dam tailings.
- Confirmation sampling and additional static testing of samples collected from deeper till horizons.
- Collection of additional (non-surface) haul road samples to increase spatial coverage and confidence in material geology and geochemistry.
- Collection of naturally oxidized, high-sulphide sample(s) for kinetic testwork and assessment of pH and metal leaching potential of this material under acidic conditions.
- Incorporation of available static test results into geological/geochemical block model that can be used to refine the PAG versus NPAG waste rock tonnages for the deposit.

The results of the pre-mining geochemical characterization will also be used to inform the operational phase ML/ARD Monitoring & Management Plan, which will consist of the following:

- Definition of geochemical analyses required for the classification or environmental rock types.
- Derivation of proxies and criteria to classify PAG versus NPAG materials rapidly on site.
- Definition of optimum sampling frequency of waste rock, ore, tailings and overburden throughout the life of mine based on the observed geochemical variability.
- Definition of criteria distinguishing construction from non-construction materials.
- Development of material handling and ARD prevention/mitigation strategies.

The implementation of the above Plan will confirm whether acidic conditions can be anticipated during the closure phase and will inform the adoption of appropriate mitigation to be applied (refer to Section 6.7.8 for mitigation measures).

6.7.6.1.2 Surface Water Quantity Modelling Results

The Mine Site includes the source and headwaters of Crusher Lake, Mud Lake, Tent Lake as well as a small portion of the Cameron Flowage contributing drainage area. Development of the mine will result in an artificial and managed regime of surface water movement and runoff at the site.

Surface water runoff from the surrounding area of the Mine Site, stockpiles, Mine Site roads and till stockpiles will be managed with the aid of berms and newly constructed channels, which will discharge into collection/sedimentation ponds. Surface runoff that falls directly into the pit will be dewatered during operations and also discharged into the north settling pond.

Catchment Areas End-of-Mine Conditions

During the EOM condition (Figure 6.7-15), the Mine Site discharges to the Killag River and Tent Lake outfalls. The contributing drainage area to the Killag River outfall encompasses the Crusher Lake, Mud Lake, Till Stockpile, and North Settling Pond subcatchment areas. Due to the proposed site configuration, the baseline catchment area to Crusher Lake and Mud Lake is reduced by approximately 52% and 43%, respectively, however, the catchment area for the Killag River remains the same. The contributing drainage area to Tent Lake encompasses the East Collection Pond subcatchment area that represents the proposed crusher pad. There is an increase in the EOM condition catchment area by approximately 28% due to the proposed site configuration.

Catchment Areas Post-Closure Conditions

As part of the Project Site reclamation plan, the pit will be filled with water from groundwater inflows, direct precipitation and site contact water. Water will no longer be pumped from the pit to the North Settling Pond, and runoff from the waste rock piles will be diverted into the pit (Figure 6.7-16). Overflow from the pit will be directed to the Killag River. The capacity of the pit is approximately 16,000,000 m^3. During PC conditions an additional 12.5 ha will be routed to Mud Lake, reducing the impact to Mud Lakes catchment area from baseline conditions to 35% decrease. The catchment area to Tent Lake remains the same as EOM conditions.

A summary of the catchment areas under baseline, EOM, and PC conditions is provided in Table 6.7-21.

Table 6.7-21 Summary of Catchment Areas under Baseline, End-of-Mine and Post-Closure Conditions

Catchment Area	Baseline Conditions	EOM Conditions	PC Conditions
Killag River (ha)	3871.7	3871.7	3871.7
Crusher Lake (ha)	109.5	52.4	52.4
Mud Lake (ha)	166.3	94.8	107.3
Tent Lake (ha)	28.4	36.3	36.3

Killag River

Monthly runoff values are highest in April due to the combination of rainfall and snowmelt from the snowpack. Monthly runoff values are lowest in July, August, and September due to the lower precipitation and higher evaporation rates. Monthly runoff values are also low in January and February due to the accumulation of snowfall in the snowpack that does not contribute to runoff until daily temperatures exceed 0 degrees Celsius, triggering snowmelt.

There is a 0.91% and 0.03% increase in total annual runoff between baseline and EOM and between baseline and PC conditions, respectively. The percent changes in annual runoff are low due to the relatively small area of the Mine Site compared to the contributing drainage area to the Killag River outfall. The difference between the annual runoff values under EOM and PC conditions is partially attributed to the varying seepage rates from the waste rock, ore, and till stockpiles. Seepage rates are related to the infiltration rates to the stockpiles that are dependent on the permeability of the stockpile cover material. The difference in annual runoff is also attributed to the difference between the pumping rate from the pit during EOM conditions, and the overflow rate from the pit under PC conditions.

Crusher Lake

Monthly runoff values are highest in April and lowest in July, August, and September. The percent changes in total annual runoff from baseline to EOM conditions and from baseline to PC conditions are both -52.1%. The negative values indicate that there are decreases in annual runoff from baseline conditions. The percent changes are proportional to the reductions in catchment areas. Evaluation of this indirect impact to Mud Lake is considered in Sections 6.8 and 6.9 (wetlands and fish habitat).

Mud Lake

Monthly runoff values are highest in April and lowest in July, August, and September. The percent changes in total annual runoff from baseline to EOM conditions and from baseline to PC conditions are -43.0% and -35.5%, respectively. The negative values indicate that there are decreases in annual runoff from baseline conditions. The percent changes are proportional to the reductions in catchment areas. The increase in the percent change in annual runoff from EOM to PC conditions is also attributed to the increase in catchment area. Under EOM conditions, the low grade ore stockpiles discharge to the North Settling Pond and the Killag River. Under PC conditions, the low grade ore stockpiles are removed and the area where they were located discharges to Mud Lake, resulting in an increase in contributing drainage area. Evaluation of this indirect impact to Mud Lake is considered in Sections 6.8 and 6.9 (wetlands and fish habitat).

Tent Lake

Monthly runoff values are highest in April and lowest in July, August, and September. The percent change in total annual runoff from baseline to EOM and from baseline to PC conditions is 53.1%, indicating there is an increase in annual runoff from baseline conditions. The proposed development within the Tent Lake catchment area includes the construction of the crusher pad and the East Collection Pond that results in an increase in catchment area of approximately 27.8%. The increase in runoff volume is also attributed to the increase in impervious surface area between baseline and EOM/PC conditions due to the construction of the proposed impermeable crusher pad. Evaluation of this indirect impact to the headwaters of the Tent Lake Catchment is considered in Sections 6.8 and 6.9 (wetlands and fish habitat).

Pit Filling Time

As part of the proposed reclamation plan for Beaver Dam, the pit will be allowed to naturally fill with water. As part of the PC WBM a pit filling time is calculated. Appendix F.1 presents the inputs to and the results for the pit filling time calculation. The inputs to the pit include groundwater inflow, direct precipitation minus evaporation, pit wall runoff and Beaver Dam Mine Site runoff. Groundwater inflow rates were calculated based on the stage of the water in the pit. Direct precipitation and evaporation is calculated by multiplying the difference between the total annual precipitation and total annual lake evaporation rate by the surface area of the water in the pit. Pit wall runoff is calculated by multiplying the total annual precipitation by the surface area of the pit above the stage and the runoff coefficient of the pit wall. The time to fill the pit is equal to the sum of the volume of water in the pit divided by the total inflow rate to the pit at each stage. Based on these calculations the pit filling time is equal to 13.8 years. A detailed summary of the Water Balance Analysis and Pit Filling calculation is provided in Appendix G.5 Beaver Dam Mine Site- Water Balance Analysis.

Table 6.7-22. Pit Filling Time Calculation Beaver Dam Mine Site

Stage Elevation	Surface Area	Volume	Groundwater Inflow	Precipitation Evaporation	Pit Wall Runoff	Surface Water Ditch Inflow	Time to Fill to Level
m	m^2	m^3	m^3/day	m^3/day	m^3/day	m^3/day	days
127	250,679	15,922,102	495	579	314	1,588	567
120	233,141	14,234,298	606	538	369	1,588	705
110	205,312	12,047,184	621	474	457	1,588	631
100	189,323	10,065,681	624	437	508	1,588	556
90	163,450	8,309,266	627	377	590	1,588	493
80	150,309	6,740,655	629	347	631	1,588	435
70	127,595	5,351,578	631	295	703	1,588	377
60	115,159	4,137,642	632	266	743	1,588	320
50	90,705	3,104,288	633	209	820	1,588	252
40	74,025	2,284,510	634	171	873	1,588	198
30	55,930	1,638,735	635	129	930	1,588	157
20	46,784	1,124,288	635	108	959	1,588	119

Stage Elevation	Surface Area	Volume	Groundwater Inflow	Precipitation Evaporation	Pit Wall Runoff	Surface Water Ditch Inflow	Time to Fill to Level
m	m^2	m^3	m^3/day	m^3/day	m^3/day	m^3/day	days
10	32,266	731,422	636	74	1,005	1,588	85
0	24,826	449,162	636	57	1,028	1,588	61
-10	15,949	246,236	636	37	1,056	1,588	40
-20	10,808	112,633	636	25	1,072	1,588	22
-30	4,632	38,139	636	11	1,092	1,588	11
Total (days)							**5,031**
Total (years)							**13.8**

6.7.6.2 Haul Road

Portions of the Haul Road will have to be widened to accommodate two-way traffic. However, some deviations in the existing route will be required and new road construction will be completed. This will marginally increase the quantity of surface water runoff along the Haul Road. Road construction will include a clear porous subgrade or cross drainage culverts in order for wetland hydrology to be maintained post-construction.

The Haul Road crosses three watercourses, which are between 6 and 13 m wide, via single lane timber bridges. These bridges will be replaced with dual lane, clear-span, pre-engineered, single arch modular bridges designed to cause no impediment on water flow and fish passage.

The road also crosses several smaller watercourses. Many of the existing culverts are in poor shape (crushed, blocked, and deteriorated) but where construction or drainage changes take place this will facilitate the restoration of the existing drainage conditions and improve fish passage where deemed appropriate.

6.7.6.3 Touquoy Mine Site

The primary potential effect of the continued use of the Touquoy facility on surface water quality is the use of the exhausted open pit for tailings storage with possible seepage degrading surface water quality in receiving environments and the potential for Accidents and Malfunctions as described in Section 6.18. Deposition of tailings in the exhausted open pit for Beaver dam ore processing will accelerate the time to naturally fill the pit and create a pit lake during reclamation. However, this does not change the environmental effects predicted for the reclamation and closure plans for the existing Touquoy Mine Site as it simply changes the total time for the pit to fill. Project effects are discussed further in the sections below.

There are no further effects to surface water quality or quantity anticipated to be caused by the processing of ore and the management of tailings (exhausted pit) from the Beaver Dam Mine. Surface water quality and quantity will continue to be monitored over the life of the Touquoy facility as part of existing approval for the Touquoy mine life and the revised approval for the proposed extended life of the Touquoy site associated with processing of Beaver Dam ore.

6.7.6.3.1 **Surface Water Quality Modelling Results**

Mill Process to Reduce Cyanide Concentrations in Tailings Slurry

Tailings will be subject to cyanide destruction at the process plant before flowing to the exhausted open pit. Based on recent effluent quality monitoring results at Touquoy for the existing operation, cyanide destruction to cyanate is highly effective. Tailings samples are routinely collected at the discharge end of the tailings pipeline and the supernatant is sampled for WAD cyanide, strong acid disassociated cyanide (total cyanide), and cyanate. The results indicate that treatment reduces WAD cyanide by more than 99.5% based on an average feed concentration of 34 mg/L. The tailings supernatant averages 0.04 mg/L WAD cyanide and total cyanide concentrations averages 0.54 mg/L. Cyanate decomposes harmlessly. The majority of the residual cyanide reagent introduced to the tailings during ore processing will be degraded and hydrolyzed to carbon dioxide and ammonium during storage in the tailings pond. Similarly, this will be expected to occur for the Beaver Dam tailings being stored in the Touquoy open pit. Based on the efficiencies of cyanide destruction to cyanate (i.e. cyanide destruction) in the existing Touquoy TMF, there is no expectation that cyanide destruction will be an issue in processing of Beaver Dam ore. Potential failures related to cyanide destruction and proposed open pit disposal will be addressed in the updated Touquoy TMF operation and surveillance manual as well as in the groundwater contingency plan as required in the industrial approval. Frequent monitoring of feed influent and post-cyanide treatment effluent identifies problems early in the plant and a rigorous system of escalating process adjustments, corrective actions, and confirmation monitoring is initiated to ensure WAD and total cyanide in effluent is limited to acceptable concentrations in the TMF.

Degraded Pit Water Quality due to Tailings Deposition

Mill operation for Beaver Dam ore processing is planned to be consistent with Touquoy ore processing. A total of 7.250 Mt Beaver Dam ore will be processed at the existing Touquoy mill facility, extending operation at the Touquoy Mine Site for approximately an additional 37 months. Beaver Dam ore processing amounts to approximately 5.577 Mm^3 of tailings deposited sub-aqueously in the exhausted open pit. Deposition of tailings in the exhausted open pit is simulated to degrade the water quality in the pit compared to naturally filling of the pit as per the Touquoy reclamation plan (Stantec 2017b).

As presented in the technical report (Stantec 2018d), the water quality model characterized this change in pit water quality in operation and reclamation. As described in the source terms report (Lorax, 2018) in Appendix E.3, water quality modelling considered the pore water quality in the tailings and the pit floor/ walls, the dilution from surface runoff and direct precipitation in the pit and the water quality of the mixture based on the geochemistry of the individual water quality parameters. For Beaver Dam, geochemical source term predictions were derived from upscaling of kinetic tests and Touquoy monitoring data, to represent the pore water quality of pit walls/floor in the water quality model. Pore water is expected to have elevated metal (e.g., arsenic, cobalt, copper), ammonia, nitrate and cyanide concentrations thus reducing pit lake water quality at the time of discharge. Results of the water quality model in the exhausted open pit over time for metals, ammonia, and cyanide parameters are presented in the technical report provided in Appendix G.6.

Based on the water balance model results (Stantec 2018d), no water will be discharged from the exhausted Touquoy open pit until the pit reaches the spillway elevation in Year 7. This allows for many years of water treatment in the pit as a batch reactor with the objective of adjusting the pH to precipitate metals, potentially improving discharge criteria toward MDMER discharge criteria. As an additional benefit of the slow filling of the pit over time, the residence time and exposure to the atmosphere will increase, thus enhancing the natural UV degradation of cyanide and improving water quality in the pit lake.

The water quality in the Touquoy open pit will be monitored during the pit filling and as the pit level approaches the spillway elevation. The water quality will be compared to the MDMER discharge limits and will be treated as required to meet these limits. The MDMER discharge limits will decrease from the existing limits to those presented in Table 6.7-16 effective June 2, 2021. The discharge from the Touquoy Mine Site is anticipated to occur after this period, and therefore the lower MDMER limits will apply.

Change to Moose River Water Quality from Effluent Discharge and Groundwater Seepage

The water quality model of Moose River predicts the effluent concentrations under normal discharge from the Touquoy open pit combined with the groundwater seepage contributions in Moose River under the same climate conditions. Moose River will primarily be driven by climatic conditions, and April flows were selected in the modelling to represent a worst-case dilution ratio between the effluent discharge from the Touquoy open pit and Moose River (Figure 6.7-17). This results in conservatively higher estimates of mass loadings to the receiving environment from the Project.

Based on the groundwater flow model results, the open pit acts as a sink (i.e., gaining groundwater to the Touquoy open pit) below the more permeable bedrock layer at 104 m in elevation. The interaction between the Touquoy open pit lake and Moose River is limited to flow from Moose River to the pit during this period. Therefore, there are no water quality effects to Moose River during this period. When the pit lake level rises into and above more permeable layer at elevations above 104 m, the groundwater flow gradients will reverse, and seepage rate from the open pit will migrate towards Moose River at approximately 310 m^3/d. The flow rate in Moose River in April is 125 times this rate, and therefore represents a dilution ratio of approximately 125.

Concentrations of cobalt, copper and nitrite in groundwater were predicted in the model above the CCME FAL (Freshwater Aquatic Life guidelines) or NSE EQS (Nova Scotia Environment Environmental Quality Standards) in the untreated pit lake at discharge. The groundwater seepage quality was assumed to be consistent with the source terms pore water quality, at an estimated average concentration of 0.002 mg/L of arsenic to Moose River. Based on the assimilative capacity model in Moose River these parameters meet CCME FAL/NSE EQS after mixing with Moose River 100 m downstream of the discharge point.

The water quality discharged from the pit lake to Moose River will be treated to meet MDMER discharge/regulatory closure criteria or site-specific guidelines, if required. Without treatment, arsenic concentrations of 0.86 mg/L are predicted to exceed the MDMER discharge criteria of 0.3 mg/L in Year 19 based on climate normal conditions. Therefore, arsenic concentrations in the discharge to Moose River are predicted to be 0.3 mg/L (post treatment). Once mixed with the background water quality in Moose River, the concentration 100 m downstream of SW-2 is predicted to be 0.023 mg/L for arsenic and 0.184 for aluminum. Although this arsenic concentration is above the NSE Tier 1 and CCME guidelines of 0.005 mg/L, the background levels at SW-2 also exceed the guidelines at 0.018 mg/L. The aluminum concentration is predicted below the 75th percentile receiver quality in Moose River. Based on the CCME guideline (2001), the arsenic concentration is below the reported lowest toxic levels for fish, algae and aquatic plants. A Site-Specific Water Quality Objective was derived for arsenic, following CCME (2007) protocols, using a species sensitivity distribution (SSD) approach. The SSD approach was comprised of identifying chronic toxicity data for species, analyzing the data using a regression approach and selecting the final chronic effects benchmark. The HC5 (i.e., the concentration that is hazardous to no more than 5% of a species in the community) was selected as the final chronic effects benchmark as per CCME (2007) guidance. The resultant guideline using the protocol is 30 µg/L. The details related to the SSWQO for arsenic are provided in Appendix A of Intrinsik Report in Appendix G.4. The predicted receiving environment concentration of 0.023 mg/L is below any of the no observed effect concentration (NOEC) or low observed effect concentration (LOEC) data for arsenic (see Appendix G.4 (Appendix A)). Hence, risks to aquatic life associated with predicted arsenic concentrations are anticipated to be low.

Cyanide concentrations in the receiving environment were also predicted. Weak acid dissociated (WAD) cyanide concentrations were predicted to be lower than the existing CCME guideline for cyanide (0.005 mg/L), which is based on free cyanide. Total cyanide concentrations (which can include a mixture of Strong Acid Dissociated, or SAD, WAD and free cyanide) were predicted to be higher than the CCME guideline (free cyanide). This guideline is not a relevant guideline to compare Total cyanide, SAD or even WAD forms of cyanide to, as it is based on the free ion, as opposed to bound forms of cyanide (such as WAD or SAD), which have far lower toxic potential. Based on the receiving environment predictions, WAD cyanide is less than half of the Total Cyanide predicted concentration (0.002 mg/L WAD, compared to 0.007 mg/L Total Cyanide). This implies that the majority of the Total Cyanide prediction would be SAD, and hence, unlikely to dissociate in the receiving environment (mean pH in receiving environment is 6.05). Predicted WAD concentrations in the receiving environment are below the NS Tier 1 guideline, indicating acceptable levels of risk to aquatic life. The predicted Total Cyanide concentration in the receiving environment only marginally exceeds the free cyanide guideline, and since the majority of the predicted cyanide is anticipated to be SAD, risk to aquatic life associated with cyanide are considered to be low.

During reclamation the water level in the Touquoy open pit lake will be maintained through pumping to the existing Touquoy TMF at or beneath the permeable bedrock layer at 104 m elev. until water quality improves to meet discharge criteria. This low pit lake level will provide more than adequate storage of the inflow design flood and freeboard as the lowest open pit level at surface is at 110 m elev. As the Touquoy open pit lake has approximately 17.5 m of water cover, the potential for settled tailings to be resuspended due to wind or wave action is unlikely with little potential of migration of Beaver Dam tailings to Moose River. This water cover over the deposited tailings will limit oxygen thus reducing metal leaching conditions and further improving water quality in the pit lake.

As the pit lake is planned to be treated to MDMER and any regulatory closure criteria or site-specific guidelines prior to discharge, the magnitude of the effect is expected to be negligible on Moose River quality and downstream tributaries. Discharge and seepage flow from the pit lake to Moose River during closure will be permeant and will occur regularly based on climate conditions. The change on water quality of Moose River will be irreversible. The environmental effect is considered not significant after mitigation measures have been implemented.

Dilution of Pit Lake from Freshwater Make-up

Process freshwater make-up water requirements of approximately 5.8% of production or 544 m³/d will be sourced from Scraggy Lake as per the existing NSE approval for Touquoy ore processing or other sources as directed in the NSE approval for Beaver Dam. Should additional process make-up water be required in a water reclaim deficit scenario than the Scraggy Lake supply will be supplemented with treated effluent from the existing Touquoy polishing pond. As surface water quality in the polishing pond meets effluent discharge criteria based on surface water quality results for Touquoy, the make-up water pumped to the open pit is not expected to degrade the pit lake quality and may benefit water quality through dilution.

6.7.6.3.2 Surface Water Quantity Modelling Results

Accelerated Filling of the Pit

As originally planned in the approved Touquoy Gold Mine Project Reclamation Plan (Stantec 2017b), the inflow of groundwater, surface flow and precipitation into the pit will naturally create a lake upon closure of the site. No change to this method is planned to follow the deposition of Beaver Dam tailings, except that the time to fill the pond is accelerated given the decrease in available volume taken by the tailings.

Based on a 3-dimensional model of the Touquoy ore body presented in the water and tailings management plan (Appendix G.2), the total storage capacity of the exhausted open pit at the lowest surface elevation 110 m CGVD 2013 is estimated at 9.325 Mm^3. The water balance model predicted the amount of water and tailings stored in the pit over the 10-year simulation period. Based on results of the water balance model and the derived elevation storage relationship, tailings will be deposited in the open pit for a total of 37 months reaching an elevation in the pit of 90.5m (CGVD 2013). This amounts to approximately 17.5 m of water cover above the tailings, assuming the spillway invert elevation of 108 m. The water balance model simulated that it would take an additional 37 months or a total of 114 months from commencement of operation to fill the pit to the spillway invert elevation. Figure 6.7-18 and 6.7-19 (below) illustrate the predicted elevation and storage of tailings and water in the exhausted Touquoy open pit over the 10-year simulation period.

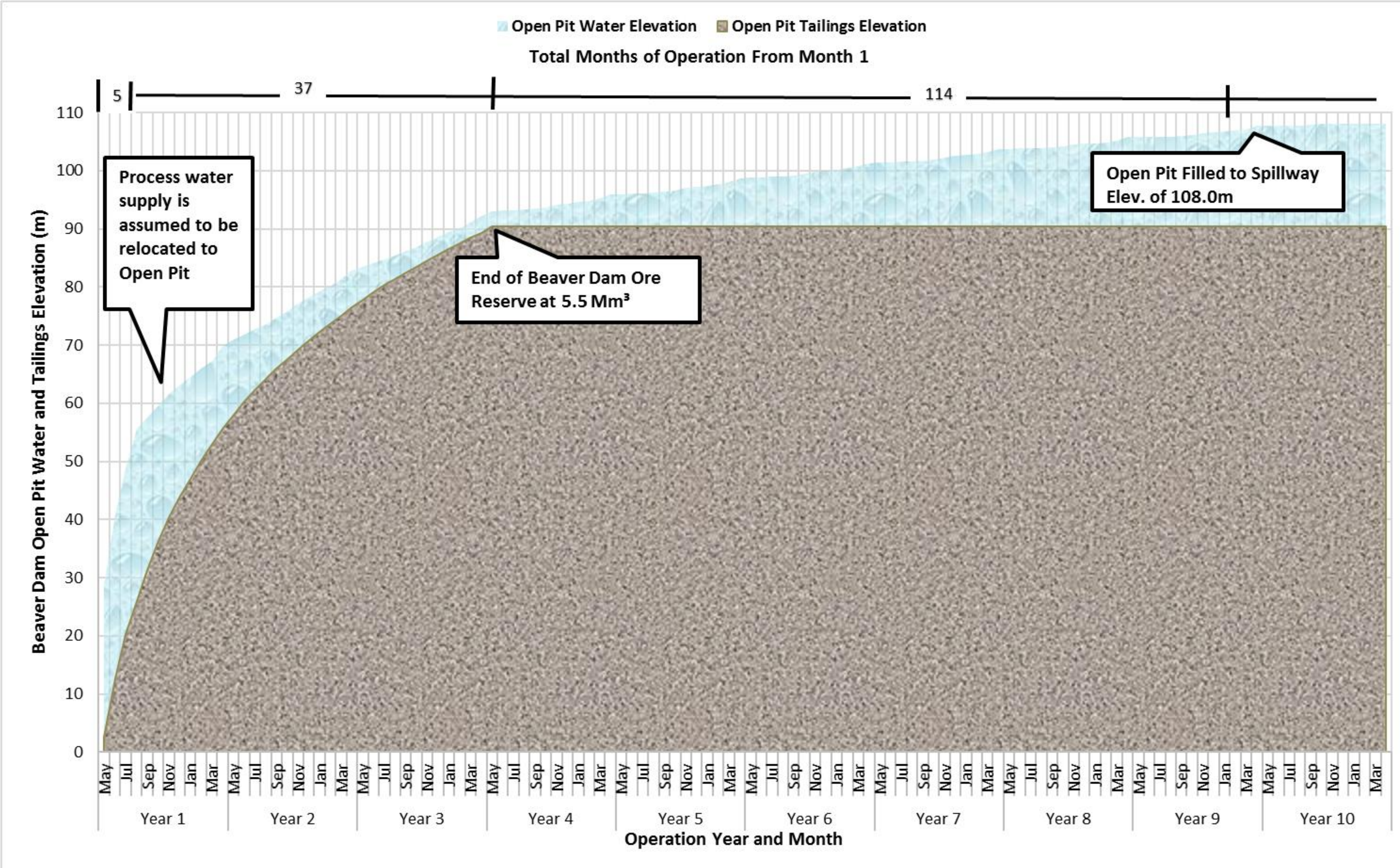

Figure 6.7-18 Tailings and Water Elevation in the Exhausted Touquoy Open Pit

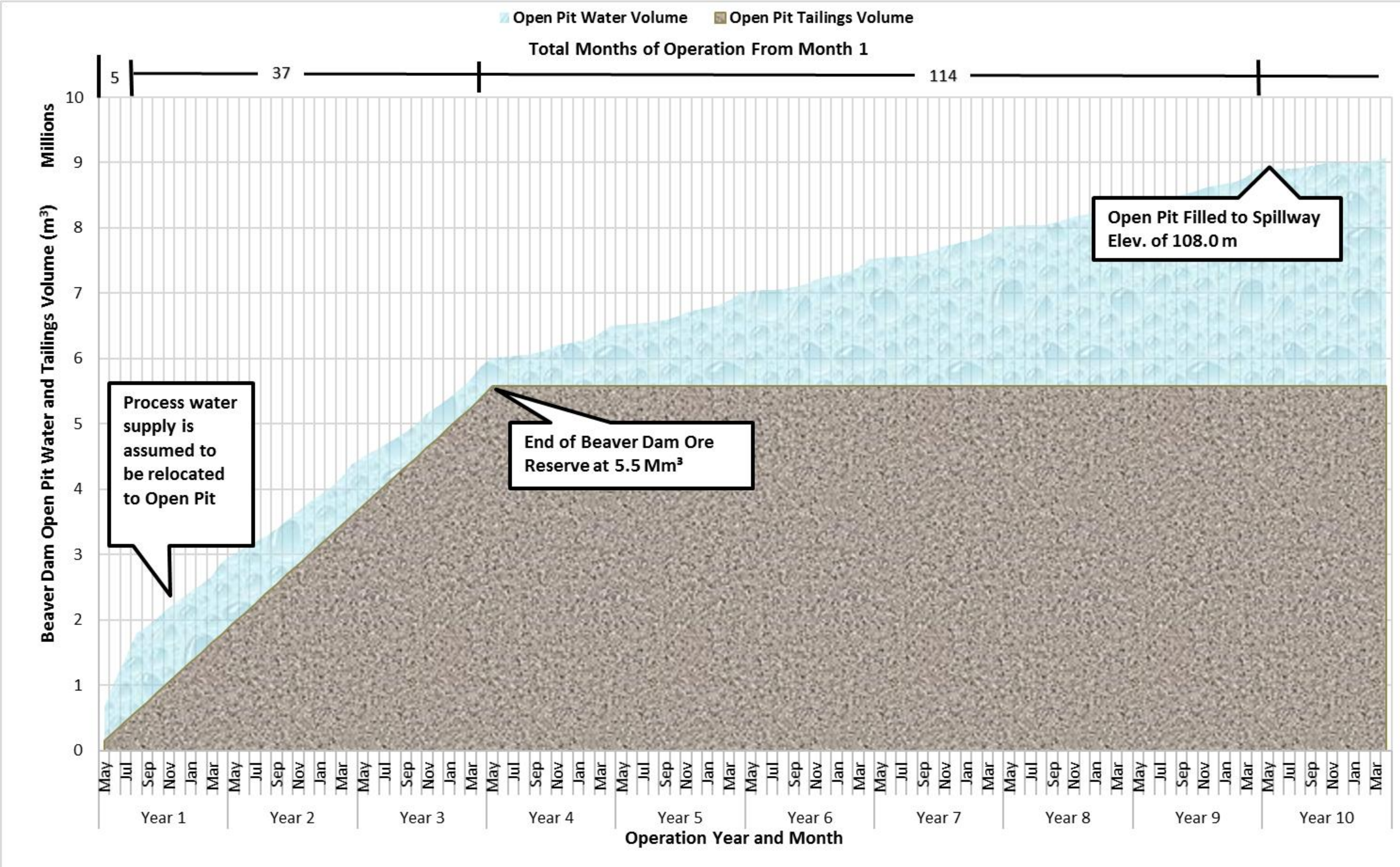

Figure 6.7-19 Tailings and Water Storage in the Exhausted Touquoy Open Pit Reduction in Freshwater Demand

Initially, process water will be reclaimed at a rate of 8,960 m³/d from the existing Touquoy TMF until surplus water storage in the pond is depleted. Based on results of the water balance model under climate normal conditions, 3 – 5 months of process water surplus will be available depending on the month of start-up. Subsequently, process water will be reclaimed from the exhausted Touquoy open pit at the same rate, recirculated as a closed loop through the mill facility during the remaining period of processing Beaver Dam ore at the Touquoy facility. As the current practice at Touquoy, this water management strategy reduces the quantity of mine contact water or the at the site and a lower demand on freshwater supplies.

Extended Withdrawal from Scraggy Lake

As discussed above, process freshwater make-up requirements for Beaver Dam ore processing is similar to existing Touquoy operation. Freshwater make-up requirements are at flow volumes in accordance with the existing Scraggy Lake water withdrawal permit issued by NSE for industrial purposes. The use of surface water for industrial purposes is highly regulated in NS and involves a proponent making application to NSE and providing rationale for the use of the water and information on the lack of impacts associated with the water use. Water withdrawal from Scraggy Lake will require to be extended for an additional 3 years for processing Beaver Dam ore. An extension to the existing approval will be requested by the Proponent. Incremental effects to surface water quantity at Scraggy Lake is not expected, due to the extended withdrawal period.

Water Management in Open Pit

A spillway is proposed to be installed at elev. 108 m to prevent the pit lake from overtopping. The capacity of the spillway will be sized to accommodate the Canadian Dam Association inflow design flood and associated freeboard requirements for wind run-up and wave set-up and in consideration of DFO requirements. As shown in Figure 6.7-17, the spillway will discharge to a conveyance channel that outlets to Moose River, approximately 70 meters downstream of the surface water monitoring station SW-2. As the predevelopment and post development catchment areas draining to the discharge location at Moose River are similar, Moose River is capable of handling the resultant flows. Any required erosion and scour protection of Moose River at the discharge location will be considered in design. There are no changes in surface water management of the open pit catchment from Touquoy ore processing to Beaver dam ore processing, with the exception of the timing to discharge to Moose River.

6.7.6.4 Surface Water Project Effects Summary

The following summaries are provided for each Mine Site specific to pre-mitigation project interactions for surface water quality and quantity, based on results of predictive modelling completed at each Mine Site.

6.7.6.4.1 Surface Water Quality Summary at Beaver Dam of Predicted Conclusions

- The results of the predictive water quality assessment demonstrate the need for treatment of the mine effluent water prior to discharge to the Killag River
  - Arsenic and Copper will likely require treatment (post-closure) to reduce concentration below MDMER objectives
  - Arsenic, Copper, Iron and Zinc have potential to exceed CCME, background or Site-specific guidelines within the Killag River at the Near-Field location (100 m downstream of discharge point).

- Treatment will occur, as required, prior to discharge into the receiving environment to ensure discharge meets MDMER regulations and concentrations in the Killag River do not exceed CCME or Site-Specific guidelines.
- It is unlikely that ARD onset will occur during the operations phase (4-5 years). Therefore, there is no urgency with regard to waste rock cover being placed during operations
- At closure, the pit will be filled by diverting all surface site water to the pit, therefore submerging most of the exposed pit walls with water. This should eliminate most of the risk associated with pit wall runoff.
- Initial predictions indicate that it will take around 30 years for half of the Beaver Dam PAG waste rock to turn acidic.
- As part of the final closure plan, the Proponent will develop and implement a Geochemistry Characterization and Monitoring Plan. This Plan will determine the path forward for continued kinetic test work from Beaver Dam waste rock samples during operations and monitoring to determine if mitigation is required to manage potentially longer term acidic conditions associated with PAG waste rock at the Beaver Dam Mine Site.
- If this Plan confirms that acidic conditions are predicted during the closure phase, appropriate mitigation will be applied (refer to Section 6.7.8 for mitigation measures).

6.7.6.4.2 Surface Water Quantity Summary at Beaver Dam of Predicted Conclusions

- The proposed development of the Beaver Dam mine results in minimal increases in runoff volume to the Killag River (0.91% in EOM and 0.03% in PC conditions). The slight increase is a result of diversion of water away from adjacent watersheds.
- Proposed development results in a 52% reduction in annual runoff to Crusher Lake during EOM and PC conditions.
- Proposed development results in a 43% and 35.5% reduction in annual runoff to Mud Lake during EOM and PC conditions respectively. The Mud Lake watershed is significantly smaller than the Killag River and as such proposed development has a greater impact on Mud Lake.
- Proposed development results in a 53.1% increase in annual runoff to Tent Lake under both EOM and PC conditions due to the discharge of the crusher pad to the south, away from Cameron Flowage.
- The estimated time for the Mine Pit to fill with water is 13.8 years from the end of the EOM phase.

6.7.6.4.3 Surface Water Quality Summary at Touquoy Mine Site of Predicted Conclusions

The use of the exhausted Touquoy pit for tailings storage of Beaver Dam tailings will result in degraded water quality in the pit lake and thus in the receiving environment of Moose River through seepage and effluent discharge. As the pit lake is planned to be treated to MDMER limits and any regulatory closure criteria or site-specific guidelines prior to discharge, the magnitude of the effect is expected to be negligible on Moose River quality and downstream tributaries.

- The predicted receiving environment concentration of arsenic of 0.023 mg/L; risks to aquatic life associated with predicted arsenic concentrations are anticipated to be low.
- The aluminum concentration of 0.184 mg/L for aluminum is predicted below the 75th percentile receiver quality in Moose River.
- Elevated concentrations of arsenic, cobalt, copper and nitrite in groundwater were predicted in the model to meet CCME FAL/NSE EQS after mixing with Mooser River 100 m downstream of the discharge point.

- Predicted WAD concentrations in the receiving environment of 0.002 mg/L are below the NSE Tier 1 guideline of 0.005 mg/L free cyanide, indicating acceptable levels of risk to aquatic life.

6.7.6.4.4 **Surface Water Quantity Summary at Touquoy Mine Site of Predicted Conclusions**

The use of the exhausted Touquoy pit for tailings storages will result in the accelerated filling of the pit from that of the Touquoy reclamation plan.

- Tailings will be deposited in the open pit for a total of 37 months reaching an elevation in the pit of 90.5m (CGVD 2013). This amounts to approximately 17.5 m of water cover over the deposited tailings based on a spillway elevation of 108 m CGVD 2013 and will limit oxygen, reduce metal leaching conditions and further improved water quality.
- No water will be discharged from the exhausted Touquoy open pit until the pit reaches the spillway elevation in Year 9.
- Water withdrawal from Scraggy Lake will require to be extended for an additional 3 years for processing Beaver Dam ore.

6.7.7 Preferred Alternative Haul Road

6.7.7.1 Rationale for Valued Component Selection

The same rationale was used for the valued component selection as indicated in Section 6.7.1.

6.7.7.2 Baseline Program Methodology

The same methodology was used for the baseline program for the Preferred Alternative Haul Road option as indicated in Section 6.7.2. No additional baseline studies were completed for this Haul Road option.

6.7.7.3 Baseline Conditions

The Preferred Alternative Haul Road option is 1.5 km from the nearest receptor on the primary Haul Road. Seven linear watercourses and portions of three waterbodies (Prest Lake, Miller Lake and Big Pond) were identified within the Preferred Alternative Haul Road PA. Three of the watercourses, WC-AI, AL, and AM, are named Morgan River, Duck Lake Brook, and Middle Brook, respectively. The remaining watercourses are all unnamed. Further details on the watercourses identified within the Preferred Alternative Haul Road PA are found in Section 6.9.7.

In addition to the water features, 19 wetlands were evaluated across the Preferred Alternative Haul Road PA (Section 6.8.7). Given the proximity of the Preferred Alternative Haul Road to the Haul Road, the surface water quality, was evaluated based on watersheds, geology, and users within the corridor and determined to be similar, and thus no additional baseline studies were deemed necessary to evaluate the Haul Road option.

6.7.7.4 Consideration of Consultation and Engagement Results

The Preferred Alternative Haul Road is the result of consultation and engagement on the primary haul route. The Preferred Alternative Haul Road is further from human receptors located on the “Moose River Cross Road” so-called and form residents located on the Mooseland Road. Consultation and engagement results are presented in Section 6.7.4.

6.7.7.5 Effects Assessment Methodology

The effects assessment methodology of the Preferred Alternative Haul Road is as presented in Section 6.6.5. The spatial boundary of the PA for the Preferred Alternative Haul Road is confined only to this segment and assessed independently of the primary route. The LAA and RAA remain the same as indicated in Section 6.7.5.1.

As the Project has the potential to cause direct and indirect effects to surface water quality and quantity outside of the Preferred Alternative Haul Road PA, the LAA is the appropriate boundary for evaluation of this VC.

The same Temporal, Technical, and Administrative Boundaries are considered for the Preferred Alternative Haul Road as indicated in Section 6.7.5.

6.7.7.5.1 Thresholds for Determination of Significance

The same thresholds for determination of significance as used for the primary Haul Road are utilized for the Preferred Alternative Haul Road.

6.6.7.6 Project Activities and Surface Water Quality and Quantity Interactions and Effects

Development of the Preferred Alternative Haul Road can directly impact surface water quality and quantity during the construction phase of the Project through activities such as clearing, grubbing, and construction. Six crossings will be required for the Preferred Alternative Haul Road option, including a combination of bridges (at least two) and culverts (at up to four) installations. The impacts associated with the construction of the Preferred Alternative Haul Road are likely to occur from reduced infiltration and sedimentation and have the potential to affect downstream reaches of the Preferred Alternative Haul Road respective watercourses, within the LAA.

In addition, the construction of the Preferred Alternative Haul Road will limit the overall number of damaged culvert replacements anticipated along the Haul Road. This is disadvantageous for surface water flow as well as for fish and fish habitat connectivity.

The operational phase of the Project could also impact surface water quality and quantity, as it can be affected by the removal of watercourses and wetlands. This has the potential to alter surface flows and down gradient hydrology. Water quality could be further affected from an increase in Total Suspended Solids (TSS) associated with potential siltation and release of substances to downstream receiving surface water systems adjacent to the Preferred Alternative Haul Road (LAA).

6.7.8 Mitigation

Surface water modelling was completed for the Beaver Dam Mine Site and the Touquoy Mine Site and included an assessment of the geographic extent for changes to the quantity and quality of surface water for the both Mine Sites. No current surface water supplies will be affected by the Project as designed and proposed in this EIS document.

6.7.8.1 Surface Water Quality

Refer to Table 6.7-23 for mitigation measures to reduce surface water quality and quantity effects for the Project

Table 6.7-23 Mitigation Program for Surface Water Quality and Quantity

VC	Mitigation Category	Project Phase	Mitigation Measure
Surface Water	**Quality**	CON, OP, DEC	Use of the following structures, as needed: • Silt fences • Silt curtains • Riprap • Check dams
		CON, OP, DEC	Limit exposed soil
		CON, OP	Implement Erosion and Sediment Control Plan
		OP, DEC	Segregate and manage waste rock with the potential for acid generation
		OP	Use adequately sized settling and containment ponds as required
		OP	Use flocculants and coagulants as required
		CON, OP	Install perimeter ditches around site infrastructure
		OP	Provide appropriate settling time for suspended solids prior to discharge
		OP	Ensure pit water meets applicable regulatory quality criteria for discharge – otherwise treat water prior to discharge
		OP	Direct drainage ditches to designated settling ponds or other locations
		CON, OP	Use above ground fuel storage tanks that meet applicable regulatory standards
		CON, OP	Select appropriate type of explosive that will minimize nitrogen release to surface water and groundwater
		CON, OP	Implement Surface Water Management Plan
		CON, OP	Develop and implement an Emergency Response Spill Contingency Plan
		CON, OP	Use clean, non-ore-bearing, non-watercourse derived and non-toxic materials for erosion control methods
		OP, DEC, REC	Sub-aqueous deposition of mine tailings to reduce/prevent oxides and leaching
		DEC, REC	In the event of the potential for acid rock drainage and metal leaching, implement additional studies required to

VC	Mitigation Category	Project Phase	Mitigation Measure
			assess to actual risk and, as warranted, implement mitigative measures that will manage the source material and drainage effectively utilizing methods such as segregation and encapsulation
		PC, CON, OP, DEC, REC	Minimize snow deposition into watercourses during snow removal activities
	Quantity	CON	Construct drainage ditches and ponds to maintain natural flow directions when practical
		OP	Control release of settling ponds to mimic natural hydrograph, where practicable
		OP	Recycle site water for reuse wherever practical to reduce water withdrawal from lakes or streams
		OP	Recycled water must meet acceptable water quality criteria for its intended use

6.7.9 Residual Effects and Significance

Refer to the conclusions for surface water quantity and quality for the Beaver Dam Mine Site and Touquoy Mine Site above.

The overall residual effect of the Project on surface water is assessed as not significant after mitigation measures have been implemented. See below Table 6.7-24 for details.

Table 6.7-24 Residual Environmental Effects for Surface Water

Project - VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Beaver Dam Mine Site and Haul Road (Direct loss of habitat)	Project Design to avoid and minimize direct impact wherever possible	A	M VC interaction causes direct loss of habitat	PA Effects are confined to the PA (Beaver Dam Mine Site and Haul Road)	A Timing is applicable – reduce effect by alteration during approved fish window June 1 to Sept 30	P VC interaction unlikely to recover to baseline conditions	R VC interaction will occur regularly through construction phase	IR Effects to VC are permanent	Disturbance, Habitat Loss	Not Significant
Construction – Beaver Dam Mine Site and Haul Road (Indirect changes in hydrology, water quality, and impacts from blasting)	Project Design to evaluate hydrology patterns. Erosion and Sediment Control Measures	A	L Minor changes from baseline conditions	PA Effects are confined to the PA (Beaver Dam Mine Site and Haul Road)	A Effect would be more significant during low flow conditions and/or sensitive spawning windows	MT Effects can occur beyond 12 months and up to three years	S VC interaction will occur at irregular intervals throughout construction phase	R VC will recover to baseline conditions	Change in Water Quality Disturbance	Not Significant
Operational – Beaver Dam Mine Site (Drawdown from pit dewatering and resulting predicted reduction in baseflow of Cameron Flowage (Killag River))	Surface water from pit dewatering activities will be designed to discharge back into Cameron Flowage/Killag River at rates to mimic seasonal flows, where practicable.	A	L Minor changes from baseline conditions	LAA Effect are confined to the LAA (Beaver Dam Mine Site)	A Effects would be more significant if seasonal flows are not maintained	LT Effects extend beyond 3 years	R Effects will occur at regular intervals throughout operations	R VC will recover to baseline conditions once project activities have been completed	Change in hydrology in Cameron Flowage/Killag River	Not Significant
Operational – Beaver Dam Mine Site (Surface water quality of Killag River from effluent discharge through north	Water Treatment at discharge (as required)	A	N Negligible change in water quality	LAA VC extends to Killag River and downstream	A May effect fish during spawning periods	P VC interaction is permanent	R VC interaction will occur regularly	IR VC will not return to baseline condition	Change in water quality in the Killag	Not significant

Project - VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
settling pond and groundwater seepage)										
Operational – Beaver Dam Mine Site (Reduction in surface flow to WC-5)	Predicted flow reduction. Monitoring to confirm, watercourse alteration permitting, fisheries authorization, if required	A	H VC interaction causes reduction in surface flow in WC-5	PA Effects are confined to the Beaver Dam Mine Site	A Effect would be more significant during low flow conditions and/or sensitive spawning windows	P VC interaction is permanent	C VC interaction will occur continuously	IR VC will not return to baseline condition	Disturbance	Not Significant
Operational – Beaver Dam Mine Site (Reduction in surface flow to Mud Lake and Crusher Lake)	Predicted flow reduction. Monitoring to confirm.	A	L Resultant change is outside natural variations from baseline conditions	PA Effects are confined to the PA (Beaver Dam Mine Site)	A Effect would be more significant during low flow conditions and/or sensitive spawning windows	LT Effects extend beyond 3 years	C VC interaction will occur continuously	PR Mitigation cannot guarantee a return to baseline conditions	Disturbance	Not significant
Operational – Beaver Dam Mine Site (Blasting and drilling of in-situ rock)	Pre-blasting plan, evaluation of potential to indirectly impact surface water	A	L Minor change from baseline conditions	PA Effects are confined to the PA (Beaver Dam Mine Site)	A Blasting would have more significant effect on surface water during sensitive spawning windows	ST VC interaction will occur during construction phase	R VC interaction will occur regularly	R VC returns to baseline conditions at the end of the activity	Disturbance	Not Significant
Operations Beaver Dam Mine Site and Haul Road (Release of non-mine-contact surface water to receiving waters resulting in reduction in water quality)	Erosion and Sediment Control Measures	A	L Minor change from baseline conditions	LAA Effects are confined to the LAA (Beaver Dam Mine Site and Haul Road)	A Release of sediment can effect surface waters differently depending on season	LT Effects extend beyond 3 years	S VC interaction will occur sporadically	R VC will return to baseline conditions	Disturbance	Not Significant

Project - VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Closure – Beaver Dam Mine Site (Surface water quality of Killag River from pit from effluent discharge)	Water Treatment at discharge (as required)	A	N Negligible change in water quality	LAA VC extends to Killag River and downstream	N/A	P VC interaction is permanent	R VC interaction will occur regularly	IR VC remains at the end of the activity	Disturbance	Not Significant
Closure – Beaver Dam Mine Site (Reduction in water quantity in Killag due to surface water flows directed to pit to facilitate pit filling)	Monitor the Killag River Flows and when necessary, implement direct discharge to Killag to supplement flows and mimic natural seasonal conditions	A	L Minor change from baseline conditions	LAA VC extends to Killag River and downstream	A Effect can be reduced by mimicking release to natural seasonal flow of river	LT Effects extend beyond 3 years	R VC interaction will occur regularly	R VC will return to baseline conditions	Change in hydrology in Cameron Flowage/Killag River	Not Significant
Closure – Touquoy Mine Site (Storage of Beaver Dam tailings in the Touquoy open pit mine and surface water quality of Moose River from effluent discharge and groundwater seepage)	Treatment of water quality in pit as tailings are disposed in the open pit Water Treatment at discharge (as required) Continuation of the monitoring program that is currently underway at Touquoy since 2016	A	N Negligible change in water quality	LAA VC extends to Moose River and downstream	A Effect would be more significant during low flow conditions and/or sensitive spawning windows	P VC interaction is permanent	R VC interaction will occur regularly	IR VC remains at the end of the activity	Disturbance	Not significant

Legend (refer to Table 5.10-1 for definitions)

Nature of Effect	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
A Adverse P Positive	N Negligible L Low M Moderate H High	PA Project Area LAA Local Assessment Area RAA Regional, Assessment Area	N/A Not Applicable A Applicable	ST Short-Term MT Medium-Term LT Long-Term P Permanent	O Once S Sporadic R Regular C Continuous	R Reversible IR Irreversible PR Partially Reversible

A significant adverse environmental effect for surface water has not been predicted for the Project for the following reasons, with consideration of the ecological and social context of the LAA surrounding the Project:

- During Construction:
  - linear watercourses within the PA at the Beaver Dam Mine Site will be altered to support Project development.
  - Micro-sighting of infrastructure has reduced interactions with surface water features wherever possible.
  - Systems which will be altered to support Project construction are first order streams with limited fish habitat potential and low pH.
  - Haul Road upgrade and construction, with appropriate mitigation measures including proper culvert installation and erosion and sediment control measures, will have limited residual impact to linear watercourses along this route.
- During Operations:
  - Considering water treatment, as required, for effluent discharge, the magnitude of the residual effect to the Killag River at the Beaver Dam Mine Site is considered negligible (within established criteria or background concentrations at the 100m compliance point).
  - Effluent is predicted to be of neutral pH, limiting potential impact to Killag River, a low pH river with current efforts to increase pH to support salmon restoration.
  - Changes in flow to the Killag River from pit operations and dewatering have been predicted to be minimal.
  - There is a predicted alteration to WC-5 relating to the operational water balance of the Beaver Dam Mine Site. Permitting is expected to be required to support this alteration.
  - Mud Lake and Crusher Lake will experience reductions in flow, which have been predicted to result in a low magnitude in change in these waterbodies relating to fish.
- During Closure:
  - Considering water treatment, as required, for effluent discharge, the magnitude of the residual effect to the Killag River at the Beaver Dam Mine Site is considered negligible (within established criteria or background concentrations at the 100m compliance point).
  - Effluent is predicted to be of neutral pH, limiting potential impact to Killag River, a low pH river with current efforts to increase pH to support salmon restoration.
  - Considering water treatment, as required, for effluent discharge, the magnitude of the residual effect to the Moose River at the Touquoy Mine Site is considered negligible (within established criteria or background concentrations at the 100m compliance point).

6.7.9.1 Preferred Alternative Haul Road Residual Effects and Significance

Table 6.7-25 Residual Environmental Effects for Surface Water within the Preferred Alternative Haul Road

Project - VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Preferred Alternative Haul Road (Direct loss of habitat)	Project Design to avoid and minimize direct impact wherever possible	A	M VC interaction causes direct loss of habitat	PA Effects are confined to the PA (Beaver Dam Mine Site and Haul Road)	A Timing is applicable – reduce effect by alteration during approved fish window June 1 to Sept 30	P VC interaction unlikely to recover to baseline conditions	R VC interaction will occur regularly through construction phase	IR Effects to VC are permanent	Disturbance, Habitat Loss	Not Significant
Construction – Preferred Alternative Haul Road (Indirect changes in hydrology, water quality, and impacts from blasting)	Project Design to evaluate hydrology patterns. Erosion and Sediment Control Measures	A	L Minor changes from baseline conditions	PA Effects are confined to the PA (Beaver Dam Mine Site and Haul Road)	A Effect would be more significant during low flow conditions and/or sensitive spawning windows	MT Effects can occur beyond 12 months and up to three years	S VC interaction will occur at irregular intervals throughout construction phase	R VC will recover to baseline conditions	Change in Water Quality	

Legend (refer to Table 5.10-1 for definitions)

Nature of Effect	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
A Adverse	N Negligible	PA Project Area	N/A Not Applicable	ST Short-Term	O Once	R Reversible
P Positive	L Low	LAA Local Assessment Area	A Applicable	MT Medium-Term	S Sporadic	IR Irreversible
	M Moderate	RAA Regional Assessment Area		LT Long-Term	R Regular	PR Partially Reversible
	H High			P Permanent	C Continuous	

Table 6.7-24 was reviewed and it was determined that the construction and operation of the Haul Road were the only two VC interactions applicable to surface water quality and quantity associated with the Preferred Alternative Haul Road. There were no changes in the significance criteria or overall significance for either of these VC interactions.

Mitigations presented in Table 6.7-23 will be established to reduce the impact to surface water from Project activities.

6.7.10 Proposed Compliance and Effects Monitoring Program

Surface water monitoring will be completed to verify the predicted environmental effects and the effectiveness of the mitigation measures for the surface water environment. Mitigations are outlined in Table 6.7-23.

The Preliminary Environmental Effects Monitoring Plan (EEM), located in Appendix O.1, outlines the proposed preliminary methods, timing, frequency, and locations for surface water monitoring. This document will evolve through regulatory liaison, as well as public and Mi’kmaq engagement.

6.8 Wetlands

6.8.1 Rationale for Valued Component Selection

Wetlands were selected as a valued component due to their ecological value in providing habitat for aquatic species and rare plants, the importance of wetlands in the daily lives of terrestrial species, their capacity to store water, managing downstream flooding, improving water quality, and the recharge/discharge of groundwater aquifers. The socio-economic importance of wetlands from a recreational and resource perspective is also noted in the selection of wetlands as a valued component (Section 6.1.4 of the EIS Guidelines and its potential interactions with Project activities).

6.8.2 Baseline Program Methodology

Methodology of wetland surveys within the Beaver Dam Mine Site and Haul Road are discussed below. Information pertaining to Touquoy Mine Site has been brought forward from the EARD and Focus Report. Methods and results are summarized in subheadings within the applicable sections, however, the data is not being reevaluated. For further information regarding Touquoy Mine Site, refer to the EARD (CRA 2007) and Focus Report (CRA 2007a).

A desktop review of available topographic maps, provincial databases, and aerial photography was completed to aid in the determination of wetland habitat in the PA. Mapped wetland areas were identified from the ~~NSDNR~~ NSL&F Wetland Inventory Database, the Nova Scotia Topographic Database, and the Nova Scotia Wet Areas Mapping (WAM) database. The Wetland of Special Significance (WSS) GIS predictive layer provided by NSE was consulted for the presence of WSS within the PA.

Field surveys were completed within the ~~PA~~ Beaver Dam Mine Site from June to August 2015 ~~(mine footprint)~~ and within the Haul Road from June to July 2016 ~~(Haul Road)~~, following the initial desktop review. Additional wetland surveys were conducted in the western, northeastern, and eastern extensions to the Beaver Dam Mine Site in September 2018. The Beaver Dam Mine Site extended west to allow for the micro siting of the waste rock stockpile, northeast to allow for waterline discharge into Cameron Flowage, and east to accompany a second waterline discharge point as well as the micro siting of till stockpiles. Targeted surveys were completed within the ~~PA~~ Beaver Dam Mine Site and Haul Road where mapped systems were present to confirm and delineate wetland habitat. Meandering transects were also completed across the ~~PA~~ within these Project components to support efforts to delineate all wetlands present within the PA, beyond those identified in the available database resources. Trained wetland delineators and evaluators completed all field surveys. Isolated wetlands that were obviously identified as <100 m^2 in the field were not delineated due to the minimum size requirement of a provincially regulated wetland. However, if a wetland was near 100 m^2, or if the delineators were unsure of the size in the field, the wetland was delineated. Wetlands determined to be smaller than 100 m^2 post field evaluation were not included on figures nor were these small wetland areas considered for the effects assessment.

Delineated wetlands that extended outside of the PA (for both the ~~mine footprint~~ Beaver Dam Mine Site and the Haul Road ~~footprint~~) were only delineated to the PA boundary. Wetland habitat extending beyond the PA was evaluated through desktop resources, including topographic mapping, ~~NSDNR~~ NSL&F wetland inventory, and the WAM to estimate wetland type, size, and broad wetland function.

Wetland delineation was conducted in accordance with the Corps of Engineers Wetland Delineation Manual (Environmental Laboratory, 1987) and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (United States Army Corps of Engineers, 2011). In each wetland, vegetation, hydrology, and soils data were recorded at both wetland and upland data points on either side of the wetland boundary in accordance with the Corps of Engineers Wetland Delineation Manual (Environmental Laboratory, 1987).

Wetland boundaries were documented using an SXBlue II Global Positioning System (GPS) receiver unit capable of sub-metre accuracy with a handheld SXPad field computer. Any inlet and outlet streams or other features associated with each wetland present within the PA were marked during the delineation processes, as well as walked and mapped. Pink flagging tape was used to mark the boundaries of wetlands and blue flagging tape was used to mark the locations of associated watercourses.

In keeping with the Army Corps of Engineers methodologies for wetland delineation, three criteria are required in order for a wetland determination to be made:

- Presence of hydrophytic (water loving) vegetation;
- Presence of hydrologic conditions that result in periods of flooding, ponding, or saturation during the growing season; and
- Presence of hydric soils.

Hydrophytic vegetation is defined as the sum total of macrophytic plant life that occurs in areas where the frequency and duration of inundation or soil saturation produce permanent or periodically saturated soils of sufficient duration to exert a controlling influence on the plant species present (Environmental Laboratory, 1987). Hydrophytic vegetation should be the dominant plant type in wetland habitat (Environmental Laboratory, 1987).

Dominant plant species observed at each data point were classified according to their indicator status (probability of occurrence in wetlands) in accordance with the Nova Scotia Wetland Indicator Plant List. Further relevant information was reviewed in Flora of Nova Scotia (Roland, 1998).

If the majority (greater than 50%) of the dominant vegetation at a data point is classified as obligate (OBL), facultative wetland (FACW), or facultative (FAC) (excluding FAC-), then the location of the data point is considered to be dominated by hydrophytic vegetation.

A hydric soil is defined as a soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (United States

Department of Agriculture, 2003). Indicators that a hydric soil is present include soil colour (gleyed soils and soils with bright mottles and/or low matrix chroma), aquic or preaquic moisture regime, reducing soil conditions, sulfidic material (odour), soils listed on the hydric soils list, iron and manganese concretions, organic soils (histosols), histic epipedon, high organic content in surface layer in sandy soils, and organic streaking in sandy soils.

A soil pit was completed at each data point. These pits were excavated to a maximum depth of 50 cm or refusal. The soil in each pit was then examined for hydric soil indicators. The matrix colour and mottle colour (if present) of the soil were determined using the Munsell Soil Colour Charts.

Wetland habitat, by definition, either periodically or permanently, has a water table at, near, or above the land surface or is saturated with water. To be classified as a wetland, a site should have at least one primary indicator or two secondary indicators of wetland hydrology. Examples of primary indicators of wetland hydrology include watermarks, drift lines, sediment deposition, and water stained leaves. Examples of secondary indicators of wetland hydrology include oxidized root channels, dry season water table, and stunted or stressed plants.

Each area of expected wetland habitat was assessed for signs of hydrology through observations across the area and assessment of soil pits at each data point.

Touquoy Mine Site

Wetlands were identified within Touquoy Mine Site as part of the EARD process via the NSL&F Wetlands Database and air photo interpretation. These wetlands were assessed in September 2006 and in the spring of 2007 (CRA 2007).

From 2015-2017 MEL biologists conducted further wetland surveys by delineating and completing functional assessments on additional wetlands within the Touquoy Mine Site as part of the wetland permitting process.

6.8.2.1 Wetland Functional Assessment

Observations were made on wetland types, water flow path, dominant vegetation communities (and SAR/SOCI, if present), fish habitat potential and characterization, and wetland function. The analysis of wetland function was completed for each wetland using the NSE NovaWET 3.0 wetland evaluation technique. The evaluation of wetland function included gathering field and desktop information to support conclusions relating to wetland characteristics, condition and integrity of adjacent lands, identification of exceptional features, hydrologic condition and integrity, water quality, groundwater interactions, shoreline stabilization, plant community, fish and wildlife habitat and habitat integrity, and community use and value.

Results of the NovaWET functional assessment are provided in Section 6.8.3.1. In addition, summaries specific to the Guidelines for Preparation of an Environmental Impact Statement, Beaver Dam Mine, January 2016 (p. 23) are also provided herein.

6.8.3 Baseline Conditions

Updates to wetlands (total number, individual areas etc.) reflected within this section are as a result of additional surveys required by changes to the PA in order to incorporate the micrositing of Project infrastructure.

~~Sixty-three~~ Eighty-one wetlands were identified within the ~~mine footprint~~ Beaver Dam Mine Site and 116 wetlands were identified along the Haul Road ~~footprint~~ for a total of ~~179~~ 197 freshwater wetlands. The wetland types, approximate sizes within the PA, and tertiary watershed locations are described in Table 6.8-1, and indicated on Figure 6.3-3 and Figures 6.3-3A to 6.3-3L.

Table 6.8-1 Wetland Types and Approximate Sizes

Wetland	Wetland Type	Wetland Area* (m^2)	~~Footprint~~ PA Component	Tertiary Watershed
1	complex: mixed wood treed bog, tall shrub bog, open low shrub bog	37,188	Beaver Dam Mine Site	Tent Lake and Kent Lake
2	complex: coniferous treed bog, graminoid bog, low shrub bog, shrub bog	196,857	Beaver Dam Mine Site	Tent Lake, Kent Lake, and Cameron Flowage
3	shrub bog	4,658	Beaver Dam Mine Site	Cameron Flowage
4	complex: treed swamp/ treed fen, mixed wood treed swamp	13,139	Beaver Dam Mine Site	Cameron Flowage
5	mixed wood treed swamp	6,202	Beaver Dam Mine Site	Cameron Flowage
6	mixed wood treed swamp	262	Beaver Dam Mine Site	Cameron Flowage
7	cut treed swamp	306	Beaver Dam Mine Site	Cameron Flowage
8	complex: coniferous treed swamp, graminoid fen, low shrub fen, shrub swamp	16,603	Beaver Dam Mine Site	Cameron Flowage
9	open bog	307	Beaver Dam Mine Site	Kent Lake
~~10*~~ 10	low shrub fen	~~7,359~~ 18,817	Beaver Dam Mine Site	Cameron Flowage
11	complex: low shrub bog, mixed wood treed swamp	2,955	Beaver Dam Mine Site	Cameron Flowage
12	complex: open mixed wood treed swamp, coniferous treed swamp	4,475	Beaver Dam Mine Site	Cameron Flowage

Wetland	Wetland Type	Wetland Area* (m^2)	~~Footprint~~ PA Component	Tertiary Watershed
13	complex: treed swamp, coniferous treed swamp	4,816	Beaver Dam Mine Site	Cameron Flowage
~~14*~~ 14	complex: shrub bog, mixed wood treed swamp, low shrub fen	~~21,528~~ 31,655	Beaver Dam Mine Site	Cameron Flowage
15	graminoid fen	~~406~~ 1,249	Beaver Dam Mine Site	Cameron Flowage
~~16*~~ 16	open shrub swamp	~~1,321~~ 3,670	Beaver Dam Mine Site	Cameron Flowage
17*	complex: tall shrub swamp, coniferous treed bog	~~72,737~~ 76,341	Beaver Dam Mine Site	Cameron Flowage
18	coniferous treed swamp	1,864	Beaver Dam Mine Site	Cameron Flowage
19	shrub bog	11,428	Beaver Dam Mine Site	Cameron Flowage
20	mixed wood treed fen	10,106	Beaver Dam Mine Site	Cameron Flowage
21	mixed wood treed swamp	202	Beaver Dam Mine Site	Kent Lake
22	mixed wood treed swamp	274	Beaver Dam Mine Site	Kent Lake
23	coniferous treed swamp	419	Beaver Dam Mine Site	Kent Lake
24	coniferous treed swamp	328	Beaver Dam Mine Site	Kent Lake
25	coniferous treed swamp	1,416	Beaver Dam Mine Site	Kent Lake
26	coniferous treed swamp	658	Beaver Dam Mine Site	Kent Lake
27	mixed wood treed swamp	493	Beaver Dam Mine Site	Kent Lake

Wetland	Wetland Type	Wetland Area* (m^2)	~~Footprint~~ PA Component	Tertiary Watershed
28	coniferous treed swamp	222	Beaver Dam Mine Site	Kent Lake
~~29*~~ 29	complex: mixed wood treed swamp, low shrub fen, open bog, coniferous treed swamp, coniferous raised bog, graminoid fen	~~116,021~~ 112,835	Beaver Dam Mine Site	Kent Lake and Cameron Flowage
30	coniferous treed swamp	964	Beaver Dam Mine Site	Kent Lake
~~31*~~ 31	coniferous treed swamp	~~6,520~~ 10,473	Beaver Dam Mine Site	Kent Lake and Cameron Flowage
32	coniferous treed swamp	120	Beaver Dam Mine Site	Kent Lake
33	coniferous treed swamp	1,900	Beaver Dam Mine Site	Kent Lake
34	mixed wood treed swamp	1,382	Beaver Dam Mine Site	Cameron Flowage
35	coniferous treed swamp	3,376	Beaver Dam Mine Site	Kent Lake and Cameron Flowage
36	coniferous treed swamp	916	Beaver Dam Mine Site	Kent Lake
37	deciduous treed swamp	253	Beaver Dam Mine Site	Kent Lake
38	coniferous treed swamp	388	Beaver Dam Mine Site	Kent Lake and Cameron Flowage
39	coniferous treed swamp	1,857	Beaver Dam Mine Site	Cameron Flowage
40	coniferous treed swamp	8,091	Beaver Dam Mine Site	Cameron Flowage
41	graminoid marsh	910	Beaver Dam Mine Site	Cameron Flowage

Wetland	Wetland Type	Wetland Area* (m^2)	~~Footprint~~ PA Component	Tertiary Watershed
42	coniferous treed swamp	1,879	Beaver Dam Mine Site	Cameron Flowage
43	mixed wood treed swamp	81	Beaver Dam Mine Site	Cameron Flowage
44	coniferous treed bog	10,611	Beaver Dam Mine Site	Cameron Flowage
45	coniferous treed swamp	295	Beaver Dam Mine Site	Cameron Flowage
46	coniferous treed riverine swamp	754	Beaver Dam Mine Site	Cameron Flowage
47	fresh water marsh	1,029	Beaver Dam Mine Site	Cameron Flowage
48	coniferous treed swamp	2,876	Beaver Dam Mine Site	Cameron Flowage
49	coniferous treed swamp	117	Beaver Dam Mine Site	Cameron Flowage
50	coniferous tall shrub swamp	117	Beaver Dam Mine Site	Cameron Flowage
51	mixed wood treed swamp	898	Beaver Dam Mine Site	Cameron Flowage
52	coniferous treed swamp	1,620	Beaver Dam Mine Site	Cameron Flowage
53	low shrub swamp	824	Beaver Dam Mine Site	Cameron Flowage
54	coniferous treed bog	416	Beaver Dam Mine Site	Kent Lake
55	mixed wood treed swamp	616	Beaver Dam Mine Site	Cameron Flowage
56	complex: coniferous treed swamp, tall shrub swamp, low shrub bog	16,275	Beaver Dam Mine Site	Cameron Flowage

Wetland	Wetland Type	Wetland Area* (m^2)	~~Footprint~~ PA Component	Tertiary Watershed
57*	complex: coniferous treed swamp, deciduous treed swamp	~~88,769~~ 88,717	Beaver Dam Mine Site	Tent Lake and Cameron Flowage
58	deciduous treed swamp	581	Beaver Dam Mine Site	Cameron Flowage
59	coniferous treed swamp	65,348	Beaver Dam Mine Site	Cameron Flowage
60	coniferous treed swamp	2,963	Beaver Dam Mine Site	Cameron Flowage
61*	complex: deciduous treed swamp, tall shrub swamp, open low shrub fen	~~24,653~~ 25,953	Beaver Dam Mine Site	Cameron Flowage
62	coniferous treed swamp	832	Beaver Dam Mine Site	Cameron Flowage
63	coniferous treed swamp	~~492~~ 486	Beaver Dam Mine Site	Kent Lake
200	soft wood swamp	1,677	Beaver Dam Mine Site	Cameron Flowage
201	mixed wood swamp	284	Beaver Dam Mine Site	Cameron Flowage
202	soft wood swamp	571	Beaver Dam Mine Site	Cameron Flowage
203	open bog	3,925	Beaver Dam Mine Site	Cameron Flowage
204	soft wood swamp	8,295	Beaver Dam Mine Site	Cameron Flowage
205	mixed wood swamp	1,371	Beaver Dam Mine Site	Cope Brook
206	shrub swamp	3,298	Beaver Dam Mine Site	Cameron Flowage
207	complex: mixed wood treed swamp, bog	67,613	Beaver Dam Mine Site	Cameron Flowage

Wetland	Wetland Type	Wetland Area* (m^2)	~~Footprint~~ PA Component	Tertiary Watershed
208	soft wood bog	6,478	Beaver Dam Mine Site	Cameron Flowage
209	shrub bog	2,024	Beaver Dam Mine Site	Cameron Flowage
210	soft wood bog	11,058	Beaver Dam Mine Site	Cameron Flowage
211	soft wood swamp	10,474	Beaver Dam Mine Site	Cameron Flowage
212	shrub swamp	13,987	Beaver Dam Mine Site	Cameron Flowage
213	shrub swamp	992	Beaver Dam Mine Site	Cameron Flowage
214	mixed wood swamp	6,041	Beaver Dam Mine Site	Cameron Flowage
215	shrub swamp	16,447	Beaver Dam Mine Site	Cameron Flowage
216	shrub swamp	1,397	Beaver Dam Mine Site	Cameron Flowage
217	soft wood swamp	5,230	Beaver Dam Mine Site	Cameron Flowage
Total Delineated Wetland Habitat within ~~Mine Footprint~~ Beaver Dam Mine Site: ~~783,272 m2 (78.33 ha)~~ 974,825 m^2 (97.48 ha)				
64*	complex: low shrub bog, mixed wood treed swamp	15,979	Haul Road	Tent Lake
65	open bog	65	Haul Road	Tent Lake
66*	complex: graminoid fen, mixed wood treed swamp, high shrub fen	15,423	Haul Road	Tent Lake
67*	complex: low shrub fen, tall shrub fen	1,433	Haul Road	Tent Lake

Wetland	Wetland Type	Wetland Area* (m^2)	~~Footprint~~ PA Component	Tertiary Watershed
68*	complex: shrub fen, graminoid fen and mixed wood treed swamp	5,579	Haul Road	Tent Lake
69*	complex: shrub fen, graminoid fen, and mixed wood treed swamp	3,899	Haul Road	Tent Lake
70*	tall shrub swamp	631	Haul Road	Tent Lake
71	deciduous treed swamp	425	Haul Road	Brandon Lake
72	deciduous treed swamp	1,471	Haul Road	Brandon Lake
73*	complex: tall shrub swamp, tall shrub fen	26,893	Haul Road	Brandon Lake
74*	complex: mixed wood treed swamp, fresh water marsh	12,340	Haul Road	Brandon Lake
75	mixed wood treed swamp	144	Haul Road	Brandon Lake
76*	complex: mixed wood treed swamp, open graminoid fen	10,405	Haul Road	Brandon Lake
77*	mixed wood treed swamp	1,204	Haul Road	Brandon Lake
78	mixed wood treed swamp	194	Haul Road	Brandon Lake
79*	coniferous treed swamp	3,703	Haul Road	Brandon Lake
80*	coniferous bog	979	Haul Road	Brandon Lake
81	tall shrub swamp	154	Haul Road	Brandon Lake
82*	mixed wood treed swamp	616	Haul Road	Brandon Lake
83*	mixed wood treed swamp	535	Haul Road	Brandon Lake
84*	low shrub swamp	695	Haul Road	Brandon Lake
85*	low shrub swamp	322	Haul Road	Brandon Lake
86*	mixed wood swamp	4,684	Haul Road	Brandon Lake
87*	open bog	362	Haul Road	Brandon Lake
88	tall shrub swamp	417	Haul Road	Brandon Lake

Wetland	Wetland Type	Wetland Area* (m^2)	~~Footprint~~ PA Component	Tertiary Watershed
89*	treed swamp	6,194	Haul Road	Brandon Lake
90*	mixed wood treed swamp	4,495	Haul Road	Brandon Lake
91*	mixed wood treed swamp	1,060	Haul Road	Brandon Lake
92*	mixed wood treed swamp	1,943	Haul Road	Brandon Lake
93	graminoid marsh	166	Haul Road	Brandon Lake
94*	mixed wood treed swamp	1,748	Haul Road	Brandon Lake
95*	mixed wood treed swamp	263	Haul Road	Brandon Lake
96*	mixed wood treed swamp	861	Haul Road	Brandon Lake
97	mixed wood treed swamp	107	Haul Road	Brandon Lake
98*	mixed wood treed swamp	1,540	Haul Road	Rocky Brook Lake
99*	mixed wood treed swamp	694	Haul Road	Rocky Brook Lake
100	shrub swamp	1,582	Haul Road	Rocky Brook Lake
101	clear cut swamp	219	Haul Road	Rocky Brook Lake
102	complex; mixed wood treed bog, mixed wood treed swamp	5,439	Haul Road	Rocky Brook Lake
103	low shrub bog	455	Haul Road	Rocky Brook Lake
104	low shrub swamp	102	Haul Road	Rocky Brook Lake
105	low shrub bog	284	Haul Road	Rocky Brook Lake
106*	low shrub bog	1,701	Haul Road	Rocky Brook Lake
107	coniferous treed swamp	186	Haul Road	Lake Alma
108	tall shrub swamp	183	Haul Road	Lake Alma
109	coniferous treed swamp	1,606	Haul Road	Lake Alma and Rocky Brook Lake
110*	shrub bog	912	Haul Road	Lake Alma
111*	mixed wood swamp	1,060	Haul Road	Lake Alma

Wetland	Wetland Type	Wetland Area* (m^2)	~~Footprint~~ PA Component	Tertiary Watershed
112*	mixed wood swamp	3,595	Haul Road	Lake Alma
113*	mixed wood treed swamp	1,940	Haul Road	Lake Alma
114	coniferous swamp	242	Haul Road	Lake Alma
115*	mixed wood treed swamp	582	Haul Road	Lake Alma
116	coniferous swamp	892	Haul Road	Lake Alma
117	coniferous swamp	147	Haul Road	Lake Alma
118	coniferous swamp	428	Haul Road	Lake Alma
119	coniferous treed swamp	328	Haul Road	Lake Alma
120	low shrub swamp	115	Haul Road	Lake Alma
121	coniferous swamp	~~154~~ 466	Haul Road	Lake Alma
122	coniferous treed swamp	200	Haul Road	Lake Alma
123	mixed wood treed swamp	818	Haul Road	Lake Alma
124*	mixed wood treed swamp	528	Haul Road	Lake Alma
125	mixed wood treed swamp	344	Haul Road	Lake Alma
126	mixed wood treed swamp	63	Haul Road	Lake Alma
127*	treed bog	185	Haul Road	Lake Alma
128	tall shrub bog	409	Haul Road	Lake Alma
129	treed bog	2,006	Haul Road	Lake Alma
130	coniferous treed swamp	1,092	Haul Road	Middle Beaver Lake and Lake Alma
131	mixed wood treed swamp	1,087	Haul Road	Middle Beaver Lake
132	mixed wood treed swamp	2,425	Haul Road	Lake Alma
133	low shrub bog	102	Haul Road	Lake Alma
134	treed swamp	398	Haul Road	Lake Alma

Wetland	Wetland Type	Wetland Area* (m²)	~~Footprint~~ PA Component	Tertiary Watershed
135*	shrub fen	934	Haul Road	Lake Alma
136	mixed wood treed swamp	522	Haul Road	Lake Alma
137*	mixed wood treed swamp	2,404	Haul Road	Lake Alma
138	shrub bog	1,521	Haul Road	Lake Alma
139	tall shrub bog	106	Haul Road	Lake Alma
140	treed bog	230	Haul Road	Lake Alma
141	high shrub bog	60	Haul Road	Lake Alma
142	low shrub bog	342	Haul Road	Lake Alma
143	complex: graminoid bog, deciduous treed swamp	526	Haul Road	Lake Alma
144*	tall shrub fen	2,034	Haul Road	Lake Alma
145*	low shrub bog	1,462	Haul Road	Lake Alma
146*	complex: graminoid fen, mixed wood treed swamp	2,653	Haul Road	Lake Alma
147*	complex: low shrub bog, mixed wood treed swamp	2,708	Haul Road	Lake Alma
148*	low shrub bog	9,220	Haul Road	Lake Alma
149*	low shrub bog	1,811	Haul Road	Lake Alma
150	marsh	145	Haul Road	Lake Alma
151*	tall shrub bog	2,959	Haul Road	Lake Alma
152*	clear cut mixed wood swamp	2,046	Haul Road	Lake Alma
153*	shrub swamp	2,416	Haul Road	Lake Alma
154*	open bog	1,991	Haul Road	Lake Alma
155*	mixed wood treed swamp	717	Haul Road	Lake Alma
156*	shrub bog	14,756	Haul Road	Lake Alma and Eagles Nest Basin

Wetland	Wetland Type	Wetland Area* (m^2)	~~Footprint~~ PA Component	Tertiary Watershed
157*	complex: shrub fen, shrub swamp	7,006	Haul Road	Lake Alma and Eagles Nest Basin
158	shrub swamp	575	Haul Road	Eagles Nest Basin
159*	mixed wood treed swamp	1,995	Haul Road	Eagles Nest Basin
160*	freshwater marsh	1,237	Haul Road	Eagles Nest Basin
161	mixed wood swamp	1,618	Haul Road	Eagles Nest Basin
162*	mixed wood treed swamp	1,756	Haul Road	Eagles Nest Basin
163*	clear-cut swamp	1,107	Haul Road	Eagles Nest Basin
164*	mixed wood treed swamp	3,320	Haul Road	Eagles Nest Basin
165*	mixed wood treed swamp	1,623	Haul Road	Eagles Nest Basin
166	shrub swamp	68	Haul Road	Eagles Nest Basin
167*	mixed wood treed swamp	875	Haul Road	Eagles Nest Basin
168*	open bog	664	Haul Road	Eagles Nest Basin
169*	mixed wood treed swamp	607	Haul Road	Eagles Nest Basin
170*	mixed wood treed swamp	1,893	Haul Road	Eagles Nest Basin
171*	mixed wood treed swamp	4,329	Haul Road	Rocky Lake
172	mixed wood treed swamp	229	Haul Road	Rocky Lake
173*	mixed wood treed swamp	4,814	Haul Road	Rocky Lake
174*	mixed wood treed swamp	2,513	Haul Road	Rocky Lake
175*	shrub swamp	611	Haul Road	Rocky Lake
176*	mixed wood treed swamp	446	Haul Road	Rocky Lake
177*	shrub swamp	755	Haul Road	Rocky Lake
178*	mixed wood treed swamp	4,439	Haul Road	Rocky Lake
179*	mixed wood treed swamp	3,412	Haul Road	Rocky Lake
Total Delineated Wetland Habitat within Haul Road: ~~256,887 m2 (25.69 ha)~~ 257,199 m^2 (25.72 ha)				

Wetland	Wetland Type	Wetland Area* (m²)	~~Footprint~~ PA Component	Tertiary Watershed
Total Delineated Wetland Habitat within ~~PA~~ the Beaver Dam Mine Site and Haul Road component: ~~104.01 ha~~ 123.20 ha				

Wetland area is calculated based on field delineation within the Project Area.

*Wetland # marked with an * extend beyond the Project Area boundaries, and total size has not been calculated.*

Note: Wetlands 180 to 199 are located within the Preferred Alternative Haul Road and are discussed in detail in Section 6.8.7.

In general, hydrological flow within wetlands present in the ~~mine footprint PA~~ Beaver Dam Mine Site initiates at the southern extent of the PA, at the division of three tertiary watershed boundaries (see watershed characteristics in Section 6.7.3.1). Larger wetland complexes straddle the watershed boundaries (notably wetlands 1, 2, 29, 32, and 57) and act as the primary outflow water source for downgradient wetlands, watercourses, and lower lying lakes. Wetlands 1 and 2 exist as bog complexes, which intercept and store precipitation and small scale water seepage from surrounding land prior to draining via additional aquatic features to the north and south. As is typical of these habitats in Nova Scotia, bog formations located on higher land have the ability to source water to more than one tertiary watershed. In this case, water predominantly flows northward into the Cameron Flowage tertiary watershed, although water is also drained southward, notably from wetland 2 into wetland 1 and the Tent Lake tertiary watershed. The same can be said for wetlands 29 and 57, which also exist as complexes (albeit with a larger swamp component), but outflow northward toward Crusher Lake and Cameron Flowage and southward into Kent Lake and Tent Lake tertiary watersheds, respectively. A fourth tertiary watershed, the Cope Brook Tertiary Watershed, is located in the western extent of the Beaver Dam Mine Site. Only one wetland, wetland 205, is found within this watershed. This wetland is isolated with no direct connectivity to surface waters feeding Cope Brook. Hydrologic flow within this tertiary watershed is directed south west towards Cope Brook.

As water drains northward through the ~~mine footprint PA~~ Beaver Dam Mine Site, it does so via predominantly swamp habitat, often associated with watercourses or small-scale surface channelization (i.e., throughflow in nature). While intermixed with a scattering of isolated wetlands, swamps dominate the central portions the Cameron Flowage tertiary watershed and act as either mechanisms to drain water northward from the larger wetland complexes in the south, or in the case of isolated wetlands, form in small topographically defined basin formations. The major receptors of water within the mine PA are initially Crusher Lake, with Mud Lake and Cameron Flowage ultimately receiving most water from within the PA prior to it draining offsite to the southeast. Larger riparian swamp wetlands (e.g., wetland 17 and wetland 61) border Mud Lake and Cameron Flowage, intercepting water prior to releasing it into the water bodies.

A lesser quantity of water exists within wetlands located in the headwaters of the Kent Lake watershed, whereby wetland 29 appears to be the major outflow of water. The remaining wetlands identified in this watershed are isolated in nature and provide groundwater recharge capacities rather than act as a source of surface water discharge to lower lying features.

Due to its extensive length and intersection with seven separate tertiary watersheds, wetlands along the Haul Road ~~PA~~ vary between outflow wetlands located at headwater locations, throughflow wetlands that drain water toward lower reaches of the watersheds, and some instances of wetlands within lower portions of the watershed. As is typical of the Nova Scotia landscape, however, smaller isolated wetlands were also identified in all regions of all watersheds.

Touquoy Mine Site

Six wetlands were identified within the Touquoy Mine Site in 2006 as part of the EARD process, five of which were assessed. One of these wetlands was deemed to not be affected from Project development and therefore was not evaluated (CRA 2007).

A total of 52 wetlands were identified within the Touquoy Mine Site (including the western bypass road) during field studies by MEL biologists from 2015-2017. These wetlands were identified for wetland permitting process and functional assessments were completed to support permitting. Evaluation will be limited to riparian wetlands along Moose River, downstream of the discharge location, to confirm potential indirect impacts from the Beaver Dam Mine Project.

6.8.3.1 Functional Assessment Results

The NovaWET functional evaluation technique consists of 11 major sections associated with key wetland functions as listed below:

- Watershed Characteristics;
- Wetland Characterization;
- Condition and Integrity of Adjacent Land;
- Identification of Exceptional Features;
- Hydrologic Condition and Integrity;
- Water Quality;
- Groundwater Interactions;
- Shoreline Stabilization and Integrity;
- Plant Community;
- Fish and Wildlife Habitat and Integrity; and
- Community Use/Value

Each section contains questions specific to a function that supports the assessor in determining to what degree the wetland provides significant functions (SF). NovaWET continues to identify critical (SF red flag functions highlighted red) wetland functions that are often unique or rare or associated with higher risk to the watershed if lost. The Wetland Functional Assessment Summary Table included in **Appendix H.1** provides the results of the SF determination for all wetlands within the ~~Mine Site~~ Beaver Dam Mine Site and Haul Road ~~PAs~~.

Additional details for each wetland, including functional summary sheets, plant lists, photographs, and data sheets were recorded by MEL staff during field evaluations, but have not been included in this document due to the volume of data (179 wetlands within the ~~PA~~ Beaver Dam Mine Site and the Haul Road). These data are available upon request.

The following sections provide results of the NovaWET functional assessment.

Watershed Characteristics

The functional assessments conducted for the 179 wetlands located within the ~~PA~~ Beaver Dam Mine Site and the Haul Road determined that the overall watershed condition of the nine relevant tertiary watersheds is in a relatively unaltered state. Urban/commercial development is not present within the watersheds and, therefore, existing roads account for the impervious surfaces calculated within the watershed evaluation, resulting in a range of 0% to 0.62%, with the higher percentages being along the existing Haul Road. Therefore, condition is classified as low. Wetland habitat cover ranges from 3.40% to 22.19% of the total land area of the watersheds. Four of the watersheds provide a high ability to contribute to floodwater protection (<10% wetland cover), all of which comprise the future Haul Road ~~footprint~~. Moderate floodwater protection (10 to 20% wetland cover) is afforded by four watersheds (of which two comprise the future ~~mine footprint~~ Beaver Dam Mine Site and two comprise the Haul Road ~~footprint~~), and one watershed provides low floodwater protection (>20% wetland cover) and comprises the Haul Road ~~footprint~~.

Most buffer areas surrounding the wetlands are highly vegetated. These wetlands and buffers generally offer high quality wildlife habitat and good water quality functions. Forestry activity was documented in habitat along the Haul Road and is also present surrounding the ~~mine footprint PA~~ Beaver Dam Mine Site. All wetlands assessed were determined to provide high plant community integrity as the plants are generally composed of native species characteristic of the wetland type with a minor component of non-native species.

Table 6.8-2 Detailed Watershed Evaluation Results

Tertiary Watershed	Watershed #	Location in Project Area	Describe Watershed Condition (% impervious surface)	% wetland cover	Total WS Area (ha)	Total (WL) area ha	Road Surface length (m)	Road area ha (6.5 m wide)
Cameron Flowage	1EM-2D	Beaver Dam Mine Site	0.00	12.52	6727.78	842.11	0	0
Kent Lake	1EM-2H	Beaver Dam Mine Site	0.00	22.19	871.12	193.31	0	0
Tent Lake	1EM-2F	Beaver Dam Mine Site /Haul Road	0.00	16.43	1086.9	178.53	0	0
Brandon Lake	1EM-2G	Haul Road	0.00	6.22	1214.2	75.55	0	0
Rocky Brook Lake	1EM-2N	Haul Road	0.62	3.40	1416.73	48.1	13434	8.7321
Lake Alma	1EM-2P	Haul Road	0.00	7.27	5041.43	366.35	363	0.23595
Middle Beaver Lake	1EM-2M	Haul Road	0.19	4.30	671.57	28.86	2014	1.3091
Eagle's Nest Basin	1EL-2C	Haul Road	0.04	10.57	5117.9	540.81	3317	2.15605
Rocky Lake	1EL-2H	Haul Road	0.00	16.84	3111.17	523.95	0	0
Cope Brook	1EM-2-J	Beaver Dam Mine Site	0.00	8.8	1204.99	106.05	0	0

Wetland Characteristics

The majority (~~63%~~ 65%) of wetlands identified within the ~~mine footprint PA~~ Beaver Dam Mine Site were classified as swamps. Similarly, the majority of wetlands identified along the Haul Road were also classified as swamp habitat (65%). There were several wetland complexes within the ~~PA~~ Beaver Dam Mine Site and Haul Road that comprised of some combination of shrub and treed bog and swamp and fen habitat. Many of these extended beyond the PA boundaries. Table 6.8-3 outlines the wetland types identified throughout the ~~PA~~ Beaver Dam Mine Site and Haul Road.

Table 6.8-3 Wetland Types within the ~~PA~~ Beaver Dam Mine Site and Haul Road

Project Area (PA)	Mine Site	Haul Road
Wetland Complex		
Number of Wetlands	~~13~~ 14	13
% of total wetlands identified within each representative PA	~~21%~~ 17%	11%
Treed or Shrub Swamps		
# of Wetlands	~~40~~ 53	75
% of total wetlands identified within each representative PA	~~63%~~ 65%	65%
Bog		
# of Wetlands	~~5~~ 9	23
% of total wetlands identified within each representative PA	~~8%~~ 11%	20%
Fen		
# of Wetlands	3	2
% of total wetlands identified within each representative PA	~~5%~~ 4%	2%
Marsh		
# of Wetlands	2	3
% of total wetlands identified within each representative PA	~~3%~~ 2%	3%

The average size of the wetlands within the ~~mine footprint~~ Beaver Dam Mine Site is just over 1 ha. The wetlands identified in southern portions of the ~~mine footprint PA~~ Beaver Dam Mine Site are in headwater positions, as they are situated at the boundary of three tertiary watersheds within the West River Sheet

Harbour Secondary Watershed, and many wetlands are sources of surface water for first order stream formation within their respective watersheds. Wetlands within the northern half of the ~~mine footprint PA~~ Beaver Dam Mine Site, however, are located in central portions of the tertiary watershed and, therefore, likely act as throughflow features.

The majority of wetlands identified along the Haul Road were also classified as swamps (approximately 65%). The vast majority of wetland habitat identified within the Haul Road ~~PA~~ was partially delineated, with wetland habitat extending beyond the PA boundaries. Wetlands within the Haul Road ~~PA~~ straddle seven tertiary watersheds and range from wetlands in headwater positions to wetlands near, or at the bottom of watersheds.

Detailed biophysical wetland information for each delineated wetland including wetland type, dominant vegetation, soil and hydrological conditions is provided in a Wetland Characterization Table in Appendix H.2.

Table 6.8-4 provides selected functional wetland information utilized as part of the functional assessment analysis throughout this chapter.

Table 6.8-4 Wetland Functional Information

Wetland ID	Wetland Type	Wetland Size (m2)	Landscape Position	Landform	Water Flow Path	Water Regime	Watercourse Association	Standing Water and % cover in wetland	Adjacent Upland Land Use	Stressors	Wetland Hydrology Altered?
~~Mine Footprint~~ Beaver Dam Mine Site											
1	complex: Mixed wood treed bog, tall shrub bog, open low shrub bog	37,188	Terrene	Basin	Outflow-Headwater	Permanently saturated	No	<5%	Forested	None	No
2	complex: Coniferous treed bog, graminoid bog, low shrub bog, shrub bog	196,857	Terrene	Basin	Outflow-Headwater	Permanently saturated	Stream	0%	Forested	None	No
3	shrub bog	4,658	Terrene	Basin	Isolated	Permanently Saturated	No	50%	Forested	None	No
4	complex: Treed swamp/ treed fen, mixed wood treed swamp	13,139	Terrene	Basin	Throughflow	Permanently Saturated, Seasonally Flooded	Stream	20%	Forested	None	No
5	mixed wood treed swamp	6,202	Terrene	Basin	Outflow-Headwater	Permanently saturated	No	5%	Forested	None	No
6	mixed wood treed swamp	262	Terrene	Basin	Isolated	Seasonally saturated	No	0%	Forested	ATV trails	Old skidder tracks
7	cut treed swamp	306	Terrene	Basin	Isolated	Seasonally flooded/ Permanently saturated	No	<5%	Forested	Trails	No
8	complex: Coniferous treed swamp, graminoid fen, low shrub fen, shrub swamp	16,603	Lentic lake	Basin	Bidirectional- non-tidal /Throughflow	Permanently saturated	Lake	30%	Forested	Cabin	Outlet man-made (constructed lake)

Wetland ID	Wetland Type	Wetland Size (m2)	Landscape Position	Landform	Water Flow Path	Water Regime	Watercourse Association	Standing Water and % cover in wetland	Adjacent Upland Land Use	Stressors	Wetland Hydrology Altered?
9	open bog	307	Terrene	Basin	Isolated	Seasonally flooded/ Permanently saturated	No	5%	Forested/ Roads	Infill at outlet	Drainage, ditching, and outlet adjustment
10	low shrub fen	~~7,359~~ 18,817	Lentic lake	Basin	Bidirectional- non-tidal	Permanently saturated	Lake	50%	Forested	None	No
11	complex: low shrub bog, mixed wood treed swamp	2,955	Lotic Stream (ephemeral)	Basin	Throughflow	Permanently saturated	No	5%	Forested	None	No
12	complex: Open mixed wood treed swamp, coniferous treed swamp	4,475	Terrene	Basin	Isolated	Seasonally saturated	No	0%	Forested	None, but some rutting and an old clearing	No
13	complex: Treed swamp, coniferous treed swamp	4,816	Terrene	Basin	Throughflow	Seasonally flooded/ Permanently saturated	No	20%	Forested	Dam at outlet	Dam at outlet
14	complex: Shrub bog, Mixed wood treed swamp, low shrub fen	~~21,528~~ 31,655	Terrene / Lotic Stream	Basin	Throughflow	Permanently saturated	Streams	8%	Forested/ Road	None	No
15	graminoid fen	~~406~~ 1,249	Lentic Pond	Basin	Outflow	Permanently saturated	Stream/ Pond	20%	Forested	Access trail	Pond is man-made
16	open shrub swamp	~~1,321~~ 3,670	Terrene	Basin	Outflow-Headwater (inferred)	Permanently saturated	No	<5%	Forested	None	No
17	complex: Tall shrub swamp, coniferous treed bog	~~72,737~~ 76,341	Lentic lake	Basin	Bidirectional- non-tidal/ throughflow	Permanently Saturated, Permanently Flooded	Stream/ Lake	40%	Forested	None	No
18	coniferous treed swamp	1,864	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	Access trail	No

Wetland ID	Wetland Type	Wetland Size (m2)	Landscape Position	Landform	Water Flow Path	Water Regime	Watercourse Association	Standing Water and % cover in wetland	Adjacent Upland Land Use	Stressors	Wetland Hydrology Altered?
19	shrub bog	11,428	Terrene	Basin	Isolated	Permanently saturated	No	1%	Forested	Clear-cut	No
20	mixed wood treed fen	10,106	Terrene/Lotic Stream	Basin	Throughflow	Permanently flooded/ Permanently saturated	Stream	25%	Forested/ Road/ Trail	Culverts	Outlet has a culvert
21	mixed wood treed swamp	202	Terrene	Basin	Isolated	Seasonally saturated	No	0%	Forested	Ruts	Surface
22	mixed wood treed swamp	274	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	No
23	coniferous treed swamp	419	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested/ Clear-cut	None	No
24	coniferous treed swamp	328	Terrene	Basin	Isolated	Permanently Saturated	No	0%	Forested/ Clear-cut	Clear-cut	No
25	coniferous treed swamp	1,416	Terrene	Basin	Isolated	Permanently saturated	No	1-2%	Forested	Logging	No
26	coniferous treed swamp	658	Terrene	Basin	Isolated	Permanently flooded	No	100%	Forested	Excess water level - potentially road runoff, but source unknown	No
27	mixed wood treed swamp	493	Terrene	Basin	Outflow-Headwater	Permanently saturated	Stream	5%	Forested	None	No
28	coniferous treed swamp	222	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	Logging	No

Wetland ID	Wetland Type	Wetland Size (m2)	Landscape Position	Landform	Water Flow Path	Water Regime	Watercourse Association	Standing Water and % cover in wetland	Adjacent Upland Land Use	Stressors	Wetland Hydrology Altered?
29	complex: Mixed wood treed swamp, low shrub fen, open bog, coniferous treed swamp, coniferous raised bog, graminoid fen	~~131,498~~ 112,835	Lentic lake	Basin	Outflow-Headwater (northern extent) Throughflow (southeastern extent)	Permanently flooded/ Permanently saturated	Lake/ Stream	25%	Forested	Very little	Trenched inlet
30	coniferous treed swamp	964	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	No
31	coniferous treed swamp	~~6,520~~ 10,473	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	No
32	coniferous treed swamp	120	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	No
33	coniferous treed swamp	1,900	Lotic Stream	Basin	Throughflow	Permanently saturated	No	5%	Forested	Trenching	Ditching
34	mixed wood treed swamp	1,382	Terrene	Basin	Isolated	Permanently Saturated	No	0%	Forested/ Clear-cut	Rutting	No
35	coniferous treed swamp	3,376	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	Road	Road/ Culvert
36	coniferous treed swamp	916	Terrene	Slope	Isolated	Permanently saturated	No	0%	Forested	None	No
37	deciduous treed swamp	253	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	Old skidder ruts	Surface
38	coniferous treed swamp	388	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	No
39	coniferous treed swamp	1,857	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	Forest harvest	No
40	coniferous treed swamp	8,091	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	No

Wetland ID	Wetland Type	Wetland Size (m2)	Landscape Position	Landform	Water Flow Path	Water Regime	Watercourse Association	Standing Water and % cover in wetland	Adjacent Upland Land Use	Stressors	Wetland Hydrology Altered?
41	graminoid marsh	910	Terrene	Basin	Isolated	Seasonally saturated	No	0%	Forested/ Road	None	Unknown; evidence of fluctuation
42	coniferous treed swamp	1,879	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	Historic logging/ rutting	No
43	mixed wood treed swamp	81	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested/ Logged	None	No
44	coniferous treed bog	10,611	Terrene	Basin	Throughflow	Permanently flooded	No	90%	Forested	Dead and dying woody debris	Beaver dam
45	coniferous treed swamp	295	Terrene	Basin	Isolated	Permanently saturated	No	<5%	Forested	None	No
46	coniferous treed riverine swamp	754	Lotic Stream	Basin	Throughflow	Permanently saturated	Stream	0%	Forested	None	No
47	fresh water marsh	1,029	Terrene	Basin	Isolated	Permanently flooded	No	80%	Forested	Dead and dying woody plants	No
48	coniferous treed swamp	2,876	Terrene	Basin	Throughflow	Seasonally flooded	Stream	0%	Forested/ Road	Dead and dying woody debris	Ditching and abandoned beaver impoundment
49	coniferous treed swamp	117	Terrene	Basin	Isolated	Permanently saturated	No	5%	Forested	None	No
50	coniferous tall shrub swamp	117	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	No
51	mixed wood treed swamp	898	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	No
52	coniferous treed swamp	1,620	Terrene	Basin	Throughflow	Seasonally saturated	Stream	0%	Forested	Dead and dying plants/ Blowdown	No

Wetland ID	Wetland Type	Wetland Size (m2)	Landscape Position	Landform	Water Flow Path	Water Regime	Watercourse Association	Standing Water and % cover in wetland	Adjacent Upland Land Use	Stressors	Wetland Hydrology Altered?
53	low shrub swamp	824	Terrene	Basin	Outflow-Headwater	Permanently saturated	Stream	<5%	Forested/ Clear-cut	None	No
54	coniferous treed bog	416	Lotic	Basin	Isolated	Permanently saturated	No	0%	Forested/ Road	Road	Road
55	mixed wood treed swamp	616	Terrene	Basin	Isolated	Seasonally flooded/ Permanently saturated	No	0%	Forested	Dead and dying woody plants	Ditching into wetland
56	complex: Coniferous treed swamp, tall shrub swamp, low shrub bog	16,275	Terrene	Basin	Throughflow	Permanently flooded/ Permanently saturated	Streams	5%	Forested/ Trails/ Road	Ditching, roads and some infill	Ditching
57	complex: Coniferous treed swamp, deciduous treed swamp	~~88,769~~ 88.717	Terrene	Basin	Outflow-Headwater	Seasonally saturated/ Permanently saturated	Stream	0%	Forested	None	No
58	deciduous treed swamp	581	Terrene	Slope	Isolated	Permanently saturated	No	0%	Forested	None	No
59	coniferous treed swamp	65,348	Terrene	Basin	Throughflow	Permanently flooded/ Permanently saturated	Streams	70%	Forested/ Roads	Drill pads, cutting, roads, flooding, beaver dam, and dead and dying woody plants	Ditching, dam and culvert
60	coniferous treed swamp	2,963	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	clear cut	No
61	complex: Deciduous treed swamp, tall shrub swamp, open low shrub fen	~~24,653~~ 25,953	Lentic lake	Basin	Throughflow/ Bidirectional- non - tidal	Permanently flooded/ Permanently saturated	Lake	20%	Forested/ Tailings	None	No

Wetland ID	Wetland Type	Wetland Size (m2)	Landscape Position	Landform	Water Flow Path	Water Regime	Watercourse Association	Standing Water and % cover in wetland	Adjacent Upland Land Use	Stressors	Wetland Hydrology Altered?
62	coniferous treed swamp	832	Lentic lake	Basin	Bidirectional- non - tidal	Permanently saturated	Lake	0%	Forested/ Cameron Flowage	None	No
63	coniferous treed swamp	~~492~~ 486	Terrene	Basin	Isolated	Permanently Saturated	No	0%	Forested	No	No
200	soft wood swamp	1,677	Terrene	Basin	Isolated	Seasonally Saturated	No	0%	Forested	None	No
201	mixed wood swamp	284	Terrene	Basin	Isolated	Permanently Saturated	No	0%	Forested	None	No
202	soft wood swamp	571	Terrene	Basin	Isolated	Permanently Saturated	No	0%	Forested	None	No
203	open bog	3,925	Terrene	Basin	Isolated	Permanently Saturated	No	0%	Forested/ Road	Road	Ditching
204	soft wood swamp	8,295	Terrene	Basin	Isolated	Seasonally Saturated	No	0%	Forested/ Road	Road	Ditching
205	mixed wood swamp	1,371	Terrene	Basin	Inflow - Drainage	Permanently Saturated	No	0%	Forested/ Road/ Logged	Road/ Logging	Ditching
206	shrub swamp	3,298	Lotic Stream	Basin	Throughflow	Permanently Saturated	Stream	2%	Forested/ Logged	Logging	No
207	complex: mixed wood treed swamp, bog	67,613	Terrene	Basin	Outflow	Permanently Saturated	Stream	4%	Forested/ Logged	Logging	No
208	soft wood bog	6,478	Terrene	Basin	Isolated	Permanently Saturated	No	3%	Forested	None	No
209	shrub bog	2,024	Terrene	Basin	Isolated	Permanently Saturated	No	0%	Forested	None	No
210	soft wood bog	11,058	Lotic Stream	Basin	Inflow - Stream, Drainage	Permanently Saturated	Stream	10%	Forested/ Logged	None	No

Wetland ID	Wetland Type	Wetland Size (m2)	Landscape Position	Landform	Water Flow Path	Water Regime	Watercourse Association	Standing Water and % cover in wetland	Adjacent Upland Land Use	Stressors	Wetland Hydrology Altered?
211	soft wood swamp	10,474	Terrene	Basin	Isolated	Permanently Saturated	No	0%	Forested	None	No
212	shrub swamp	13,987	Terrene	Basin	Isolated	Permanently Saturated	No	0%	Forested/ Road	Road	No
213	shrub swamp	992	Terrene	Basin	Isolated	Permanently Saturated	No	0%	Forested/ Road	None	No
214	mixed wood swamp	6,041	Terrene	Basin	Isolated	Permanently Saturated	No	0%	Forested/ Road	Road	No
215	shrub swamp	16,447	Lotic Stream	Basin	Outflow	Permanently Saturated	Stream	0%	Forested/ Logged	None	No
216	shrub swamp	1,397	Terrene	Basin	Isolated	Permanently Saturated	No	0%	Forested/ Road	None	Ditching/access road
217	soft wood swamp	5,230	Lotic Stream	Basin	Throughflow	Permanently Saturated	Stream	1%	Forested	None	No
Haul Road											
64	Complex: Low shrub bog, mixed wood treed swamp	15,979	Terrene	Basin	Throughflow	Permanently flooded	No	40%	Forested/ Road	Road	Road
65	open bog	65	Terrene	Basin	Isolated	Seasonally saturated	No	0%	Forested/ Road	Road	Road
66	Complex: graminoid fen, mixed wood treed swamp, high shrub fen	15,423	Terrene	Basin	Throughflow	Permanently flooded	Stream	65%	Forested/ Road	None	Road
67	Complex: low shrub fen, tall shrub fen	1,433	Terrene	Basin	Outflow	Permanently saturated	No	20%	Forested/ Road	None	No

Wetland ID	Wetland Type	Wetland Size (m2)	Landscape Position	Landform	Water Flow Path	Water Regime	Watercourse Association	Standing Water and % cover in wetland	Adjacent Upland Land Use	Stressors	Wetland Hydrology Altered?
68	Complex: shrub fen, graminoid fen and mixed wood treed swamp	5,579	Terrene	Basin	Throughflow	Seasonally saturated	No	10%	Forested/ Road	None	No
69	Complex: Shrub fen, graminoid fen and mixed wood treed swamp	3,899	Lentic	Basin	Throughflow (inferred from wet areas mapping)	Permanently saturated	Stream	5%	Forested/ Road	None	No
70	tall shrub swamp	631	Terrene	Basin	Isolated (inferred)	Permanently saturated	No	20%	Forested/ Road	None	No
71	deciduous treed swamp	425	Terrene	Basin	Isolated	Seasonally saturated	No	0%	Forested/ Road	None	No
72	deciduous treed swamp	1,471	Terrene	Basin	Outflow	Seasonally saturated	No	0%	Forested/ Road	None	Road
73	Complex: tall shrub swamp, tall shrub fen	26,893	Terrene	Basin	Throughflow	Permanently saturated	No	10%	Forested/ Road	None	No
74	Complex: Mixed wood treed swamp, fresh water marsh	12,340	Terrene	Basin	Throughflow	Permanently flooded	Stream	15%	Forested/ Road	None	Road/ Tree fall
75	mixed wood treed swamp	144	Terrene	Basin	Isolated	Seasonally saturated	No	1%	Forested/ Road	None	No
76	Complex: mixed wood treed swamp, open graminoid fen	10,405	Lotic	Basin	Throughflow	Permanently flooded/ Permanently saturated	Stream	2%	Forested/ Road	Roads, culverts, and garbage	Roads and culverts (2)
77	mixed wood treed swamp	1,204	Terrene	Basin	Throughflow (inferred)	Permanently saturated	No	0%	Forested/ Road	None	Road
78	mixed wood treed swamp	194	Terrene	Basin	Isolated	Seasonally saturated	No	0%	Forested/ Road	None	No

Wetland ID	Wetland Type	Wetland Size (m2)	Landscape Position	Landform	Water Flow Path	Water Regime	Watercourse Association	Standing Water and % cover in wetland	Adjacent Upland Land Use	Stressors	Wetland Hydrology Altered?
79	coniferous treed swamp	3,703	Terrene	Basin	Throughflow	Permanently saturated	Stream	0%	Forested/ Road/ Trail	None	Road, bridge, and culverts
80	coniferous bog	979	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested/ Road/ Cut block	None	Road
81	tall shrub swamp	154	Terrene	Basin	Isolated	Permanently saturated	No	20%	Forested/ Road	None	No
82	mixed wood treed swamp	616	Terrene	Basin	Isolated	Permanently saturated	No	1%	Forested/ Road	None	No
83	mixed wood treed swamp	535	Terrene	Basin	Isolated (inferred)	Permanently saturated	No	0%	Forested	None	Ditching
84	low shrub swamp	695	Terrene	Basin	Isolated (inferred)	Seasonally saturated	No	0%	Forested/ Road/ Cut block	Rutting/ Clear-cut	Old cut block
85	low shrub swamp	322	Terrene	Basin	Isolated (inferred)	Seasonally saturated	No	0%	Forested/ Road	None	No
86	mixed wood swamp	4,684	Terrene	Basin	Isolated (inferred)	Permanently saturated	No	0%	Forested/ Road	None	No
87	open bog	362	Terrene	Basin	Isolated (inferred)	Permanently saturated	No	5%	Forested/ Road	Rutting. Clear-cut	No
88	tall shrub swamp	417	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	Rutting	Rutting
89	treed swamp	6,194	Terrene	Basin	Isolated (inferred)	Permanently saturated	No	0%	Forested	Rutting	No
90	mixed wood treed swamp	4,495	Terrene	Basin	Outflow (inferred)	Permanently saturated	No	1%	Forested	Logging road/ Ditching	Ditching
91	mixed wood treed swamp	1,060	Terrene	Basin	Isolated (inferred)	Permanently saturated	No	1%	Forested	None	Ditching

Wetland ID	Wetland Type	Wetland Size (m2)	Landscape Position	Landform	Water Flow Path	Water Regime	Watercourse Association	Standing Water and % cover in wetland	Adjacent Upland Land Use	Stressors	Wetland Hydrology Altered?
92	mixed wood treed swamp	1,943	Terrene	Basin	Throughflow	Permanently saturated	No	1%	Forested	None	Water passes beneath upland into ditch and joins with WC
93	graminoid marsh	166	Terrene	Basin	Isolated	Permanently flooded	No	90%	Forested/ Road	None	Altered by road
94	mixed wood treed swamp	1,748	Lotic	Basin	Throughflow	Permanently flooded/ Permanently saturated	Stream	20%	Forested/ Road	None	Ditching
95	mixed wood treed swamp	263	Terrene	Basin	Isolated	Permanently saturated	No	2%	Forested	None	No
96	mixed wood treed swamp	861	Terrene	Basin	Isolated (inferred)	Permanently saturated	No	0%	Forested	None	No
97	mixed wood treed swamp	107	Terrene	Basin	Isolated	Permanently saturated	No	30%	Forested/ Road	None	Surface
98	mixed wood treed swamp	1,540	Terrene	Basin	Throughflow	Permanently flooded/ Permanently saturated	Stream	20%	Forested/ Road	None	No
99	mixed wood treed swamp	694	Terrene	Basin	Isolated	Permanently saturated	No	3%	Forested/ Road	None	Cut block
100	shrub swamp	1,582	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	Old clearing
101	clear cut swamp	219	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	Cut block
102	Complex; mixed wood treed bog, mixed wood treed swamp	5,439	Terrene	Basin	Isolated	Permanently saturated	No	15%	Forested/ Road/ Cut block	None	No
103	low shrub bog	455	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested/ Impervious	None	Cut block

Wetland ID	Wetland Type	Wetland Size (m2)	Landscape Position	Landform	Water Flow Path	Water Regime	Watercourse Association	Standing Water and % cover in wetland	Adjacent Upland Land Use	Stressors	Wetland Hydrology Altered?
104	low shrub swamp	102	Hillslope	Basin	Isolated	Permanently saturated	No	0%	Forested	None	Old cut block
105	low shrub bog	284	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	Cut block
106	low shrub bog	1,701	Terrene	Basin	Isolated (inferred)	Permanently saturated	No	0%	Forested/ Impervious	None	Old cut block
107	coniferous treed swamp	186	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	No
108	tall shrub swamp	183	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	No
109	coniferous treed swamp	1,606	Terrene	Basin	Isolated	Permanently saturated	No	1%	Forested/ Road/ Cut block	Old cut block	No
110	shrub bog	912	Terrene	Basin	Isolated	Permanently saturated	No	1%	Forested	None	No
111	mixed wood swamp	1,060	Lotic	Basin	Throughflow	Permanently saturated	Stream	5%	Forested	None	No
112	mixed wood swamp	3,595	Terrene	Basin	Outflow-Headwater	Permanently saturated	Stream	8%	Forested	None	No
113	mixed wood treed swamp	1,940	Terrene	Basin	Isolated (inferred)	Permanently saturated	No	3%	Forested	None	No
114	coniferous swamp	242	Terrene	Basin	Isolated	Permanently saturated	No	<5%	Forested	None	No
115	mixed wood treed swamp	582	Terrene	Basin	Isolated (inferred)	Permanently saturated	No	2%	Forested	None	No
116	coniferous swamp	892	Terrene	Basin	Isolated	Seasonally saturated	No	0%	Forested	None	No
117	coniferous swamp	147	Terrene	Basin	Isolated	Seasonally saturated	No	4%	Forested	None	No
118	coniferous swamp	428	Terrene	Basin	Isolated	Permanently saturated	No	2%	Forested	None	No

Wetland ID	Wetland Type	Wetland Size (m2)	Landscape Position	Landform	Water Flow Path	Water Regime	Watercourse Association	Standing Water and % cover in wetland	Adjacent Upland Land Use	Stressors	Wetland Hydrology Altered?
119	coniferous treed swamp	328	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	No
120	low shrub swamp	115	Terrene	Basin	Isolated	Seasonally saturated	No	0%	Forested	None	No
121	coniferous swamp	~~154~~ 466	Terrene	Basin	Isolated	Seasonally saturated	No	0%	Forested	None	No
122	coniferous treed swamp	200	Terrene	Basin	Isolated	Seasonally saturated	No	0%	Forested	None	No
123	mixed wood treed swamp	818	Terrene	Basin	Isolated	Seasonally saturated	No	2%	Forested	None	No
124	mixed wood treed swamp	528	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	No
125	mixed wood treed swamp	344	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	No
126	mixed wood treed swamp	63	Terrene	Basin	Isolated	Seasonally saturated	No	0%	Forested	None	No
127	treed bog	185	Terrene	Basin	Outflow (inferred from wet areas mapping)	Permanently saturated	No	5%	Forested	None	No
128	tall shrub bog	409	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	No
129	treed bog	2,006	Terrene	Basin	Isolated	Permanently saturated	No	2%	Forested	None	No
130	coniferous treed swamp	1,092	Terrene	Basin	Isolated	Permanently saturated	No	3%	Forested	None	No
131	mixed wood treed swamp	1,087	Lotic	Basin	Throughflow	Permanently saturated	Stream	10%	Forested	None	No
132	mixed wood treed swamp	2,425	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	No
133	low shrub bog	102	Terrene	Basin	Isolated	Permanently saturated	No	5%	Forested	None	No

Wetland ID	Wetland Type	Wetland Size (m2)	Landscape Position	Landform	Water Flow Path	Water Regime	Watercourse Association	Standing Water and % cover in wetland	Adjacent Upland Land Use	Stressors	Wetland Hydrology Altered?
134	treed swamp	398	Terrene	Basin	Isolated	Seasonally saturated	No	5%	Forested	None	No
135	shrub fen	934	Terrene	Basin	Throughflow	Permanently saturated	Stream	0%	Forested	None	No
136	mixed wood treed swamp	522	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	No
137	mixed wood treed swamp	2,404	Terrene	Basin	Throughflow	Permanently saturated	Stream	5%	Forested	None	No
138	shrub bog	1,521	Terrene	Basin	Isolated	Permanently saturated	No	20%	Forested/ Road	None	Road
139	tall shrub bog	106	Terrene	Basin	Isolated	Permanently flooded	No	28%	Forested/ Road	None	Road
140	treed bog	230	Terrene	Basin	Isolated	Seasonally saturated	No	0%	Forested/ Road	None	No
141	high shrub bog	60	Terrene	Basin	Isolated	Permanently flooded	No	40%	Forested/ Road	None	Road
142	low shrub bog	342	Lotic	Basin	Throughflow	Permanently saturated	Stream	2%	Forested/ Road/ Clearing	None	Road
143	Complex: graminoid bog, deciduous treed swamp	526	Lotic	Basin	Throughflow	Permanently saturated	Stream	45%	Forested/ Road	None	No
144	tall shrub fen	2,034	Terrene	Basin	Throughflow	Permanently saturated	Stream	10%	Forested/ Road	None	Road
145	low shrub bog	1,462	Terrene	Basin	Isolated (inferred)	Permanently saturated	No	0%	Forested/ Road	Road	No
146	Complex: graminoid fen, mixed wood treed swamp	2,653	Terrene	Basin	Outflow	Permanently flooded	Stream/Pond	75%	Forested/ Road	None	Road restricting outflow

Wetland ID	Wetland Type	Wetland Size (m2)	Landscape Position	Landform	Water Flow Path	Water Regime	Watercourse Association	Standing Water and % cover in wetland	Adjacent Upland Land Use	Stressors	Wetland Hydrology Altered?
147	Complex: low shrub bog, mixed wood treed swamp	2,708	Terrene	Basin	Outflow (inferred)	Permanently saturated	No	5%	Forested/ Road	None	No
148	low shrub bog	9,220	Terrene	Basin	Throughflow	Permanently saturated	No	5%	Forested/ Road	Rutting/ Road	No
149	low shrub bog	1,811	Terrene	Basin	Isolated (inferred)	Permanently saturated	No	6%	Forested/ Road	Rutting/ Road	Impoundment of water near road
150	marsh	145	Terrene	Basin	Isolated	Permanently flooded	No	95%	Forested/ Road	Road	No
151	tall shrub bog	2,959	Terrene	Basin	Isolated	Permanently saturated	No	2%	Forested/ Road	Road	No
152	clear cut mixed wood swamp	2,046	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	Skidder tracks/ Clear-cut	No
153	shrub swamp	2,416	Terrene	Basin	Outflow (inferred)	Permanently saturated	No	5%	Forested	None	No
154	open bog	1,991	Terrene	Basin	Outflow (inferred)	Permanently flooded/ Permanently saturated	No	30%	Forested/ Road	Road	No
155	mixed wood treed swamp	717	Terrene	Basin	Isolated	Temporarily flooded/ Permanently saturated	No	20%	Forested	Road	No
156	shrub bog	14,756	Terrene	Basin	Outflow/headwater (inferred)	Permanently saturated	No	1%	Forested/ Road	Road	No
157	Complex: shrub fen, shrub swamp	7,006	Lentic	Basin	Throughflow (inferred from wet areas mapping)	Permanently saturated	No	1%	Forested/ Road	Road	No

Wetland ID	Wetland Type	Wetland Size (m2)	Landscape Position	Landform	Water Flow Path	Water Regime	Watercourse Association	Standing Water and % cover in wetland	Adjacent Upland Land Use	Stressors	Wetland Hydrology Altered?
158	shrub swamp	575	Terrene	Basin	Isolated	Permanently flooded/ Permanently saturated	No	15%	Forested/ Road	Road	Road
159	mixed wood treed swamp	1,995	Lotic Stream	Basin	Throughflow	Permanently flooded/ Permanently saturated	Stream	15%	Forested/ Road	Road	Beaver dam at outlet
160	freshwater marsh	1,237	Lotic Stream	Basin	Throughflow	Permanently flooded/ Permanently saturated	Stream	60%	Forested/ Road	None	No
161	mixed wood swamp	1,618	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	Rutting	Ditching
162	mixed wood treed swamp	1,756	Terrene	Basin	Isolated	Permanently saturated	No	5%	Forested	None	Road
163	clear cut swamp	1,107	Terrene	Basin	Isolated	Permanently saturated	No	10%	Forested/ Road	Clear-cut/ Rutting	Rutting
164	mixed wood treed swamp	3,320	Terrene	Basin	Isolated (inferred)	Permanently saturated	No	1%	Forested/ Road	None	No
165	mixed wood treed swamp	1,623	Lotic	Basin	Throughflow	Temporarily Flooded/ Permanently Saturated	Stream	10%	Forested	Road	Input from ditching
166	shrub swamp	68	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested/ Road	Road	Ditching
167	mixed wood treed swamp	875	Terrene	Basin	Isolated	Permanently saturated	No	3%	Forested/ Road	Road	No
168	Open bog	664	Terrene	Basin	Bidirectional-non-tidal	Permanently saturated	Pond	75%	Forested/ Road	None	No
169	mixed wood treed swamp	607	Terrene	Basin	Isolated (inferred)	Permanently saturated	No	2%	Forested/ Road	Log pile	Culvert at outlet

Wetland ID	Wetland Type	Wetland Size (m2)	Landscape Position	Landform	Water Flow Path	Water Regime	Watercourse Association	Standing Water and % cover in wetland	Adjacent Upland Land Use	Stressors	Wetland Hydrology Altered?
170	mixed wood treed swamp	1,893	Terrene	Basin	Isolated (inferred)	Permanently saturated	No	0%	Forested	None	No
171	mixed wood treed swamp	4,329	Riverine	Basin	Throughflow	Permanently saturated	Stream and River (inferred)	10%	Forested/ Road	None	No
172	mixed wood treed swamp	229	Terrene	Basin	Isolated	Temporarily flooded/ Permanently saturated	No	5%	Forested/ Road	Rutting/ Clear-cut	Ditching
173	mixed wood treed swamp	4,814	Lotic	Basin	Throughflow	Permanently saturated	Stream	10%	Forested	Skidder tracks	No
174	mixed wood treed swamp	2,513	Terrene	Basin	Outflow	Permanently saturated	Stream	5%	Forested	None	No
175	shrub swamp	611	Terrene	Basin	Outflow (inferred)	Seasonally flooded	No	5%	Forested/ Road	Skidder tracks	No
176	mixed wood treed swamp	446	Terrene	Basin	Isolated (inferred)	Permanently saturated	No	0%	Forested	None	No
177	shrub swamp	755	Terrene	Basin	Isolated (inferred)	Seasonally flooded	No	70%	Forested/ Road	Road	No
178	mixed wood treed swamp	4,439	Terrene	Basin	Isolated (inferred)	Temporarily flooded	No	40%	Forested/ Road	Garbage	Roads
179	mixed wood treed swamp	3,412	Terrene	Basin	Isolated	Seasonally flooded/ Permanently saturated	No	5%	Forested/ Road	None	No

Identification of Exceptional Features

Wetland functional evaluation was completed at each wetland within the ~~PA~~ Beaver Dam Mine Site and Haul Road. As part of this functional assessment, along with a review of the NSE GIS predictive WSS layer, each wetland was reviewed to determine if it meets the threshold for a Wetland of Special Significance (WSS). Wetlands of Special Significance are defined in the Nova Scotia Wetland Conservation Policy (NSE, 2011b, p. 24) as:

Areas of bog, fen, marsh, swamp, etc. that play particularly important roles in providing ecosystem services or functions (e.g., supporting rare or migratory species, protecting drinking water supplies, maintaining watershed health). These areas exist on local, watershed, regional, provincial, national and international scales….

The [Nova Scotia] Government will consider the following to be WSS:

- All salt marshes;
- Wetlands that are within or partially within a designated Ramsar site, Provincial Wildlife Management Area (crown and provincial lands only), Provincial Park, Nature Reserve, Wilderness Area or lands owned or legally protected by non-government charitable conservation land trusts;
- Intact or restored wetlands that are project sites under the North American Waterfowl Management Plan and secured for conservation through the NS–EHJV;
- Wetlands known to support at-risk species as designated under the federal Species at Risk Act; (endangered or threatened) or the Nova Scotia Endangered Species Act (endangered or threatened); and,
- Wetlands in designated protected water areas as described within Section 106 of the Environment Act.

Figures 6.3-3, 6.3-3A to 6.3-3L indicate the proximity of the wetlands identified within the PA to: Ramsar Sites; Provincial Wildlife Management Areas (Crown and Provincial lands only); Provincial Parks; Nature Reserves; Wilderness Areas; Lands owned or legally protected by non-governmental charitable conservation land trusts; intact or restored wetlands under the North American Waterfowl Management Plan; and protected water areas. No wetlands within the PA are present within any of these special habitats, shown on the above-noted figures.

A review of the NSE predictive WSS layer identified two WSS within portions of the PA, Wetland 29 and Wetland 64. Wetland 29 is classified as a predicted WSS by NSE due to the historic presence of multiple observations of boreal felt lichen (*Erioderma pedicellatum)* (listed as Endangered by SARA/COSEWIC/NSESA) in 2013 (pers.comm. Charles Sangster, NSE). Wetland 64, which exists along the proposed Haul Road, is identified as a predicted WSS by NSE due to the observations of possible breeding/nesting by an olive-sided flycatcher (OSFL) in 2009 (pers.comm. Charles Sangster, NSE).

Although suitable breeding habitat for the OSFL is present within Wetland 64, none were observed at the breeding bird survey point during surveys completed during appropriate breeding periods (i.e. June 13 and 25, 2016). The nearest occurrence of the OSFL identified by MEL during the 2016 field program is approximately 1.7 km to the northeast of Wetland 64. To determine whether the OSFL triggers the designation of a WSS, and to discern associated permitting requirements, additional regulatory consultation is required.

Three locations of boreal felt lichen ~~was~~ were confirmed by MEL during field surveys within Wetland 29 on May 8, 2015 as shown on Figure 6.13-3. However, its location is beyond the footprint of the proposed Project and as such, impacts to it are not expected as a result of the Project. A follow up survey conducted in the fall of 2016 determined that all three thalli were no longer present. Their absence was reconfirmed on December 4, 2017. Additional micro siting has increased the distance between Project infrastructure and Wetland 29 (wetland and phorophyte critical function zone) as per the Amended Recovery Strategy for boreal felt lichen (ECCC, 2018). Wetland 29 is a potential WSS based on historical presence of boreal felt lichen. For more information regarding boreal felt lichen refer to Section 6.13.

In addition to Wetland 29, fifteen additional wetlands had a bird SAR observed within or directly adjacent to the wetland (30m) during field surveys completed by MEL. The wetlands-associated SAR bird sightings and the presence of suitable breeding habitat are indicated in Table 6.8-5 below.

Table 6.8-5 Wetlands with Observed Bird SAR and Potential Breeding Habitat

Wetland ID and Type	Observed SAR and Ranks	Suitable Breeding Habitat Present (Y/N)*
WL8-complex: Coniferous treed swamp, graminoid fen, low shrub fen, shrub swamp	Olive-sided flycatcher (SARA, COSEWIC, NSESA T, S3B)	Y
WL14- complex: Shrub bog, Mixed wood treed swamp, low shrub fen	Olive-sided flycatcher (SARA, COSEWIC, NSESA T, S3B)	Y
WL29 complex: Mixed wood treed swamp, low shrub fen, open bog, coniferous treed swamp, coniferous raised bog, graminoid fen	Canada warbler (SARA/COSEWIC T, NSESA E, S3S4B)	Y
WL51- mixed wood treed swamp	Olive-sided flycatcher (SARA, COSEWIC, NSESA T, S3B)	Y
WL53- low shrub swamp	Chimney swift (SARA/COSEWIC T, NSESA E, S2B S1M)	N
WL57- complex: Coniferous treed swamp, deciduous treed swamp	Canada warbler (SARA/COSEWIC T, NSESA E, S3S4B)	Y
WL66- complex: graminoid fen, mixed wood treed swamp, high shrub fen	Canada warbler (SARA/COSEWIC T, NSESA E, S3S4B)	Y
WL71- deciduous treed swamp	Canada warbler (SARA/COSEWIC T, NSESA E, S3S4B)	Y

Wetland ID and Type	Observed SAR and Ranks	Suitable Breeding Habitat Present (Y/N)*
WL72- deciduous treed swamp	Canada warbler (SARA/COSEWIC T, NSESA E, S3S4B)	Y
WL76- complex: mixed wood treed swamp, open graminoid fen	Canada warbler (SARA/COSEWIC T, NSESA E, S3S4B)	Y
WL89- treed swamp	Barn swallow (COSEWIC T, NSESA E, S3B)	N
WL132- mixed wood treed swamp	Canada warbler (SARA/COSEWIC T, NSESA E, S3S4B)	Y
WL148- low shrub bog	Canada warbler (SARA/COSEWIC T, NSESA E, S3S4B)	Y
WL156- shrub bog	Olive-sided flycatcher (SARA, COSEWIC, NSESA T, S3B)	N
WL157- complex: shrub fen, shrub swamp	Olive-sided flycatcher (SARA, COSEWIC, NSESA T, S3B)	N
WL173- mixed wood treed swamp	Canada warbler (SARA/COSEWIC T, NSESA E, S3S4B)	Y

** Preferred habitat for the noted SAR are provided in Table 6.8--6*

Of the four SAR birds identified in wetlands, the barn swallow and the chimney swift do not utilize wetland habitat for breeding purposes, although they do use wetlands for foraging habitat, specifically water components where insects are present. The olive-sided flycatcher prefers conifer forests near meadows and ponds and the Canada warbler prefers wet forests and riparian shrub forests. Regulatory consultation is required to determine permitting requirements specific to the above wetlands with identified SAR present, including whether these wetlands are designated as a WSS.

Mainland moose tracks were observed within Wetland 210 and directly adjacent to Wetland 206. Both of these wetlands are located at the northern extent of the western extension of the Beaver Dam Mine Site. Mainland moose forage for aquatic vegetation within wetlands during the summer and suitable habitat is present within both wetlands for foraging activities.

Hydrologic Condition and Integrity

The significance of this wetland function is determined by evaluating a wetlands ability to manage water. Landscape and wetland characteristics, such as position in the landscape, connectivity to watercourses, evidence of water detention in the wetland, and vegetation composition and density, combine to determine the capacity of the wetlands to hold water, retard flows and hence maintain downstream flood potential.

The vast majority of all wetlands in the PA are natural, or have been somewhat modified by either historical tree harvesting, access woods roads, or lie adjacent to the existing roads located within the Haul Road ~~PA~~. However, a low quantity of wetlands (~~13~~ 15 within the ~~Mine Site PA~~ Beaver Dam Mine Site and 16 within the Haul Road ~~PA~~) has been determined important for maintaining stream flows. Conversely, the majority of wetlands ~~within each PA~~ (~~41~~ 48 in the ~~Mine Site PA~~ Beaver Dam Mine Site, and 89 within the Haul Road ~~PA~~) provide a high ability to detain surface water, hence reducing peak flows in downstream receptors.

Water Quality

A wetland's ability to provide water quality functions is determined by surrounding landscape conditions, as well as the characteristics of the wetland. Wetland source water from impervious surfaces (developed areas) or land delivering sediment are more likely to possess a higher water quality functional significance than wetlands which are primarily sourced water from undisturbed sources. As well, vegetative density and a wetland's position in the landscape can determine filtering potential that wetlands play in improving water quality. The proximity of a wetland to a downstream fish or water resource is also considered as part of the evaluation.

The NovaWET evaluation determined that almost all (~~60~~ 78 of 81) wetlands within the ~~Mine Site PA~~ Beaver Dam Mine Site and 104 of the 116 wetlands identified within the Haul Road ~~PA~~ provide high functional significance for improving water quality.

Groundwater Interactions

NovaWET identifies a recharge wetland as SRFF. However, it is difficult to determine the classification of the groundwater interaction types by visual inspection alone, therefore, although the determination of groundwater versus recharge is identified in Section 6.7.6 the following discussion related to recharge/discharge potential of the wetlands existing in the PA is provided below to supplement the NovaWET results

A wetland is a groundwater discharge area if groundwater moves upwards from underlying soils towards the land surface, whereas recharge wetlands exhibit groundwater that flows vertically downward from the wetland to underlying mineral soils. Groundwater discharge maintains high water tables and wetland habitat, whereas recharge sites replenish aquifers (Siegela, 1988).

Surface water and groundwater interactions across the PA are discussed in detail within Section 6.7.6.

As outlined above, it is difficult to determine groundwater interactions within wetlands by visual inspection alone. It can be assumed, however, that within an area the size of the PA, a combination of discharge and recharge wetlands exist.

Landscape characteristics that are likely to indicate recharge wetlands include:

- Geographically isolated wetlands that contain all water entering them;
- Mineral soils and/or a lack of restrictive sub-surface components that may prevent the downward movement of water and recharge potential;
- Surrounding upland soils prevent the downward movement of water (e.g., clays, shallow bedrock);

- Lack of outlet or restricted outlets, inflow wetlands, and lentic wetlands; and
- Land sloped away from a wetland (e.g., wetlands are elevated in the watershed or near a watershed divide).
- Source: NovaWET 3.0

Wetland composition within the PA includes many isolated wetlands, which provide potential groundwater recharge functions. However, it appears that the majority of wetlands throughout the ~~mine footprint PA~~ Beaver Dam Mine Site, especially those major wetland complexes situated at the tertiary watershed divide (wetlands 1, 2, 29 and 57), contain watercourse outlets draining via additional throughflow wetlands toward Crusher Lake, Mud Lake, and, ultimately, Cameron Flowage. These wetlands, as well as the throughflow wetlands, which intercept water from these systems, are more likely to exist as groundwater discharge wetlands via surface water flows (e.g., perennial watercourses, drainage channels, sheet flow, etc.). As discussed in Section 6.5.3, underlying bedrock geological conditions within the ~~mine footprint PA~~ Beaver Dam Mine Site (and on a regional basis) are comprised of greywacke and slate found in the region, which as a result of their impermeability and poorly jointed rocks, act as a confining layer throughout the region. This results in the majority of water sourced to the wetlands via precipitation, snow melt, and surface runoff/sheet flow, being drained across the surface (via wetlands, watercourses, and other micro-surface features) in a discharge fashion.

The same can be said for wetlands existing within the Haul Road ~~PA~~. A scattering of isolated wetlands exists within the PA and provide some groundwater recharge functions. However, their relative size and limited water source (e.g., precipitation and small scale surface water runoff) reduces their ability to affect groundwater recharge at a landscape level. The majority of wetlands throughout the Haul Road ~~PA~~ acts as throughflow or outflow features and, therefore, acts as groundwater discharge features.

Fish and Wildlife Habitat and Integrity

Results of the NovaWET evaluations determined that ~~seven~~ eight wetlands within the ~~mine footprint PA~~ Beaver Dam Mine Site (wetlands 8, 10, 17, 29, 56, 59, ~~and~~ 61, and 217) provide high functional significance for wildlife and fish habitat. Eleven wetlands provide a high functional significance for the same functions within the Haul Road ~~PA~~ (wetlands 64, 66, 68, 69, 79, 146, 154, 157, 159, 160, and 171). The determination of high significance was afforded to these wetlands as a result of the wetlands' association with potential fish passage via connected watercourses, fish habitat the wetland provides, and access to open water habitat to support migratory birds.

Apart from multiple species of birds, ~~no priority wildlife species were identified in wetlands within the PA during field evaluations.~~ Mainland moose tracks were observed in Wetland 210 and immediately adjacent to Wetland 206, and were the only other priority wildlife species identified. Evidence of the Mainland Moose (tracks) ~~was~~ were also identified approximately 20 m north of wetland 56 in the northern portion of the ~~mine footprint PA~~ Beaver Dam Mine Site~~, as well as beyond the northwestern PA boundary~~. The Mainland Moose uses wetlands to access submerged and emergent aquatic vegetation during summer and often seek out streams, ponds, and shorelines of lakes in summer to escape heat and insects (NSDNR, 2007). ~~However, although~~ Although not directly observed, wetlands identified within the PA provide potential habitat for priority wildlife species (e.g., Maritime shrew (S3) and the rock vole (S2)) which have been documented within 5 km of the PA. The fisher (*Martes pennanti* (S2)) is a largely nocturnal hunter with large home ranges and elusive behavior.

The Snapping Turtle (SARA SC, NSESA V), which was identified in two locations during field studies (one along Highway 224 as it intersects the Haul Road ~~PA~~ and one along Mooseland Road at the Touquoy

Mine Site), is a species which requires wetland habitat as part of its life cycle activities. Wetlands within the ~~PA~~ Beaver Dam Mine Site and Haul Road which provide suitable habitat for this species include wetlands 8, 10, 17, 29, 59, 61, 66, 68, 69, 159, 168, ~~and~~ 171, and 207. These wetlands all provide standing water to a depth exceeding 0.5 m, therefore, it is presumed that the open water portions of these wetlands provide potential overwintering habitat for Snapping Turtles.

~~Approximately a third (23)~~ Twenty six of the wetlands in the ~~Mine Site PA~~ Beaver Dam Mine Site have been determined to provide life cycle supporting habitat for fish species or provide other habitat support to fish (e.g., riparian vegetation, water quality, buffer functions) as a result of their association with watercourses. Whereas, just under a quarter (25) of the wetlands identified in the Haul Road ~~PA~~ provide these functions. Wetlands 61,171, 173, and 174 have been determined to provide habitat for fish species of commercial, aboriginal, or recreational importance (e.g., brook trout, American eel, small-mouthed bass). No priority fish species were identified within wetlands, with the exception of expected fish habitat for American eel within Wetland 171.

Multiple priority bird species were identified within and in close proximity to wetlands during point count bird surveys and via incidental sightings during field assessments completed throughout the PA. In addition, focused bird surveys (point counts) were completed in many other habitat types and locations throughout the PA that do not constitute wetland habitat. A full list of priority bird species observed within the PA is provided in Section 6.13.3. The list was narrowed down to priority bird species that were identified at point locations within, and directly adjacent to, wetland habitat, and that use wetlands as part of their preferred breeding habitat. These species are listed in Table 6.8-6, together with the preferred wetland habitat.

Table 6.8-6 Observed Bird Priority Species and Wetland Habitat Association

Bird Species	Preferred Wetland Habitat
Eastern wood-pewee	Wooded habitat, in riverside habitat
Canada warbler	Wet forests, riparian shrub forests
Rusty blackbird	Wet forests including fens, bogs, swamps and beaver pond
Spotted sandpiper	Semi-open area near shoreline of ponds, lakes, river and streams
Greater yellowlegs	Muskeg, wet bogs, marshes
Wilson's snipe	Wet, marsh, bogs, fens alder and willow swamps, wet meadows
Northern harrier	Nest on ground in grassland and wetland vegetation- marshes
Yellow-bellied flycatcher	Boreal coniferous forests and peatlands, bogs, swamps and muskeg
Tennessee warbler	Bogs, swamps and forests
Olive-sided flycatcher	Conifer forests near meadows and ponds

The NovaWET evaluation determined that at least one SAR bird was identified at point count locations within or directly adjacent to seven wetlands in the ~~Mine Site PA~~ Beaver Dam Mine Site and 12 wetlands within the Haul Road ~~PA~~. At least one SOCI bird was identified at point count locations within or directly adjacent to 13 wetlands in the ~~Mine Site PA~~ Beaver Dam Mine Site and 25 wetlands within or adjacent to wetlands within the Haul Road ~~PA~~. It should be noted, however, that these observations are based on detection points (e.g., point count locations) and do not specify whether the bird identified is using, or how it might be using, the wetland habitat as its preferred habitat.

Shoreline Stabilization and Integrity

The ability for a wetland to stabilize and provide stabilizing support to shorelines is determined initially by the association the wetland has with a watercourse (stream, lake, pond, etc.) or tidal features (e.g., estuary, ocean). Other factors that determine the significance a wetland may play in providing these functions include vegetation characteristics (e.g., density, widths, species type, streambank colonization), but also the characteristics of the waterbody to which the wetland is adjacent (e.g., subjected to wave action, high flows, and other erosive forces).

As a result of the NovaWET evaluations, nine wetlands (wetlands 4, 8, 10, 14, 17, 29, 44, 48, and 61) within the ~~mine footprint PA~~ Beaver Dam Mine Site provide a high functional significance in this regard, whereas seven wetlands (wetlands 66, 69, 74, 76, 79, 157, and 171) provide a high functional significance within the Haul Road ~~PA~~.

Plant Community

None of the wetlands comprise plant communities that are rare regionally or provincially. As discussed in information provided earlier in this section, wetlands present within the PA include treed and shrub swamps, bog, fen, marsh, and wetland complexes comprising variations of each wetland type. Wetland vegetation composition within all wetland habitats is typical to those existing in similar habitat throughout the province. Treed and shrub swamps are predominantly coniferous or mixed wood, with lesser amounts of deciduous swamp occurring. Bog habitats within the PA vary between low and high shrub bogs to treed bogs, and areas of fen habitat predominantly comprise low shrubs or exist entirely as graminoid features. The few marsh habitats identified consist entirely of graminoid vegetation.

Table 6.8-7 provides the dominant species per wetland habitat type that wetlands within the PA support. Dominant vegetation on a per wetland basis is provided in the Wetland Characterization Table (Appendix H.2).

Table 6.8-7 Dominant Vegetation Supported by Wetland Habitat within the Project Area

Wetland Habitat Type	Dominant Species Supported
Treed and Shrub Swamps	Balsam fir, black and red spruce, red maple, yellow birch, mountain holly, cinnamon fern, three-seeded sedge, Canada bunchberry, bristly dewberry.
Shrub and Treed Bogs	Tamarack, black spruce, balsam fir, speckled alder, balsam fir, sheep laurel, Labrador tea, leatherleaf, cinnamon fern, bog fern, three-seeded sedge.
Graminoid and shrub Fen	Red maple, black spruce, tamarack, wild raisin, common winterberry, Atlantic sedge, bog cranberry, royal fern.

Wetland Habitat Type	Dominant Species Supported
Graminoid Marsh	Bluejoint reed grass, harlequin blue flag, tussock's sedge, Common woolly bulrush, Canada manna grass.

Overall plant integrity within wetlands was determined via the NovaWET process by evaluating specific vegetative characteristics within wetlands identified during the study. Characteristics include presence of invasive or exotic species, extent of disturbances, vegetative density, and the presence of rare or endangered species (priority species).

The evaluation concluded that ~~approximately half (29)~~ 31 of the 81 ~~mine footprint PA~~ Beaver Dam Mine Site wetlands were rated as comprising a highly significant diversity of species, whereas 25 of the 116 wetlands within the Haul Road ~~PA~~ are also rated as such.

Six wetlands (wetlands 4, 12, 14, 17, 29, and 33) comprise at least one priority plant species (vascular and non-vascular) within the ~~mine footprint PA~~ Beaver Dam Mine Site and eight wetlands (wetlands 80, 115, 129, 135, 137, 147, and 157) comprise priority plant species in the Haul Road ~~PA~~. Apart from Wetland 29, which contained the boreal felt lichen (SARA/COSEWIC/NSESA), a federally listed SAR, all priority species identified in the wetlands exist as SOCI. As such, wetland 29 is expected to be a WSS, although, as discussed in Identification of Exceptional Features subsection above, the location of the historical boreal felt lichen ~~observed during field surveys~~ observations ~~is~~ are located beyond the ~~PA~~ Beaver Dam Mine Site boundary, albeit in a wetland which extends into the PA. Follow up surveys conducted in 2016 and 2017 determined that no boreal felt lichen thalli are present. As per the Amended Recovery Strategy for boreal felt lichen (ECCC, 2018), the micro siting and division of the waste rock stockpile has removed Project infrastructure from the phorophyte and wetland critical function zones (500 m and 50 m, respectively). Therefore, impacts to this species as a result of Project activities are not expected.

The overall integrity and quality of plants has been determined to be high in over half of the wetlands identified in the ~~mine footprint PA~~ Beaver Dam Mine Site (~~35~~ 45) and the Haul Road ~~PA~~ (61), likely as a result of minimal disturbance in land use surrounding the wetlands and/or few direct activities, such as tree harvesting and existing roads, within the wetlands existing in the ~~PA~~ Beaver Dam Mine Site and Haul Road.

Community Use/Value

Community use and value of wetlands include, among others, access and visibility for humans to complete activities such as hunting, recreational, wildlife viewing, plant and berry gathering, fishing, etc.

The large majority of wetlands identified in the PA have been determined to provide a low functional significance for community use and value, largely as a result of inaccessibility to humans. No wetlands have been determined to provide a high significance for this function.

6.8.4 Consideration of Consultation and Engagement Results

Key issues raised during public consultation and Mi'kmaq engagement relating to wetlands include direct impacts during construction activities at the Beaver Dam Mine Site and during Haul Road construction, as well as potential indirect effects from Project activities. Overall potential effects on habitat loss from direct and indirect wetland impacts was cited as a concern, including potential effects to use by Mi'kmaq peoples for hunting, fishing, trapping, and gathering.

The results of the public consultation and Mi'kmaq engagement have been considered in the environmental effects assessment, including the Proponent's commitments on mitigation and monitoring measures and proposed compliance and effects monitoring programs, as well as the Proponent's broader commitment to ongoing public consultation and Mi'kmaq engagement. Specific to evaluating the effect on wetlands, these are found within the following environmental effects assessment.

6.8.5 Effects Assessment Methodology

6.8.5.1 Boundaries

Spatial Boundaries

The spatial boundaries used for the assessment of effects to wetlands are the ~~Project areas (PA) for the mine footprint and the Haul Road, and the LAA consisting of surface water systems immediately adjacent to and receiving drainage from the PA.~~ PA, LAA, and RAA. The PA (Figure 5.4-1) consists of the three project components; Beaver Dam Mine Site, Touquoy Mine Site, and the Haul Road and extends from Marinette to Moose River Gold Mines, Halifax County, NS. The Beaver Dam Mine Site is located at the eastern end of the Beaver Dam Mines Road and has been extended to the east and west in order to encompass the micro siting of the till stockpile and the waste rock stockpile, respectively. The Haul Road spans from the Beaver Dam Mine Site to Moose River Gold Mines, where the Touquoy Mine Site [processing and exhausted pit (to be used to dispose Beaver Dam tailings)] is located. The PA has been extended to the east and west in order to encompass the micro siting of the waste rock stockpile and the till stockpile.

The LAA (Figure 6.7-12) consists of portions of downstream aquatic habitats and headwaters where appropriate, depending on project activities, up to the maximum size of the tertiary watershed(s). The LAA boundaries were defined considering the maximum expected extent of direct and indirect impacts to the aquatic environment as well as the location of project activities across all three project components.

The RAA (Figure 6.7-13) encompasses the three secondary watersheds that the PA is located within. These watersheds are the West River Sheet Harbour secondary watershed, the Tangier River secondary watershed, and the Fish River secondary watershed. The RAA is broader than the expected Project impacts and considers other Project boundaries as per the cumulative effects methodology.

As the Project has the potential to cause direct and indirect effects to wetlands outside of the PA, the LAA is the appropriate boundary for evaluation of this VC.

The PA, LAA and RAA were refined for the wetland cumulative effects assessment modelling exercise as discussed in Section 6.8.5.3.

Temporal Boundaries

The temporal boundaries used for the assessment of effects to wetlands are the construction phase, operational phase, decommissioning and reclamation phase, and post-closure phase.

Technical Boundaries

No technical boundaries were identified for the effects assessment of wetlands.

Administrative Boundaries

Administrative boundaries for the protection and conservation of wetland habitat in Nova Scotia include the Nova Scotia Wetland Conservation Policy (2011b), the Environmental Goals and Sustainable

Prosperity Act (EGSPA 2007) and the Environment Act (1994) and its' Activities Designation Regulations (1995).

Further wetland protection is provided on a federal level by the Federal Policy of Wetland Conservation (1991).

6.8.5.2 Wetland Cumulative Effects Modelling

A wetland cumulative effects modelling assessment was completed for wetlands losses associated with the Beaver Dam Mine Site.

As stated in section 6.8.2.1, wetland functional assessment was completed for each observed wetland within the PA using the NSE NovaWET 3.0 wetland evaluation technique. NovaWET 3.0 is a tool to evaluate individual wetland functions only and does not evaluate wetland functional loss, either individually or cumulative loss of multiple wetlands within any spatial watershed boundary (sub-drainage basin, tertiary or larger watershed). As such, the purpose of the wetland cumulative effects assessment is to evaluate the spatial cumulative effects associated with the loss of wetlands as a result of developing the Beaver Dam Mine Site.

Through completion of a modelling exercise, wetland loss (including loss of wetland function metrics) has been extrapolated to examine potential cumulative effects spatially.

The wetland cumulative effects modelling assessment was completed by establishing individual wetland function “metrics” and evaluating them as indicators of potential wetland function loss. The following metrics were established:

- Wetland Area;
- Loss of Wetland Habitat Function including:
    - Moose: mainland moose
    - Turtles: wood turtle and snapping turtle
    - Birds: Canada warbler, olive-sided flycatcher, and rusty blackbird

Spatial Boundaries

The spatial boundaries used for the assessment of cumulative effects of wetland loss (area and habitat function metrics) vary depending on the wetland function metric being evaluated. Table 6.8-8 provides the spatial boundaries evaluated as part of the wetland cumulative effects modelling:

Table 6.8-8 Spatial Boundaries

Function Metric	Spatial Boundary Assessed	Spatial Boundary Description
Wetland Area	PA	The Beaver Dam Mine Site
	LAA	Portions of downstream aquatic habitats and headwaters where appropriate, depending on project activities, up to the maximum size of the tertiary watershed(s)

Function Metric	Spatial Boundary Assessed	Spatial Boundary Description
	RAA	The secondary watershed that the PA is located within (i.e. the West River Sheet Harbour secondary watershed).
Mainland Moose	PA	The Beaver Dam Mine Site
	LAA	A 2 km buffer surrounding the Beaver Dam Mine Site and defined considering the maximum expected extent of direct and indirect impacts to the chosen metric, as well as the location of project activities at the Beaver Dam Mine Site.
	RAA	Not assessed.
Turtles	PA	The Beaver Dam Mine Site
	LAA	A 2 km buffer surrounding the Beaver Dam Mine Site and defined considering the maximum expected extent of direct and indirect impacts to the chosen metric, as well as the location of project activities at the Beaver Dam Mine Site.
	RAA	Not assessed
Birds	PA	The Beaver Dam Mine Site
	LAA	A 2 km buffer surrounding the Beaver Dam Mine Site and defined considering the maximum expected extent of direct and indirect impacts to the chosen metric, as well as the location of project activities at the Beaver Dam Mine Site.
	RAA	Not assessed

Methods

Wetlands play countless roles in the maintenance of a healthy ecosystem. Among other functions, wetlands improve water quality, control floods, regulate water temperature, retain nutrients, and provide habitat for aquatic and terrestrial species. In order to evaluate the cumulative effects of wetland loss and their associated functions, modelling was completed based on the development of the following wetland function metrics:

- Wetland Area: A larger wetland, or larger frequency of wetlands and area in a given spatial boundary is likely to provide more wetland functions than a smaller wetland, or lesser frequency of wetlands and area in a given spatial boundary. Therefore, for the purposes of the wetland cumulative effects modelling assessment, wetland area has been analyzed as an indicator of potential wetland function loss. In order to effectively determine the loss of wetland area (and potential wetland function loss) the modelling quantified the area of wetland habitat directly impacted by mine development and its associated infrastructure, and compared it to predicted wetland area present in the LAA and RAA. This analysis enabled the potential wetland functions loss (based on the wetland area metric), to be made within the spatial boundaries assessed.

- Loss of Wetland Habitat Function: loss of wetland habitat function was evaluated by considering the loss of habitat provision for specific wildlife species that typically utilize wetlands for their survival and lifecycle tendencies. The three habitat metrics used were: moose habitat, turtle habitat, and bird habitat. These were evaluated using the following species and their requirements:
    - Moose: mainland moose
    - Turtles: wood turtle and snapping turtle
    - Birds: Canada warbler, olive-sided flycatcher, and rusty blackbird

These species were chosen because they include species at risk (SAR) (olive-sided flycatcher, SARA Threatened; Canada warbler, SARA Threatened; NSESA Endangered, mainland moose, NSESA Endangered; snapping turtle, SARA Special Concern, NSESA Vulnerable; wood turtle, SARA/NSESA Threatened and rusty blackbird, SARA Special Concern, NSESA Endangered), they utilize a variety of wetland habitat types for critical biological functions, and they had either been identified within the PA during field surveys or have potential to be present in the PA based on habitat provision or confirmed observations of the species in close proximity to the Beaver Dam Mine Site.

It should be noted that while the DNR forestry GIS layer does contain information on Canada warbler habitat (i.e. dense, deciduous shrub), it is derived from 1:12,500 aerial photographs and lacks the ability to appropriately distinguish suitable habitat for this species. Therefore, modeling was not possible for Canada warbler within the LAA. As such, Canada warbler was removed from the model exercise associated with the LAA so as not to bias the outcome. Canada warbler habitat was however determined for the PA based on data collected during field programs in combination with desktop resources.

The wetland function metrics were assessed within the spatial and temporal boundaries outlined in Table 6.8-9. In addition, the method of analysis performed on each wetland function metric is provided. For the purposes of this evaluation, Year 0 is considered "prior to any mine development activities" and Year 5 is considered "the completion of mine development" (i.e. complete wetland alteration and at maximum operational footprint/activity).

Table 6.8-9 Spatial and Temporal Assessments for Wetland Function Metrics

Function Metric	Spatial Boundary Assessed	Temporal Boundary Assessed	Method of Data Analysis
Wetland Area	PA	Between Year 0 and Year 5	A comparison between wetland area prior to mine development within the PA, and wetland area at completion of mine development within the PA.
	LAA	Year 0	Wetland area within LAA and RAA is not expected to change as a result of the Beaver Dam Mine Site; therefore, a comparison of wetland area at Year 5
	RAA	Year 0	

Function Metric	Spatial Boundary Assessed	Temporal Boundary Assessed	Method of Data Analysis
			within the PA, to predicted wetland area within the LAA and RA at Year 0 will be made.
Mainland moose	PA	Between Year 0 and Year 5	A comparison between predicted moose wetland habitat prior to mine development within the PA, and predicted moose wetland habitat at completion of mine development within the PA.
	LAA	Year 0 only	A comparison of predicted moose wetland habitat at Year 5 within the PA, to predicted moose wetland habitat within the LAA at Year 0 will be made.
	RAA	Not assessed	Impact at RAA extent not considered likely.
Turtles	PA	Between Year 0 and Year 5	A comparison between predicted turtle wetland habitat prior to mine development within the PA, and predicted turtle wetland habitat at completion of mine development within the PA.
	LAA	Year 0 only	A comparison of predicted turtle wetland habitat at Year 5 within the PA, to predicted turtle wetland habitat within the LAA at Year 0 will be made.
	RAA	Not assessed	Impact at RAA extent not considered likely.
Birds	PA	Between Year 0 and Year 5	A comparison between predicted birds wetland habitat prior to mine development within the PA, and predicted birds wetland habitat at completion of mine development within the PA.
	LAA	Rusty blackbird and olive-sided flycatcher - Year 0 only Canada warbler – Not assessed	A comparison of predicted Rusty Blackbird and Olive-sided flycatcher wetland habitat at Year 5 within the PA, to predicted Rusty Blackbird and Olive-sided flycatcher wetland habitat within the LAA at Year 0 will be made. Canada Warbler comparison not possible due to insufficient GIS data.
	RAA	Not assessed	Impact at RAA extent not considered likely.

Although not considered a quantifiable determination of potential wetland functional loss as a result of the Project, the analysis described in Table 6.8-11, provides the ability to extrapolate important wetland functional metrics, and assess their potential loss as a result of developing the Beaver Dam Mine Site.

It is recognized that wetlands play important water quality and purification functions, however, as a result of the general water management measures being implemented for the mine development, water quality has not been included in this analysis. Refer to Section 6.7 (Surface Water Quality and Quantity), for a detailed description of the potential effects to water quality as a result of mine development, and methods that will be employed to ensure environmental standards are met.

Each of the wetland function metrics being evaluated in the cumulative effects wetland modelling exercise required the gathering of datasets which could be utilized digitally to compare to each other. The metric “Wetland Area” involved the combined collection of desktop and field wetland data. Conversely, the wetland function metrics for Moose, Turtle and Birds wetland habitats required a comprehensive desktop review to identify predicted important habitats for each of the species being evaluated, as well as habitat data collected during field surveys. Based on scientific literature, important wetland habitats were defined as those that support biological requirements for species survival. Determination of these important habitats supported the development of the datasets required for the cumulative effects model. The datasets utilized for the metrics being evaluated in the model within each spatial boundary are provided in Tables 6.8-10 and 6.8-11.

Table 6.8-10 Metrics and Associated GIS Layers used in the Cumulative Effects Assessment of Wetland Loss

Wetland Loss						
Metric	Value	Reference for Habitat Selection	PA		LAA/ RAA	
			GIS Layer	Attributes Used to Select Suitability	GIS Layer	Attributes Used to Select Suitability
Wetland Area	Area of all wetlands	Nova Scotia Wetland Evaluation Technique (Version 3.0, September 2011)	Field delineated wetlands	All wetlands	All NSE database wetland types (also used for RAA)	All wetlands

Table 6.8-11 Metrics and Associated GIS Layers used in the Cumulative Effects Assessment of Loss of Wetland Function

Loss of Wetland Function							
Metric	Biological Requirement	Habitat that provides for the Biological Requirement	Reference for Habitat Selection	PA		LAA	
				GIS Layer	Attributes Used to Select Suitability	GIS Layer	Attributes Used to Select Suitability
Mainland moose	Foraging and thermoregulation	Wetlands with access to aquatic vegetation	Action Plan for the Recovery of Eastern Moose (*Alces alces americana*) in Mainland Nova Scotia (Nova Scotia Department of Natural Resources, 2007) and Status Report on The Eastern Moose (*Alces americana* Clinton) in Mainland Nova Scotia (Parker, 2003)	Field delineated wetlands	Bogs (where aquatic vegetation is likely), marshes, fens with open water. Any type of wetland if adjacent to a waterbody or beaver flowage	NSE wetlands database layer	Bogs (where aquatic vegetation is likely), marshes, fens with open water. Any type of wetland adjacent to waterbodies or beaver flowage
				NSE waterbodies	Waterbodies (i.e. lakes, standing water, ponds)	NSE waterbody database layer	Waterbodies (i.e. lakes, standing water, ponds)
				DNR Forestry	Beaver flowage queried as non-forested area that is or has been occupied by beavers	DNR forestry	Beaver flowage queried as a non-forested area that is or has been occupied by beavers
				Visual aerial inspection	Visual inspection of aerial imagery to identify open waterbodies (i.e. lakes, standing water, ponds)	Visual aerial inspection	Visual inspection of aerial imagery to identify open waterbodies (i.e. lakes, standing water, ponds)
Wood turtle and snapping turtle	Thermoregulation, movement, hibernation and mating	Floodplains or riparian wetlands or wetlands within 350m of a stream or river	Recovery Strategy for the Wood Turtle (*Glyptemys insculpta*) in Canada (Environment Canada, 2016); Protecting and Conserving Wood turtles: A Stewardship Plan for Nova Scotia	Field delineated wetlands	Riparian wetlands or wetlands within 350m of a stream or river with potential turtle habitat (as per field assessment)	NSE wetland database layer	Riparian wetlands or wetlands within 350m of a watercourse
				Field delineated watercourses	Potential turtle habitat, as per field assessment	NSE watercourse database layer	All watercourses

Loss of Wetland Function							
Metric	Biological Requirement	Habitat that provides for the Biological Requirement	Reference for Habitat Selection	PA		LAA	
				GIS Layer	Attributes Used to Select Suitability	GIS Layer	Attributes Used to Select Suitability
			(MacGregor and Elderkin, 2003); Management Plan for the Snapping Turtle (*Chelydra serpentine*) in Canada (Environment and Climate Change Canada, 2016); personal communication with Mark Pulsifer (October 23, 2018)			Ecological Land Classification Layer	Floodplains adjacent to watercourses, queried as smooth topography
				Visual aerial inspection	Visual inspection of aerial imagery to identify floodplains and riparian wetlands	Visual aerial inspection	Visual inspection of aerial imagery to identify floodplains and riparian wetlands
Canada warbler (CAWA)	Breeding	Forested swamps with dense, deciduous shrub layer	Recovery Strategy for the Canada Warbler (*Cardellina canadensis*) in Canada	Field delineated wetlands	Wetlands where CAWA were observed and swamps with a dense, deciduous shrub layer (as per field assessment)	Data unavailable	
Olive-sided flycatcher (OSFL)	Breeding	Open wetlands with tall snags	Recovery Strategy for the Olive-sided (*Contopus cooperi*) in Canada (Environment Canada, 2016)	Field delineated wetlands	Wetlands where OSFL were observed and open wetlands (i.e. bogs, fens) with tall snags (as per field assessment)	NSE wetland database layer.	Bogs, fens
				Visual aerial inspection	Visual inspection of aerial imagery to identify open wetlands (i.e. bogs, fens)	Visual aerial inspection	Visual inspection of aerial imagery to identify open wetlands (i.e. bogs, fens)
Rusty blackbird (RUBL)	Breeding	Portion of coniferous dominant riparian wetlands that are within 50m of a watercourse or waterbody	Management Plan for the Rusty Blackbird (*Euphagus carolinus*) in Canada (Environment Canada, 2014); and personal communication with Dr. Cynthia Staicer (October 23, 2018)	Field delineated wetlands	Wetlands where RUBL were observed and coniferous dominant treed wetlands adjacent to or within 50m of a watercourse or waterbody (i.e. lake, pond)	NSE wetland database layer	Wetlands intersecting the forestry layer and adjacent to or within 50m of a watercourse or waterbody (i.e. lake, pond)
				NSL&F Wet Areas Mapping Database	Surface water queried as depth to water between 0-0.1m	NSL&F Wet Areas Mapping Database	Surface water queried as depth to water between 0-0.1m
				Visual aerial inspection	Visual inspection of aerial imagery to identify treed wetlands adjacent to watercourses or waterbodies (i.e. lake, pond)	Visual aerial inspection	Visual inspection of aerial imagery to identify treed wetlands adjacent to watercourses or waterbodies (i.e. lake, pond)
				Field delineated watercourses	All watercourses	NSL&F forestry	Coniferous dominated forests, queried as the main species type being one of the following: Balsam Fir, Black Spruce, Eastern Hemlock, Red Spruce, Eastern Larch, Red and Black Spruce mixed stand, Unclassified Softwood, or Other Softwood

Once compiled, the datasets listed in Table 6.8-11 were arithmetically overlaid for each wetland function metric using ArcGIS (ArcMap version 10.4.1) at each geographic scale to create a habitat suitability layer at Year 0. The PA was also analyzed at Year 5. Interactions between wetlands generally, and the predicted suitable habitats created to model loss of wetland function metrics was achieved by overlaying the Beaver Dam Mine and its associated infrastructure footprint with the developed layers. Direct impacts to the developed layers were clipped out to calculate the predicted losses.

By modeling the impact of the Beaver Dam Mine Site and its associated infrastructure on wetland area and the predicted suitable wetland habitat for moose, turtles, and birds, the extent of impact was determined and potential loss of these wetland function metrics could be assessed.

Results of this process are provided in Section 6.8.6.4.

Modelling Limitations and Assumptions

The wetland cumulative effects modelling was developed to better understand the potential cumulative effect of wetland area and wetland function metric loss geographically, and over time. In order to produce a reasonable method to address this issue that falls within the realistic parameters of evaluating potential effects associated with the Beaver Dam Mine Project, there were multiple limitations and assumptions built into the modelling process. The following information provides a discussion of these limitations and assumptions, and their impact on the outcome of the assessment.

Certain assumptions were made in the selection of the four wetland function metrics. Initially, they were chosen to represent various wetland characteristics that can play an important role in determining a wetland's function. Wetlands play numerous roles in an ecosystem, and it is difficult to narrow those functions down for the purposes of a modelling exercise. However, for the purpose of this modelling exercise it was necessary to do so. The four wetland function metrics were assessed using available data layers. The biological requirements, habitat descriptions, and representative data layers were chosen using scientific information from peer-reviewed papers, government documents and/or conversations with specialists. To the best of our knowledge, they depict an accurate snapshot of the wetland habitat used by each species modelled. Limitations were observed when it came to compiling available data, for example, Canada Warbler, which utilize a dense, deciduous shrub layer, was not able to be modeled given the lack of available data. When creating this layer, it was determined that the available GIS datasets narrowed the search too much, resulting in an overly conservative selection of suitable wetland habitat. Furthermore, all GIS layers used are limited by the accuracy and precision of the publicly available data from which they came. For all metrics, field assessments and ground truthing in the PA resulted in more accurate data. When comparing this level of detail to the LAA and RAA, where data is far less accurate and less precise, the analysis is underestimated at these larger geographic scales. <u>The analysis performed at the LAA and RAA levels underrepresent predicted suitable wetland habitat, making the comparative area of impacted suitable wetland habitat in the PA less than the results of the modelling exercise suggests.</u>

In the context of meeting the objectives of the wetland cumulative effects modelling exercise, the modeling methods were developed to get the best possible analysis of cumulative effects. However, given the current resources and limitations in available data, a protracted model was not able to be produced. Instead, the study aimed to qualitatively show the cumulative effects of the project footprint on wetlands and metrics of their function within the LAA/RAA and over the life of the active mine (5 years) where possible within the PA. The mine footprint was used in the model to show area of impact. There are certain limitations around this, as it does not accurately show the potential indirect impacts to upgradient and downgradient wetland habitats. The impacted area assessed only includes the portion of the wetland directly beneath the Beaver Dam Mine infrastructure footprint, when in reality there could be impacts to other extents of the remaining wetland.

Lastly, for the purposes of this modeling exercise the study was not able to predict the future changes within the LAA and RAA and how those changes may affect wetland habitat and functions.

6.8.5.3 Thresholds for Determination of Significance

A significant adverse effect from the Project on wetlands is defined as an effect ~~that is likely to cause a permanent net loss of wetland function. An adverse effect that does not cause a permanent net loss in wetland function is considered to be not significant.~~ to wetlands that is likely to cause an adverse change in watershed health (water quality or quantity) in the tertiary watersheds directly affected by the Project, or an effect to wetlands that is likely to cause a permeant loss of >10% wetland habitat for a SAR species identified in the PA within the tertiary watersheds.

6.8.6 Project Activities and Wetland Interactions and Effects

Potential interaction between Project activities and wetland habitat within the PA is outlined in Tables 6.8-12 - 6.8-14 below.

Table 6.8-12 Potential Wetland Interactions with Project Activities at Beaver Dam Mine Site

Project Phase	Duration	Relevant Project Activity

Site Preparation and Construction	1 year	• Clearing, grubbing, and grading in preparation of construction
		• Rock blasting in preparation of construction
		• ~~Existing settling pond dewatering in preparation of construction~~
		• Watercourse and wetland alteration in preparation of construction
		    o Mine Site road construction
		    o Till and waste rock from site preparation transport and storage
		• Surface infrastructure installation and construction
		• Collection and settling pond construction
		• ~~Environmental monitoring of surface water discharges and adjacent wetlands~~
		• ~~General management of wastes derived from preparation and construction activities~~
		• ~~Accidents and malfunctions to include fuel and other spills, forest fires, settling pond overflow, slope failure, an unplanned explosive event, and mobile equipment accidents~~

Operation and Maintenance	3-4 years	• Rock blasting to access and extract ore o Interaction between groundwater drawdown and wetlands • ~~Surface mine dewatering to facilitate access to and extraction of ore~~ • ~~Management of waste rock produced from crushing and preparing ore for transport~~

Project Phase	Duration	Relevant Project Activity
		• ~~Treatment~~ Ditching of site surface water runoff and surface mine pumped water ○ Alteration of surface water hydrology • ~~Petroleum products management~~ • ~~Environmental monitoring of surface water discharges and adjacent wetlands~~ • ~~General management of wastes derived from operation and maintenance activities~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, settling pond overflow, slope failure, an unplanned explosive event, and mobile equipment accidents~~
Decommissioning and Reclamation	1-2 years	• Site reclamation activities • Interactions between groundwater drawdown and wetlands • Alterations to surface water hydrology from ditching • ~~Environmental monitoring of adjacent wetlands~~ • ~~General management of wastes derived from decommissioning and reclamation activities~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and mobile equipment accidents~~

Table 6.8-13 Potential Wetland Interactions with Project Activities along Haul Road

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Rock blasting in preparation of construction • ~~Till and waste rock from site preparation transport and storage~~ • Watercourse and wetland alteration in preparation of construction ○ Haul Road construction and upgrades • ~~Environmental monitoring of adjacent wetlands~~ • ~~General management of wastes derived from preparation and construction activities~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and a haul truck accident~~
Operation and Maintenance	3-4 years	• Haul Road maintenance and repairs, ~~including salting~~ • ~~Environmental monitoring of adjacent wetlands~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and a haul truck accident~~
Decommissioning and Reclamation	-	N/A[1]
1 Decommissioning and Reclamation of the Haul Road is not expected. The Haul Road will be returned to owner for forestry industry		

Table 6.8-14 Potential Wetland Interactions with Project Activities at ~~Touquoy Processing and Tailings Management Facility~~ Touquoy Mine Site

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Tailings pipeline, make-up water pipeline alteration, and relocation of reclaim infrastructure • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and mobile equipment accidents~~
Operation and Maintenance	3-4 years	• ~~Environmental monitoring of surface water discharges and adjacent wetlands~~ • ~~General management of waste derived from processing activities~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and a haul truck accident~~
Decommissioning and Reclamation	1-2 years	• ~~Environmental monitoring of surface water discharges and adjacent wetlands~~ • Post closure interaction with discharge from Touquoy Mine Site pit to Moose River riparian wetlands • ~~Accidents and malfunctions to include fuel and other spills, and forest fires~~

6.8.6.1 Wetland Impacts

Development of the ~~mine~~ Beaver Dam Mine Site and Haul Road will cause direct and indirect impacts to wetlands mostly during the construction phase of the Project. Direct impacts will be associated with clearing, grubbing, infilling, and development of the mine and its associated infrastructure. Along the Haul Road, upgrading of the road (widening and new sections of road as needed (Section 3B; Figure 2.2-2)) will account for the greatest impact to wetland habitat. Indirect impacts are a by-product of direct impacts associated with the construction activities, as well as potential indirect impacts to wetlands from mine operations (dewatering, blasting, and accidents). Table 6.8-15 provides general impact types and a description of various direct and indirect examples by which these may occur as a result of Project activities. Detailed discussion regarding potential impacts to groundwater recharge as a result of wetland loss associated with the Project is included after Table 6.8-15.

~~The Touquoy facility is currently under construction. There are no direct or indirect effects to wetlands anticipated to be caused by the processing of ore and the management of tailings from the Project. The use of the Touquoy facility for the processing of Beaver Dam ore will not involve construction or operation of the Mine Site, use of the Tailings Management Facility, or discharge of effluent into surface water bodies and adjacent wetlands; therefore, no effects are anticipated at the Touquoy facility related to the processing of Beaver Dam ore, with the exception of the continued potential for accidents and malfunctions and continued environmental monitoring.~~

Table 6.8-15 Direct and Indirect Wetland Impacts

Impact Type	Direct Impact	Project Phase	Indirect Impact	Project Phase
Alteration of Wetland Hydrology: If the hydrological regime of a wetland is altered, the vegetation, character, and function of the wetland also have potential to change.	Complete dewatering (removing wetland), infilling or flooding of a wetland to facilitate Project development resulting in conversion from wetland to upland habitat.	C	Hydrologically connected upstream wetlands may also be at risk of indirect impacts as a result of downstream alteration activities (e.g., water outflow changes, land elevation changes, blasting, etc. causing dewatering). Inadvertent damming of up-gradient wetlands from construction related infrastructure (e.g., roads with lack of flow through infrastructure).	C/D
	Alteration of hydrological inputs and outputs into partially altered wetlands has the potential to alter remaining (undeveloped) wetland habitat.	C/O/D	Removal of on-site outflow and throughflow wetland habitat has the potential to alter the localized hydrology in downgradient wetlands.	C
			Hydrological changes can affect the use of the wetland by wildlife as habitat.	C
			Blasting adjacent to wetlands has the potential to alter subsurface water flows, especially in fractured rock. This activity has the potential to increase or decrease subsurface hydrological flow to adjacent wetland habitats and can precipitate drier (dewatering) or wetter conditions in those habitats.	C/O
			Groundwater drawdown will reduce groundwater inputs to specific wetlands causing dryer conditions (14 intact wetlands within the predicted radius of influence).	O/D
			Surface water ditching will reduce water inputs to specific wetlands causing dryer conditions (e.g. Wetlands, 4, 8, 11, 14, and 17).	C/O/D
Alteration of Water Quality:	Removal (alteration) of wetland from the landscape leading to reduced or no water supply to downgradient aquatic receivers (e.g., streams, additional wetlands, and lakes).	C/O/D	Alteration of the wetlands increases the risk of downgradient sedimentation.	C/O/D
			The effects of increased sedimentation as a result of up-gradient activities (e.g., earth moving, removal of vegetation, soil stockpiling) has the capacity to suffocate existing plant life and increase nutrient levels in downgradient wetlands. Dust created as a result of construction activities can have a similar impact.	C/O/D
			Runoff from acid producing rock exposed during construction and operations activities has the potential for negatively altering water quality within downgradient wetland habitat.	C/O/D
Vegetative and Habitat Integrity:	Extensive ground works, including activities such as blasting in and adjacent to wetlands has the potential to destabilize land surfaces and the root zone of vegetative areas, including wetland buffers.	C/D	Introduction of invasive species can occur indirectly into wetlands when equipment or people enter the wetlands or via runoff or dust from the roads. Introduction of mine and Haul Road traffic during construction and operation can elevate this risk. Invasive species, such as purple loosestrife (*Lythrum salicaria*), can severely degrade wetland habitat and function. No purple loosestrife was noted during field surveys in the ~~mine footprint~~ Beaver Dam Mine Site or Haul Road ~~PA~~.	C/O/D
	Loss of vegetative cover decreases wildlife habitat availability and also has the potential to reduce natural surface water drainage.	C	Dust accumulation on vegetation can smother and stress the plants. The dust can also provide minerals and nutrients into the wetland habitat.	C/O/D
	Seeds and roots of invasive species can be transferred from construction equipment, transportation vehicles, or workers into adjacent wetland habitat during construction and operational activities.	C/O/D		
Malfunctions and Accidents: Accidental spills of contaminants in up-grade work areas has the potential to drain into down-gradient wetlands, and can cause negative impact to wetland function, and potential use of the habitat by wildlife.				C O D

[1] *C = Site Preparation and Construction Phase O = Operation and Maintenance Phase D = Decommissioning and Reclamation*

6.8.6.2 Impacts to Groundwater Recharge

As discussed earlier in this section, the PA comprises a combination of groundwater recharge and discharge wetlands, although discharge wetlands appear to dominate the landscape. Smaller isolated wetlands have the ability to hold water for longer and allow penetration of surface water into the relatively impermeable bedrock geology. Removal of recharge wetlands form the landscape removes the ability for water to be collected, stored, and fed into underlying aquifers. However, once other water loss factors such as evapotranspiration have been accounted for, the loss of smaller recharge wetlands (e.g., isolated features lacking an outlet and/or lentic wetlands located adjacent to lakes) is not expected to affect groundwater levels on a landscape level.

Proposed wetland impacts within the Cameron Flowage tertiary watershed encompass varied wetland habitats, including portions of the larger headwater wetland complexes (wetlands 2 ~~and 29~~) in southern portions of the ~~PA~~ Beaver Dam Mine Site, which are acting as discharge systems. Proposed wetland impact areas within these complexes appear to be located at their northern extents, in closer proximity to their discharge points (streams). As such, the wetland impact areas are likely not affecting critical groundwater recharge functions to any large degree at these locations; rather, discharge of water to lower lying aquatic receptors is more likely.

~~From the headwater position, water flows via throughflow wetlands and streams toward Crusher Lake, and in the case of Wetland 57, directly toward Cameron Flowage. These wetlands offer minimal groundwater recharge capacities; therefore, their alteration is unlikely to affect groundwater recharge.~~

A collection of isolated wetlands exists ~~in northern portions of the Kent Lake tertiary watershed, in~~ on land encompassing the eastern waste rock stockpile. ~~future Waste Rock Storage Area, and in between Crusher Lake, Mud Lake, and Cameron Flowage.~~ As discussed, these isolated wetlands are more likely to provide groundwater recharge abilities than those which are part of continuous wetland throughflow systems. Based on the proposed Project design within the ~~Mine Study Area~~ Beaver Dam Mine Site, many of these wetlands will be completely altered as a result of Project infrastructure. Of note, however, is the limited size of these wetlands in comparison with other, non-isolated wetlands present within the ~~PA~~ Beaver Dam Mine Site. It is not anticipated that alteration of the smaller isolated wetlands will bear critical impact to groundwater recharge capacity, especially at a more regional scale (i.e., secondary watershed level).

~~In most cases, the other larger lentic wetlands adjacent to Crusher Lake, Mud Lake, and Cameron Flowage receive water from up-gradient systems, as well as bi-directional water flow from the lakes themselves and, hence, act as discharge features. Apart from some partial impact to the outer edges of these wetlands, for the most part, these wetlands will not be altered as a result of the Project. On-site water will be managed via the construction of water settling ponds and a diversion channel. The diversion channel will act as a mechanism to transport water from southern portions of the mine infrastructure to Cameron Flowage, with a goal of maintaining current water input into the lake. Therefore, water currently being sourced by Cameron Flowage into wetland 61 by bi-directional flow for example, will be maintained.~~

Wetlands being impacted as a result of the Haul Road upgrades also comprise a variety of characteristics which determine them to act as discharge or recharge wetlands. Regardless of wetland type, size, or local landscape conditions, etc., the proposed upgrades to the Haul Road are minimal (e.g., narrow infill for road widening or new sections of road where necessary to manage site lines and turning radii) and hydrological flow within the wetland will be maintained beneath the road via installation of culverts (or other accepted methods). As such, the ability for the wetland to maintain existing groundwater recharge functions (should it currently do so) will not be affected by the proposed activities.

The following summary is provided:

- The variability of wetland types and landscape conditions (e.g., soil types, landscape position, geological conditions) present within the PA determines a wetland's ability to perform groundwater discharge or recharge functions;
- The PA is dominated by surface flow and groundwater discharge wetlands as a result of underlying impermeable geological conditions;
- Isolated wetlands scattered throughout both the ~~mine~~ Beaver Dam Mine Site and Haul Road sites are likely to provide groundwater recharge functions, however, due to their small size and limited source of water (precipitation and surface runoff), alteration of these wetlands is not expected to impact groundwater recharge at the landscape level; and,
- Within the ~~Mine Study Area~~ Beaver Dam Mine Site, proposed infrastructure design involves the partial alteration of large, headwater complexes, multiple throughflow systems, and multiple small isolated wetlands. The large wetland complexes comprise outflow/discharge points and, as such, groundwater discharge is likely occurring. Isolated wetlands are small in size, especially in comparison to the regional setting (i.e., secondary watershed). Minimal disturbance is planned within lentic wetlands. There are no expansive or contiguous areas of wetland habitat performing groundwater recharge functions expected to be altered as part of the Project. For these reasons, wetland alteration associated with the Project is not expected to alter groundwater recharge capacity. Conversely, due to the anticipated alteration footprint on discharge wetlands, surface water flows from headwater positions, toward lower lying receiving wetlands (e.g., surrounding Crusher and Mud Lakes and Cameron Flowage) are expected to be altered. ~~Diversion channels, settling pools, and other Project infrastructure will be constructed to manage potential surface water imbalances and/or reductions in drainage toward lower lying receptor wetlands (refer to Section 6.3 Surface Water Quality and Quantity).~~

6.8.6.3 Wetland Impact Extent

6.8.6.3.1 Direct Wetland Impacts

Expected direct impact extent as a result of Project activities during the temporal lifetime of the mine are described in Table 6.8-16 for the ~~Mine Site PA~~ Beaver Dam Mine Site and Table 6.8-17 for the Haul Road ~~PA~~. Indirect hydrological ~~and water quality~~ wetland impacts to adjacent wetlands within the PA that may be expected as a result of the Project, as well as those within the Haul Road ~~PA~~ are discussed separately.

The following potential direct impact extents are included in the Tables 6.5-16 and 6.5-17. Only wetlands where expected direct habitat alteration is expected are included in these tables.

P – Partial habitat loss of wetland

C – Complete habitat loss of wetland

* *Indicates total wetland area within PA: wetland extends off-site beyond the PA boundary*

Table 6.8-16 Expected Direct Wetland Impacts within the Beaver Dam Mine Site

Wetland #	Wetland Size (m2) inside BDMS	Estimated Direct Impact Area (m2)	Infrastructure	Direct Impact Type
2	196,857	12,859	Waste Rock Stockpile East	P
3	4,658	4,658	Waste Rock Stockpile East	C
4	13,139	4,629	Waste Rock Stockpile East	P
5	6,202	6,202	Waste Rock Stockpile East	C
6	262	262	Waste Rock Stockpile East	C
10	18,817	3,296	Waste Rock Stockpile West	P
12	4,475	2,625	Waste Rock Stockpile East	P
13	4,816	2,605	Waste Rock Stockpile East	P
14	31,655	250	Road	P
17	90,633	5,446	Open Pit/Waterline	P
19	11,428	644	Waterline	P
20	10,106	623	Road/Waterline	P
31	10,473	2,701	Waste Rock Stockpile West	P
34	1,382	760	Ore Stockpile	P
42	1,879	1,764	Waste Rock Stockpile East	P
43	81	81	Waste Rock Stockpile East	C
44	10,611	10,611	Waste Rock Stockpile East	C
45	295	295	Waste Rock Stockpile East	C
46	754	754	Waste Rock Stockpile East	C
47	1,029	1,029	Waste Rock Stockpile East	C

Wetland #	Wetland Size (m2) inside BDMS	Estimated Direct Impact Area (m2)	Infrastructure	Direct Impact Type
48	2,876	2,876	Waste Rock Stockpile East	C
49	117	117	Waste Rock Stockpile East	C
50	117	117	Waste Rock Stockpile East	C
51	898	898	Waste Rock Stockpile East	C
52	1,620	1,620	Waste Rock Stockpile East	C
53	824	824	Waste Rock Stockpile East	C
55	616	500	Open Pit/Waterline	P
56	16,275	16,275	Open Pit	C
57	88,717	18,260	Road/Tll Stockpile/Crusher	P
58	581	581	Till Stockpile	C
59	65,348	61,746	Open Pit	P
60	2,963	2,885	Till stockpile	P
61	24,653	1,242	Open Pit/Waterline	P
201	284	284	Waste Rock Stockpile West	C
203	3,925	3,607	Waste Rock Stockpile West	P
207	67,613	37	Waste Rock Stockpile West	P
208	6,478	6,478	Waste Rock Stockpile West	C
211	10,474	10,474	Waste Rock Stockpile West	C
212	13,987	13,987	Waste Rock Stockpile West	C
213	992	283	Road	P
214	6,041	3,065	Waste Rock Stockpile West	P

Wetland #	Wetland Size (m2) inside BDMS	Estimated Direct Impact Area (m2)	Infrastructure	Direct Impact Type
215	16,447	12,622	Waste Rock Stockpile West	P
216	1,397	179	Waterline	P
Total Impact Area: Beaver Dam Mine Site		**221,080**	**Total complete wetland alteration**	**20**
			Total partial wetland alteration	**24**

As outlined in Table 6.8-16, ~~34~~ 20 wetlands will be completely altered and ~~17~~ 24 wetlands will be partially altered as a result of mining activities and associated infrastructure within the ~~mine footprint PA~~ Beaver Dam Mine Site. Micro siting of Project infrastructure has reduced the total area of wetland loss within the Beaver Dam Mine Site from 317,293 m^2 to 221,080 m^2.

Expected direct impact extent to wetlands as a result of Project activities during the temporal lifetime of the Project are described in Table 6.8-17 for the Haul Road ~~PA~~. Only wetlands with expected direct impacts are included.

Table 6.8-17 Expected Direct Wetland Impacts within the Haul Road ~~PA~~

Wetland #	Wetland Size (m2) inside HR	Estimated Direct Impact Area (m2)	Infrastructure	Direct Impact Type
64	15,979	~~159~~ 224	road upgrade and waterline	P
65	65	28	road upgrade	P
66*	15,423	1,136	road upgrade	P
68*	5,579	1	road upgrade	P
69*	3,899	108	road upgrade	P
70*	631	188	road upgrade	P
72	1,471	178	road upgrade	P
73*	26,893	2,537	road upgrade	P
74*	12,340	1,135	road upgrade	P
75	144	1	road upgrade	P
76*	10,405	354	road upgrade	P
79*	3,703	303	road upgrade	P
80*	979	6	road upgrade	P

Wetland #	Wetland Size (m2) inside HR	Estimated Direct Impact Area (m2)	Infrastructure	Direct Impact Type
81	154	90	road upgrade	P
82*	616	1	road upgrade	P
86*	4,684	855	road upgrade	P
89*	6,194	290	road upgrade	P
94*	1,748	308	road upgrade	P
98*	1,540	377	road upgrade	P
109	1,606	253	new road	P
111*	1,060	7	new road	P
112*	3,595	256	new road	P
116	892	11	new road	P
120	115	84	new road	P
123	818	189	new road	P
124*	528	72	new road	P
125	344	102	new road	P
126	63	3	new road	P
133	102	13	new road	P
136	522	214	new road	P
138	1,521	720	road upgrade	P
139	106	1	road upgrade	P
142	342	30	road upgrade	P
143	636	25	road upgrade	P
144*	2,034	80	road upgrade	P
145*	1,462	321	road upgrade	P
146*	2,653	329	road upgrade	P
147*	2,708	345	road upgrade	P

Wetland #	Wetland Size (m2) inside HR	Estimated Direct Impact Area (m2)	Infrastructure	Direct Impact Type
148*	9,220	1,834	road upgrade	P
149*	1,811	1,134	road upgrade	P
150	145	107	road upgrade	P
151*	2,959	614	road upgrade	P
153*	2,416	92	road upgrade	P
154*	1,991	626	road upgrade	P
155*	717	175	road upgrade	P
156*	14,756	1,479	road upgrade	P
157*	7,006	3,181	road upgrade	P
158	575	209	road upgrade	P
159*	1,995	700	road upgrade	P
160*	1,237	93	road upgrade	P
161*	1,618	377	road upgrade	P
162*	1,756	321	road upgrade	P
163*	1,107	329	road upgrade	P
164*	3,320	479	road upgrade	P
166	68	68	road upgrade	C
167*	875	227	road upgrade	P
168*	664	56	road upgrade	P
169*	607	50	road upgrade	P
171*	4,329	32	road upgrade	P
172	229	48	road upgrade	P
173*	4,814	7	road upgrade	P
176*	446	62	road upgrade	P
179	3,412	90	road upgrade	P

Wetland #	Wetland Size (m2) inside HR	Estimated Direct Impact Area (m2)	Infrastructure	Direct Impact Type
Total Impact Area: Haul Road		**~~23,500~~**	**Total complete wetland alteration**	**1**
		23,565	**Total partial wetland alteration**	**62**

** Indicates total wetland area within PA: wetland extends off-site beyond the PA boundary*

As outlined in Table 6.8-17, 1 wetland will be completely altered and 62 wetlands will be partially altered as a result of Haul Road construction and upgrading activities. In total, across the entire ~~PA~~ Beaver Dam Mine Site and Haul Road, a total of ~~35~~ 21 wetlands are expected to be completely altered to support Project development, and ~~79~~ 86 wetlands are expected to require partial alteration to support Project infrastructure and development.

6.8.6.3.2 Indirect Wetland Impacts

Potential hydrological ~~and water quality~~ related indirect impact types are also anticipated in the ~~mine footprint~~ Beaver Dam Mine Site and Haul Road ~~PA~~. In addition, due to the nature of proposed activities (e.g., active construction site, presence of vehicles and construction equipment), all wetlands identified within the PA have potential to be indirectly impacted as a result of accidents and malfunctions. Mechanisms to reduce the potential for vegetative and habitat impacts from accidents and malfunctions will be addressed and discussed in Section 6.18.

Beaver Dam Mine Site

Potential for downgradient, indirect wetland impacts can be expected throughout the ~~mine footprint PA~~ Beaver Dam Mine Site as a result of up-gradient hydrological alteration. Primarily, the alteration of hydrological conditions in up-gradient wetlands and watercourses will affect natural inflows, outflows, and hydroperiod characteristics in contiguous wetland systems. In addition, where up-gradient alteration is occurring, but a direct hydrological flow is being maintained, potential exists for indirect impacts to downgradient water quality conditions. Within the ~~Mine Site PA~~ Beaver Dam Mine Site, areas with heightened risk of these indirect impact types include wetlands (and associated watercourses) bordering Crusher Lake (i.e., Wetlands 4, 8, 10, and 11) due to them directly receiving water from up-gradient wetlands and watercourses which are subject to alteration (e.g., headwater and throughflow wetlands). Similarly, Wetlands 20, 14, and 17, all of which act as throughflow wetlands that intercept water prior to it draining into Mud Lake, are also at potential risk of indirect hydrological ~~and water quality~~ impacts as a result of up-gradient alteration activities. At the eastern extent of the ~~mine footprint PA~~ Beaver Dam Mine Site, alteration to Wetland 57, a headwater wetland, has the potential to indirectly impact its downgradient aquatic receptors, which include watercourse 14, ~~the eastern extent of Wetland 59, and~~ Wetland 61 and Wetland 217. ~~At the southern extent of the mine footprint PA, alteration to wetland 29 has the potential to indirectly impact lower lying portions of the same wetland system, as it extends beyond the southern mine footprint PA boundary.~~

Potential also exists for up-gradient hydrological alteration as a result of downgradient hydrological alteration. Examples include altered outflow (i.e., faster or slower outflows due to Mine Site drainage infrastructure), causing either dewatering (drying hydrological trend) or flooding conditions in up-gradient wetlands. Locations within the ~~mine footprint PA~~ Beaver Dam Mine Site where this is considered a possibility include southern extents of Wetland 2 and southern portions of Wetland 57.

The placement of Project infrastructure located in areas that will cause a direct loss of watercourses also has the potential to indirectly affect the hydrology of downstream receiving wetlands. For instance, WC-2, 3, 4, and 5 are directly lost due to the placement of the eastern waste rock stockpile. These watercourses all flow north into Wetlands 4, 8, 11, and 13. The watercourses within Wetlands 4, 11, and 13 are characterized by entrenched channels and therefore the relationship between surface water and wetland hydrology is less than it is in the southern portions of Wetland 8, where WC-4 is braided and has shallow banks that allow for the flooding of water into the wetland during high flow conditions.

Due to the placement of the waste rock stockpiles and the low grade ore stockpiles within the contributing area to Crusher Lake and Mud Lake (109.5 ha and 166.3 ha, respectively), runoff that would naturally flow to Mud Lake via WC-5 from Crusher Lake, is directed to the Killag River via the north settling pond until EOM (Figure 2.2-1). In PC, low grade ore stockpiles are removed and runoff from this area is directed back into Mud Lake. The result of the change in runoff from natural conditions (baseline) is a 52% reduction in flow to Crusher Lake (at EOM and PC). In Mud Lake there is an estimated 43.0% reduction in volume discharged into the Lake during EOM and 35.5% reduction during PC conditions (Appendix G.5).

Crusher lake is an open water body approximately 4 ha in size and is described in Table 6.7-5. A reduction of flow of 52% will likely result in the steadying of water level fluctuations within the lake and the majority of the potential impact will be at the outlet to WC-5. Wetlands 8 and 10 are lacustrine wetlands (lentic) located on the east and western extent of the lake, respectively. Wetland 10 does not receive any additional surface water from any other features whereas Wetland 8 receives additional water from WC-4 and 5 (which will be lost due to infrastructure placement as discussed above). Both wetlands are permanently saturated and have water flow paths characterized as bidirectional non-tidal. Wetland 8 is a shrub/fen complex with 30% standing water cover and Wetland 10 is a fen with 50% standing water cover. A reduction of water levels within Crusher Lake is not likely to have an adverse effect on the function of Wetlands 8 and/or 10.

The construction of Project infrastructure within the contributing area to Mud Lake will also result in a decrease in flow rate within WC-5. The downstream portion of WC-5 flows north from Crusher Lake to Mud Lake. Flow will be reduced by approximately 43%. WC-5 flows through Wetlands 8, 14 and 17 in a defined channel, with limited interaction with the adjoining wetland habitat. The reduction of flow rates in WC-5 could have an indirect effect on these adjoining wetlands, but it anticipated to be minor and localized.

Mud Lake exists as an open water body within Wetland 17. This wetland is a complex comprised of tall shrub swamp, coniferous treed bog, and low shrub fen communities. Within Mud Lake, the substrate is dominated by mud, with emergent vegetation along the edges when the water level is high. While bathymetry data was not collected for Mud Lake, the depth is not believed to exceed 2 m based on direct observation during wetland and fishing surveys. Early in the spring, water levels are high and emergent vegetation is abundant. Through the summer, much of the water dries up, leaving exposed natural mud flats. The reduction of 43.0% results in a predicted 7cm reduction in average annual water level within Mud Lake, and therefore, Wetland 17. Given the natural seasonal variability in water levels observed in Wetland 17, the reduction in water level of 7 cm is not expected to have a significant effect on the wetland. This habitat has demonstrated resilience to natural water level fluctuations. Small scale, local changes in vegetation species composition responding to changes in hydrology may occur, but it is expected to be minor.

There is a predicted increase in runoff volume discharged to the Killag River of 0.91% and 0.03% during EOM and PC, respectively. This minor increase is expected to have negligible impacts to the Killag River riparian wetlands (Wetlands 61, 62, and 217).

In relation to indirect wetland impacts from groundwater drawdown, there are 22 wetlands within the radius of influence during the most conservative conditions (dry) at EOM. Of the 22 wetlands 8 are being completely altered from mine development and were not carried forward in this analysis. The remaining 14 wetlands within the radius of influence vary from being partially altered to unaltered from direct mine development.

Any wetland that is situated over the radius of influence has the potential to be affected from drawdown. Simulated drawdown is generally less than 10 cm outside of the PA and is negligible beyond the LAA (Appendix F.5). Intact wetlands within the radius of influence are simulated to experience drawdowns that range between 0.1 to 2 m. Refer to the below table for intact wetlands within the simulated drawdown radius of influence.

Table 6.8-18: Intact Wetlands within the Simulated Drawdown Radius of Influence.

Wetland	Area (m^2)	Location within Radius of Influence	Discharge/Recharge	Simulated Drawdown (m)
1	37,188	Partial	Recharge	0.1
2	196,857	Partial	Recharge	0.1
4	13,139	Complete	Discharge	2
7	306	Complete	Recharge	1
8	16,603	Partial	Discharge	1
17	76,341	Partial	Discharge	2
19	11,428	Partial	No GW interaction	0.5
20	10,106	Partial	Discharge	2
34	1,382	Complete	Recharge	2
57	88,717	Complete	Discharge/Recharge	0.5
61	25,953	Complete	Discharge	2
62	832	Complete	Discharge	0.1
216	1,397	Complete	No GW interaction	0.5
217	5,230	Complete	Discharge	0.1

Note: Discharge/recharge is based on professional judgement not NovaWET evaluation.

Wetlands regularly undergo seasonal Relative Groundwater Depth (RGWD) fluctuations in response to annual precipitation, seasonal variability and frequency of local precipitation events. Geographically isolated wetlands have been reported to have seasonal fluctuations ranging as high as ±20 cm (Keddy, 2001). Keddy (2001) also found that wetlands associated with lakes and watercourses were found to have seasonal variability as high as ± 1.5 m. The US Army Corp (2009) stipulates that wetland hydrology is defined as saturation of soils 20 cm below the surface or groundwater levels within 30 cm of the surface for a period of two consecutive weeks in the growing season.

Drawdown caused by mining can affect all wetlands that have direct connectivity to groundwater (discharge and recharge wetlands). Drawdown can change the hydroperiod of a wetland and reduce water levels which can cause an adverse effect on wetland function (Mortellaro et al. 1995). Effects include dryer conditions, wetter conditions, change in flow direction, changes to vegetation, and changes to wildlife habitat (e.g. fish and amphibians).

Large wetland systems within the radius of influence at the Beaver Dam Mine Site that have ample standing water (e.g. Wetland 2) are less likely to be affected by drawdown. Conversely, the impact to dryer more marginal wetlands (e.g. Wetland 57) are likely to be more severe.

If wetlands become dryer, organic soils can subside (Tiner, 2005) and plans may become stressed. Most plants, however, can survive dry conditions and reproduce under altered hydrologic conditions (Tiner, 2005).

The riparian wetlands along Cameron Flowage (Wetlands 61, 62, and 217) are unlikely to be significantly impacted by drawdown because these wetlands act as discharge systems and are highly influenced by their interaction with Cameron Flowage as oppose to groundwater.

Drawdown can influence direction of flow within a wetland. Wetland 17, which borders the southern extent of Mud Lake, for instance, has the potential for direction of flow to change from flowing north into Killag River to south towards the open pit. A change in flow direction could create wetter conditions in certain portions of the wetland and dryer conditions in another.

Loss of groundwater can also convert discharge wetlands into recharge wetlands which in turn reduces surface water levels (Tiner, 2005). Changes in surface water quantity can affect downstream wetlands that receive surface water flows, as discussed above, as well as fish and fish habitat (Section 6.9).

Overall, changes in hydrology (i.e. reduced overland flow) due to the placement of Project infrastructure has the potential to affect the functionality of wetlands. More detailed infrastructure design is required to minimize these impacts. This will be completed at the permitting level. Targeted monitoring for wetlands will also be conducted to verify the accuracy of the predicted environmental effects and the effectiveness of mitigation measures. Refer to the EEM (Appendix O.1) and the Preliminary Wetland Compensation plan (Appendix H.3) for further information.

Haul Road

The potential for indirect wetland impacts as a result of upgrading and new construction of the proposed Haul Road also exists. However, due to the limited alteration footprint to up-gradient wetlands from Haul Road infrastructure and standard road construction mitigation methods that will be employed as part of the construction process, downgradient, indirect impacts are not expected.

There is an increase (53.1%) in the predicted annual runoff volume discharged to the Tent Lake watershed due to mine development. Runoff at the crusher location, within the Beaver Dam Mine Site, is directed to a collection pond before being released south into Wetland 64. Wetland 64 is located at the northern extent of the Haul Road, at its connection to the Beaver Dam Mine Site. Runoff discharged into this wetland is also likely to flow to Wetlands 66, 68, and 69 via WC-B prior to entering Tent Lake. Wetland 64 is a complex comprised of a low shrub bog and mixed wood treed swamp. An increase in flow is likely to have a greater impact to wetlands in closer proximity to the input source. This increase in flow has the potential to raise water levels up to 5 cm. This change may flood the banks of WC-B and add water to the wetlands downstream, increasing their respective hydroperiods. These changes in the water regime can alter plant communities, expand wetland habitat, and increase suitable fish habitat within wetlands. Since Wetlands 64 and 66 are permanently flooded wetland an increase in water levels is not anticipated to have an adverse effect. Flooding of Wetland 64 may have a positive impact as it may increase suitable habitat for greater yellowlegs and fish. Wetlands 68 and 69, farther downstream, have less standing or inundated surface water and are classified as seasonally and permanently saturated, respectively. These two wetlands may experience a change as discussed above because of a more substantial alteration in the wetlands hydroperiod. Targeted monitoring for wetlands will also be conducted to verify the accuracy of the predicted environmental effects and the effectiveness of mitigation measures. Refer to the EEM (Appendix O.1) for further information.

As is consistent with alteration to all wetlands associated with the Project, protection and viability of connected, unaltered areas of wetland habitat are considered as part of the provincial wetland alteration process. Design of suitable hydrological connectivity structures (e.g., culverts), the implementation of a Project EPP, and ESC methods will be employed to ensure that indirect impacts to upstream or downstream wetlands will not occur as a result of the activities associated with the Haul Road. In addition, however, post construction monitoring will be performed at alteration locations as discussed in Section 6.8.8 to ensure this expectation.

Furthermore, as part of the design process associated with the new Haul Road, the proponent has committed to identifying culverts that are currently in disrepair (i.e., are not effectively maintaining wetland hydrological connection) and removing them where appropriate. This will remove hydrological connectivity barriers and, in combination with the installation of culverts along the new alignment, will improve natural wetland characteristics.

A comprehensive wetland monitoring program will be developed to meet the requirements of wetland alteration permits issued for direct and indirect wetland alterations associated with the Project.

Touquoy Mine Site

During mine operations, tailings generated through processing Beaver Dam ore will be deposited in the Touquoy Mine Site open pit. At post closure and once water quality in the Touquoy Mine Site open pit meets MDMER discharge criteria, water surplus will be released into Moose River via a spillway. Under climate normal conditions the average predicted monthly open pit overflow into Moose River varies seasonally from 0.9 L/s in July to 44.2 L/s in April. The average effluent flow rate is 13.9 L/s (AppendixG.6 Stantec, 2018). Additionally, through the completion of a groundwater model it was determined that seepage from the open pit to Moose River is predicted at 3.6 L/s (Appendix F.6 Stantec, 2018).

Within Moose River, there is an average predicted increase in flow from both open pit overflow and groundwater seepage of 3.89%, during August (when Moose River flows are the lowest). No indirect impacts to wetlands are expected from this minor increase in flow.

6.8.6.4 Wetland Cumulative Effects Modelling Results

The Wetland Cumulative Effects Modelling exercise was completed to support the determination of wetland effects associated with the Beaver Dam Mine Site and its associated infrastructure. The modeling exercise was completed across the three spatial boundaries noted in Section 6.8.5.2:

The modelling has enabled a determination of the following to be made:

- The extent of wetland area loss at the PA (i.e. Beaver Dam Mine Site), LAA, and RAA at Year 0 (i.e. prior to any mine development activities) and Year 5 (i.e. completion of mine development /complete wetland alteration)
- The extent of predicted mainland moose, snapping turtle, wood turtle, olive-sided flycatcher and rusty blackbird wetland habitat within the PA and LAA at Year 0.
- The extent of Canada warbler habitat loss within the PA between Year 0 and Year 5.
- The extent of predicted mainland moose, snapping turtle, wood turtle, olive-sided flycatcher and rusty blackbird loss in the PA between Year 0 and Year 5.

Results of the modelling exercise are provided in Tables 6.8-19 below: For the purposes of Table 6.8-19, Modelling Parameters refer to method by which wetland function metrics were compared to each other, temporally and spatially.

When reviewing the results of the modelling in the following tables, the reader is reminded of the limitations associated with the modelling completed in the LAA and RAA: *i.e.* the analysis performed within the LAA and RAA spatial boundaries underrepresent predicted suitable wetland habitat. As such, the comparative area of impacted suitable wetland habitat in the PA are expected to be less than the results of the modelling exercise suggest.

Table 6.8-19 Wetland Cumulative Effects Modelling Results

Modelling Parameter	Wetland Area Losses	Predicted Moose Wetland Habitat Losses	Predicted Turtle Wetland Habitat Losses	Predicted Bird Wetland Habitat Losses
A comparison between Year 0 (prior to mine development) within the PA, and at completion of mine development within the PA.	Loss of 22% wetland area	Loss of 26% mainland moose wetland habitat	Loss of 12% wood turtle and snapping turtle wetland habitat.	The loss of 24% rusty blackbird wetland habitat. The loss of 13% Canada warbler wetland habitat. The loss of 10% olive-sided flycatcher wetland habitat
A comparison between Year 5 (completion of mine development) within the PA, to the LAA at Year 0 (prior to mine development).	Loss of 4% wetland area in comparison to LAA.	Loss of 3% predicted Mainland Moose habitat in comparison to LAA.	Loss of 1% predicted Turtle habitat in comparison to LAA.	Loss of 5% predicted rusty blackbird wetland habitat in comparison to LAA. Canada warbler – not assessed Loss of 2% predicted olive-sided flycatcher wetland habitat in comparison to LAA.
A comparison between Year 5 (completion of mine development) within the PA, to the RAA at Year 0 (prior to mine development)	Loss of 0.01% wetland area in comparison to RAA.	N/A – not assessed	N/A – not assessed	N/A – not assessed

**RAA only used for wetland area*

Note: Areas (ha) rounded to the nearest tenth of a decimal place.

Discussion

Utilizing a combination of field data and desktop resources, the wetland cumulative effects modelling exercise has provided an ability for four wetland function metrics to be predicted within the PA, LAA and RAA. The potential loss of the wetland function metrics post Beaver Dam Mine development has also been evaluated. Development of a predictive future model was beyond the scope and resources available at the time of writing. However, a qualitative approach to assessing the future cumulative effects of the Project on wetland function (by way of evaluating the wetland function metrics) was possible and is discussed below.

The direct and indirect impacts on wetlands within the Beaver Dam Mine Site will affect the functional abilities of these wetlands (i.e. water quality, water storage capacity, regulation of water temperature, nutrient retention, and provision of wildlife habitat among others) during the Project, and into the future. The mitigation and monitoring actions described in Section 6.8.8 will lessen these impacts and help ensure the integrity of wetlands beyond the Beaver Dam Mine Site remain viable.

As discussed in Section 6.8.6.1, direct wetland area loss is expected as a result of the Beaver Dam Mine Project. The loss of wetland area will result in changes to <u>all wetland functions</u> (including the metrics discussed above). For example, loss of wetland area would reduce water storage capacity, and could lead to increased risk of flooding in downstream environments. However, despite the loss of wetland area and thus its function within the PA, modeling results suggest that when compared to the LAA and RAA <u>wetland area being lost as a result of the Project is 4% of the modelled LAA wetland area, and 0.01% of the modelled RAA area.</u>

Five wildlife species metrics were also evaluated as part of the modelling exercise, the results of which can be used to highlight other potential wetland functional losses, as a result of the Beaver Dam Mine Project. The wildlife species metrics evaluated were; mainland moose habitat, wood turtle and snapping turtle habitat, olive-sided flycatcher habitat, rusty blackbird habitat and Canada warbler habitat.

Mainland Moose are a generalist species: instead of occupying a narrow niche they utilize a variety of habitats. As previously discussed, Moose utilize wetlands with access to aquatic vegetation, a component which was used to model potential wetland habitat within the modeling exercise. However, they have also been found to utilize large clear-cuts for forage, although this habitat forage availability for moose in a cleared forest doesn't peak until 7-15 years after cutting (Snaith and Beazley, 2004). Impact on moose wetland habitat is expected within the PA as a result of wetland loss, however clearing of vegetation within the PA may eventually provide new habitat for moose, post re-generation in the future. The provision of thermoregulation from mature stands is also required for Moose (Snaith and Beazley, 2004). Within the PA, there is the potential for direct and indirect impact to wetlands comprising moose habitat, and which could provide the thermoregulation characteristics which moose require. However, moose in Nova Scotia generally prefer areas with few or no roads, which already exist within the PA. While moose have been observed in and near wetlands within the PA (both during field surveys and according to the ACCDC report), the existing roads extending through the PA reduces the extent of suitable moose habitat within the PA. <u>The modeling exercise determined that the loss of potential moose wetland habitat within the PA is 26% which; represents 3% of the predicted suitable moose wetland habitat in the LAA.</u>

Wood turtle and snapping turtle wetland habitat is expected to be impacted by the Project. As it relates to wetlands, snapping turtles prefer muddy sites–in deep anoxic mud in marshy areas for overwintering, and rocky slow-moving streams for mating (COSEWIC 2008). Wood turtles prefer rivers and streams with sandy or gravely-sandy bottoms for breeding, deep pools for overwintering but are also known to utilize forested habitats in late summer (COSEWIC 2007). It should be noted however, that they rarely move more than 300m from water. While neither species was observed in the PA during field surveys, turtle habitat was observed in multiple watercourses within the PA. Both species were recorded as being observed within 100 km of the PA according to the ACCDC report (wood turtle = 16.6km ± 1.0; snapping turtle = 15.4km ± 0.1). Both species have high site fidelity – they will return to the same nesting and overwintering locations year after year (COSEWIC, 2007; Environment and Climate Change Canada, 2016; Pulsifer, pers. comm. 2018). The modelling exercise suggests that loss of suitable turtle habitat within the PA between Year 0 and Year 5 equates to a 12% loss. It should be noted however, that in order to run a model that encompassed the two turtle species generally and within the scope of this analysis, the GIS layer variables used in the modeling exercise were somewhat broader in their definition in comparison to the defined habitat preferences for each species discussed above. For example, the GIS attributes to define habitat include *"riparian wetlands or wetlands within 350m of a stream or river from riparian wetlands"*, whereas field evaluators defined suitable habitat more specifically based on the individual habitat preferences (i.e. for snapping turtle, wetlands with deep muddy soils adjacent to rocky slow-moving streams). As such, the predicted habitats determined within the modelling exercise could be looked upon as conservative and likely over-predict potential habitat present. Crucially however, consistency was maintained in the methods modelled for the PA and the LAA, which enabled the determination of potential turtle wetland habitat loss within the PA (12%) to be determined. The loss of predicted suitable turtle wetland habitat when comparing the PA (post mine development) to the LAA (prior to development) represents approximately 1% of the total available suitable habitat in the LAA using the approach discussed.

The potential for impact to songbird wetland habitat is expected as a result of the Beaver Dam Mine Project. Three bird species were modelled as part of the cumulative effects assessment: Canada warbler, olive-sided flycatcher, and rusty blackbird. These species were all observed within the PA during field surveys and recorded as being present within 5km of the Project in the ACCDC report. The lack of publicly available habitat data for Canada warbler (i.e. dense, deciduous shrub), modeling was not available within the LAA. Canada warbler habitat was however determined for the PA based on data collected during field programs in combination with desktop resources. The other two birds did have available wetland habitat data layers and were modelled at the LAA spatial extent. Research has shown that some species respond positively to forestry practices and may return to a logged area once the activity is over, especially if it has created open patches that allow for foraging. A study in Alberta showed that the abundance of alder flycatchers, a species with similar foraging requirements to olive-sided flycatcher, increased in a previously cut area (Tittler et al., 2001). Additionally, rusty blackbirds can also tolerate forestry activities as long has their habitat of coniferous dominant trees of varied heights near waterbodies is maintained (pers. comm. C. Staicer 2018). While forestry is different from the development of a Mine Site, similar activities will be occurring (i.e. forest clearing, transport of large trucks, and disturbance of aquatic features). It is therefore feasible to consider that new habitats suitable to support these birds will be created in the future. The modelling exercise determined that potential habitat loss for the Canada warbler, olive-sided flycatcher and rusty blackbird within the PA between Year 0 (pre-mine development) and Year 5 (post mine development) was 13%, 10% and 24% respectively. The modelling also determined that the predicted suitable wetland habitat loss within the PA post mine development, in comparison to the predicted habitat within the LAA (pre-mine development) for the olive-sided flycatcher and the rusty blackbird is 2% and 5% respectively.

Development of the Beaver Dam Mine Site will have cumulative effects on wetland loss and wetland functions. For the purpose of the modelling exercise, wetland function loss is represented by four wetland function metrics: wetland area and habitat provision for moose, turtles, and birds which will be impacted during the construction activities and mine operations.

The modelling exercise has shown that wetland alteration within the PA is expected to result in a loss of wetland function metrics ranging between 10-26% (when comparing pre and post mine development within the PA). However, when compared to the LAA, these changes represent smaller percentages of predicted wetland area ranging between 1-5% when comparing wetland loss in the PA (post mine development) to the LAA (pre-mine development).

This in conjunction with the mitigation and monitoring steps (as described in Section 6.8.7), result in the determination that adverse effects are occurring as a result of wetland loss, but are not considered significant as it relates to wetlands and their functions within the PA.

6.8.6.5 Wetland Avoidance

Due to the location in which the proposed activity can be performed (the location of the gold ore is fixed by geology), the extent to which the proposed Project can be manoeuvred to avoid impact to wetland habitat is limited. The waste rock storage pile location has been relocated west to avoid the large headwater wetlands 1 and 2. Stockpile locations have been placed to reduce wetland impact and may still be able to be micro-sighted to limit or reduce wetland alteration. Infrastructure has been placed to limit potential direct and indirect impact to Crusher Lake, Mud Lake, and its associated watercourse 5 that drains from Crusher Lake to Mud Lake.

The preliminary Haul Road design has been based on following the existing footprint of the Beaver Dam Mines Road and the Moose River Cross Road to reduce overall wetland impact and habitat fragmentation. Where new road construction is required to improve sight lines and/or turning radii, landscape conditions (e.g., topography) are the driving factor in the new Haul Road ~~footprint~~. However, wetland avoidance is a key consideration during planning and engineering of new sections of road, where possible. One section of new road is planned (Figure 2.2-2). Wetland avoidance, landscape conditions, locations of watercourses, sight lines, and safety, will be key planning factors during the detailed engineering for this road.

It has been determined that one wetland (Wetland 29) exists as WSS as a result of the presence of the boreal felt lichen. The predictive NSE WSS database indicates that Wetland 64 also exists as a possible WSS due to it comprising possible nesting or breeding for the olive-sided flycatcher. To determine whether a mobile species such as the olive-sided flycatcher triggers the designation of a WSS, and to discern associated permitting requirements, additional regulatory consultation is required. Both WSS polygons fall within the PA. The boreal felt lichen observed during field surveys is located in an extent of Wetland 29 that exists beyond the southern ~~PA~~ Beaver Dam Mine Site boundary, and as such is not expected to be impacted as a result of Project activities. The micro siting and division of the waste rock stockpile has further increased the distance of Project infrastructure to Wetland 29. The waste rock stockpile east is situated beyond the phorophyte critical function zone (500 m) and the wetland critical function zone (50 m). No evidence of nesting/breeding olive-sided flycatcher was observed within Wetland 64 during breeding bird surveys completed within the wetland by MEL. In addition, four additional SAR birds were identified within or adjacent to fifteen (15) other wetlands within the PA (30 m). Suitable breeding habitat is present for two of the species (olive-sided flycatcher and Canada warbler) within twelve (12) of the 15 wetlands. Regulatory consultation should be completed to determine whether Wetland 64 and any of the additional 12 wetlands are classified as a WSS, however, it is not anticipated that these wetlands will be classified as WSS because the SAR birds are mobile species and similar suitable habitat is present within close proximity. A water line is the only Project infrastructure expected to alter conditions within Wetland 64, encompassing a total of 65 m^2. The discharge from this waterline (via the eastern collection pond) is directed to Wetland 64. The impacts of this discharge are discussed in Section 6.8.6.3.2 but are not anticipated to adversely effect the wetland.

The wetlands within the PA do not contain other critical wetland functions that warrant avoidance (e.g., significant fish habitat, presence of critical wildlife habitat, groundwater recharge ability, etc.).

Efforts will be made during the final design process to avoid as much wetland habitat as possible. Infrastructure that may offer more flexibility in this regard includes the detailed design of the Haul Road upgrade alignment, Mine Site access roads, water diversion channels, settling ponds, and stockpile areas. Details associated with micro-sighting and final wetland alteration requirements will be confirmed at the wetland alteration permitting stage of this Project.

6.8.7 Preferred Alternative Haul Road

6.8.7.1 Rationale for Valued Component Selection

Same rationale for valued component selection as indicated in Section 6.8.1.

6.8.7.2 Baseline Program Methodology

Trained wetland delineators completed field surveys for wetlands in September 2018 following the methodology outlined in Section 6.8.2.

6.8.7.3 Baseline Conditions

Twenty wetlands were identified within the Preferred Alternative Haul Road PA. The wetland types, approximate sizes within the Preferred Alternative Haul Road PA, and tertiary watershed locations are described in Table 6.8-20, and indicated on Figure 6.7-3 and Figures 6.7-3A to 6.7-3L.

Table 6.8-20 Preferred Alternative Haul Road Wetland Types and Approximate Sizes.

Wetland	Wetland Type	Wetland Area* (m2)	Tertiary Watershed
180*	softwood treed swamp	4,526	Rocky Lake /First Rocky Lake
181*	softwood treed swamp	410	Rocky Lake /First Rocky Lake
182*	softwood treed swamp	6,455	Rocky Lake
183	softwood treed swamp	287	Rocky Lake
184	softwood treed swamp	467	Rocky Lake
185*	cut-over swamp	2,378	Rocky Lake
186*	graminoid fen	13,140	Duck Lake/ Rocky Lake
187*	swamp/fen complex	5,277	Duck Lake
188*	mixed wood swamp	1,001	Duck Lake

Wetland	Wetland Type	Wetland Area* (m2)	Tertiary Watershed
189*	cut-over swamp	3,550	Duck Lake
190*	softwood treed swamp	1,520	Duck Lake
191	cut-over swamp	369	Duck Lake
192*	mixed wood swamp	1,126	Duck Lake
193*	softwood treed swamp	1,258	Duck Lake
194*	softwood treed swamp	10,450	Otter Lake
195*	cut-over swamp	1,389	Otter Lake
196	cut-over swamp	1,733	Otter Lake
197*	softwood treed swamp	1,690	Otter Lake
198*	softwood swamp/bog complex	17,071	Eagle's Nest Basin
199*	mixed wood treed fen	16,211	Eagle's Nest Basin
Total Wetland Area within the Preferred Alternative Haul Road PA		**90,308**	

Wetland area is calculated based on field delineation within the Preferred Alternative Haul Road PA.
*Wetland # marked with an * extend beyond the Preferred Alternative Haul Road PA boundaries, and total size has not been calculated.*

In general, hydrological flow within wetlands present in the Preferred Alternative Haul Road PA flows southeast. The Preferred Alternative Haul Road PA spans across five tertiary watersheds that include the First Rocky Lake, Rocky Lake, Duck Lake, Otter Lake, and Eagle's Nest Basin Lake.

Two wetlands straddle watershed boundaries, wetlands 180 and 181, both of which are softwood treed swamps. Wetland 186, while within the Duck Lake tertiary watershed within the Preferred Alternative Haul Road PA, once outside this PA it also straddles the Rocky Lake tertiary watershed. Additionally, there are two wetland complexes: Wetland 187 is a swamp/fen complex and WL198 is a softwood swamp/bog complex. Water flowing through Wetland 187, moves into Miller Lake, which is south of the Preferred Alternative Haul Road. Wetland 198 intercepts and stores precipitation and small-scale water seepage from surrounding land prior to draining into the lakes surrounding it. There are two fens within the Preferred Alternative Haul Road PA: Wetlands 186 and 199. Wetland 186 continues out of the Preferred Alternative Haul Road PA boundary where it is adjacent to Rocky Lake. Wetland 199 continues out of the Preferred Alternative Haul Road PA boundary where it is adjacent to Big Pond.

As water drains southward through the Preferred Alternative Haul Road PA, it does so via predominantly swamp habitat, often associated with watercourses or small-scale surface channelization (i.e. throughflow in nature). Swamps lacking surface water flow are isolated, and thus more likely to provide groundwater recharge capacities rather than acting as a source of surface water discharge. The receiving environments from wetlands with surface water connections include an unnamed lake south of Prest Lake in Rocky Lake tertiary watershed, Miller Lake and an unnamed lake in Duck Lake tertiary watershed, Sandy Pond in Otter Lake tertiary watershed, and Big Pond in Eagle's Nest Basin Lake tertiary watershed.

6.8.7.3.1 **Functional Assessment Results**

The NovaWET functional evaluation technique consists of 11 major sections associated with key wetland functions as described previously.

Each section contains questions specific to a function that supports the assessor in determining to what degree the wetland provides significant functions (SF). NovaWET continues to identify critical (SF red flag functions) wetland functions that are often unique or rare or associated with higher risk to the watershed if lost. The Wetland Functional Assessment Summary Table included in Appendix H.1 provides the results of the SF determination for all wetlands within Preferred Alternative Haul Road PA.

Additional details for each wetland, including functional summary sheets, plant lists, photographs, and data sheets were recorded by MEL staff during field evaluations, but have not been included in this document due to the volume of data. This data is available upon request.

The following sections provide results of the NovaWET functional assessment.

6.8.7.3.1.1 Watershed Characteristics

The functional assessments conducted for the 20 wetlands located within the Preferred Alternative Haul Road PA determined that the overall watershed condition of the five relevant tertiary watersheds is in a relatively unaltered state (Table 6.5-2). Urban/commercial development is not present within the watersheds and, therefore, existing roads account for the impervious surfaces calculated within the watershed evaluation, of which there are none. Therefore, condition is classified as low. Wetland habitat cover ranges from 7.50% to 16.84% of the total land area of the watersheds

Table 6.8-21 Detailed Watershed Evaluation Results

Tertiary Watershed	Watershed #	Location in Project Area	Describe Watershed Condition (% impervious surface)	% wetland cover	Total WS Area (ha)	Total WL Area (ha)	Road Surface length (m)	Road area ha (@6.5 m wide)
Otter Lake	1EL-2-E	Preferred Alternative Haul Road	0.00	13.6	1,382	187.55	0	0
Duck Lake	1EL-2-F	Preferred Alternative Haul Road	0.00	7.5	1,145	86.25	0	0
Eagle's Nest Basin	1EL-2-C	Preferred Alternative Haul Road	0.00	10.6	5,118	540.81	3317	2.16
Rocky Lake	1EL-2-H	Preferred Alternative Haul Road	0.00	16.8	3,111	523.95	0	0
First Rocky Lake	1EL-5-H	Preferred Alternative Haul Road	0.03	8.2	263	21.42	1,757	1.14

6.8.7.3.1.2 Wetland Characteristics

The majority (80%) of wetlands identified within the Preferred Alternative Haul Road PA were classified primarily as swamps. Two fens (graminoid and mixed wood treed fen) exist within the Preferred Alternative Haul Road PA as well as two complexes. The complexes are comprised of a combination of swamp-bog and swamp-fen wetland types. Many of these delineated wetlands extend beyond the Preferred Alternative Haul Road PA boundaries. Table 6.8-20 outlines the wetland types identified throughout the Preferred Alternative Haul Road PA.

Table 6.8-22 Wetland Types within the PA

Project Area (PA)	Preferred Alternative Haul Road
Wetland Complex	
Number of Wetlands	2
% of total wetlands identified within the PA	10%
Treed or Shrub Swamps	
# of Wetlands	16
% of total wetlands identified within each representative PA	80%
Fen	
# of Wetlands	2
% of total wetlands identified within each representative PA	10%

The average size of the wetlands within the Preferred Alternative Haul Road PA is just under 0.5 ha. All identified wetlands, except those that fall on the watershed boundary, are located within lower portions of their respective tertiary watersheds and most likely act as throughflow features for surface water.

Detailed biophysical wetland information for each delineated wetland including wetland type, dominant vegetation, soil and hydrological conditions is provided in a Wetland Characterization Table in Appendix H.2.

Table 6.8-23 Wetland Functional Information

Wetland ID	Wetland Type	Wetland Size (m2)	Landscape Position	Landform	Water Flow Path	Water Regime	Watercourse Association	Standing Water and % cover in wetland	Adjacent Upland Land Use	Stressors	Wetland Hydrology Altered?
Preferred Alternative Haul Road											
180	Softwood treed swamp	4,526	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested/Road	Forestry	No
181	Softwood treed swamp	410	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested/Road	Forestry	No
182	Softwood treed swamp	6,455	Terrene	Basin	Outflow	Permanently Saturated	Stream	0%	Forested	None	No
183	Softwood treed swamp	287	Terrene	Basin	Isolated	Permanently Saturated	No	0%	Forested	None	No
184	Softwood treed swamp	467	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	No
185	Cut-over swamp	2,378	Terrene	Basin	Outflow (via drainage)	Permanently saturated	No	0%	Logged/ Forested	Forestry	Cut block
186	Graminoid fen	13,140	Lentic	Basin	Outflow	Permanently saturated	Lake	0%	Forested	None	No
187	Swamp/fen complex	5,277	Lentic	Basin	Inflow	Permanently saturated	Lake	0%	Logged/ Forested	Forestry	Cut block
188	Mixed wood swamp	1,001	Terrene	Basin	Outflow (via drainage)	Permanently saturated	No	0%	Logged/ Forested	Forestry	Cut block
189	Cut-over swamp	3,550	Terrene	Basin	Isolated	Permanently saturated	No	0%	Logged/ Forested	Forestry	Cut block
190	Softwood treed swamp	1,520	Lotic/ Stream Entrenched	Basin	Throughflow	Permanently saturated	Stream	0%	Logged/ Forested	Forestry	Cut block
191	Cut-over swamp	369	Terrene	Basin	Isolated	Seasonally saturated	No	0%	Logged/ Forested	Forestry	Cut block

Wetland ID	Wetland Type	Wetland Size (m2)	Landscape Position	Landform	Water Flow Path	Water Regime	Watercourse Association	Standing Water and % cover in wetland	Adjacent Upland Land Use	Stressors	Wetland Hydrology Altered?
192	Mixed wood swamp	1,126	Lotic/ Stream Entrenched	Basin	Outflow (via drainage)	Permanently saturated	Abutted to stream	0%	Forested	None	No
193	Softwood treed swamp	1,258	Lotic/ Stream Entrenched	Basin	Throughflow	Permanently saturated	Stream	0%	Forested/	None	No
194	Softwood treed swamp	10,450	Terrene	Basin	Outflow (via drainage)	Permanently saturated	No	0%	Forested	None	No
195	Cut-over swamp	1,389	Terrene	Basin	Isolated	Permanently saturated	No	0%	Logged/ Forested	Forestry	Cut block
196	Cut-over swamp	1,733	Terrene	Basin	Isolated	Permanently Saturated	No	0%	Logged/ Forested	Forestry	Cut block
197	Softwood treed swamp	1,690	Terrene	Basin	Isolated	Permanently saturated	No	0%	Logged/ Forested	Forestry	No
198	Softwood swamp/ bog complex	17,071	Terrene	Basin	Outflow (via drainage)	Permanently saturated	No	0%	Forested	None	No
199	Mixed wood treed fen	16,211	Lotic/ Stream Floodplain	Basin	Throughflow	Permanently saturated	Stream	0%	Forested/ Road	None	No

6.8.7.3.1.3 Identification of Exceptional Features

Wetland functional evaluation was completed at each wetland within the Preferred Alternative Haul Road PA. As part of this functional assessment, along with a review of the NSE GIS predictive Wetland of Special Significance (WSS) layer, each wetland was reviewed to determine if it meets the threshold for a WSS. Wetlands of Special Significance.

Figure 6.8-1 indicates the proximity of the wetlands identified within the Preferred Alternative Haul Road PA to: Ramsar Sites; Provincial Wildlife Management Areas (Crown and Provincial lands only); Provincial Parks; Nature Reserves; Wilderness Areas; Lands owned or legally protected by non-governmental charitable conservation land trusts; intact or restored wetlands under the North American Waterfowl Management Plan; and protected water areas. No wetlands within the Preferred Alternative Haul Road PA are present within any of these special habitats, shown on the above-noted figures.

A review of the NSE predictive WSS layer identified no WSS within portions of the Preferred Alternative Haul Road PA.

Two lichen SAR were identified within or in close proximity to wetlands in the Preferred Alternative Haul Road PA. Three individual frosted glass-whiskers lichen (COSEWIC SC, SARA SC, S1?) were observed within Wetland 199. Blue felt lichen (COSEWIC SC, SARA, SC, NSESA V, S3) was observed approximately 50 m east of Wetland 182 and within Wetland 186.

Avifauna SAR were observed at point count locations during breeding bird surveys that were in the vicinity of wetlands. An olive-sided flycatcher (SARA T, S2B) was observed approximately 740 m north of Wetland 198 and another individual was observed approximately 15 m south of Wetland 193. An eastern wood-pewee (NSESA V, S3S4B) was observed approximately 620 m northeast of Wetland 197. The olive-sided flycatcher has a preference for wetland habitat whereas the eastern wood-pewee typically prefers deciduous forest and forest edges and does not have an affinity to wetland habitat.

6.8.7.3.1.4 Hydrologic Condition and Integrity

No wetlands within the Preferred Alternative Haul Road PA have been determined important for maintaining stream flows. However, 15 wetlands within the Preferred Alternative Haul Road PA provide a high ability to detain surface water, hence reducing peak flows in downstream receptors.

6.8.7.3.1.5 Water Quality

The NovaWET evaluation determined that all wetlands within the Preferred Alternative Haul Road PA provide high functional significance for improving water quality.

6.8.7.3.1.6 Groundwater Interactions

Half of the wetlands within the Preferred Alternative Haul Road PA act as throughflow or outflow features, therefore they provide groundwater discharge features. The other half of the wetlands are either inflows or isolated, however, their relative size and limited water source (e.g. precipitation and small-scale surface water runoff) reduces their ability to affect groundwater recharge at a landscape level. The only wetland to provide recharge functions was WL180.

6.8.7.3.1.7 Fish and Wildlife Habitat and Integrity

Results of the NovaWET evaluations determine that two wetlands within the Preferred Alternative Haul Road PA (wetlands 187 and 199) provide high functional significance for wildlife and fish habitat. No wildlife species were identified in wetlands within the Preferred Alternative Haul Road PA during field evaluations, however, suitable habitat for snapping turtle was observed in Wetland 193.

Wetlands 187 and 199 were found to provide life cycle supporting habitat for fish species or other habitat support to fish (e.g. riparian vegetation, water quality, buffer functions) as a result of their association with watercourses. However, all of the watercourses observed were found to be entrenched, therefore fish habitat or supporting habitat was not found within wetland boundaries. The following wetlands are adjacent to or have entrenched watercourses running through them: Wetlands 182, 186, 187, 190, 193, and 199.

Although not observed, there is potential for mainland moose to utilize the wetlands within the Preferred Alternative Haul Road PA.

Two priority bird species were identified in close proximity to wetlands during point count bird surveys completed throughout the Preferred Alternative Haul Road PA. Focused bird surveys (point counts) were completed in many habitat types and locations throughout the Preferred Alternative Haul Road PA that do not constitute wetland habitat. A full list of priority bird species observed within the Preferred Alternative Haul Road PA is provided in Section 6.12.3. The list was narrowed down to priority bird species that were identified at point locations within, and directly adjacent to, wetland habitat, and that use wetlands as part of their preferred breeding habitat. These species are listed in Table 6.8-24, together with the preferred wetland habitat. This preferred breeding habitat was not observed at wetlands within the Preferred Alternative Haul Road PA.

Table 6.8-24 Observed Bird Priority Species and Wetland Habitat Association

Bird Species	Preferred Wetland Habitat
Eastern wood-pewee	Wooded habitat, in riverside habitat
Olive-sided flycatcher	Conifer forests near meadows and ponds

The NovaWET evaluation determined that at least one SAR bird was identified at point count locations in the vicinity of three wetlands in the Preferred Alternative Haul Road PA. At least one SOCI bird was identified at point count locations in the vicinity of 9 wetlands. It should be noted, however, that these observations are based on detection points (i.e. point count locations) and do not specify whether the bird identified is using, or how it might be using, the wetland habitat as its preferred habitat.

6.8.7.3.1.8 Shoreline Stabilization and Integrity

As a result of the NovaWET evaluations, no wetlands within the Preferred Alternative Haul Road PA provide high functional significance in this regard.

6.8.7.3.1.9 Plant Community

None of the wetlands comprise plant communities that are rare regionally or provincially. As discussed in information provided earlier in this section, wetlands present within the Preferred Alternative Haul Road PA include treed swamps, bogs, fens, and wetland complexes comprising variations of each wetland type. Wetland vegetation composition within all wetland habitats is typical to those existing in similar habitat throughout the province. Treed swamps are predominantly coniferous or mixed wood. The bog habitat within the Preferred Alternative Haul Road PA is part of a softwood swamp/bog complex. Areas of fen habitat vary between mixed wood treed fens and dominated by graminoid species.

Table 6.8-25 provides the dominant species per wetland habitat type that wetlands within the Preferred Alternative Haul Road PA support. Dominant vegetation on a per wetland basis is provided in the Wetland Characterization Table (Appendix H.2).

Table 6.8-25 Dominant Vegetation Supported by Wetland Habitat within the Project Area

Wetland Habitat Type	Dominant Species Supported
Treed Swamps	Balsam fir, black and red spruce, red maple, yellow birch, mountain holly, cinnamon fern, three-seeded sedge, Canada bunchberry, bristly dewberry.
Bog Complex	Tamarack, black spruce, balsam fir, common winterberry, sheep laurel, cinnamon fern, hare's tail cottongrass, three-seeded sedge.
Graminoid and Treed Fen	Red maple, black spruce, tamarack, wild raisin, mountain holly, three-seeded sedge, cinnamon fern, royal fern, Canada reed grass, tussock sedge, leatherleaf.

The evaluation concluded that approximately half (9) of the Preferred Alternative Haul Road PA wetlands were rated as comprising a highly significant diversity of species.

No wetlands have priority non-vascular plant species within the Preferred Alternative Haul Road PA. Two wetlands contained SAR lichen species; Wetland 186 contained blue felt lichen (COSEWIC SC, SARA SC, NSESA V, S3) and Wetland 199 contained frosted glass-whiskers lichen (COSEWIC SC, SARA SC, S1?).

The overall integrity and quality of plants has been determined to be high in over half of the wetlands identified in the Preferred Alternative Haul Road PA (12) likely as a result of minimal disturbance in land use surrounding the wetlands and/or few direct activities, such as tree harvesting and existing roads, within the wetlands existing in the Preferred Alternative Haul Road PA.

6.8.7.3.1.10 Community Use/Value

The large majority of wetlands identified in the Preferred Alternative Haul Road PA have been determined to provide a low functional significance for community use and value, largely as a result of inaccessibility to humans. No wetlands have been determined to provide a high significance for this function.

6.8.7.4 Considerations of Consultation and Engagement Results

The Preferred Alternative Haul Road is the result of consultation and engagement on the Primary Haul Road. Refer to Section 6.8.4 for key issues raised during public consultation and Mi'kmaq engagement relating to wetlands.

6.8.7.5 Effects Assessment Methodology

6.8.7.5.1 Boundaries

6.8.7.5.1.1 Spatial Boundaries

The spatial boundaries used for the assessment of effects to wetlands along the Preferred Alternative Haul Road are the PA, LAA, and RAA. The Preferred Alternative Haul Road PA (Figure 5.4-1) encompasses 50 m on either side of a 5.7 km long center line. The eastern and western extent of the Preferred Alternative Haul Road PA connects to the Haul Road at a pre-existing forestry road and to Mooseland Road, respectively. The Preferred Alternative Haul Road PA runs north of Sandy Pond and Miller Lake.

The LAA (Figure 6.8-2) consists of portions of downstream aquatic habitats and headwaters where appropriate, depending on project activities, up to the maximum size of the tertiary watershed(s). The LAA boundaries were defined considering the maximum expected extent of direct and indirect impacts to the aquatic environment.

The RAA (Figure 6.8-3) encompasses the two secondary watersheds that the PA is located within. These watersheds are the Tangier River secondary watershed, and the Fish River secondary watershed. The RAA is broader than the expected Project impacts and considers other Project boundaries as per the cumulative effects methodology.

As the Project has the potential to cause direct and indirect effects to wetlands outside of the Preferred Alternative Haul Road PA, the LAA is the appropriate boundary for evaluation of this VC.

6.8.7.5.1.2 Temporal Boundaries

The temporal boundaries used for the assessment of effects to flora are the construction phase, operational phase, and decommissioning and reclamation phase.

6.8.7.5.1.3 Technical Boundaries

No technical boundaries were identified for the effects assessment of habitat and flora.

6.8.7.5.1.4 Administrative Boundaries

Administrative boundaries for the protection and conservation of wetland habitat in Nova Scotia include the Nova Scotia Wetland Conservation Policy (2011b), the Environmental Goals and Sustainable Prosperity Act (EGSPA 2007) and the Environment Act (1994) and its' Activities Designation Regulations (1995).

Further wetland protection is provided on a federal level by the Federal Policy of Wetland Conservation (1991).

6.8.7.5.2 **Thresholds for Determination of Significance**

The thresholds for determination of significance regarding wetlands within the Preferred Alternative Haul Road are identical to the thresholds for determination of significance for this VC throughout the entire PA, as presented within Section 6.8.5.3.

6.8.7.6 Project Activities and Wetland Interactions and Effects

Potential interactions between Project activities and wetland habitat within the Preferred Alternative Haul Road PA is outlined in Table 6.8-26.

Table 6.8-26 Potential Wetland Interactions with Project Activities along the Preferred Alternative Haul Road

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Rock blasting in preparation of construction • Watercourse and wetland alteration in preparation of construction ○ Haul Road construction and upgrades
Operation and Maintenance	3-4 years	• Haul Road maintenance and repairs
Decommissioning and Reclamation	-	N/A[1]

1 Decommissioning and Reclamation of the Haul Road is not expected. The Haul Road will be returned to owner for forestry industry

Development of the Preferred Alternative Haul Road will cause direct and indirect impacts to wetlands mostly during the construction phase of the Project. Direct impacts will be associated with clearing, grubbing and infilling associated with road construction. Indirect impacts are a by-product of direct impacts associated with the construction activities, as well as potential indirect impacts to wetlands from construction activities (potential blasting and accidents). Table 6.8-15 provides general impact types and a description of various direct and indirect examples by which these may occur as a result of Project activities.

6.8.7.6.1 **Direct Impacts**

The Preferred Alternative Haul Road is yet to be microsited, however, the following table (Table 6.8-27) presents expected impacts to wetlands following the current Preferred Alternative Haul Road center line (P - Partial habitat loss of wetland; C – Complete habitat loss of wetland).

Table 6.8-27 Expected Direct Wetland Impacts within the Preferred Alternative Haul Road

Wetland #	Wetland Size (m^2) inside Preferred Alternative Haul Road PA	Estimated Direct Impact Area (m^2)	Infrastructure	Direct Impact Type
180*	4,526	2,108	Preferred Alternative Haul Road	P
182*	6,455	1,338	Preferred Alternative Haul Road	P
184	467	149	Preferred Alternative Haul Road	P
185*	2,378	785	Preferred Alternative Haul Road	P
186*	13,140	3,257	Preferred Alternative Haul Road	P
187*	5,277	431	Preferred Alternative Haul Road	P
188*	1,001	49	Preferred Alternative Haul Road	P
189*	3,550	847	Preferred Alternative Haul Road	P

Wetland #	Wetland Size (m^2) inside Preferred Alternative Haul Road PA	Estimated Direct Impact Area (m^2)	Infrastructure	Direct Impact Type
190*	1,520	451	Preferred Alternative Haul Road	P
191	369	265	Preferred Alternative Haul Road	P
192*	1,126	115	Preferred Alternative Haul Road	P
193*	1,258	171	Preferred Alternative Haul Road	P
194*	10,450	1,674	Preferred Alternative Haul Road	P
196	1,733	787	Preferred Alternative Haul Road	P
197*	1,690	305	Preferred Alternative Haul Road	P
198*	17,071	4,366	Preferred Alternative Haul Road	P
199*	16,211	1,871	Preferred Alternative Haul Road	P
Total	**82,222**	**18,969**		

As outlined in the above table, seventeen wetlands will be partially altered, none will be completely altered, and three will be avoided following the centerline (27 m wide) of the Preferred Alternative Haul Road. A total wetland impact area of 18,969 m^2 is expected based on a worst-case scenario. Micro siting and detailed design of the route has not yet been completed.

6.8.7.6.2 **Indirect Impacts**

The effect of indirect impacts to wetlands on the Beaver Dam Mine Site and Haul Road is discussed in Section 6.8.6. The indirect impacts discussed within that section effect wetlands within the Preferred Alternative Haul Road similarly.

6.8.7.6.3 **Impacts to Groundwater Recharge**

Based on the results of NovaWET, one wetland within the Preferred Alternative Haul Road is a recharge wetland (Wetland 180), 16 are discharge wetlands (Wetlands 181, 182, 185, 186, 187, 188, 189, 190, 192, 193, 194, 195, 196, 197, 198, and 199), and the remaining three wetlands (Wetlands 183, 184, and 191) could not be determined based on the NovaWET questions. Overall, discharge wetlands dominate the Preferred Alternative Haul Road PA, therefore, impact to these wetlands is not likely to affect critical groundwater recharge functions at these locations. Discharge of water to lower lying aquatic receptors, however, is a more likely impact.

Hydrological flow within the wetlands will be maintained beneath the Preferred Alternative Haul Road via installation of culverts (or other accepted methods). As such, the ability for the wetland to maintain existing groundwater recharge functions (should it currently do so) will not be affected by the proposed activities.

6.8.8 Mitigation ~~and Monitoring~~

In order to mitigate and reduce overall loss of function of wetland habitat, the actions provided in Table 6.8-28 will be implemented within wetlands where direct impacts and potential indirect impacts to wetland habitat are expected. Mitigation methods are provided for the pre-construction and construction/operation[1] phases of the Project to support ~~mine~~ Beaver Dam Mine Site and Haul Road development.

In addition, the proponent is committed to engaging in wetland compensation activities for the wetland loss associated with the Project as required by the provincial wetland alteration process. A preliminary Wetland Compensation Plan ~~will be~~ has been developed ~~and submitted to NSE with the goal of providing a final plan prior to receiving wetland alteration approval~~ and can be found in Appendix H.3. This plan ~~will~~ includes the following options for compensation, prepared in consultation with CWS and NSE:

- On-the-ground restoration opportunities to meet a ~~minimum of 1:1~~ 2:1 ratio and to be completed in a watershed near the Project area to the extent possible;
- Other secondary forms of compensation that CWS and NSE consider valuable to support the wetland conservation program in Nova Scotia; and
- Collaboration with local community groups and the Mi'kmaq of Nova Scotia to the extent possible.

[1] *Due to similarities between the construction and operation phases, mitigation methods outlined in Table 6.5-12 have been done so in combination with each other.*

Table 6.8-28 Mitigation for Wetlands

VC	Mitigation Category	Project Phase	Mitigation Measure
Wetlands	**N/A**	PC, CON, OP, DEC	Complete pre-construction site meetings for all relevant staff/contractors related to working around wetlands and watercourses to minimize unauthorized disturbance
		PC	Ensure all wetlands are visually delineated (e.g. - flagged)
		PC	Complete detailed design of Haul Road and micro siting of Beaver Dam Mine Site infrastructure to avoid or minimize wetland impact
		CON	Acquire and adhere to wetland alteration permits
		CON	Implement construction methods that reduce the potential to drain or flood surrounding wetlands
		CON	Complete work within Wetland 64 (Potential WSS) outside of the breeding season for Olive-sided Flycatcher
		CON, OP	Direct runoff through natural vegetation, wherever practicable
		CON, OP	Minimize erosion of wetland soils by limiting flow velocities by means of hydraulic dissipation techniques
		CON, OP	Minimize the rutting of wetland habitat by limiting the use of machinery within wetland habitat and use of swamp mats/corduroy bridges as required
		CON, OP	Conduct vegetation management (cutting and clearing) in or near wetlands and watercourses in accordance with applicable guidelines
		CON, OP, DEC	Implement Erosion and Sediment Control Plan
		CON, OP, DEC	Maintain pre-construction hydrological flows through wetland habitats and partially altered wetlands, wherever practicable
		CON, OP, DEC	Re-vegetate slopes adjacent to wetlands to limit erosion and sediment release
		DEC	Compensate for permanent loss of wetland function through implementation of the site specific wetland compensation plan, subject to NSE approval

6.8.9 Residual Effects and Significance

The predicted residual environmental effects of Project development and production on wetlands are assessed to be adverse, but not significant. The overall residual effect of the Project on wetlands is assessed as not significant after mitigation measures have been implemented and short time frame for the Project considered.

Table 6.8-29 Residual Environmental Effects for Wetlands

Project VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Significance Criteria for Residual Environmental Effects						Residual Effect	Significance
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Beaver Dam Mine Site and Haul Road (clearing and grubbing, direct wetland alteration, and widening and new Haul Road construction)	Sediment and erosion control, best management practices, spill preparedness, and engagement in the wetland permitting process.	A	H VC interaction causes direct loss of wetland habitat	PA Potential adverse effect to wetlands inside the PA	A Seasonal aspects may affect VC	P VC unlikely to recover to baseline conditions	O Effects occur once during the construction phase	IR VC will not recover to baseline conditions	Habitat loss and disturbance	Not significant
Operational – Beaver Dam Mine Site (groundwater drawdown and surface water quantity)	Sediment and erosion control, best management practices, and spill preparedness.	A	M Moderate change from baseline conditions	LAA Potential adverse effect to wetlands outside of the PA	A Seasonal aspects may affect VC	LT Effects may extend beyond 3 years	R Effects occur at regular intervals throughout the project	PR Mitigation cannot guarantee a return to baseline conditions	Disturbance	Not significant
Operational – Haul Road (surface water quantity)	Sediment and erosion control, best management practices, and spill preparedness.	A	L Small change from baseline conditions	LAA Potential adverse effect to wetlands outside of the PA	A Seasonal aspects may affect VC	LT Effects may extend beyond 3 years	S Effects occur at irregular intervals throughout the Project	R VC will recover to baseline condition	Disturbance	Not significant
Post Closure – Touquoy Mine Site (altered hydrology in Moose River and associated riparian wetlands)	Discharge to mimic seasonal flows wherever practicable	A	N Negligible increase in water quantity	LAA VC interaction may extend beyond PA	A Seasonal aspects may affect VC	P Permanent discharge	R Effects are expected to occur over a regular interval	R VC will recover to baseline conditions	Disturbance	Not significant
Reclamation – Beaver Dam Mine Site (wetland restoration)	Sediment and erosion control, best management practices, and spill preparedness.	P	M VC interaction restores wetland habitat	PA Potential adverse effect confined to the PA	A Seasonal aspects may affect VC	ST Effects are limited to occur from as little as 1 day to 12 months	O Effects occur once during the reclamation phase	R VC will recover to baseline condition	N/A	Not Significant

Project VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Significance Criteria for Residual Environmental Effects						Residual Effect	Significance
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		

Legend (refer to Table 5.10-1 for definitions)

Nature of Effect		Geographic Extent		Duration		Frequency	
A	Adverse	PA	Project Area	ST	Short-Term	O	Once
P	Positive	LAA	Local Assessment Area	MT	Medium-Term	S	Sporadic
		RAA	Regional Assessment Area	LT	Long-Term	R	Regular
Magnitude				P	Permanent	C	Continuous
N	Negligible	**Timing**					
L	Low	N/A	Not Applicable			**Reversibility**	
M	Moderate	A	Applicable			R	Reversible
H	High					IR	Irreversible
						PR	Partially Reversible

A significant adverse environmental effect for wetlands has not been predicted for the Project for the following reasons, with consideration of the ecological and social context of the LAA surrounding the Project:

- During construction, direct impacts to wetlands will occur. However, these losses, when considered inside the LAA, are 4 % the total available wetland habitat. The majority of wetlands proposed for alteration are common type (swamp habitat), and no loss of wetlands of special significance are proposed.
  - Within the LAA there is a predicted cumulative loss of wetland habitat for SAR:
    - Mainland moose – 3%
    - Snapping turtle and wood turtle – 1%
    - Rusty blackbird – 5%
    - Olive-sided flycatcher – 2%
- During operations, limited impact to wetlands is predicted based on control of surface water flows to mimic baseline hydrologic conditions and implementation of sediment and erosion control measures.
- During Closure, limited impact to wetlands is predicted based on control of surface water flows to mimic baseline hydrologic conditions and implementation of sediment and erosion control measures. In addition, there is an opportunity to potentially restore wetland habitat within the PA.

6.8.9.1 Residual Effects and Significance of the Preferred Alternative Haul Road

Table 6.8-30 Residual Environmental Effects for Wetlands within the Preferred Alternative Haul Road

Project VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Significance Criteria for Residual Environmental Effects						Residual Effect	Significance
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Preferred Alternative Haul Road (clearing and grubbing, direct wetland alteration, and widening and new Preferred Alternative Haul Road construction)	Sediment and erosion control, best management practices, spill preparedness, and engagement in the wetland permitting process.	A	M VC interaction causes direct loss of wetland habitat	PA Potential adverse effect to wetlands inside the PA	A Seasonal aspects may affect VC	P VC unlikely to recover to baseline conditions	O Effects occur once during the construction phase	IR VC will not recover to baseline conditions	Habitat loss and disturbance	Not significant

Legend (refer to Table 5.10-1 for definitions)

Nature of Effect	Geographic Extent	Duration	Frequency
A Adverse	PA Project Area	ST Short-Term	O Once
P Positive	LAA Local Assessment Area	MT Medium-Term	S Sporadic
	RAA Regional Assessment Area	LT Long-Term	R Regular
Magnitude		P Permanent	C Continuous
N Negligible	**Timing**		
L Low	N/A Not Applicable		**Reversibility**
M Moderate	A Applicable		R Reversible
H High			IR Irreversible
			PR Partially Reversible

Table 6.8-29 was reviewed and it was determined that the construction and operation (water quantity) of the Haul Road were the only two VC interactions applicable to wetlands within the Preferred Alternative Haul Road. There are no anticipated impacts to water quantity related to the operation of the Preferred Alternative Haul Road, therefore, this VC interaction was not carried forward or presented within the table above.

In contrast to the construction of the Beaver Dam Mine Site and Haul Road, construction of the Preferred Alternative Haul Road has a lesser magnitude of impact (moderate) on wetlands. Although the VC interaction causes a direct loss of wetland habitat only partial alteration of wetlands is expected through the construction of the Preferred Alternative Haul Road.

Mitigations presented in Table 6.8-28 will be established to reduce the impact of Project activities on flora and habitat.

6.8.10 Proposed Compliance and Effects Monitoring Program

Wetland monitoring will be completed to verify the accuracy of the predicted environmental effects and the effectiveness of the mitigation measures outlined in Table 6.8-28. A Wetland Monitoring Plan will be established through the life cycle of the permitting process and will commit to monitoring during baseline/pre-construction to establish baseline conditions, and through the operational phase, reclamation and post closure (as determined to be required). Wetland monitoring will be completed for the Project on selected representative wetlands that have been predicted to have direct or indirect effects from project development.

The Preliminary Environmental Effects Monitoring Plan (EEM), located in Appendix O.1, outlines the proposed preliminary methods, timing, frequency, and locations for wetland monitoring. This document will evolve through regulatory permitting, as well as public and Mi'kmaw engagement.

In addition to the EEM, a Preliminary Wetland Compensation Plan (Appendix H.3) has been developed in order to satisfy the Nova Scotia Wetland Conservation Policy's (2011) objective of preventing no net loss of wetland habitat and function. Wetland compensation will be initiated within three years of wetland alteration.

6.9 Fish and Fish Habitat

6.9.1 Rationale for Valued Component Selection

This section summarizes the methods used during evaluation of fish and fish habitat conducted by MEL biologists at waterbodies, wetlands, and linear watercourses identified as being potentially fish bearing throughout the PA. Linear watercourses were identified and described across the Beaver Dam Mine Site ~~footprint PA~~ (summer 2015) and the Haul Road ~~footprint PA~~ (spring 2016), and three waterbodies within the Beaver Dam Mine Site ~~footprint~~ (Crusher Lake, Mud Lake, and Cameron Flowage) were described for physical parameters in the summer of 2015. An additional linear watercourse, Moose River was analyzed as part of the Touquoy Mine Site EARD (Summers of 2005 and 2006). Wetland delineation and evaluation were completed in 2015 (Beaver Dam Mine Site ~~footprint PA~~) and 2016 (Haul Road ~~PA~~). Wetlands and watercourses within the Touquoy Mine Site were originally assessed in 2006 as part of the Touquoy Mine EARD process. Further assessments were completed on additional wetlands and watercourses discovered by MEL from 2015-2017 as part of the wetland and watercourse permitting processes.

Each of these systems was evaluated for the presence of fish habitat and potential ability to support fish species during initial assessment and identification. Once this was completed, fishing locations and methods were determined within reaches of linear watercourses where fish potential was higher, and within identified waterbodies, and a variety of fishing surveys were completed.

Field assessments to complete electrofishing and supporting fish collection were conducted on September 17-18, 2015 within the Beaver Dam Mine Site's ~~footprint PA's~~ linear watercourses. Additional field assessments were also completed between June 20-27, 2016 within linear watercourses within the Haul Road ~~PA~~ and two waterbodies within the Beaver Dam Mine Site ~~footprint PA~~. Fishing surveys included: detailed fish habitat assessment surveys; electrofishing within linear watercourse reaches; fish collection within linear watercourses and waterbodies; water quality surveys; and aquatic ecosystem condition benthic surveys (Canadian Aquatic Biomonitoring Network (CABIN) protocol, [Environment Canada, 2012]). The method for each fishing survey is described in detail below.

6.9.2 Baseline Program Methodology

Methodology of fish and fish habitat surveys within the Beaver Dam Mine Site and Haul Road are discussed below. Information pertaining to Touquoy Mine Site has been brought forward from the EARD and Focus Report. Methods and results are summarized in subheadings within the applicable sections, however, the data has not been re-evaluated. For further information regarding Touquoy Mine Site and specifically the baseline conditions of the Moose River, which is the ultimate receiving environment for discharge from the pit at Touquoy post-closure, refer to the EARD (CRA 2007) and Focus Report (CRA 2007a).

Fish habitat characterization was completed for each linear watercourse, wetland, and waterbody identified within the ~~PA~~ Beaver Dam Mine Site and Haul Road. The methods to complete habitat characterization were adopted from the *Standard Methods Guide for Freshwater Fish and Fish Habitat Surveys in Newfoundland and Labrador: Rivers and Streams* (Sooley et al., 1998). Further to this initial characterization, a detailed fish habitat survey was also completed at each 100 m length electrofishing site, including the identification of physical units (i.e., run, riffle, or pool), designation of substrate type, and depth and width (wetted and bankfull) of the linear section of the watercourse. The presence or absence of over-head cover, undercut banks, and woody debris was also recorded since these habitat features affect the ability of the watercourse and associated wetland habitat to support fish communities.

As described in the *Standard Methods Guide for Freshwater Fish and Fish Habitat Surveys in Newfoundland and Labrador: Rivers and Streams*, water quality and quantity tolerances of the Atlantic salmon (*Salmo salar*) were used as an index of the relative health of the river for fish populations. The Atlantic salmon was chosen as an indicator species for several reasons (Sooley et al., 1998):

- Salmon inhabit areas targeted for the assessments (riffle and pool habitat);
- Salmon are sensitive to acidification;
- Salmon are a predatory species at the top of the food chain; and
- Data exists that defines preferred habitat conditions for this species.

Touquoy Mine Site

Within the Touquoy Mine Site, fish habitat was characterized in Moose River as part of the EARD process. Habitat assessments and electrofishing was conducted as spot checks to determine species presence. Refer to the Touquoy Mine Site EARD (CRA 2007) for further methodological details.

6.9.2.1 Electrofishing

Sampling sites of approximately 100 m in length were selected as representative habitats with high potential to support fish along a section of a watercourse within each tertiary watershed throughout the Haul Road ~~PA~~ and across watercourses identified within the Beaver Dam Mine Site ~~footprint PA~~. The purpose of the electrofishing surveys was to determine what species of fish are present within watercourses and associated wetlands within the PA and to estimate population. Fifteen electrofishing sites were selected; eight within the Beaver Dam Mine Site ~~footprint PA~~ and seven within the Haul Road ~~PA~~. These locations are shown on Figures 6.7-3 and 6.7-3A to 6.7-3L. Fishing was completed under Fisheries and Oceans Canada Fishing License # 341208.

Standardized data collection forms developed by the New Brunswick (NB) Aquatic Resources Data Warehouse, the NB Department of Natural Resources and Energy, and the NB Wildlife Council (2002, updated 2006) were adapted for use for field data collection during electrofishing surveys. Field data collected included the physical and chemical parameters of the electrofishing site, along with electrofishing methods and settings, and results of electrofishing surveys.

Prior to sampling, each site was blocked off with barrier nets (1/8" mesh) that were secured to the streambed at either end of the 100 m linear reach of watercourse in order to prevent the loss of stunned or frightened fish. Barrier nets have a floating top line, and were anchored to the shoreline with rebar or rocks and to the substrate with rocks. The Electrofishing Site Form (NB Aquatic Resources Data Warehouse, NB Department of Natural Resources and Energy, NB Wildlife Council, 2002, updated 2006) was completed to identify and describe the physical and chemical characteristics of the reach to be sampled. This site description helped the electrofishing crew determine the appropriate settings on the electrofishing unit based on physical parameters of the watercourse, conductivity, and species expected to be present. Survey effort (in electrofishing seconds) was recorded on the Electrofishing Site Form as well. Water quality measurements were recorded in the field with a Horiba U22 Multi-parameter probe or YSI 650 MDS & 600 QS Multi-Probe.

Fisheries and Oceans Canada's Interim Policy for the Use of Backpack Electrofishing Units (2003) was reviewed and followed by all members of the electrofishing crew. This document provides a detailed list of standard equipment, safety, training, and emergency response procedure requirements for electrofishing. Each electrofishing crew consisted of two individuals, one of which (the crew lead) was a qualified person as defined under the DFO Interim Electrofishing Policy. The crew lead is responsible for operating the backpack electrofisher according to their training and the Policy, and for communicating safety policies and electrofishing procedures to the second crew member.

Fish were sampled within the isolated sampling areas using a Halltech Battery Backpack Electrofisher (HT-2000) with unpulsed direct current (DC) and a single pass or double pass depending on the location. The operator waded upstream to eliminate the effects of turbidity caused by bottom sediment and probed the anode into likely fish habitat within the site. A second crew member walked ahead of the operator to net any stunned fish using a D-frame landing net (1/8" mesh). All captured fish were held in a live well containing ambient stream water, which was kept out of the sun and checked regularly. At the conclusion of each pass, fish in the live well were identified (species confirmation) and measured (total length in mm). Status, sex, and maturity were also recorded for individual fish using the Individual Fish Measurement Form (NB Aquatic Resources Data Warehouse, NB Department of Natural Resources and Energy, NB Wildlife Council, 2002, updated 2006). After recuperating, all fish were released upstream and outside of the sampling site.

6.9.2.2 Fish Collection and Characterization

Two representative survey locations, site A and site B, within Cameron Flowage and Crusher Lake were chosen to complete fish collection within the Beaver Dam Mine Site ~~footprint PA~~. Fish collection was completed in 2016 to support and supplement electrofishing efforts completed in 2015 within linear watercourses in the Beaver Dam Mine Site ~~footprint PA~~. At each lentic sampling location, MEL biologists placed a fyke net, eel pot, and two minnow traps to capture and record fish presence to support fish species identification and relative abundance of fish species present. Fyke nets were placed in the shallow inshore littoral zone at sites A and B within Crusher Lake and Cameron Flowage. The fyke nets were fixed in place by stakes driven into the substrate of the waterbody through each wing of the net. Eel pots were also placed near the fyke nets within the littoral shelf of the two waterbodies to support fish collection within the PA. These eel pots were baited with cat food. Finally, two minnow traps were also placed and baited with cat food at each location to further support the collection of smaller fish and aid in species identification within the PA.

MEL biologists also placed minnow traps along the linear watercourses in deeper pools within the Haul Road ~~PA~~ during electrofishing surveys in 2016 to support the collection and identification of smaller fish in locations where electrofishing was not possible to due water depth.

Details of the fish collection locations, survey dates, and times are provided in Table 6.9-1.

Table 6.9-1 Fish Collection Locations and Details

Fish Collection Location	Fish Collection Methodology	Survey Location Coordinates		Survey Date	Survey Time	Tertiary Watershed
		Easting	Northing			
Crusher Lake A	Fyke Net	521617	4990137	June 27, 2016	4hr 26mins	Cameron Flowage
	Eel Pot	521579	4990165		4hr 44mins	
	Minnow trap 1	521577	4990161		4hr 26mins	
	Minnow trap 2	521573	4990171		4hr 25mins	
Crusher Lake B	Fyke Net	521566	4990193	June 27, 2016	4hr 25mins	Cameron Flowage
	Eel Pot	521563	4990196		4hr 23mins	
	Minnow trap 1	521563	4990186		4hr 23mins	
	Minnow trap 2	521569	4990189		4hr 23mins	
Cameron Flowage A	Fyke Net	522708	4990370	June 24, 2016	4hr 55mins	Cameron Flowage
	Eel Pot	522708	4990378		4hr 17mins	
	Minnow trap 1	522718	4990368		4hr 58mins	
	Minnow trap 2	522705	4990365		4hr 11mins	
Cameron Flowage B	Fyke Net	522743	4990338	June 24, 2016	5hr 08mins	Cameron Flowage
	Eel Pot	522728	4990345		4hr 52mins	
	Minnow trap 1	522753	4990318		5hr 05mins	
	Minnow trap 2	522729	4990352		5hr 08mins	
Electrofishing 1 Haul Road (Crossing B)	Minnow trap 1	522691	4988578	June 20, 2016	2hr 18mins	Tent Lake
	Minnow trap 2	522697	4988568		2hr 18mins	
	Minnow trap 3	522700	4988555		2hr 17mins	
Electrofishing 3 Haul Road (Crossing N)	Minnow trap 1	521856	4983929	June 22, 2016	2hr 02mins	Brandon Lake/Rocky Brook Lake
	Minnow trap 2	521867	4983925		2hr 07mins	

Fish Collection Location	Fish Collection Methodology	Survey Location Coordinates		Survey Date	Survey Time	Tertiary Watershed
		Easting	Northing			
	Minnow trap 3	521877	4983920		2hr 11mins	
Electrofishing 5 Haul Road (Crossing V)	Minnow trap 1	517417	4982555	June 16, 2016	2hr 25mins	Lake Alma
	Minnow trap 2	517429	4982564		2hr 26mins	

Note: Minnow traps were not utilized in Electrofishing 2, 4, 6, and 7 survey locations along the Haul Road due to low water depths.

All captured fish were held in a live well containing ambient lake water, which was kept out of the sun and checked regularly. Fish in the live well were identified to species and measured (total length in mm). After recuperating, all fish were released into the waterbody and outside of the sampling site.

The suite of survey methods (detailed habitat surveys, electrofishing, and fish collection with eel pots, fyke nets, and/or minnow traps) was selected based on ability to identify the breadth of species diversity present throughout various habitat types available in the PA.

Fish population characterization was completed through two mechanisms, the two pass depletion population estimate and the catch per unit of effort (CPUE), depending on the location of sampling and method of fish collection (e.g., electrofishing, netting).

Two-Pass Depletion Population Estimate

Two passes of electrofishing occurred within 100 m stretches of the watercourses within the Haul Road ~~PA~~. The fish were recorded by species and counted separately per pass and by watercourse. For all electrofishing locations within the Haul Road ~~PA~~, the two-pass depletion method was used to estimate population size of fish species found in the sampled watercourses. This depletion method can be used when the stream is very small, it is expedient to collect all data within a short time period, such as one day, and the population being estimated is relatively small (roughly less than 2,000 individuals (Lockwood and Schneider, 2000). Using this data, population estimate and variance of population estimated was calculated. The formulas (Heimbuch et al., 1997) are provided below:

Population estimate $N=C_1^2/(C_1-C_2)$
Variance of $N= C_1^2C_2^2(C_1+C_2)/(C_1-C_2)^4$
Standard error of $N=\sqrt{\text{Variance of } N}$

N*=Population estimate*
C_1*=number of fish removed in first pass*
C_2*=number of fish removed in second pass*

CPUE is usually assumed to be proportional to abundance and therefore included in stock assessment as a relative index of abundance. CPUE expresses how many fish (all species) are caught by a unit of effort (Hinton and Maunder, 2003). CPUE was calculated for each fish collection net (fyke, minnow trap, eel pot) deployed in Cameron Flowage and Crusher Lake in 2016. CPUE was also calculated for the one-pass electrofishing methodology completed within the Beaver Dam Mine Site ~~footprint PA~~ in 2015.

CPUE=Catch (fish)/Effort (time in hours)

The catch consists of how many fish were caught in a certain piece of fishing equipment. In the field, each fish was recorded and counted. The effort consists of the wetted time, which is equivalent to the time each piece of equipment was present in the waterbody. The start time and the end time were recorded for each piece of fishing equipment as they were placed and removed from the waterbody (Hinton and Maunder, 2003).

6.9.2.3 Water quality

Water quality was measured at each representative linear section of watercourses chosen for electrofishing within the Beaver Dam Mine Site ~~footprint PA~~ (September 2015) and the Haul Road ~~PA~~ (June 2016) (15 locations). Water quality measurements were also collected from Crusher Lake and Cameron Flowage during fish collection surveys. All water quality measurements were collected using a Horiba multi-probe (W-22XD) or YSI 650 MDS & 600 QS Multi-Probe water quality instrument. Parameters recorded include dissolved oxygen (mg/L), water temperature (°C), pH, and specific water conductivity (S/m).

6.9.2.4 Aquatic Ecosystem Condition

Benthic macroinvertebrate sampling was completed using the national standardized CABIN protocol (Environment Canada, 2012). Benthic sampling was completed at each electrofishing reach in watercourses within the Haul Road ~~PA~~ and at three locations within the Beaver Dam Mine Site ~~footprint PA~~ where confirmed fish presence was known. Benthic sampling was completed to support fish habitat evaluation as a baseline measurement, as biological parameters may detect impacts to the aquatic ecosystem that the physical and chemical parameters cannot, such as changes in water quantity, presence of invasive species, and habitat degradation. Benthic macroinvertebrates are common inhabitants of streams and lakes and are important in moving energy through food webs. Benthic macroinvertebrates are relatively long-lived (one to three years) and, therefore, can reflect cumulative impacts to aquatic ecosystem.

A site description, water chemistry, substrate characteristics, and channel measurements were recorded at each sampling location. The traveling kick net method was used to sample for macroinvertebrates. Using a 400 µm mesh kick net, the sampler shuffled upstream in a zigzag pattern for the standardized sampling effort (three minutes). The sample was then transferred to the sample jars and preserved with a 70% isopropanol solution. The samples were recorded, labeled, and sent to Envirosphere Consultants Ltd. for analysis.

MEL provided ten 'kick net (d-net)' samples to Envirosphere Consultants Ltd. in Windsor, Nova Scotia on July 7, 2016 for biological analysis (identification and assessment for biological species composition and abundance). The ten samples (14 x 250 ml) contained organisms in preservative collected from each electrofishing reach within linear watercourses within the Haul Road ~~PA~~ (7 in total) from June 22-24, 2016 and from three selected locations within linear watercourses connected to Cameron Flowage and Crusher Lake in the Beaver Dam Mine Site ~~footprint PA~~. Two locations within the Haul Road ~~PA~~ (watercourse A and Watercourse AH) required multiple bottles to collect samples (14 sample jars from 10 locations were transported for analysis).

Laboratory Methods: Sub-Sampling

Prior to sorting, samples and sub-samples were rinsed on a 0.5 mm 20 cm diameter circular sieve to remove preservative. To ensure a reasonable processing time, three of the fourteen samples were then sub-sampled at 50% or 75% to ensure processing efficiency. Sub-sampling involved dividing the sample in four, by weight. The sample was spread evenly in the sieve and divided into fourths, with quarters transferred in their entirety into plastic trays. The trays with contents were weighed and verified to be within 0.5 to 1.0 g of each other to ensure even distribution of the material. Two or three of the four trays were randomly selected for sorting and identification and the others held until the final sample analysis was completed to allow an opportunity for further analysis if necessary to ensure adequate counts for interpretation. Final counts and biomass for the sub-samples were extrapolated to 100% based on the sub-sample percentage (i.e., 50%). Sub-sampling can affect measures of animal abundance and biomass by increasing variability and may lead to slightly reduced estimates of taxon richness compared to whole samples.

Sorting and Identification

Samples and sub-samples were examined at 6 to 6.4 times magnification on a stereomicroscope, with a final brief check at 16 times magnification. Organisms were removed and subsequently stored in labeled vials in 70% isopropyl alcohol. Sorting efficiency for lab personnel is checked periodically by re-sorting samples to ensure average recovery levels of 90% or better. Wet weight biomass (grams per sample) was estimated for each sample by weighing animals to the nearest milligram at the time of sorting and after blotting to remove surface water.

Organisms were identified to an appropriate taxonomic level, typically to genus, using conventional literature for the groups involved. Organisms were identified by Valerie Kendall (M.Env.Sc.) and verified by Heather Levy (B.Sc. Honours) of Envirosphere Consultants Ltd. Sorting of animals from the samples, identification, total number of animals of each type (taxonomic group), as well as total abundance, were determined for each sample. These numbers were used to calculate several indices of benthic community health, which can be compared between sites and, with time, at each site (an index of community health is like a body mass index or an IQ, which gives a single number that can be used to compare individuals or things). Indices calculated are all commonly used in studies of this kind and include: EPT Ratio (ratio of abundance of mayflies (Ephemeroptera), caddisflies (Trichoptera), and stoneflies (Plecoptera), to total numbers of organisms); Total Abundance (number of animals in the sample and per unit area); and Taxon Richness (number of taxa per sample). Abundance in kick net samples was expressed on a per sample basis. All organisms present were included in estimates.

All electrofishing, fish collection, water quality, and benthic sampling locations are shown on Figures 6.7-3 and 6.7-3A to 6.7-3L.

6.9.3 Baseline Conditions

This section describes the results from fish habitat surveys, supporting electrofishing surveys, fish collection, benthic invertebrate sampling, and water quality surveys within the watercourses and associated wetland habitat within the Beaver Dam Mine Site ~~footprint~~ and Haul Road ~~PA~~. A photographic log of the watercourses and fish habitat encountered in the PA is included as **Appendix J.1.**

Updates to watercourses reflected within this section are as a result of additional surveys required by changes to the PA in order to incorporate the micrositing of Project infrastructure.

6.9.3.1 Fish Habitat Assessment

The potential for each watercourse and wetland to support fish habitat and fish was evaluated across the PA. As identified in Section 6.7, 34 linear watercourses were identified within the Haul Road ~~PA~~ and ~~14~~ 18 linear watercourses were identified within the Beaver Dam Mine Site ~~footprint PA~~. Three waterbodies were identified within the Beaver Dam Mine Site ~~footprint PA~~ (Crusher Lake, Mud Lake, and Cameron Flowage), all of which were expected to support fish. No waterbodies were identified within the Haul Road ~~PA~~. One hundred and ~~seventy-eight~~ ninety-seven wetlands were evaluated across the Beaver Dam Mine Site ~~footprint~~ and Haul Road ~~PA~~. Fish habitat potential was determined at each location during field identification/evaluation and collection of physical characteristics of each watercourse/wetland. Detailed fish habitat surveys and supporting electrofishing were completed at seven representative watercourse reaches within the Haul Road ~~PA~~ (one per tertiary watershed) and also at eight locations within watercourses in the Beaver Dam Mine Site ~~footprint PA~~ to understand fish species presence and characterization of fish populations. Based on the physical characteristics of watercourses and waterbodies within the PA, and also based on fish collected during electrofishing and netting surveys, the type and quality of fish habitat has been described.

This qualitative description of fish habitat is based on the *Standard Methods Guide for Freshwater Fish and Fish Habitat Surveys in Newfoundland and Labrador: Rivers and Streams* (Sooley et al., 1998) and the descriptions provided are for fish of the Salmonidae family, using the Atlantic salmon as the indicator species. Descriptions provided in Table 6.9-2 below specifically identify suitable habitats for spawning, rearing, refuge, overwintering, feeding, and passage for Atlantic salmon and brook trout identified within the PA.

Table 6.9-2 describes the fish habitat potential at each identified watercourse within the PA. Fish habitat potential is described based on the categories identified by Beak (1980) and detailed in the NL Guide (Sooley et al., 1998) referenced herein. These classifications are based in some cases on very short sections of watercourses evaluated within the PA only and, therefore, should be considered as preliminary summaries of fish habitat potential, with detailed evaluation necessary during the permitting stages of this Project to confirm fish habitat.

Table 6.9-2 Fish Habitat Descriptions (taken from Beak, 1980)

Type	Fish Habitat Descriptions
I	Good salmonid spawning and rearing habitat, often with some feeding pools for larger age classes: flows: moderate riffles; current: 0.1 - 0.3 m/s; depth: relatively shallow, 0.3 - 1 m; substrate: gravel to small cobble size rock, some larger rocks or boulders; and general habitat types: primarily riffle, pool.
II	Good salmonid rearing habitat with limited spawning, usually only in isolated gravel pockets, good feeding and holding areas for larger fish in deeper pools, pockets, or backwater eddies: flows: heavier riffles to light rapids; current: 0.3-1.0 m/s; depth: variable from 0.3 - 1.5 m; substrate: larger cobble/rubble size rock to boulders and bedrock, some gravel pockets between larger rocks; general habitat types: run, riffle, pocket water, pool.
III	Poor rearing habitat with no spawning capabilities, used for migratory purposes: flows: very fast, turbulent, heavy rapids, chutes, small waterfalls, current: 1 m/s or greater; depth: variable, 0.3 - 1.5 m; substrate: large rock and boulders, bedrock; and general habitat types: run, pocket water, cascades.
IV	Poor juvenile salmonid rearing habitat with no spawning capability, provides shelter and feeding habitat for larger, older salmonids (especially brook trout): flows: sluggish; current: 0.15 m/s; depth: variable but often 1 m; substrate: soft sediment or sand, occasionally large boulders or bedrock, aquatic macrophytes present in many locations; and general habitat types: flat, pool, glide.

Table 6.9-3 Fish Habitat Potential within Linear Watercourses in the Beaver Dam Mine Site ~~Footprint~~ and Haul Road ~~PA~~

WC ID	Tertiary Watershed	UTM		Fish Habitat Type	Fish Habitat Provisions
		Easting	Northing		
Beaver Dam Mine Site					
1	Tent Lake	522631	4989087	IV	Feeding, Refuge, and Passage
2	Cameron Flowage	522050	4990014	IV	Feeding, Refuge, and Passage
3	Cameron Flowage	522024	4989866	IV	Feeding, Refuge, and Passage
4	Cameron Flowage	521450	4990084	II	Rearing, Feeding, Refuge, and Passage
5 (top near wetland 2)	Cameron Flowage	521808	4989574	IV	Feeding, Refuge, and Passage
5 (lower near wetland 14)	Cameron Flowage	521555	4990209	II	Rearing, Feeding, Refuge, and Passage
6	Cameron Flowage	521379	4990527	IV	Feeding, Refuge, and Passage
7	Cameron Flowage	521438	4990346	II	Rearing, Feeding, Refuge, and Passage
8	Cameron Flowage	521343	4990272	IV	Feeding, Refuge, and Passage
9	Cameron Flowage	521536	4990206	II	Rearing, Feeding, Refuge, and Passage
10	Kent Lake	521394	4989508	II	Rearing, Feeding, Refuge, and Passage
11	Kent Lake	521166	4989752	IV	Overwintering, Feeding, Refuge, and Passage

WC ID	Tertiary Watershed	UTM		Fish Habitat Type	Fish Habitat Provisions
		Easting	Northing		
12	Cameron Flowage	522202	4990328	II	Feeding, Refuge, and Passage
13	Cameron Flowage	522689	4990224	IV	Feeding, Refuge, and Passage
14	Cameron Flowage	522734	4990027	I	Overwintering, Rearing, Feeding, Refuge, and Passage
15	Cameron Flowage	520961	4990506	IV	Passage
16	Cameron Flowage	520825	4990602	IV	Feeding, Refuge, and Passage
17	Cameron Flowage	520937	4990712	IV	Rearing, Feeding, Refuge, and Passage
18	Cameron Flowage	523010	4989995	IV	Passage
Cameron Flowage	Cameron Flowage	522675	4990410	II	Overwintering, Rearing, Feeding, Refuge, and Passage
Mud Lake	Cameron Flowage	521453	4990907	IV	Overwintering, Feeding, Refuge, and Passage
Crusher Lake	Cameron Flowage	521564	4990129	IV	Overwintering, Feeding, Refuge, and Passage
Haul Road ~~PA~~					
A	Tent Lake	522628	4988891	IV	Feeding, Refuge, and Passage
B	Tent Lake	522705	4988568	II	Rearing, Feeding, Refuge, and Passage
C	Tent Lake	522752	4988169	II	Rearing, Feeding, Refuge, and Passage
D	Tent Lake	522828	4987773	III	Passage
E	Brandon Lake	522907	4987152	I	Spawning, Rearing, Feeding, Refuge, and Passage

WC ID	Tertiary Watershed	UTM		Fish Habitat Type	Fish Habitat Provisions
		Easting	Northing		
F	Brandon Lake	522841	4986566	II	Rearing, Feeding, Refuge, and Passage
G	Brandon Lake	522621	4986085	II	Rearing, Feeding, Refuge, and Passage
H (Keef Brook)	Brandon Lake	522562	4985938	III	Feeding, Refuge, and Passage
I	Brandon Lake	522547	4985881	II	Rearing, Feeding, Refuge, and Passage
J	Brandon Lake	522554	4985838	II	Rearing, Feeding, Refuge, and Passage
K	Brandon Lake	522306	4984470	II	Rearing, Feeding, Refuge, and Passage
L	Brandon Lake	522312	4984339	I	Spawning, Rearing, Feeding, Refuge, and Passage
M	Brandon Lake	522234	4984150	II	Rearing, Feeding, Refuge, and Passage
N (West River Sheet Harbour)	Brandon Lake / Rocky Brook Lake	521887	4983922	I	Spawning, Overwintering, Rearing, Feeding, Refuge, and Passage
O	Lake Alma	521193	4983426	IV	Feeding, Refuge, and Passage
P	Lake Alma	520111	4982977	II	Feeding, Refuge, and Passage
Q	Lake Alma	518454	4982878	I	Spawning, Rearing, Feeding, Refuge, and Passage
R	Lake Alma	518335	4982893	IV	Feeding, Refuge, and Passage
S	Lake Alma	518117	4983044	II	Rearing, Feeding, Refuge, and Passage
T	Lake Alma	517873	4982824	II	Rearing, Feeding, Refuge, and Passage
U	Lake Alma	517441	4982674	II	Rearing, Feeding, Refuge, and Passage

WC ID	Tertiary Watershed	UTM		Fish Habitat Type	Fish Habitat Provisions
		Easting	Northing		
V	Lake Alma	517395	4982554	III	Rearing, Feeding, Refuge, and Passage
W	Lake Alma	517500	4982275	IV	Feeding, Refuge, and Passage
X	Lake Alma	517549	4982187	II	Rearing, Feeding, Refuge, and Passage
Y	Lake Alma	517595	4982084	II	Rearing, Feeding, Refuge, and Passage
Z	Lake Alma	517703	4981908	II	Feeding, Refuge, and Passage
AA	Eagles Nest	516527	4979693	II	Rearing, Feeding, Refuge, and Passage
AB	Eagles Nest	516303	4979597	IV	Feeding, Refuge, and Passage
AC	Eagles Nest	515091	4979240	II	Rearing, Feeding, Refuge, and Passage
AD (Morgan River)	Eagles Nest	514588	4978868	I	Spawning, Overwintering, Rearing, Feeding, Refuge, and Passage
AE	Rocky Lake	514402	4978588	II	Rearing, Feeding, Refuge, and Passage
AF	Rocky Lake	514346	4978527	II	Rearing, Feeding, Refuge, and Passage
AG	Rocky Lake	514286	4978468	III	Feeding, Refuge, and Passage
AH	Rocky Lake	514249	4978518	I	Spawning, Rearing, Feeding, Refuge, and Passage

~~Eight~~ Twelve of the ~~14~~ 18 linear watercourses, as described in Table 6.9-3, within the Beaver Dam Mine Site ~~footprint PA~~ are classified as poor juvenile salmonid rearing habitat with no spawning capability. These streams would provide shelter and feeding habitat for larger, older salmonids (especially brook trout). Watercourse 4, located south of Crusher Lake, watercourse 5 (lower portion), located north of Crusher Lake, and its tributaries (watercourse 7 and watercourse 9) are all classified as good salmonid rearing habitat with limited spawning, usually only in isolated gravel pockets, good feeding and holding areas for larger fish in deeper pools, pockets, or backwater eddies (Sooley et al., 1998). Watercourse 12, located west of Wetland 59 with direct connectivity to Cameron Flowage, also provides good salmonid rearing habitat with limited spawning potential. Watercourse 14, a small watercourse located south of Cameron Flowage, is classified as good salmonid spawning and rearing habitat, often with some feeding pools for larger age classes. However, although substrate and flow meet the requirements for this classification, its small size and average and expected low water depths limit potential for spawning within this tributary.

Mud Lake and Crusher Lake are classified as poor juvenile salmonid rearing habitat based on their sluggish flows, substrate, and depth. These lakes primarily provide shelter and feeding opportunities for larger, older brook trout. Cameron Flowage is classified as good salmonid rearing habitat with some limited potential for spawning. Overwintering could also occur within Cameron Flowage based on observed water depths.

There is a 6.9 km section of the West River Sheet Harbour downstream of the confluence with the Killag River to Sheet Harbour Lake, which is wide, shallow and exposed without holding habitat for adult fish, that was identified by NSSA as a partial migration barrier (NSLC Adopt A Stream, 2017). Remediation of this area is currently ongoing through the NSLC Adopt A Stream Project. Another potential barrier to fish movement during low flow conditions is present at the Lime Doser Station in the Killag River. No other barriers were observed during field studies or a desktop review.

Nineteen of the 34 linear watercourses evaluated within the Haul Road ~~PA~~ are classified as good salmonid rearing habitat with some limited spawning opportunities. Four watercourses are classified as poor rearing habitat with no spawning potential. Watercourse E, located in the upper reaches of the Brandon Lake Tertiary Watershed on the north side of Cope Pond, is classified as good salmonid spawning and rearing habitat. Watercourse L is also located in the Brandon Lake Tertiary Watershed and is a tributary to the West River Sheet Harbour. This watercourse is also classified as good spawning and rearing habitat.

The West River Sheet Harbour (watercourse N) runs through the PA and is known to support all life stages associated with the Salmonidae family, including spawning. In addition to salmonids, the West River Sheet Harbour is also known to support American eel (*Anguilla rostrada),* brown bullhead (*Ameiurus nebulosus*), yellow perch (*Perca flavescens*), creek chub (*Semotilus atromaculatus*), and white sucker (*Catostomus commersonii*) (NSFA, 2016).

Watercourse Q is a tributary that drains directly to Lake Alma in the Lake Alma Tertiary Watershed. Inside the PA, this watercourse was classified as good salmonid rearing and spawning habitat; however, this watercourse was observed to be subterranean downstream within the PA draining towards Lake Alma, which would act as a barrier to fish passage.

The Morgan River (watercourse AD) is located near the south end of the Haul Road ~~PA~~ in Eagle's Nest Tertiary Watershed. Like the West River Sheet Harbour, the Morgan River is also known to support all life stages of salmonids, including spawning. Its direct tributary, watercourse AH, located in the Rocky Lake Tertiary Watershed, is also good rearing and spawning habitat. The Morgan River is known to support white sucker, brook trout, white perch, yellow perch, banded killifish, rainbow trout, American eel, golden shiner, sticklebacks, alewife, northern redbelly dace, and brown bullhead (Alexander, Kerekes, & Sabean, 1986). The Atlantic Salmon Federation has indicated that the salmon is extirpated from the Tangier Watershed (https://www.asf.ca/main.html).

Table 6.9-4 describes the fish habitat present within each wetland and its associated watercourse in the Beaver Dam Mine Site ~~footprint~~ and Haul Road ~~PA~~. Wetlands that were determined not to support fish habitat (i.e., no surface water connectivity and/or open water present within the wetland habitat) are not included in this table and are not discussed further in this section. Some throughflow wetlands included in this table only support fish habitat within the watercourse draining through it. If so, this is identified in the table below. Others will support fish habitat both within the watercourse itself and the surrounding wetland habitat.

Touquoy Mine Site

Moose River, which runs along the western extent of the Touquoy Mine Site, was determined to provide habitat for Atlantic salmon and brook trout during surveys conducted in 2005 as part of the Environmental Assessment (CRA, 2007). Atlantic salmon (juveniles) were observed and suitable rearing and potential spawning habitat is available for the species. It was presumed that the Atlantic salmon observed were landlocked due to their proximity to a known landlocked population within Scraggy Lake. American eel, white sucker, and minnow species were also observed in Moose River. Although not observed, surveys determined that there is good adult and juvenile brook trout feeding habitat, fair rearing habitat, and potential spawning habitat available within Moose River (CRA, 2007).

Table 6.9-4 Fish Habitat Present within Each Wetland and Associated Watercourse

WL ID	Hydrological Regime	Associated Watercourse	Potential Fish habitat	Qualitative Description	Habitat Potential
Beaver Dam Mine Site ~~Footprint PA~~					
2	Headwater - outflow	WC-5 and WC-3	Fish habitat only within watercourses draining as outflows from this wetland habitat (northern extent of wetland habitat)	Feeding, Refuge, and Passage	Open Water, Direct connectivity to downstream fish resource
4	Throughflow	WC-2 and WC-3	Fish habitat within standing and open water in wetland	Feeding, Refuge, and Passage	Open Water, Direct connectivity to downstream fish resource
5	Headwater - outflow	WC-2	Fish habitat only within intermittent watercourse (western extent of wetland habitat)	Seasonal passage	Open Water, Direct connectivity to downstream fish resource
8	Bi-directional non-tidal / Throughflow	WC-4, WC-5, and Crusher Lake	Open water observed in wetland and WC5 throughflow through wetland habitat. Along the southern shore of Crusher Lake	Overwintering, Rearing, Feeding, Refuge and Passage.	Open Water, Direct connectivity to downstream fish resource
10	Lentic – bi-directional - non-tidal	Crusher Lake	Open water and vegetated habitat along lake edge	Overwintering, Rearing, Feeding, Refuge and Passage.	Open Water, Direct connectivity to downstream fish resource
11	Throughflow	WC-4	Fish habitat within standing and open water in wetland	Rearing, Feeding, Refuge, and Passage	Open Water, Direct connectivity to downstream fish resource
13	Throughflow	WC-4	Fish habitat only within watercourse except in extreme flood events. Currently small beaver dam at outlet causing localized flooding within the wetland	Rearing, Feeding, Refuge, and Passage	Open Water, Direct connectivity to downstream fish resource
14	Throughflow	WC-3, WC-5, WC-7, and WC-8	Fish habitat only within watercourse except in extreme flood events	Overwintering, Rearing, Feeding, Refuge, and Passage (within WC only)	Open Water, Direct connectivity to downstream fish resource
15	Headwater - outflow	WC-8	Open water observed in wetland with confirmed surface water connections to downstream resources	Feeding, Refuge, and Passage	Open Water, Direct connectivity to downstream fish resource
17	Lentic – bi-directional - non-tidal/throughflow	WC-5 and Mud Lake	Open water observed in wetland and WC5 throughflow through wetland habitat. Along the shores of Mud Lake	Overwintering, Rearing, Feeding, Refuge and Passage.	Open Water, Direct connectivity to downstream fish resource
20	Throughflow	WC-3	Open water observed in wetland with intermittent surface water connections to downstream resources	Feeding, Refuge, and Passage	Open Water, Direct connectivity to downstream fish resource
29	Headwater - outflow (northern extent) Throughflow (southeastern extent)	WC-10 and WC-11	Open water observed in wetland with confirmed surface water connections to downstream resources	Overwintering, Feeding, Refuge, and Passage	Open Water, Direct connectivity to downstream fish resource
33	Throughflow	WC-11	Fish habitat only within watercourse except in extreme flood events	Overwintering, Feeding, Refuge, and Passage (within wc only)	Open Water, Direct connectivity to downstream fish resource
44	Throughflow	WC-5	Open water observed in wetland with confirmed surface water connections to downstream resources. Currently beaver dam at outlet causing extensive flooding within the wetland	Overwintering, Rearing, Feeding, Refuge and Passage.	Open Water, Direct connectivity to downstream fish resource
46	Throughflow	WC-5	Fish habitat only within watercourse except in extreme flood events	Feeding, Refuge, and Passage	Open Water, Direct connectivity to downstream fish resource
48	Throughflow	WC-4	Fish habitat only within watercourse except in extreme flood events	Feeding, Refuge, and Passage	Open Water, Direct connectivity to downstream fish resource
52	Throughflow	WC-5	Fish habitat only within intermittent watercourse except during high water level events	Passage	Open Water, Direct connectivity to downstream fish resource
53	Headwater - outflow	WC-5	Fish habitat only within watercourse except in extreme flood events	Passage	Open Water, Direct connectivity to downstream fish resource
56	Throughflow	WC-12	Fish habitat present where standing water is present – drain system present	Feeding, Refuge, and Passage	Open Water, Direct connectivity to downstream fish resource
57	Headwater - outflow	WC-14	Fish habitat only within watercourse (northern extent of wetland) except in extreme flood events	Feeding, Refuge, and Passage	Open Water, Direct connectivity to downstream fish resource

WL ID	Hydrological Regime	Associated Watercourse	Potential Fish habitat	Qualitative Description	Habitat Potential
59	Throughflow	WC-12 and WC-14	Open water observed in wetland with confirmed surface water connections to downstream resources	Overwintering, Rearing, Feeding, Refuge, and Passage	Open Water, Direct connectivity to downstream fish resource
61	Throughflow/bi-directional non-tidal	WC-13 and Cameron Flowage	Open water observed in wetland with confirmed surface water connection to downstream resources	Feeding, Refuge, and Passage	Open Water, Direct connectivity to downstream fish resource
62	Bi-directional non-tidal	Cameron Flowage	Open water observed along lake edge	Overwintering, Feeding, Refuge, and Passage	Open Water, Direct connectivity to downstream fish resource
206	Throughflow	WC-17	Fish habitat only within watercourse except in flood events	Rearing, Feeding, Refuge, and Passage	Potential connectivity to downstream fish resource
207	Inflow/outflow	WC-16	Fish habitat only within watercourse except in flood events	Feeding, Refuge, and Passage	Potential connectivity to downstream fish resource
210	Inflow	WC-15	Fish habitat only within watercourse	Passage	No Connectivity to downstream fish resource
~~Beaver Dam~~ Haul Road					
64	Throughflow	A	Open water observed in wetland with confirmed surface water connections to downstream resources	Overwintering, Feeding, Refuge, and Passage	Open Water, Direct connectivity to downstream fish resource
66	Throughflow	B	Fish habitat within open water sections of the wetland.	Rearing, Feeding, Refuge, and Passage	Open Water, Direct connectivity to downstream fish resource
67	Throughflow	C	Fish habitat only within watercourse except in extreme flood events	Rearing, Feeding, Refuge, and Passage	Open Water, Direct connectivity to downstream fish resource
68	Throughflow	B and C	Fish habitat within watercourses and shallow open water sections within wetland habitat	Rearing, Feeding, Refuge, and Passage	Open Water, Direct connectivity to downstream fish resource
69	Lentic/Throughflow	D	Fish habitat present in connected open water – riparian wetland	Overwintering, Feeding, Refuge, and Passage	Open Water, Direct connectivity to downstream fish resource
73	Throughflow	E	Fish habitat only within intermittent watercourse through the wetland except in extreme flood events	Spawning, Rearing, Feeding, Refuge, and Passage	Open Water, Direct connectivity to downstream fish resource
74	Throughflow	F	Fish Habitat potential in open water marsh habitat and watercourse	Overwintering, Rearing, Feeding, Refuge, and Passage	Open Water, Direct connectivity to downstream fish resource
76	Throughflow	G	Open water observed in wetland with presumed surface water connections to downstream resources	Overwintering, Rearing, Feeding, Refuge, and Passage	Open Water, Direct connectivity to downstream fish resource
79	Throughflow	J, I, and H	Fish habitat only within watercourse except in extreme flood events	Rearing, Feeding, Refuge, and Passage	Open Water, Direct connectivity to downstream fish resource
94	Throughflow	M	Fish habitat only within intermittent watercourse except in extreme flood events	Rearing, Feeding, Refuge, and Passage	Open Water, Direct connectivity to downstream fish resource
111	Throughflow	O	Fish habitat only within watercourse except in extreme flood events	Feeding, Refuge, and Passage	Open water, Watercourse intermittent, Connectivity downstream undetermined
112	Headwater - outflow	O	Fish habitat only within watercourse except in extreme flood events	Feeding, Refuge, and Passage	Open water, Watercourse intermittent, Connectivity downstream undetermined
135	Throughflow	Q	Fish habitat only within watercourse except in extreme flood events	Feeding, Refuge, and Passage	Open water, Watercourse intermittent, no surface water connection to downstream resource (subterranean)
137	Throughflow	R	Fish habitat only within watercourse except in extreme flood events	Feeding, Refuge, and Passage	Open water, Watercourse intermittent, no surface water connection to downstream resource (subterranean)
142	Throughflow	W	Fish habitat only within watercourse except in extreme flood events	Feeding, Refuge, and Passage	Open Water, Direct connectivity to downstream fish resource

WL ID	Hydrological Regime	Associated Watercourse	Potential Fish habitat	Qualitative Description	Habitat Potential
143	Throughflow	X	Fish habitat only within watercourse except in extreme flood events	Rearing, Feeding, Refuge, and Passage	Open Water, Direct connectivity to downstream fish resource
144	Throughflow	Y	Fish habitat only within watercourse except in extreme flood events	Rearing, Feeding, Refuge, and Passage	Open Water, Direct connectivity to downstream fish resource
146	Headwater - outflow	Z	Open water behind blocked culvert within wetland habitat	Overwintering, Rearing, Feeding, Refuge, and Passage	Open Water, Direct connectivity to downstream fish resource
154	Headwater - outflow	n/a	Fish habitat within watercourse outlet draining outside of PA and standing water within the wetland	Feeding, Refuge, and Passage	Open Water, Direct connectivity to downstream fish resource
159	Throughflow	AA	Inundation caused by beaver activity has extended potential fish habitat throughout wetland.	Overwintering, Feeding, Refuge, and Passage	Open Water, Direct connectivity to downstream fish resource
160	Throughflow	AA	Open water observed in wetland with confirmed surface water connections to downstream resources	Overwintering, Rearing, Feeding, Refuge and Passage.	Open Water, Direct connectivity to downstream fish resource
165	Throughflow	AC	Fish habitat only within watercourse except in extreme flood events. Inlet from ditching, outlet natural channel	Rearing, Feeding, Refuge, and Passage	Open Water, Direct connectivity to downstream fish resource
171	Throughflow	AD and AE	Fish habitat only within watercourse except in extreme flood events	Spawning, Overwintering, Rearing, Feeding, Refuge, and Passage	Open Water, Direct connectivity to downstream fish resource
173	Throughflow	AF	Fish habitat only within watercourse except in extreme flood events	Rearing, Feeding, Refuge, and Passage	Open Water, Direct connectivity to downstream fish resource
174	Headwater - outflow	AG	Fish Habitat only within watercourse.	Feeding, Refuge, and Passage	Open Water, Direct connectivity to downstream fish resource

~~Twelve~~ Twenty-six wetlands and associated watercourses have been evaluated to provide potential fish habitat based on the NL Guide for the salmonid family within the Beaver Dam Mine Site ~~footprint PA~~. These wetlands are associated with the following surface water systems:

- Crusher Lake: Wetlands 8 and 10
- Mud Lake: Wetland 17
- Cameron Flowage: Wetlands 61 and 62
- Watercourse 2: Wetlands 4 and 5
- Watercourse 3: Wetlands 2, 4, 14, and 20
- Watercourse 4: Wetlands 8, 11, 13, 14, 48
- Watercourse 5 (and smaller tributaries): Wetlands 2, 8, 14, 17, 44, 46, 52, and 53
- Watercourse 7: Wetland 14
- Watercourse 8: Wetland14, and 15
- Watercourse 10: Wetland 29
- Watercourse 11: Wetlands 29 and 33
- Watercourse 12: Wetlands 56 and 59
- Watercourse 13: Wetland 61
- Watercourse 14: Wetland 57 and 59
- Watercourse 15: Wetland 210
- Watercourse 16: Wetland 207
- Watercourse 17: Wetland 206

Most of these wetlands provide habitat that supports feeding, refuge and passage within and through the Beaver Dam Mine Site ~~footprint PA~~ surface water systems. Wetlands that provide potential overwintering and rearing habitat are associated with waterbodies and open water features on site. These wetlands include Wetland 8 and 10 (Crusher Lake), Wetland 17 (Mud Lake), Wetland 29 open water section just south of the PA, Wetland 44 (beaver impoundment), Wetland 59 (previous dug waterbody for historical mining activities), and Wetland 62 (Cameron Flowage).

Within the Haul Road ~~PA~~, twenty-five wetlands have been determined to support potential fish habitat. The Haul Road ~~PA~~ is linear by nature, so limited evaluation of each watercourse and associated wetland was completed. As a result, fish habitat conclusions especially within this area of the PA should be considered preliminary, as downstream connectivity was not confirmed. Open deep-water marsh habitat providing potential overwintering habitat for salmonids was documented in Wetlands 64, 74, 76, 146 (blocked culvert backing water up), 159 (beaver impoundment), and 160. The only potential spawning habitat documented associated with wetland habitat within the Haul Road ~~PA~~ was limited to the watercourse habitat present within/draining through wetland habitat. The majority of wetland habitat identified as potentially supporting fish offers refuge, feeding and passage, with some rearing habitat for fish species.

A desktop evaluation for priority fish species revealed that no priority species were documented within 5km of the Project Area by the Atlantic Canada Conservation Data Centre (ACCDC) reports provided for the Beaver Dam Mine Site ~~footprint~~ and for the Haul Road. No location sensitive species of fish have been identified within 5km of either the mine footprint of the Haul Road ~~PA~~. Priority fish species identified as having an elevated potential to be located within the Project Area, based on habitat preferences, and broad geographic range, include *Anguilla rostrata* (American eel), *Salmo salar* (Atlantic salmon), *Culaea inconstans* (brook stickleback), and *Osmerus mordax* (landlocked rainbow smelt). ~~and *Rhinichthys atratulus* (Blacknose dace).~~

As described, habitat descriptions for all identified watercourses, waterbodies and wetlands that could support fish are based on requirements for the salmonid family (salmon as the indicator species). Atlantic salmon (southern uplands population) (COSEWIC E) were not observed within the PA, but are expected to potentially utilize areas within the PA, as described in this section. These habitat descriptions are also relevant for Brook trout, which was observed in the PA. Further details relating to Atlantic salmon habitat can be found in Section 6.13 (Species at Risk).

The non-salmonid commercial, aboriginal, and recreational (CAR) species identified in the PA during fish collection studies included: American eel, white sucker, and yellow perch. According to the Nova Scotia Freshwater Fish Species Distribution Records, white perch and alewife have been recorded in these watersheds as well (NSFA, 2016). Though the habitat type described above is based on salmonid needs, the habitat potential is applicable to all fish related to access to the resource. Watercourse physical characteristics are found in Table 6.7-4 and 6.7-6. The following are CAR species specific habitat descriptions.

American Eel

American eel (COSEWIC T) was observed within the PA and according to the Nova Scotia Department of Fisheries and Aquaculture (NSFA, 2016), are known in the West River Sheet Harbour. Suitable habitat for the eel is varied.

As a catadromous species, eels spend the majority of their lives in freshwater, moving to the Sargasso Sea to spawn. Their distribution includes marine waters of the western Atlantic Ocean, and some freshwater systems connected to the Atlantic Ocean in South America, North America and Greenland. Within the freshwater environment, mature American eels are habitat generalists, frequently found in natural watercourses that offer structural complexity and shade in the form of coarse woody debris, varied substrate, in-stream vegetation and an available food source of forage fish, invertebrates, molluscs and vegetation.

Fish habitat was assessed for various lifecycles of the American eel. Migration habitat was determined based on a contiguous fresh water system connecting two separate waterbodies. Juvenile habitat requires various benthic substrates, woody debris and or vegetation for protection and cover. Overwintering habitat required mud/silt sections of stream beds with depths of a minimum 30 cm to ensure the watercourse does not freeze to death during winter months.

Potential American eel habitat was found to be within 30 tributary watercourses to the three confirmed eel bearing watercourses. Tributary systems were inferred using both field data and NS topographical watercourse mapping. A review of literature documents that American Eels are not restricted to contiguous watercourses and possess the ability to traverse over land in wet, low lying grass habitats (MacGregor et al. 2011). As such all remaining watercourses within the PA are believed to be potentially accessible to the American eel, even if habitat provision in those watercourses is low. Detailed assessment of specific American eel habitat within the PA is provided in Section 6.13 (Species at Risk).

Details relating to habitat requirements of other species of conservation interest identified within the PA are also found in Section 6.13.

Alewife

Alewife are found in open water habitats over all bottom types (Page and Burr, 2011). They spawn almost exclusively in lakes and large still waters and genetic differentiation between populations suggests that they typically return to their river of origin for spawning (DFO, 2016). Alewife do not migrate into fresh water until river temperatures start to warm and spawning usually occurs in June (NSSA 2005b; Gilhen 1974).

According to the Nova Scotia Freshwater Fish Species Distribution Records alewife has been recorded in the watersheds of the PA (NSFA, 2016). Within the Beaver Dam Mine Site, potential spawning habitat for Alewife can be found within Crusher Lake, Cameron Flowage, and Mud Lake. Along the Haul Road, Alewife are known to the Morgan River (Watercourse AD).

Yellow Perch

Most yellow perch do not appear to migrate, but some do, in patterns, which tend to be short and local (Brown, Runciman, Bradford, & Pollard, 2009). The yellow perch is a schooling, shallow water fish that can adapt to a wide variety of warm or cool habitats. They are found in large lakes, small ponds, or gentle rivers but are most abundant in clear, highly vegetated lakes (1-10 m depth) that have muck, sand, or gravel bottoms (Brown, Runciman, Bradford, and Pollard 2009). They prefer summer temperatures of 21-24^{o}C. Yellow perch feed on aquatic insects, crustaceans, and a variety of fishes and their eggs (NSSA 2005a). Spawning occurs from April through July, but usually during May in Nova Scotia, at water temperatures of 9-12^{o}C. The adults move into shallow areas of lakes or up into tributary streams. Males are first to arrive and the last to leave. Yellow perch spawn at night or in early morning, most often in areas where there is debris or vegetation on the bottom (NSSA 2005a).

Yellow perch are known to the West River Sheet Harbour (watercourse N) (NSFA, 2016) and potential habitat also exists in Cameron Flowage, watercourse 13 and wetlands 10, 17, 29, 61, and 62.

White Perch

Similar to yellow perch, white perch are found in pools and other quiet-water areas of medium to large rivers (Page and Burr 2011). White Perch use both brackish and freshwater, but in Nova Scotia are more commonly seen in fresh water habitats usually over mud substrate (Bigelow and Schroeder 2002). Spawning occurs in June in shallow areas of either fresh or brackish water (Gilhen 1974). They are typically resident species wherever they are found.

According to the Nova Scotia Freshwater Fish Species Distribution Records, white perch has been recorded in the watersheds of the PA (NSFA, 2016). Similarly to yellow perch, potential habitat is available in watercourse 13 and wetlands 10, 17, 29, 61, and 62. Suitable habitat also exists in Crusher Lake and Cameron Flowage.

White Sucker

White sucker are found on the bottom in warm, shallow water areas of lakes and quiet streams. They feed on small aquatic plants and animals filtered out of sand or mud (Gilhen 1974). White sucker prefer summer temperatures of 24^{o}C and are most abundant in areas with aquatic vegetation and underwater debris that provide cover. White sucker are active year-round, spawning in May-June when they migrate into small streams and tributaries with water temperatures of 10-18^{o}C (NSSA 2005b). Preferred spawning habitat for white sucker is shallow gravel riffles of moderate water velocity. Lake populations sometimes spawn on gravel shoals where there is wave action (NSSA 2005b). The adults leave the spawning ground after a week or two and return to the river or lake they originated from (NL Department of Environment and Climate Change, n.d. and Adopt a Stream).

Being habitat generalists that can withstand a wide range of water temperatures, white sucker are anticipated to be within the majority of the watercourses of the PA. Some of the watercourses/waterbodies that offer suitable habitat are; Crusher Lake, Mud Lake, Cameron Flowage as well as the West River Sheet Harbour (Watercourse N).

6.9.3.2 Electrofishing

Beaver Dam Mine Site ~~Footprint PA~~

Within the eight electrofishing locations in the mine footprint, a total of 44 individual fish were captured at five watercourse locations including: Watercourse 4 south of Crusher Lake; Watercourse 5 north of Crusher Lake; Watercourse 12 located between Wetland 56 and Wetland 59; Wetland 56; and Watercourse 13 located between Wetland 59 and Cameron Flowage. No fish were observed in the upper reaches of Watercourse 5 located south of Crusher Lake, or within the two locations fished along Watercourse 3 which drains north through the central portion of the Beaver Dam Mine Site ~~footprint PA~~.

Table 6.9-5 outlines a summary of fish species captured within the Beaver Dam Mine Site ~~footprint~~.

Table 6.9-5 Fish Species Captured within Beaver Dam Mine Site ~~Footprint PA~~ Linear Watercourses

Species	Total Number Captured	Relative Abundance (%)	Species of Commercial, Aboriginal or Recreational (CAR) Interest	Species Ranking (ACCDC)	Average Length per species within Beaver Dam Mine Site
Brook trout (*Salvelinus fontinalis*)	10	22.7	Yes	~~S4~~ S3	8.6
Ninespine stickleback (*Pungitius pungitius*)	11	25	No	S5	3.1
Northern redbelly dace (*Chrosomus eos*)	9	20.5	No	S5	5.9
Banded killifish (*Fundulus diaphanous*)	11	25	No	S5	6.4
Lake chub (*Couesius plumbeus*)	1	2.3	No	S5	4.5
Brown bullhead (*Ictalurus nebulosus*)	1	2.3	No	S5	6.0
Unconfirmed Fish Species	1	2.3	N/A	N/A	3.3

*Note: Smallmouth Bass that was originally identified in this table was reconfirmed as a Banded Killifish based on photographs. Slimy Sculpin that was originally identified has been listed as unconfirmed fish species.

Table 6.9-6 presents the results of the individual fish data for fish collected in each watercourse within the Beaver Dam Mine Site ~~footprint PA~~.

Table 6.9-6 Individual Fish Details: Beaver Dam Mine Site

Sampling site	Common name	Scientific name	Fork length (cm)	Total length (cm)	Age[i]
WC-4	Ninespine stickleback	*Pungitius pungitius*		4.0	Mature
	Ninespine stickleback	*Pungitius*		5.0	Mature
	Ninespine stickleback	*Pungitius pungitius*		3.0	Immature
	Ninespine stickleback	*Pungitius pungitius*		3.0	Immature
	Ninespine stickleback	*Pungitius pungitius*		3.0	Immature
	Ninespine stickleback	*Pungitius pungitius*		3.0	Immature
	Ninespine stickleback	*Pungitius pungitius*		3.0	Immature
	Ninespine stickleback	*Pungitius pungitius*		2.5	Immature
	Ninespine stickleback	*Pungitius pungitius*		2.5	Immature
	Ninespine stickleback	*Pungitius pungitius*		2.5	Immature
	Ninespine stickleback	*Pungitius pungitius*		2.5	Immature
	~~Slimy Sculpin~~ Unconfirmed Fish Species *	~~*Cottus cognatus*~~ N/A		3.3	Immature
WC-5 (top- near WL2)		---No Fish---			
WC-5 (lower- near WL14)	Brook trout	*Salvelinus fontinalis*	13.0	15.0	Immature
	Northern redbelly dace	*Chrosomus eos*	6.0	8.0	Mature
	Northern redbelly dace	*Chrosomus eos*	6.0	8.0	Mature
	Northern redbelly dace	*Chrosomus eos*	4.8	6.0	Mature
WC-3 (top- near WL2)		---No Fish---			
WC-3 (lower- near WL20)		---No Fish---			
WC-12	Brook trout	*Salvelinus fontinalis*	6.0	7.0	Immature
	Brook trout	*Salvelinus fontinalis*	6.0	7.0	Immature
	Brook trout	*Salvelinus fontinalis*	4.8	6.0	Immature
WL-56	Banded killifish	*Fundulus diaphanus*	3.0	4.0	
	Northern redbelly dace	*Chrosomus eos*	3.0	4.0	Immature
WC-13	Brook trout	*Salvelinus fontinalis*	14.0	17.0	Immature
	Brook trout	*Salvelinus fontinalis*	10.0	12.0	Immature
	Brook trout	*Salvelinus fontinalis*	4.0	5.0	Immature
	Northern redbelly dace	*Chrosomus eos*	5.0	6.0	Mature

Sampling site	Common name	Scientific name	Fork length (cm)	Total length (cm)	Age[i]
	Banded killifish	*Fundulus diaphanus*	6.5	7.5	
	Northern redbelly dace	*Chrosomus eos*	5.0	6.0	
	Brook trout	*Salvelinus fontinalis*	5.0	6.0	
	Banded killifish	*Fundulus diaphanus*	5.0	6.0	
	~~Smallmouth Bass~~ Banded killifish*	~~*Micropterus dolomieui*~~ *Fundulus diaphanus*	8.0	9.0	
	Brook trout	*Salvelinus fontinalis*	4.2	5.0	
	Banded killifish	*Fundulus diaphanus*	6.0	7.0	
	Banded killifish	*Fundulus diaphanus*	6.0	7.0	
	Banded killifish	*Fundulus diaphanus*	5.0	6.0	
	Lake chub	*Couesius plumbeus*	4.0	4.5	
	Banded killifish	*Fundulus diaphanus*	6.0	7.0	
	Banded killifish	*Fundulus diaphanus*	6.0	7.0	
	Banded killifish	*Fundulus diaphanus*	5.2	6.0	
	Brook trout	*Salvelinus fontinalis*	5.0	6.0	
	Brown bullhead	*Ictalurus nebulosus*	5.0	6.0	
	Northern redbelly dace	*Chrosomus eos*	4.0	5.0	
	Northern redbelly dace	*Chrosomus eos*	4.0	5.0	
	Northern redbelly dace	*Chrosomus eos*	4.5	5.5	
	Banded killifish	*Fundulus diaphanus*	3.5	4.0	
WL59	Fish Observed in open water sections, but depth prevented safe sampling.				

*Note: Fish identifications have been reconfirmed.

Within the Beaver Dam Mine Site ~~footprint PA~~, ~~two~~ one species of commercial, aboriginal, or recreational (CAR) interest ~~were~~ was confirmed, the Brook Trout ~~and the Smallmouth Bass~~. Furthermore, Brook Trout ranked by the ACCDC as S3 and is therefore a species of conservation interest.

Brook Trout was confirmed within Watercourse 5 north of Crusher Lake (between Crusher Lake and Mud Lake) (one individual fish), Watercourse 12 (three individual fish) (between Wetland 56 and Wetland 59), and within Watercourse 13, the short tributary leading from Cameron Flowage west into Wetland 59 (6 individual fish). Based on the observed Brook Trout in WC-5, it is expected that this species would be present and utilizing wetland habitat in Wetlands 8 and 44 on the south side of Crusher Lake, and Wetland 17 adjacent to Mud Lake. Brook Trout was confirmed in WC-12, Wetland 56, and WC-13 demonstrating that this species is also present in Wetland 56 (where open water is present) and throughout Wetland 59, which is classified as an open water marsh.

Mature Brook Trout, in the fall of the year, migrate to spawn in lakes or streams. Trout mature in about two to four years within fresh water. If the river habitat is suitable for Brook Trout and they do not experience any stressors throughout the year, they tend not to travel large distances. Most of the populations existing in larger rivers act this way. They do not move until the fall at the onset of spawning. Even then, if the river has adequate habitat diversity, they tend not to travel large distances. Other populations have adapted to various river conditions. They travel very large distances (>120 km) in search of thermal refuge and/or spawning habitat. Some spawn in the main stem of rivers, while others utilize tributaries (NS Department of Agriculture and Fisheries, 2005). No maps exist within Nova Scotia to specifically highlight confirmed or potential spawning habitat or migratory routes for Brook Trout. Habitat assessments in Section 6.7.3.1 describe potential habitat within the PA for spawning, nursery, feeding, overwintering for trout. Bathymetry for each watercourse and wetland identified to support fish habitat is provided in Section 6.8.6.

~~The Smallmouth Bass was confirmed only at Watercourse 13, the tributary adjacent to Cameron Flowage with one individual fish caught. Smallmouth Bass migrate seasonally and some populations are non-migratory. Lake populations of Smallmouth Bass have short spawning migrations. Most adult Smallmouth Bass migrate downriver in late June and July and repeatedly migrate back to the same nesting site each year (Brown, Runciman, Pollard, Grant, & Bradford, 2009). Smallmouth Bass are considered an exotic species in Nova Scotia and care should be taken when considering project design to avoid continued spreading of this fish species throughout surface water systems. Consultation with DFO will be completed with respect to this species at the permitting stage. No maps exist within Nova Scotia with confirmed or potential spawning habitat and/or migratory routes for Smallmouth Bass.~~

Although not captured during electrofishing, potential habitat exists for other CAR species within the Beaver Dam Mine Site. As discussed in Section 6.9.3.1, potential habitat for yellow perch and white perch exists in watercourse 13 and wetland 10, 17, 29, 61, and 62.

No fish species at risk (SAR) ~~or species of conservation interest (SOCI)~~ were captured within the Beaver Dam Mine Site ~~footprint PA~~ during electrofishing surveys.

Haul Road ~~PA~~

Within the seven electrofishing locations in the Haul Road ~~PA~~, a total of 53 individual fish were captured at four watercourse locations including: Watercourse N (West River Sheet Harbour), Watercourse V (tributary draining into Lake Alma), Watercourse AA (tributary between Mink and Brady Lake), and Watercourse AH (tributary draining to the Morgan River). No fish were captured in Watercourse B or Watercourse H (Keef Brook). Both are located at the top of the Tent Lake and Brandon Lake tertiary watersheds respectively. As well, no fish were captured within Watercourse O, a tributary located within the upper reaches of the Lake Alma tertiary watershed.

Table 6.9-7 outlines a summary of fish species captured within the Haul Road ~~PA~~.

Table 6.9-7 Fish Species Captured within the Haul Road ~~PA~~ Linear Watercourses

Species	Total Number Captured	Relative Abundance %	Species of Commercial, Aboriginal or Recreational (CAR) Interest	Species Ranking	Average Length per species within Haul Road ~~Footprint~~
American eel (*Anguilla rostrata*)	36	60	Yes	COSEWIC T/~~S5~~ S2	24.0
Banded killifish (*Fundulus diaphanous*)	6	10	No	S5	7.5
Brook trout (*Salvelinus fontinalis*)	7	11.67	Yes	~~S4~~ S3	11.54

Species	Total Number Captured	Relative Abundance %	Species of Commercial, Aboriginal or Recreational (CAR) Interest	Species Ranking	Average Length per species within Haul Road ~~Footprint~~
Golden shiner (*Migonus crysoleucas*)	2	3.3	No	S5	8.75
Lake chub (*Couesius plumbeus*)	3	5	No	S5	8.7
White sucker (*Catostomus commersoni*)	5	8.3	Yes	S5	16.3
Yellow perch (*Perca flavescens*)	1	1.7	Yes	S5	8.5

Note: Blacknose dace that was originally identified in this table was reconfirmed as a Lake Chub.

Table 6.9-8 presents the results of the individual fish data for fish collected in each watercourse within the Haul Road ~~PA~~.

Table 6.9-8 Individual fish Details: ~~Beaver Dam~~ Haul Road

Watercourse	Common name	Scientific Name	Fork Length (cm)	Total Length (cm)
B	---No Fish---			
H	---No Fish---			
N	Yellow perch	*Perca flavescens*	8	8.5
	White sucker	*Catostomus commersoni*	16	18
	Banded killifish	*Fundulus diaphanus*	7.25	7.5
	~~Blacknose Dace~~ Lake chub*	~~*Rhinichthys atratulus*~~ *Couesius plumbeus*	8.5	9
	American eel	*Anguilla rostrata*	-	21
	American eel	*Anguilla rostrata*	-	18
	American eel	*Anguilla rostrata*	-	12
	American eel	*Anguilla rostrata*	-	29
	American eel	*Anguilla rostrata*	-	15
	American eel	*Anguilla rostrata*	-	31
	American eel	*Anguilla rostrata*	-	27
	American eel	*Anguilla rostrata*	-	30
	American eel	*Anguilla rostrata*	-	25
	American eel	*Anguilla rostrata*	-	20
	American eel	*Anguilla rostrata*	-	10
	American eel	*Anguilla rostrata*	-	11
	American eel	*Anguilla rostrata*	-	15
	American eel	*Anguilla rostrata*	-	19

Watercourse	Common name	Scientific Name	Fork Length (cm)	Total Length (cm)
	American eel	*Anguilla rostrata*	-	35
	White sucker	*Catostomus commersoni*	24	25
	Banded killifish	*Fundulus diaphanus*	7	7.5
	White sucker	*Catostomus commersoni*	17	18
	Brook trout	*Salvelinus fontinalis*	6.5	7
	American eel	*Anguilla rostrata*	-	45
	Lake chub	*Couesius plumbeus*	7.5	8
	American eel	*Anguilla rostrata*	-	30
	American eel	*Anguilla rostrata*	-	27
	American eel	*Anguilla rostrata*	-	45
	American eel	*Anguilla rostrata*	-	20
	American eel	*Anguilla rostrata*	-	19
O	---No Fish---			
V	American eel	*Anguilla rostrata*		20
	Brook trout	*Salvelinus fontinalis*	10	10.5
	Brook trout	*Salvelinus fontinalis*	6	6.25
	Brook trout	*Salvelinus fontinalis*	14.5	15
	Brook trout	*Salvelinus fontinalis*	19.5	20
	Brook trout	*Salvelinus fontinalis*	5.25	5.5
	American eel	*Anguilla rostrata*	-	31
AA	Banded killifish	*Fundulus diaphanous*	-	8
	Golden shiner	*Notemigonus crysoleucas*	7	8
	Lake chub	*Couesius plumbeus*	8.5	9
	White sucker	*Catostomus commersoni*	9.5	10
	White sucker	*Catostomus commersoni*	9.5	10.5
	Banded killifish	*Fundulus diaphanous*	-	7.25
	Banded killifish	*Fundulus diaphanous*	-	7
	Banded killifish	*Fundulus diaphanous*	-	8
	Golden shiner	*Notemigonus crysoleucas*	9.5	9.5
AH	Brook trout	*Salvelinus fontinalis*	19	20
	American eel	*Anguilla rostrata*	-	23
	American eel	*Anguilla rostrata*	-	35
	American eel	*Anguilla rostrata*	-	29
	American eel	*Anguilla rostrata*	-	14
	American eel	*Anguilla rostrata*	-	31

Watercourse	Common name	Scientific Name	Fork Length (cm)	Total Length (cm)
	American eel	*Anguilla rostrata*	-	17
	American eel	*Anguilla rostrata*	-	22
	American eel	*Anguilla rostrata*	-	10
	American eel	*Anguilla rostrata*	-	17
	American eel	*Anguilla rostrata*	-	24
	American eel	*Anguilla rostrata*	-	32
	American eel	*Anguilla rostrata*	-	36
	American eel	*Anguilla rostrata*	-	20

*Note: Fish identifications have been reconfirmed.

Within the Haul Road ~~PA~~, four species of commercial, aboriginal, or recreational (CAR) interest were confirmed, the brook trout, American eel, white sucker and yellow perch. Brook trout (7) and American eel (36) were confirmed at Watercourse N (West River Sheet Harbour), Watercourse V (Tributary to Lake Alma), and Watercourse AH (Tributary to the Morgan River). White sucker (5) were confirmed at Watercourse N (West River Sheet Harbour) and Watercourse AA (tributary to Lake Alma). Based on the presence of the white sucker at Watercourse AA, this species is also expected to be present in Wetlands 159 and 160. The yellow perch was confirmed at Watercourse N (West River Sheet Harbour) and brook trout and American eel were confirmed at Watercourse AH, indicating these species will also be utilizing any associated available wetland habitat in Wetlands 171, 173 and 174 within the Haul Road ~~PA~~.

The preferred habitat for alewife, American eel, brook trout, white perch, white sucker, and yellow perch have been described in previous sections.

No maps exist within Nova Scotia with confirmed or potential spawning habitat and/or migratory routes for Yellow Sucker and White Perch.

Two fish species at risk (SAR) or species of conservation interest (SOCI) were captured within the Haul Road ~~PA~~ during electrofishing surveys: the American eel (COSEWIC T) ~~and the Blacknose dace (S3)~~ brook trout (S3). Details relating to these species are provided in Section 6.13.3.1.

Touquoy Mine Site

Fish observed from 2006 electrofishing surveys of Moose River as part of the EARD include; American eel, white sucker, and minnow species (CRA 2007).

6.9.3.3 Fish Collection

Fish collection was completed to support electrofishing and fish habitat surveys across the Beaver Dam Mine Site ~~footprint~~ and the Haul Road ~~PA~~. The focus of fish collection efforts was within two waterbodies within the Beaver Dam Mine Site ~~footprint~~ (Crusher Lake and Cameron Flowage) where fyke nets, minnow traps and eel pots were deployed at two locations within each waterbody to collect additional information about fish species and abundance within the PA. Minnow traps were also deployed within linear watercourses within the Haul Road ~~PA~~ during electrofishing, but as no lakes or other larger waterbodies are present within the Haul Road ~~footprint~~, no significant fish collection effort was completed within this portion of the PA.

Beaver Dam Mine Site ~~Footprint PA~~

Crusher Lake Fish Collection: A total of eight individual fish of two species were captured during netting at Crusher Lake Site A: banded killifish (*Fundulus diaphanus*; n=6) and golden shiner (*Notemigonus crysoleucas*; n=2). A total of six individual fish of two species were captured during netting at Crusher Lake Site B: brown bullhead (*Ictalurus nebulosus*; n=3) and golden shiner (*Notemigonus crysoleucas*; n=3).

Within Crusher Lake (both sampling locations) the relative abundance for the banded killifish is 42.9%, the golden shiner is 35.7% and the brown bullhead is 21.4%.

Table 6.9-9 Fish Species Captured within Crusher Lake Sites A and B

Species	Total Number Captured	Relative Abundance (%)	Species of Commercial, Aboriginal or Recreational (CAR) Interest	Species Ranking (ACCDC)	Average Length per species within Crusher Lake
Banded killifish (*Fundulus diaphanous*)	6	42.9	No	S5	8.45
Brown bullhead (Ictalurus nebulosus)	3	21.4	No	S5	13.33
Golden shiner (*Notemigonus crysoleucas*)	5	35.7	No	S5	8.63

Table 6.9-10 presents the results of the individual fish data collected at Site A and B within Crusher Lake.

Table 6.9-10 Individual Fish Data: Crusher Lake

Site	Equipment	Species	Scientific Name	Fork Length (cm)	Total Length (cm)
A	Eel Pot	Banded killifish	*Fundulus diaphanous*		8.9
A		Banded killifish	*Fundulus diaphanous*		8.5
A		Banded killifish	*Fundulus diaphanous*		7.4
A		Banded killifish	*Fundulus diaphanous*		8.8
A		Banded killifish	*Fundulus diaphanous*		8.4
A		Banded killifish	*Fundulus diaphanous*		8.7
A		Golden shiner	*Notemigonus crysoleucas*	7.9	8.5
A		Golden shiner	*Notemigonus crysoleucas*	8.0	8.4
A	Fyke Net	-No Fish-			
A	Minnow Trap 1	-No Fish-			
A	Minnow Trap 2	-No Fish-			
B	Eel Pot	Golden shiner	*Notemigonus crysoleucas*	8.5	9.0
B		Brown bullhead	*Ictalurus nebulosus*		12.5

Site	Equipment	Species	Scientific Name	Fork Length (cm)	Total Length (cm)
B	Fyke Net	Brown bullhead	*Ictalurus nebulosus*		11.5
B		Brown bullhead	*Ictalurus nebulosus*		16.0
B		Golden shiner*	*Notemigonus crysoleucas*		
B	Minnow Trap 1	-No Fish-			
B	Minnow Trap 2	Golden shiner	*Notemigonus crysoleucas*	7.3	8.0

*Note: Predation occurred on Golden Shiner in fyke net.

No CAR species or SAR/SOCI species were captured during fish collection efforts in Crusher Lake. Brook Trout were identified just north of Crusher Lake in WC-5, and are expected to be present in Crusher Lake, based on direct connectivity of WC-5 to Crusher Lake.

Cameron Flowage Fish Collection: A total of 15 individual fish of four species were captured during the surveys within Cameron Flowage Site A: brown bullhead (*Ictalurus nebulosus*; n=2), golden shiner (*Notemigonus crysoleucas*; n=5), white sucker (*Catostomus commersoni*; n=1) and yellow perch (*Perca flavescens*; n=7). A total of 12 individual fish of two species were captured during the surveys within Cameron Flowage Site B: white Sucker (*Catostomus commersoni*; n=1) and yellow perch (*Perca flavescens*; n=11).

Within Cameron Flowage (both sampling locations) the relative abundance of the yellow perch is 66.7%, golden shiner is 18.5% and the white sucker and brown bullhead are both at 7.4%.

Table 6.9-11 Fish Species Captured within Cameron Flowage Sites A and B

Species	Total Number Captured	Relative Abundance (%)	Species of Commercial, Aboriginal or Recreational (CAR) Interest	Species Ranking (ACCDC)	Average Length per species within Cameron Flowage
Brown bullhead (Ictalurus nebulosus)	2	7.4	No	S5	9.80
Golden shiner (*Notemigonus crysoleucas*)	5	18.5	No	S5	9.72
White sucker (*Catostomus commersoni*)	2	7.4	Yes	S5	14.55
Yellow perch (*Perca flavescens*)	18	66.7	Yes	S5	10.62

Table 6.9-12 presents the results of the individual fish data collected at Site A and B within Cameron Flowage.

Table 6.9-12 Individual Fish Data: Cameron Flowage

Site	Equipment	Species	Scientific Name	Fork Length (cm)	Total Length (cm)
A	Eel Pot	Yellow perch	*Perca flavescens*	12.3	13.5
A		Yellow perch	*Perca flavescens*	10.2	12.0
A		Yellow perch	*Perca flavescens*	7.3	8.9
A		Yellow perch	*Perca flavescens*	8.7	10.2
A		Golden shiner	*Notemigonus crysoleucas*	8.4	9.5
A		Yellow perch	*Perca flavescens*	10.2	11.9
A	Fyke Net	Yellow perch	*Perca flavescens*	11.1	11.9
A		Yellow perch	*Perca flavescens*	12.1	12.9
A		White sucker	*Catostomus commersoni*	13.9	15.7
A	Minnow Trap 1	Golden shiner	*Notemigonus crysoleucas*	9.2	10.1
A		Golden shiner	*Notemigonus crysoleucas*	9.4	10.1
A		Golden shiner	*Notemigonus crysoleucas*	9.4	10.1
A	Minnow Trap 2	Golden shiner	*Notemigonus crysoleucas*	7.9	8.8
A		Brown bullhead	*Ictalurus nebulosus*	-	10.0
A		Brown bullhead	*Ictalurus nebulosus*	-	9.6
B	Eel Pot	Yellow perch	*Perca flavescens*	11.2	11.7
B		Yellow perch	*Perca flavescens*	9.5	10.1
B		Yellow perch	*Perca flavescens*	7.8	9.1
B	Fyke Net	Yellow perch	*Perca flavescens*	11.4	12.0
B	Minnow Trap 1	Yellow perch	*Perca flavescens*	8.7	9.1
B		Yellow perch	*Perca flavescens*	9.6	9.9
B		Yellow perch	*Perca flavescens*	8.5	9.0
B		Yellow perch	*Perca flavescens*	8.9	9.3
B		Yellow perch	*Perca flavescens*	12.5	12.9
B		Yellow perch	*Perca flavescens*	8.4	9.1
B		Yellow perch	*Perca flavescens*	7.2	7.6
B		White sucker	*Catostomus commersoni*	13.0	13.4
B	Minnow Trap 2	No Fish			

Two CAR species were captured in Cameron Flowage: yellow perch and white sucker. Neither of these species was identified during electrofishing surveys within the Beaver Dam Mine Site ~~footprint PA~~. Presence of yellow perch and white sucker within Cameron Flowage indicates that these species may also be present within Wetland 59 (no fishing efforts were completed within this open water marsh), WC-12 and Wetland 56 (where open water is present). Fish collection was not completed in Mud Lake during the fish surveys in 2016. Mud Lake is present approximately 2 km upstream of Cameron Flowage (in a circular fashion), and it is reasonable to assume that species present in Cameron Flowage would also likely be present within Mud Lake and its associated wetland habitat (Wetland 17).

No SAR/SOCI species were identified during fish collection in Cameron Flowage.

Haul Road ~~PA~~

Minnow traps were deployed where possible during electrofishing surveys within the Haul Road ~~PA~~ watercourses to supplement fish habitat and electrofishing surveys. Limited water depth and lack of deeper pools in watercourses within the Haul Road ~~PA~~ resulted in limited fish collection opportunities. Where minnow traps were deployed, only one brook trout was captured in Watercourse V (tributary to Lake Alma). Brook trout was also captured during electrofishing surveys in this same watercourse, along with the American eel.

Table 6.9-13 Fish Species Captured along the Haul Road Watercourses

Watercourse	Trap Number	Species	Scientific Name	Fork Length (cm)	Total Length (cm)
B	Minnow Trap 1	---No Fish---			
B	Minnow Trap 2	---No Fish---			
B	Minnow Trap 3	---No Fish---			
N	Minnow Trap 1	---No Fish---			
N	Minnow Trap 2	---No Fish---			
N	Minnow Trap 3	---No Fish---			
V	Minnow Trap 1	Brook trout	*Salvelinus fontinalis*	6.75	7.0
V	Minnow Trap 2	---No Fish---			

*Watercourses H, O, AA, and AH did not have enough depth in pooling water to allow for deployment of minnow traps.

6.9.3.4 Characterization of Fish Populations

Table 6.9-14 outlines the results of the two-pass depletion analyses for fish populations for the watercourses within the Haul Road ~~PA~~ where electro-fishing was completed in 2016. The two-pass method allows for calculation of fish density estimates.

Table 6.9-14 Two-Pass depletion population estimates for fish caught within the Haul Road ~~PA~~

Species	Watercourse	N	Variance of N	Standard Error of N
American eel (*Anguilla rostrata*)	N	25	25.926	5.092
	V	NA*	NA*	NA*
	AH	16.2	26.957	5.192
Banded killifish (*Fundulus diaphanous*)	N	NA*	NA*	NA*
	AA	NA*	NA*	NA*
Brook trout (*Salvelinus fontinalis*)	N	NA*	NA*	NA*
	V	8	24	4.899
	AH	1	0	0

Species	Watercourse	N	Variance of N	Standard Error of N
Golden shiner (*Notemigonus crysoleucas*)	AA	NA*	NA*	NA*
Lake chub (*Couesius plumbeus*)	N	NA*	NA*	NA*
	AA	1	0	0
White sucker (*Catostomus commersoni*)	N	NA*	NA*	NA*
	AA	1	0	0
Yellow perch (*Perca flavescens*)	N	1	0	0
Notes: N = population estimate; * Two pass estimates fail if the catch on the second pass equals or exceeds that on the first pass (Heimbuch et al., 1997).				

The total number of fish of each species was used to estimate the fish populations using the Two-Pass depletion method. These numbers form a baseline estimate of population that can be compared between sites and, over time, at each of the watercourses within the Haul Road ~~PA~~.

Single-pass surveys provide a representative index of species diversity (Reid et al., 2009). Single-pass electrofishing can be used to detect spatial and temporal trends in abundance and species richness given standardized effort, but may not be representative of absolute population densities (Bertrand et al., 2006). Single pass surveys were completed within watercourses in the Beaver Dam Mine Site ~~footprint PA~~ from electrofishing surveys in 2015. This method allows for calculation of catch per unit effort (standardized quantification of species richness and identification of trends). This calculation was also completed for fish collection efforts (netting) within the Beaver Dam Mine Site ~~footprint PA~~ completed in 2016.

Table 6.9-15 Catch Per Unit Effort (CPUE) for Linear Watercourses in Beaver Dam Mine Site ~~Footprint PA~~

Watercourse	CPUE
WC-4	0.858
WC-5 (top near WL2	NA
WC-5 (lower near WL14)	0.233
WC-3 (top near WL2)	NA
WC-3 (lower near WL20	NA
WC-12	0.923
WL56	0.531
WC-13	7.005
WL59	NA
Note: NA - No fish were caught.	

Table 6.9-16 Catch Per Unit Effort (CPUE) for Cameron Flowage and Crusher Lake

Site	Equipment	CPUE
Cameron Flowage		
A	Eel	1.401
	Fyke	0.610
	Minnow 1	0.604
	Minnow 2	0.717
B	Eel	0.616
	Fyke	0.195

Site	Equipment	CPUE
	Minnow 1	1.574
	Minnow 2	NA
Crusher Lake		
A	Eel	1.690259877
	Fyke	NA
	Minnow 1	NA
	Minnow 2	NA
B	Eel	0.456308465
	Fyke	0.679194023
	Minnow 1	NA
	Minnow 2	0.228154232
	Minnow 1	NA
	Minnow 2	0.228154232
Note: NA - No fish were caught		

The total number of fish of each species was used to calculate Catch per unit effort (CPUE) for each piece of fishing equipment. The numbers form a baseline estimate of catch per unit effort that can be compared between sites and, over time, at each of the watercourses within the Beaver Dam Mine Site ~~footprint PA~~ and within Cameron and Crusher Lakes.

6.9.3.5 Water Quality

Water quality results are reported and discussed as it relates to the chemical characteristics required for suitable fish habitat. Where applicable, water quality sampling results are measured against the Canadian Council for Ministers of the Environment (CCME) Guidelines for the Protection of Aquatic Life (FWALs). Summaries of water quality measurements are presented in Table 6.9-17 and 6.9-18 for linear watercourses and Cameron Flowage in the Beaver Dam Mine Site ~~footprint~~ and the Haul Road ~~PA~~ respectively.

Table 6.9-17 Water quality measurements in the Beaver Dam Mine Site ~~footprint PA~~

Watercourse	Sampling Date	Water Temp. (^{o}C)	pH	Dissolved Oxygen (mg/L)	TDS (g/L)
WC-3 (top- near WL2)	Sept 18, 2015	16.35	4.66	18.09	0.02
WC-3 (lower- near WL20)	Sept 18, 2015	18.71	4.3	18.45	0.02
WC-4	Sept 17, 2015	13.50	5.98	14.36	0.05
WC-5 (top- near WL2)	Sept 17, 2015	17.87	5.10	19.99	0.05
WC-5 (lower- near WL14)	Sept 17, 2015	19.85	4.16	18.13	0.02
WC-12	Sept 18, 2015	14.13	5.54	14.11	0.05
WC-13	Sept 18, 2015	22.1	5.36	17.34	0.03
WL59	Sept 18, 2015	23.43	6.31	15.85	0.03
WL56	Sept 18, 2015	16.56	5.40	17.60	0.03
Benthic Sampling Locations (2016)					
WC-13	June 24, 2016	21.10	5.37	6.92	0.03
WC-4	June 24, 2016	13.8	6.55	9.28	0.02
WC-5	June 24, 2016	20.4	6.42	8.15	0.01

Watercourse	Sampling Date	Water Temp. (^{0}C)	pH	Dissolved Oxygen (mg/L)	TDS (g/L)
Fish Collection Locations (2016)					
Cameron Flowage	June 24, 2016	21.8	6.71	7.42	0.02

Table 6.9-18 Water quality measurements within the Haul Road ~~PA~~

Watercourse	Sampling Date	Water Temp. (^{0}C)	pH	Dissolved Oxygen (mg/L)	TDS (g/L)
B	June 22, 2016	22.1	4.61	3.9	0.05
H	June 22, 2016	18.2	6.19	6.3	0.05
N	June 22, 2016	18.9	5.65	8.7	0.02
O	June 23, 2016	14.0	6.04	5.3	-
V	June 23, 2016	15.5	3.43	9.3	0.05
AA	June 23, 2016	20.5	5.39	6.6	-
AH	June 23, 2016	19.5	5.53	7.4	-
Note: TDS was not collected at Watercourse Q, AC and AJ based on available parameters on the field measurement device.					

Fish species of commercial, aboriginal, or recreational interest (CAR species) identified within the PA include brook trout, white sucker, yellow perch, ~~Smallmouth Bass~~, and American eel. SAR/SOCI fish species identified include the American eel (also a CAR species) ~~and the Blacknose Dace~~. The Atlantic salmon (southern uplands population) is also potentially present within the PA and is confirmed to be in surrounding watercourses (Killag River and West River Sheet Harbour). The Atlantic salmon was not observed during electrofishing and fish collection surveys within the PA.

The Nova Scotia Trout Management Plan NS (NSDAF, 2005) identifies three classes of streams based on water quality and pH for trout species (including brook trout which is present within the Beaver Dam Mine Site ~~PA~~). Class A streams (Cool) require the average summer temperature to be <16.5 degrees Celsius. Class B streams (intermediate) temperature (average summer) ranges from 16-5-19 degrees Celsius. Finally, Class C streams (warm) require temperatures above 19 degrees or pH of <4.7 (NSDAF, 2005). The identification, maintenance, protection, and enhancement of instream habitats of class A and class B waters can benefit the trout fishery. Average summer temperatures were not collected as part of baseline surveys completed within the Beaver Dam Mine ~~PA~~. However, results shown in Tables 6.6-17 and 6.6-18 can provide information relating to the generally quality of the streams present within the PA for trout. Streams with elevated temperatures in June (WC-B, AA, AH for example) would likely demonstrate average temperatures above 19 degrees Celsius and be classified as warm streams (lower quality for trout). Watercourse 3 and Watercourse V also have low pH indicating they are Class C (warm) streams. Watercourse 4, Watercourse 12 and Watercourse O indicate potential Class A streams (cool) based on temperature readings available (not confirmed average summer temperatures).

Water temperature affects the metabolic rates and biological activity of aquatic organisms, thus influencing the use of habitat by aquatic biota. There are no CCME guidelines related to temperature and aquatic biota. Temperature preferences of fish vary between species, as well as with size, age, and season.

Trout and salmon are coldwater fish species, meaning they require cold water to live and reproduce. The optimal temperature range for these species (growth of juvenile) is 10-20°C (The Stream Steward, n.d.) to 16-20°C (Fisheries and Oceans Canada, 2012) (trout and salmon, respectively). Other CAR species observed have higher temperature ranges: ~~Blacknose Dace 19-25°C (Ontario Freshwater Fishes Life History Database, n.d.),~~ yellow perch 21-24°C (Brown, Runciman, Bradford, & Pollard, 2009), and white sucker 19-26°C (Kelly, 2014). American eels have a broader temperature range and can tolerate temperatures from 4 to 25 ºC ("American eel Fact Sheet," 2006).

Temperatures recorded in watercourses during electrofishing and fish collection in September 2015 and June 2016 ranged from 13.5⁰C (WC-4 within Beaver Dam Mine Site ~~footprint~~) to 23.43 ⁰C (Wetland 59 within Beaver Dam Mine Site ~~footprint~~). Generally, the range of temperatures within watercourses is within the required ranges for the species identified during field surveys. The warmer temperatures identified in WC-13 and Wetland 59 in the Beaver Dam Mine Site ~~footprint PA~~, and WC-B and WC-AA within the Haul Road ~~PA~~ are above the optimal range for salmonids including the brook trout and the Atlantic salmon (if present).

The CCME guidelines for the Protection of Aquatic Life establish that a range of pH from 6.5 to 9.0 is suitable within freshwater habitat. All watercourses measured in 2015 within the Beaver Dam Mine Site ~~footprint PA~~ had pH levels below the range suitable for fish within freshwater habitat (see Table 6.6-17). In 2016, during a benthic sampling event, the pH in WC-4 was recorded slightly higher than in 2015 and just within the lower end of the acceptable CCME range at 6.55. The pH within Cameron Flowage was recorded at 6.71 in 2016. Levels of pH in all watercourses within the Haul Road ~~PA~~ reported below the range suitable for fish within freshwater habitat (Table 6.6-18).

Levels of pH that were reported below the suitable range indicate the presence of acidification within watercourses across the PA. Kalff (2002) indicates that the loss of fish populations is gradual and depends on fish species, but decline is evident when pH is <6.5. He further states that a 10-20% species loss is apparent when pH<5.5.

The survival of juvenile rearing of Atlantic salmon requires freshwater pH >4.7. The Recovery Potential Assessment for the salmon completed by Fisheries and Oceans Canada indicates that acidification is an extreme threat to the salmon population (Gibson and Bowlby, 2013). Yellow perch are found in Ontario lakes with a pH range from approximately 3.9 to 9.5. Yellow perch are relatively tolerant of low pH, but reproductive success is reduced in lakes with pH < 5.5 (Krieger, Terrell, & Nelson, 1983). White suckers have been collected from areas with a pH as low as 4.3 (Dunson and Martin, 1973, as cited in Twomey, Williamson, & Nelson, 1984), but Beamish (1974) reported sharp declines in White sucker populations in Canadian lakes when the pH was lowered to 4.5 to 5.0 as a result of acid precipitation. Brook trout tolerate acidic conditions particularly well, compared with other species. They have been known to survive at pH 3.5, though only in unusual circumstances. Realistically, the lower limits are around pH 4.8 (Soil & Water Conservation Society of Metro Halifax, 2016). American eels are also more tolerant of low pH than are many other species, although densities and growth rates may be adversely affected by direct mortalities or declining abundance of prey as productivity declines at low pH (Jessop, 1995).

The atmosphere and photosynthesis by aquatic vegetation are the major sources of DO in water (CCME, 1999a). However, the amount of oxygen available for aquatic life (i.e. the concentration of oxygen in water) is affected by several independent variables including water temperature, atmospheric and hydrostatic pressure, microbial respiration, and growth of aquatic vegetation; DO can vary daily and seasonally (CCME, 1999a). The CCME guidelines for the Protection of Aquatic Life establish a minimum recommended concentration of DO of 9.5 mg/L for early life stages of cold water biota and 6.5 mg/L for other life stages (CCME, 1999a). DO levels recorded across the watercourses and waterbodies within the PA were above the recommended concentrations for both life stages of cold water biota.

Total Dissolved Solids (TDS) is a measurement of inorganic salts, organic matter and other dissolved materials in water. TDS causes toxicity through increases in salinity, changes in the ionic composition of the water and toxicity of individual ions. TDS field measurements within PA watercourses range from 0.01 to 0.05 g/L (10-50 mg/L TDS). A recent study by Weber-Scannell & Duffy (2007) reported a variety of studies that evaluated the effect of elevated TDS on freshwater aquatic invertebrates. These studies reported the commencement of effect at 499 mg/L, and most effects aren't observed until >1000 mg/L. With fish, research is limited, but preliminary studies reported in Weber-Scannell and Duffy demonstrated survival rates of salmonid embryos to elevated TDS (38% survival when exposed to 2229 mg/L for Brook trout, and 35% survival when exposed to 1395 mg/L). TDS field measurements within PA watercourses were reported between 10-50 mg/L.

The Nova Scotia Salmon Association (NSSA) is currently conducting a liming project in tertiary watersheds that are located within the PA. In order to offset the acidity of watercourses and improve water quality for Atlantic salmon, the project utilizes lime dosers (an automated system that combines powdered limestone with the watercourse) as well as helicopters that add lime to the soils within the Killag River tertiary watershed. Two lime dosers are currently in use, they are located within the West River Sheet Harbour (watercourse N) and the Killag River (Table 6.9-19; Figure 6.7-3; Figure 6.7-1). The West River Sheet Harbour lime doser, which was installed in September 2005, is located approximately 8.5 km upstream of the intersection between the Beaver Dam Mine Road and West River Sheet Harbour. The Killag River lime doser is located approximately 400 m downstream of the Beaver Dam Mine Site component of the PA. This lime doser was more recently installed, in November 2017.

Catchment liming is ongoing within the Brandon Lake Tertiary Watershed (1EM-2G), adjacent to Keef Brook (watercourse H) (Figure 6.7-3B). Watercourse H is located within the Haul Road (Beaver Dam Mines Road) as a throughflow through Wetland 79. Watercourse H eventually empties into the West River Sheet Harbour.

Table 6.9-19 Lime Doser Information

Name	Location	Installation Date
West River Lime Doser	20T 515713 m E 4988956 m N	September 1, 2005
Killag River Lime Doser	20T 523215 m E 4990075 m N	November 1, 2017
Catchment Liming – Keef Brook	Brandon Lake Tertiary Watershed	October 2016 and 2017

6.9.3.6 Aquatic Ecosystem Condition

The total number of animals of each type (taxonomic group), as well as total abundance, was determined for each sample collected from the watercourses within the Beaver Dam PA. These numbers were used to calculate several indices of baseline benthic community health, which can be compared between sites and, with time, at each site (an index of community health is like a body mass index or an IQ, which gives a single number that can be used to compare individuals or things). Indices calculated are all commonly used in studies of this kind and include: EPT Ratio (ratio of abundance of mayflies (Ephemeroptera), caddisflies (Trichoptera), and stoneflies (Plecoptera), to total numbers of organisms); Total Abundance (number of animals in the sample and per unit area); and Taxon Richness (number of taxa per sample). Abundance in kicknet samples was expressed on a per sample basis. All organisms present were included in estimates. Sediment descriptions for the ten samples (and associated sub-set samples) are presented in Table 6.9-20. Species identifications, Total Abundance, Taxon Richness and EPT Ratio measures are presented in Table 6.9-21.

Samples were dominated in numbers by Diptera (fly) larvae, principally midges (Chironomidae) at all sites and by juvenile clams (Bivalves), predominantly Sphaeriidae at Watercourse 13. Caddisfly larvae (Trichoptera) occurred frequently at all sites with the exception of one (WC-B.b), and may fly larvae (Ephemeroptera) occurred at twelve of the fourteen sites. Aquatic beetle larvae (Coleoptera), dragonfly/damselfly larvae (Odonata), stonefly larvae (Plecoptera) and dobsonfly/fishfly larvae (Megaloptera) occurred frequently at most sites. Aquatic Hemiptera (i.e. Gerridae, Corixidae, etc.) also occurred in many of the sites, as well as crustaceans, including the amphipod Hyalella azteca (found only at Watercourse 13), and copepods & cladocera (found at a total of eight sites).

Table 6.9-20 Sediment Characteristics at each Benthic Sampling Location

Characteristics of Sediments in kicknet samples, Beaver Dam collected June 22-24, 2016.	
Sample	**Sediment Description**
Beaver Dam Mine Site ~~Footprint PA~~	
Watercourse 4	Abundant fines (mud) with organics (woody, plant and other organic debris) and occasional animal casings.
Watercourse 5	Fines and medium to fine sand with organics (woody, plant and other organic debris) and occasional animal casings.
Watercourse 13	Sand with organics (woody, plant and other organic debris) and occasional mollusk shells and animal casings.
Haul Road ~~PA~~	
Watercourse B.a	Silt to fine sand with detritus, plant and woody debris and animal casings.
Watercourse B.b	Silt with minor amounts fine to medium sand, as well as, organics (woody, plant and other organic debris) and large amounts of animal casings.
Watercourse B.c	Silt with minor amounts fine sand, as well as, organics (woody, plant and other organic debris) and large amounts of animal casings.
Watercourse B.d	Silt with minor amounts fine to medium sand, as well as organics (woody, plant and other organic debris) and large amounts of animal casings.
Watercourse H (Keef Brook)	Abundant amounts of organics (plant, woody and other organic debris) with occasional silt and sand, as well as animal casings.
Watercourse N	Coarse sand to silt with organics (plant, woody and other organic debris).
Watercourse V	Medium to coarse sand with occasional fines and organics (plant, woody and other organic debris), as well as animal casings.
Watercourse AA	Medium to coarse sand and organics (plant, woody and other organic debris), as well as animal casings.

Characteristics of Sediments in kicknet samples, Beaver Dam collected June 22-24, 2016.	
Watercourse AH	Medium to coarse sand and organics (plant, woody and other organic debris), as well as occasional animal casings.
Watercourse O.a	Medium to coarse sand and organics (plant, woody and other organic debris), as well as occasional animal casings. Sample material had a noticeable film coating it, before washing.
Watercourse O.b	Medium to coarse sand and organics (plant, woody and other organic debris). Sample material had a noticeable film coating it, before washing.
Grain size classes: cobble = 6.4 cm and larger; pebble/gravel = 4 mm to 6.4 cm; sand = 0.063 mm to 2 mm; silt = 0.004 mm to 0.063 mm; clay = <0.004 mm.	

Table 6.9-21 Total Abundance, Benthic Sampling Locations

Total Abundance of organisms from samples, Beaver Dam, Nova Scotia, June 22-24, 2016.							
Location	Watercourse						
	4	5	13	B.a	B.b	B.c	B.d
Abundance	#	#	#	#	#	#	#
Diptera							
Certapogonidae-*Probezzia/Bezzia* sp	0	0	2	6	10	7	2
Chironomidae larvae	114	809	361	133	165	213	136
Chironomidae pupae	2	13	13	5	7	5	3
Diptera adult	0	1	0	1	0	1	0
Diptera larvae	0	2	0	0	0	0	1
Empididae larvae	0	0	0	0	0	0	0
Simuliidae larvae	1	6	5	1	0	0	0
Simuliidae pupae	0	3	0	0	1	0	0
Tipulidae larvae	0	0	0	0	1	0	0
Coleoptera							
Dytiscidae adult	2	0	0	0	0	0	0
Dysticidae larvae-*Ilybius*? sp	0	1	0	0	0	0	0
Dytiscidae larvae-*Hydroporus/Hygrotus* sp	1	0	0	0	0	0	0
Elimidae adult	1	0	0	0	0	0	0
Elmidae larvae-*Stenelmis* sp	0	8	9	0	0	0	0
Hydrophilidae adult	0	1	0	0	0	0	0

Total Abundance of organisms from samples, Beaver Dam, Nova Scotia, June 22-24, 2016.							
Location	Watercourse						
	4	5	13	B.a	B.b	B.c	B.d
Abundance	#	#	#	#	#	#	#
Ephemeroptera							
Ephemerellidae-*Eurylophella* sp	0	1	0	0	0	0	0
Ephemerellidae	0	0	1	0	0	0	0
Ephemeroptera-sp A	0	0	16	0	0	0	0
Ephemeroptera-sp B	0	0	4	0	0	0	0
Ephemeroptera-unidentified	0	1	12	5	1	3	2
Heptogeniidae	0	0	0	5	0	0	1
Leptophlebiidae-*Paraleptophlebia*? sp	0	0	1	0	0	0	0
Plecoptera							
Leuctridae-*Leuctra* sp	0	11	0	0	0	0	0
Perlodidae	0	0	0	1	0	0	0
Plecoptera-unidentified	0	8	0	0	0	0	0
Plecoptera-pupae	0	0	0	2	0	0	0
Trichoptera							
Hydropsychidae-*Diplectrona* sp	0	1	0	0	0	0	0
Hydropsychidae-*Hydropsyche* sp	0	1	1	0	0	0	0
Hydroptilidae-*Oxytheria* sp	0	0	0	1	0	1	1
Leptoceridae-*Oecetis*? sp	0	0	1	0	0	0	0
Limnephilidae *Grammotaulius*	1	0	0	0	0	0	0
Limnephilidae	0	0	0	0	0	0	1
Philopotamidae-*Chimarra* sp	1	1	1	0	0	0	0
Polycentropodidae	0	1	0	0	0	0	0
Polycentropodidae-*Polycentropus*	0	2	0	0	0	0	0
Trichoptera-unidentified	0	9	0	1	0	0	0
Odonata							

Total Abundance of organisms from samples, Beaver Dam, Nova Scotia, June 22-24, 2016.							
Location	Watercourse						
	4	5	13	B.a	B.b	B.c	B.d
Abundance	#	#	#	#	#	#	#
Aeshnidae-*Aesha*	0	1	3	0	0	0	0
Calopterygidae-*Calopteryx*	0	1	6	0	0	0	0
Coenagrionidae-*Argia*	0	0	1	0	0	0	0
Cordulegastridae-*Cordulegaster*	0	0	3	1	1	0	0
Odonata-unidentified	0	0	0	0	0	0	3
Megaloptera							
Corydalidae-*Chauliodes* sp	0	0	0	1	0	0	0
Corydalidae-*Nigronia* sp	0	6	1	0	0	0	0
Sialidae-*Sialis* sp	1	0	0	0	6	4	4
Collembola							
Collembola	0	0	0	1	0	1	0
Hemiptera							
Corixidae	0	0	0	2	0	0	2
Gerridae	1	1	0	3	0	1	1
Hemiptera-unidentified	0	1	0	6	0	0	0
Notonectidae	0	0	0	3	0	0	0
Pleidae-*Neoplea*	0	0	0	1	0	0	0
Vellidae-*Rhagorelia*	0	0	2	0	0	0	0
Vellidae-sp. A	0	1	0	0	0	0	0
Vellidae-sp. B	0	1	0	0	0	0	0
Hirudinea							
Helobdella stagnalis	0	0	1	0	0	0	0
Hydrachnidia							
Hydrachnidia sp. A	0	0	1	0	0	0	0
Hydrachnidia sp. B	0	0	1	0	0	0	0

Total Abundance of organisms from samples, Beaver Dam, Nova Scotia, June 22-24, 2016.							
Location	Watercourse						
	4	5	13	B.a	B.b	B.c	B.d
Abundance	#	#	#	#	#	#	#
Hydrachnidia sp. C	0	1	0	0	0	0	0
Hydrachnidia sp. D	0	0	0	0	1	0	0
Hydrachnidia sp. E	0	0	0	0	0	0	0
Hydrachnidia sp. F	0	0	0	0	0	0	0
Hydrachnidia sp. G	0	0	0	0	0	0	0
Oligochaeta							
Oligochaete	16	4	13	1	0	0	1
Nematoda							
Nematoda	0	0	0	1	1	0	0
Mollusca							
Hydrobiidae-*Amnicola limosa*?	0	0	23	0	0	0	0
Lymnaeidae-*Fossaria*? sp	0	0	1	0	0	0	0
Sphaeriidae	30	2	211	0	0	0	0
Crustacea							
Amphipoda-*Hyalella azteca*	0	0	9	0	0	0	0
Cladocera	0	0	0	24	14	16	22
Copepoda	8	48	0	0	2	0	1
Thysanoptera							
Thysanoptera-Thrip	0	0	0	0	0	0	0
Other							
Ant - terrestrial	0	0	0	0	0	1	0
Arachnida - terrestrial	0	0	0	2	0	0	1
Casts	2	5	31	56	10	20	6
SUMMARY							
Abundance (#/sample)	179	947	703	205	210	253	181

Total Abundance of organisms from samples, Beaver Dam, Nova Scotia, June 22-24, 2016.							
Location	Watercourse						
	4	5	13	B.a	B.b	B.c	B.d
Abundance	#	#	#	#	#	#	#
Taxon Richness	13	30	27	22	12	10	15
EPT:Total Ratio (%)	1.1	3.8	5.3	7.3	0.5	1.6	2.8
A question mark (?) after a name indicates a lack of key features to further identify organisms.							

Table 6.9-22 Total Abundance, Benthic Sampling Locations

Abundance of organisms from samples, Beaver Dam, Nova Scotia, June 22-24, 2016.							
Location	Watercourse						
	H	N	V	AA	AH	O.a	O.b
Abundance	#	#	#	#	#	#	#
Diptera							
Certapogonidae-*Probezzia/Bezzia* sp	1	0	0	8	0	0	0
Chironomidae larvae	198	60	41	494	69	88	154
Chironomidae pupae	10	1	3	16	6	7	26
Diptera adult	1	1	4	0	3	0	0
Diptera larvae	0	1	0	0	0	0	0
Empididae larvae	1	1	0	0	1	0	0
Simuliidae larvae	13	3	148	28	9	0	2
Simuliidae pupae	1	1	7	10	0	0	0
Tipulidae larvae	0	1	0	0	0	0	0
Coleoptera							
Dytiscidae adult	1	0	1	0	0	1	2
Dysticidae larvae-*Ilybius*? sp	0	0	4	0	0	0	6
Dytiscidae larvae-*Potamonectes*? sp	0	0	0	2	0	0	2
Gyrinidae? adult	0	0	1	0	0	0	0
Elmidae larvae-*Promoresia* sp	0	3	9	6	13	0	0
Elmidae larvae-*Stenelmis* sp	0	0	0	2	0	0	0
Elmidae larvae-unidentified	0	1	0	0	0	0	0
Ephemeroptera							
Baetidae	0	2	0	0	0	0	0
Ephemerellidae-*Eurylophella* sp	0	1	0	0	10	0	0
Ephemerellidae	1	0	0	6	0	0	0
Ephemeroptera-unidentified	0	1	0	8	0	10	18

Abundance of organisms from samples, Beaver Dam, Nova Scotia, June 22-24, 2016.							
Location	Watercourse						
	H	N	V	AA	AH	O.a	O.b
Abundance	#	#	#	#	#	#	#
Heptogeniidae	2	1	0	10	0	0	0
Heptogeniidae-*Stenonema* sp	0	0	0	0	8	0	0
Plecoptera							
Leuctridae	0	0	3	4	0	6	20
Nemouridae	3	0	16	0	0	0	0
Perlodidae	2	1	0	0	0	0	0
Plecoptera-unidentified	1	0	17	0	3	9	54
Plecoptera-pupae	0	0	1	0	0	2	0
Trichoptera							
Brachycentridae-*Brachycentrus*? sp	0	2	0	0	0	0	0
Brachycentridae-*Micrasema*? sp	0	0	0	4	6	0	0
Hydropsychidae-*Hydropsyche* sp	1	1	0	0	0	0	0
Hydropsychidae	0	4	0	0	0	0	0
Hydroptilidae-*Hydroptila* sp	0	10	0	0	4	0	0
Hydroptilidae-*Oxytheria* sp	0	0	0	0	0	15	86
Hydroptilidae-*Palaeaganetes* sp	0	0	0	0	0	3	2
Hydroptilidae	0	0	0	6	0	0	0
Leptoceridae-*Ceraclea* sp	0	1	0	0	0	0	0
Leptoceridae-*Oecetis*? sp	0	1	0	2	9	1	0
Leptostomatidae-*Lepidostoma* sp	2	0	7	2	5	1	10
Limnephilidae *Grammotaulius*? sp	0	0	1	0	0	0	0
Limnephilidae-sp A	0	0	0	0	0	9	8
Philopotamidae-*Chimarra* sp	0	0	0	18	3	0	0
Polycentropodidae-*Polycentropus* sp	0	0	0	0	0	2	6
Phrygeneidae?	0	0	0	0	0	1	2
Rhyacophilidae?	0	0	0	2	1	0	0
Trichoptera pupae	2	4	0	2	0	0	0
Odonata							
Aeshnidae-*Aesha* sp	0	0	0	0	0	0	2
Calopterygidae-*Calopteryx* sp	2	0	0	0	0	0	0
Coenagrionidae-*Argia* sp	0	0	0	0	1	0	0
Corduliidae	0	0	0	2	0	0	0
Megaloptera							

Abundance of organisms from samples, Beaver Dam, Nova Scotia, June 22-24, 2016.							
Location	Watercourse						
	H	N	V	AA	AH	O.a	O.b
Abundance	#	#	#	#	#	#	#
Corydalidae-*Nigronia* sp	0	0	0	2	0	0	0
Sialidae-*Sialis* sp	0	0	0	0	0	0	2
Collembola							
Collembola	16	0	11	4	0	1	2
Hemiptera							
Aphidae	0	0	0	2	0	0	0
Corixidae	0	0	0	8	0	0	0
Gerridae	9	0	1	8	0	0	0
Mesoveliidae	0	0	0	62	50	0	0
Hirudinea							
Hirundea sp A	0	0	0	2	0	0	0
Hydrachnidia							
Hydrachnidia sp. A	0	0	0	0	0	0	0
Hydrachnidia sp. B	0	0	0	0	0	0	0
Hydrachnidia sp. C	0	0	2	0	0	5	6
Hydrachnidia sp. D	0	0	0	0	0	0	0
Hydrachnidia sp. E	0	0	1	0	0	0	0
Hydrachnidia sp. F	0	0	1	0	0	0	0
Hydrachnidia sp. G	1	0	0	0	0	0	0
Oligochaeta							
Oligochaete	1	0	0	4	2	0	0
Nematoda							
Nematoda	0	0	0	0	0	0	0
Mollusca							
Sphaeriidae-*Sphaerium* sp	0	8	0	0	0	0	0
Sphaeriidae	0	0	0	6	0	0	0
Crustacea							
Cladocera	0	0	0	22	0	0	0
Copepoda	0	0	0	10	0	1	0
Thysanoptera							
Thysanoptera-Thrip	0	0	0	0	0	1	0
Other							
Arachnida - terrestrial	1	0	0	0	0	0	0

Abundance of organisms from samples, Beaver Dam, Nova Scotia, June 22-24, 2016.							
Location	Watercourse						
	H	N	V	AA	AH	O.a	O.b
Abundance	#	#	#	#	#	#	#
Casts	22	0	10	6	0	2	0
SUMMARY							
Abundance (#/sample)	269	110	279	762	203	163	410
Taxon Richness	21	23	20	31	18	18	19
EPT:Total Ratio (%)	5.2	26.4	16.1	8.4	24.1	36.2	50.2
A question mark (?) after a name indicates a lack of key features to further identify organisms.							

Taxon richness indicates the health of the community through its diversity, and increases with increasing habitat diversity, suitability, and water quality. Taxon richness equals the total number of taxa represented within the sample. The healthier the community is, the greater the number of taxa found within that community. Similarly, a high abundance may indicate a healthier waterbody.

The EPT index is named for three orders of pollution sensitive aquatic insects that are common in the benthic macroinvertebrate community: Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) and is commonly used as an indicator of water quality (i.e., the greater percentage of the total sample comprised of EPT organisms indicates a healthier site). Generally speaking, the EPT index increases with increasing water quality. However, there are many factors that regulate the distribution and abundance of benthic macroinvertebrates within aquatic environments (as well as biological condition within a waterbody), thus the results of this study only allow for the establishment of baseline conditions that can later be used in a monitoring program to identify potential changes to water quality within these specific environments.

As previously mentioned, there are several factors that regulate the distribution and abundance of benthic macroinvertebrates, including current speeds, temperature, altitude, season, substratum, vegetation, dissolved substances (e.g., oxygen), and pH (Hussain & Pandit, 2012). In order to illustrate the effects of some of these factors, temperature and pH will be discussed in relation to their effects on benthic macroinvertebrates.

The distribution and community structure of benthic macroinvertebrates is limited by their ability to live within a specific temperature range. Temperature affects their emergence patterns, growth rates (Sweeney & Schnack, 1977), metabolism (Angelier, 2003), reproduction (Vannote & Sweeney, 1980), and body size (Sweeney & Schnack, 1977).

Benthic macroinvertebrates vary in their sensitivity to pH (i.e., values below 5.0 and greater than 9.0 are considered harmful) (Yuan, 2004). However, studies have shown that low pH values are associated with lower diversity of benthic macroinvertebrates (Thomsen & Friberg, 2002), and cause decreased emergence rates in them (Hall, Likens, Fiance, & Hendrey, 1980), for example.

Overall abundance and taxon richness within PA watercourses were low to moderate (110-947 individuals/sample and 10-31 taxon, respectively), and EPT ratios low at eight of the sites (0.5-8.4%) and moderate (16.1-50.2%) at the remaining sites (Watercourse N, V, AH, O). The occurrence of Mollusca at some of the sites, in addition to the EPT groups (Trichoptera, Ephemeroptera and Plecoptera) at most sites suggests that dissolved oxygen and water quality is acceptable, as these groups generally are associated with aquatic habitat having good water quality.

6.9.4 Consideration of Consultation and Engagement Results

Key issues raised during public consultation and Mi'kmaq engagement relating to fish and fish habitat include potential indirect effects from wetland alteration or changes to surface water and groundwater quality and quantity on fish and fish habitat. A high value was placed on fish and fish habitat in the receiving waters based on engagement with stakeholders and the Mi'kmaq of Nova Scotia.

The results of the public consultation and Mi'kmaq engagement have been considered in the environmental effects assessment, including the Proponent's commitments on mitigation and monitoring measures and proposed compliance and effects monitoring programs, as well as the Proponent's broader commitment to ongoing public consultation and Mi'kmaq engagement. Specific to evaluating the effect on fish and fish habitat, these are found within the following environmental effects assessment.

6.9.5 Effects Assessment Methodology

6.9.5.1 Boundaries

Spatial Boundaries

The spatial boundaries used for the assessment of effects to fish and fish habitat are ~~the Project areas for the Beaver Dam Mine Site footprint and the Haul Road, and the LAA consisting of surface water systems immediately adjacent to and receiving drainage from the PAs, within each affected tertiary watershed (seven along Haul Road PA and three within the Beaver Dam Mine Site footprint PA).~~ defined below:

The PA (Figure 5.4-1) consists of the three project components; Beaver Dam Mine Site, Touquoy Mine Site, and the Haul Road and extends from Marinette to Moose River Gold Mines, Halifax County, NS. The Beaver Dam Mine Site is located at the eastern end of the Beaver Dam Mines Road and has been extended to the east and west in order to encompass the micro siting of the till stockpile and the waste rock stockpile, respectively. The Haul Road spans from the Beaver Dam Mine Site to Moose River Gold Mines, where the Touquoy Mine Site [processing and exhausted pit (to be used to dispose Beaver Dam tailings)] is located.

The LAA (Figure 6.7-12) consists of portions of downstream aquatic habitats and headwaters where appropriate, depending on project activities, up to the maximum size of the tertiary watershed(s). The LAA boundaries were defined considering the maximum expected extent of direct and indirect impacts to the aquatic environment as well as the location of project activities across all three project components.

The RAA (Figure 6.7-13) encompasses the three secondary watersheds that the PA is located within. These watersheds are the West River Sheet Harbour secondary watershed, the Tangier River secondary watershed, and the Fish River secondary watershed. The RAA is broader than expected project impacts and considers other project boundaries as per the cumulative effects methodology.

As the Project has the potential to cause direct and indirect effects to fish and fish habitat outside of the PA, the LAA is the appropriate boundary for evaluation of this VC.

Temporal Boundaries

The temporal boundaries used for the assessment of effects to fish and fish habitat are the construction phase, operational phase, decommissioning and reclamation phase, and the post-closure phase.

Technical Boundaries

No technical boundaries were identified for the effects assessment of fish and fish habitat.

Administrative Boundaries

The Project Team evaluated fish and fish habitat for the ~~Beaver Dam Mine~~ Project within the framework offered by the Fisheries Act (1985) and supporting policy statements and documents from Fisheries and Oceans Canada, including those referenced herein. DFO interpretation of serious harm to fish and species of CAR interest support the evaluation of this Valued Component for the purpose of this EIS.

6.9.5.2 Thresholds for Determination of Significance

A significant adverse effect from the Project on fish and fish habitat is defined as an effect that is likely to cause serious harm to fish, as defined by the Government of Canada (1985, Section 2(1)):

> *"serious harm to fish is the death of fish or any permanent alteration to, or destruction of, fish habitat," with fish habitat defined as "spawning grounds and any other areas, including nursery, rearing, food supply and migration areas, on which fish depend directly or indirectly in order to carry out their life processes."*

An adverse effect that does not cause a permanent loss to fish or fish habitat is considered to be not significant. Alternatively, an adverse effect that does cause a permanent loss to fish habitat may be mitigated by replacement of lost habitat and removal/rescue of fish present prior to commencement of the activity. This may also allow for an adverse effect to be considered not significant.

6.9.6 Project Activities and Fish and Fish Habitat Interactions and Effects

Table 6.9-23 Potential Fish and Fish Habitat Interactions with Project Activities at Beaver Dam Mine Site

Project Phase	Duration	Relevant Project Activity

Site Preparation and Construction	1 year	• Clearing, grubbing, and grading in preparation of construction
		• Rock blasting in preparation of construction
		• ~~Existing settling pond dewatering in preparation of construction~~
		• Watercourse and wetland alteration in preparation of construction
		  ○ Mine Site road construction
		  ○ Surface infrastructure installation and construction
		  ○ Collection and settling pond construction
		  ○ Till and waste rock from site preparation transport and storage
		• ~~Environmental monitoring of surface water discharges and fish and fish habitat~~
		• ~~General management of wastes derived from preparation and construction activities~~
		• ~~Accidents and malfunctions to include fuel and other spills, forest fires, settling pond overflow, slope failure, an unplanned explosive event, and a mobile equipment accident~~

Operation and Maintenance	3-4 years	• Rock blasting to access and extract ore

Project Phase	Duration	Relevant Project Activity
		◦ Interaction between groundwater drawdown and fish and fish habitat • ~~Surface mine dewatering to facilitate access to and extraction of ore~~ • Management of waste rock produced from crushing and preparing ore for transport • Treatment of site surface water runoff and surface mine pumped water • Ditching of site surface water runoff ◦ Alterations to surface water hydrology • ~~Petroleum products management~~ • ~~Environmental monitoring of surface water discharges and fish and fish habitat~~ • ~~General management of wastes derived from operation and maintenance activities~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, settling pond overflow, slope failure, an unplanned explosive event, and a mobile equipment accident~~
Decommissioning and Reclamation	1-2 years	• Site reclamation activities • Interactions between groundwater drawdown and fish and fish habitat • Alterations to surface water hydrology from ditching • ~~Environmental monitoring of surface water discharges~~ • ~~General management of wastes derived from decommissioning and reclamation activities~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and a mobile equipment accident~~

Table 6.9-24 Potential Fish and Fish Habitat Interactions with Project Activities along Haul Road

Project Phase	Duration	Relevant Project Activity

Site Preparation and Construction	1 year	• Clearing, grubbing, and grading in preparation of construction
		• Rock blasting in preparation of construction
		• ~~Till and waste rock from site preparation transport and storage~~
		• Watercourse and wetland alteration in preparation of construction
		    ○ Haul Road construction and upgrades and new culvert installation
		    ○ Culvert removal along current road where possible to re-establish fish passage (where hung or crushed culverts are present)
		• ~~Environmental monitoring of surface water~~
		• ~~General management of wastes derived from preparation and construction activities~~
		• ~~Accidents and malfunctions to include fuel and other spills, forest fires, and a haul truck accident~~

Operation and Maintenance	3-4 years	• Haul Road maintenance and repairs • ~~Environmental monitoring of surface water~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and a haul truck accident~~
Decommissioning and Reclamation		N/A[1]

1 Decommissioning and Reclamation of the Haul Road is not expected. The Haul Road will be returned to owner for forestry industry

Table 6.9-25 Potential Fish and Fish Habitat Interactions with Project Activities at ~~Touquoy Processing and Tailings Management Facility~~ Touquoy Mine Site

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Tailings pipeline, make-up water pipeline alteration, and relocation of reclaim infrastructure • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and mobile equipment accidents~~
Operation and Maintenance	3-4 years	• ~~Management of tailings produced from processing ore~~ • ~~Environmental monitoring of surface water and fish and fish habitat~~ • ~~General management of waste derived from processing activities~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and a haul truck accident~~
Decommissioning and Reclamation	1-2 years	• Environmental monitoring of surface water and fish and fish habitat • Post closure interaction with discharge from Touquoy Mine Site pit at Moose River

Project Phase	Duration	Relevant Project Activity
		• Accidents and malfunctions to include fuel and other spills, and forest fires

6.9.6.1 Fish and Fish Habitat Impacts

Beaver Dam Mine Site development can directly affect fish and fish habitat during the construction phase of the Project through activities such as clearing, grubbing, blasting and development of the mine/associated infrastructure. Indirect impacts that may affect fish and fish habitat ~~are possible during operations of the mine from on-going dewatering efforts within the open pit, and potential siltation and release of substances to downstream receiving surface water systems adjacent to the mine infrastructure.~~ include changes in water quality and quantity associated with direct impacts upstream.

Expected and potential direct and indirect fish and fish habitat impacts to surface water features (wetlands and watercourses) in the immediate vicinity of the PA as a result of the Project construction and development within the Beaver Dam Mine Site ~~footprint~~ are described in Table 6.9-26.

Table 6.9-26 Direct and Indirect Impacts to Fish and Fish Habitat

Impact Type	Direct Impact	Project Phase	Indirect Impact	Project Phase
Fish Mortality	Loss of habitat within Beaver Dam Mine Site ~~footprint~~ (removal of wetland or watercourse) to support mine development could result in mortality to fish for various species and life stage	C	N/A	N/A
Changes in composition and characteristics of fish populations	N/A	N/A	Loss of watercourse and/or wetland habitat or indirect operational impacts within the mine footprint may result in fish population changes including composition and characteristics of various fish species	C
Modification in Migration or local movements of fish	N/A	N/A	Construction of barriers (physical or hydraulic) within Beaver Dam Mine Site ~~footprint~~ or Haul Road resulting in a change in migration or local movements of fish	C
Reduction in Fish Populations	Potential for the increase in commercial fishing activities within the Project footprint as a result of increased access	O	N/A	N/A
Vibrations from Blasting	Vibrations from blasting activities within the Beaver Dam Mine Site ~~footprint~~ could affect fish behaviour, spawning and migration.	C O	Blasting adjacent to wetlands and watercourses has the potential to alter surface and/or subsurface water flows, especially in fractured rock. This activity has the potential to increase or decrease hydrological flow to adjacent and downstream surface water systems and can hence precipitate drying (dewatering) or wetter conditions in those habitats affecting fish habitat.	
Alteration of Fish Habitat (Hydrology): If the hydrological regime of a wetland or watercourse (WC) is altered, fish habitat can be negatively affected (reduction or severe increase in water)	Complete dewatering (removing wetland or watercourse), infilling or flooding of a wetland or WC to facilitate Project development resulting in direct loss of fish habitat	C	Hydrologically connected up-stream wetlands or watercourses and associated fish habitat may also be at risk of indirect impacts as a result of down-stream alteration activities (i.e. water outflow changes, land elevation changes, blasting etc. causing dewatering). In-advertent damming of up-gradient wetlands or watercourses from construction related infrastructure (i.e. roads with lack of flow through infrastructure) can also affect downstream fish habitat. Changes in surface hydrology can impact downstream water quantity which can affect fish habitat	C D
	Alteration of hydrological inputs and outputs into partially altered wetlands or WC has the potential to alter remaining (undeveloped) associated fish habitat.	C D	Removal of on-site watercourses or outflow and throughflow wetland habitat has the potential to alter the localized hydrology in down-gradient surface water systems and associated fish habitat.	C
			Hydrological changes can impact the use of a wetland or WC by fish and other aquatic organisms as a habitat resource.	C
			Blasting and pumping adjacent to wetlands and watercourses has the potential to alter surface and/or subsurface water flows, especially in fractured rock. This activity has the potential to increase or decrease hydrological flow to adjacent and downstream surface water systems and can hence precipitate drying (dewatering) or wetter conditions in those habitats affecting fish habitat.	C
			Surface water ditching will reduce inputs into WC-5, reducing water level and potentially affecting fish and fish habitat.	C/O/D
Alteration of Water Quality:	Removal (alteration) of wetland from the landscape leading to a change in water quality in down-gradient aquatic receivers (i.e. streams, additional wetlands and lakes) resulting in an adverse change to fish or fish habitat.	C D	Alteration of wetlands or watercourses increases the risk of down grade sedimentation which would affect fish and fish habitat	C/O/D
			The effect of increased sedimentation as a result of up-gradient activities (i.e., earth moving, removal of vegetation, soil stockpiling) has the capacity to suffocate existing plant life and increase nutrient levels in downgrade surface water systems. Dust created as a result of construction activities can have a similar impact.	C D
			Runoff from acid producing rock exposed during construction activities has the potential for negatively altering water quality within down-gradient fish habitat.	C D
Malfunctions and Accidents: Accidental spills of contaminants in up-grade work areas has the potential to drain into down-gradient surface water systems and associated fish habitat, and can cause negative impact to fish and fish habitat.				C O D

6.9.6.2 Fish and Fish Habitat Impact Extent

Expected impact extent as a result of Project activities during the temporal lifetime of the mine are described in Table 6.6-27. Some impacts are confirmed (meaning fish are present), based on electrofishing and other survey results, and some impacts are identified as potential impacts, based on connectivity to surface water that supports fish. At these locations with potential impacts, fish were not observed during on-site surveys. Further work to understand potential fish habitat and fish presence at specific alteration locations will be required to support surface water permitting (wetlands and watercourse alteration). Mitigation will be implemented to reduce the potential for direct fish mortality where fish were observed through fish rescue efforts prior to commencement of construction and completion of relevant construction activities within confirmed fish habitat within approved timing windows for construction (June 1 to Sept 30) to reduce potential for mortality of eggs and juvenile fish.

Site specific detailed information (such as habitat quality and quantity, permanent or temporary impacts) will be included in permitting applications in order for DFO to determine the level of risk and potential permitting requirements related to project impacts. These could include the need for a *Fisheries Act* authorization and the requirement for offsetting. There will be opportunities to further redesign the project to avoid/minimize the impacts.

6.9.6.2.1 Direct Fish and Fish Habitat Impacts

Beaver Dam Mine Site

Refer to the following table for potential direct fish habitat impacts within the Beaver Dam Mine Site. The following potential impact extents are included:

- P – Partial expected fish habitat loss
- C – Complete expected fish habitat loss

Table 6.9-27 Potential Direct Fish Habitat Impacts within the Beaver Dam Mine Site

Surface Water Feature (wetland or watercourses)	Mine Infrastructure	Fish Habitat Present (CAR species)	Direct Impact Type	Potential or Confirmed Impact to Fish (wetland area or watercourse linear length)
Watercourse 1	Waterline	**Potential** (based on connectivity to open water within Wetland 64)	P	3 m
Watercourse 2	Eastern Waste Rock Stockpile	**Potential** (based on electrofishing results in lower reaches of WC-5)	C	138 m
Watercourse 3	Eastern Waste Rock Stockpile	**Potential** (based on electrofishing results in lower reaches of WC-5)	C	876 m
Watercourse 4	Eastern Waste Rock Stockpile	**Confirmed** (based on electrofishing results in lower reaches of WC-4)	P	405 m
Watercourse 5	Eastern Waste Rock Stockpile	**Potential** (based on electrofishing results in lower reaches of WC-5)	P	523 m
Watercourse 12	Open Pit	**Confirmed** (electrofishing)	C	147 m
Watercourse 13	Open Pit	**Confirmed** (electrofishing)	C	150 m
Watercourse 14	Till Stockpile	**Potential** (based in connectivity to Cameron Flowage)	C	196 m
Watercourse 15	Soil Stockpile	**Low potential** for fish habitat because wetland is restricted between two wetlands	P	22 m
Wetland 2	Eastern Waste Rock Stockpile	**Potential** (based on electrofishing results in lower reaches of WC-5)	P	12,859 m^2
Wetland 4	Eastern Waste Rock Stockpile	**Potential** (based on electrofishing results in lower reaches of WC-5)	P	4,629 m^2
Wetland 5	Eastern Waste Rock Stockpile	**Potential** (based on electrofishing results in lower reaches of WC-5)	C	6,202 m^2

Surface Water Feature (wetland or watercourses)	Mine Infrastructure	Fish Habitat Present (CAR species)	Direct Impact Type	Potential or Confirmed Impact to Fish (wetland area or watercourse linear length)
Wetland 13	Eastern Waste Rock Stockpile	**Low potential** for fish to this upper reach of WC-4 but possible	P	2,605 m^2
Wetland 14	Road	**Potential** fish habitat (based on electrofishing results in WC-5)	P	250 m^2
Wetland 17	Open Pit	**Potential** (based on electrofishing results in WC-5 and associated Mud Lake)	P	5,446 m^2
Wetland 20	Road/Waterline	**Low potential** (no fish observed in WC-3 during electrofishing)	P	623 m^2
Wetland 44	Eastern Waste Rock Stockpile	**Potential** (beaver flowage impoundment and confirmed fish habitat directly north and downgradient in Wetland 8 and Crusher Lake	C	10,611 m^2
Wetland 46	Eastern Waste Rock Stockpile	**Low potential** for fish to this upper reach of WC-5	C	754 m^2
Wetland 48	Eastern Waste Rock Stockpile	**Low potential** for fish to this upper reach of WC-4	C	2,876 m^2
Wetland 52	Eastern Waste Rock Stockpile	**Low potential** for fish to this upper reach of WC-5	C	1,620 m^2
Wetland 53	Eastern Waste Rock Stockpile	**Low potential** for fish to this upper reach of WC-5	C	824 m^2
Wetland 56	Open Pit	**Confirmed** (electrofishing)	C	16,275 m^2
Wetland 57	Road/Till Stockpile/Crusher	**Low potential** for fish to this upper reach of WC-14 and into the wetland habitat.	P	18,260 m^2
Wetland 59	Open Pit	**Confirmed** (fish observed during site surveys)	P	61,275 m^2

Surface Water Feature (wetland or watercourses)	Mine Infrastructure	Fish Habitat Present (CAR species)	Direct Impact Type	Potential or Confirmed Impact to Fish (wetland area or watercourse linear length)
Wetland 61	Open Pit	**Potential** (based on electrofishing results in WC-13 and associated Cameron Flowage)	P	1,242 m^2
Wetland 215	Soil Stockpile	**Low potential** for fish because WC-15 is restricted between two wetlands	P	12,622 m^2

As outlined in Table 6.9-27, two wetlands and ~~two~~ three watercourses will be directly impacted by the mine development and are confirmed to support fish and fish habitat (Wetlands 56 and 59 and Watercourses 4, 12 and 13). ~~These impacts~~ The impacts to Wetlands 56 and 59 and watercourses 12 and 13 are all related to the development of the open pit area and impacts are expected to be permanent. As part of the open pit development, the connectivity between Wetland 56/59 and Cameron Flowage through Watercourse 13 will be removed. During operations of the mine, no ~~direct connectivity~~ fish passage between the pit and Cameron Flowage will be present. During decommissioning, the pit will be filled with water, creating a lake. ~~The current plan does not include re-establishing a connection between this lake and Cameron Flowage~~ Once the lake is full (approximately 14 years) additional water will overflow the pit walls through an engineered outfall structure directly into the Killag River (Appendix G.5, GHD, 2018). ~~However, during permitting and also during the development of the reclamation plan, consultation with DFO will be completed to review this connectivity and the long term plan for the lake and Cameron Flowage.~~ Watercourse 4 is being directly impacted by the eastern waste rock stockpile.

All other wetlands and watercourses included in Table 6.9-27 could potentially support fish, but no fish were observed during electrofishing surveys in wetlands or associated watercourses. These potential impacts to fish habitat (defined as Low Potential or Potential) are associated with the development of the waste rock pile, stockpiles and facilities to support the mine. Further detailed surveys will be required during permitting to confirm fish habitat potential within specific alteration areas within each wetland and watercourses listed in Table 6.9-27.

~~Eight~~ Seven wetlands and ~~two~~ five watercourses that potentially or have been confirmed to support fish habitat will be completely altered (direct footprint impact and associated downstream direct watercourse impacts). ~~Eight~~ Ten wetlands and ~~three~~ four watercourses that potentially or have been confirmed to support fish habitat will be partially altered (direct footprint impact and associated downstream direct watercourse impacts) as a result of mining activities and associated infrastructure associated with the Beaver Dam Mine Site ~~footprint~~ ~~PA~~.

Mortality to fish is expected to be low, once mitigation measures are implemented including fish rescue of adult fish prior to commencement of construction activities in confirmed fish habitat and adherence to approved timing windows for construction to minimize impact to eggs, larvae, and juvenile fish. Direct alteration within the Beaver Dam Mine Site ~~footprint~~ is limited to first order streams that have limited potential to support spawning. As a result, work associated with development of the mine will not affect migration patterns or local movements of fish species, and there is no expectation of change to the composition of populations of fish, given the limited numbers of fish observed within the Beaver Dam Mine Site ~~footprint~~ and its position in the landscape (first order streams). Furthermore, the three waterbodies present within the Beaver Dam Mine Site ~~footprint~~ will be avoided during Project development, limiting impact to fish populations present in these larger more significant systems (especially Cameron Flowage). The most significant watercourse draining from Crusher Lake to Mud Lake has also been directly avoided ~~during Project design planning~~ by major mining infrastructure but will be crossed by a road that connects the eastern and western waste rock stockpiles. The Beaver Dam Mine Site ~~footprint PA~~ will not be publicly accessible, so there is no expectation of an increase in commercial fishing activity as a result of this Project development.

Direct impacts to fish and indirect impacts to fish behavior, spawning grounds and migration patterns are possible from blasting activities associated with mine development. The detonation of explosives near watercourses within the Project Area can produce post-detonation shock waves which involves a rise to a high peak pressure and then a subsequent fall to below ambient hydrostatic pressure. This pressure deficit can cause impacts in fish (Wright and Hopky, 1998). An overpressure in excess of 100 kPa can result in effects in fish including damage to the swimbladder in finfish, and potential rupture and hemorrhage to the kidney, liver, spleen and sinus venous. It is also possible that fish eggs and larvae can be damaged (Wright and Hopky, 1998). The degree of damage is related to the type of explosive, size and pattern of the charges and the distance to the watercourse, depth of water within the watercourse, and species, size and life stage of the fish.

Sublethal effects have also been observed including changes in fish behavior on several occasions as a result of noise produced during blasting (Wright and Hopky, 1998). Setback recommendations and other mitigation strategies to minimize impact to fish and fish habitat from blasting activities outlined in Wright and Hopky will be adhered to during the development of the Beaver Dam Mine Site.

Expected and potential direct fish and fish habitat impacts to surface water features (wetlands and watercourses) in the immediate vicinity of the PA as a result of the Project construction and development within the Haul Road ~~PA~~ are described in Table 6.9-28 below. Potential indirect impacts to fish and fish habitat within the PA are expected to be similar across all locations where the proposed road infrastructure intersects with surface water systems and will be minimized by standard construction and mitigation techniques.

Table 6.9-28 Potential Direct Fish and Fish Habitat Impacts within the Haul Road ~~PA~~

Surface Water Feature (wetland)	Fish Habitat Present (CAR species)	Direct Impact Type	Potential or Confirmed Impact to Fish (m^2)
Wetland 66	**Potential** fish habitat	P	783.3
Wetland 73	**Potential** fish habitat	P	1570.4
Wetland 74	**Potential** fish habitat	P	344.4
Wetland 76	**Potential** fish habitat	P	229.1
Wetland 79	**Potential** fish habitat	P	303.1
Wetland 94	**Potential** fish habitat	P	274.8
Wetland 146	**Potential** fish habitat	P	199.4
Wetland 154	**Potential** fish habitat	P	120.4
Wetland 159	**Confirmed** fish habitat (electrofishing at WC-AA)	P	204.3
Potential direct impacts to fish habitat within watercourses along the Haul Road are assumed to be limited based on standard crossing construction to mitigate any impacts to fish (culverts, open bottom box culverts, bridges). More significant impacts may be possible if road alignment doesn't allow for perpendicular crossings. However, these details won't be fully understood until detailed design of the upgraded road is completed (permitting stage).			

As outlined in Table 6.9-28, nine wetlands that are expected or confirmed to support fish habitat will be partially altered within the Haul Road ~~PA~~ to support road upgrades, widening and re-alignment as required. One wetland is known to support fish (Wetland 159) based on direct connectivity with Watercourse AA. The rest of the wetlands have been identified as potential fish habitat only. Additional surveys will be required during permitting to confirm fish habitat potential at each specific alteration locations.

Limited indirect impacts are expected, once standard construction methods for culvert installation and mitigation strategies are implemented during road widening and re-alignment. Road construction will allow for a clear porous subgrade or cross drainage culverts in order for wetland hydrology to be maintained post-construction. Culverts will be installed in accordance with DFO and NSE guidance to reduce potential impacts to fish and fish habitat. Where appropriate, the Proponent will work to install open bottom box culverts to reduce potential impact on the watercourses and associated fish habitat during road construction.

Potential hydrological and water quality related indirect impact types are also anticipated in the Beaver Dam Mine Site ~~footprint~~ and Haul Road ~~PA~~. In addition, due to the nature of proposed activities (i.e. active construction site, presence of vehicles and construction equipment throughout), all fish habitat identified within the PA have potential to be indirectly impacted as a result of accidents and malfunctions and vegetative and habitat impacts (i.e. invasives, vegetation removal etc.). Mechanisms to reduce the potential for vegetative and habitat impacts from accidents and malfunctions will be addressed and discussed in Section 6.18.

6.9.6.2.2 Indirect Fish and Fish Habitat Impacts

Potential for down-gradient, indirect fish and fish habitat impacts could occur throughout the ~~footprint~~ PA as a result of up-gradient hydrological alteration. Primarily, the alteration of hydrological conditions in up-gradient wetlands and watercourses could affect natural inflows, outflows and hydroperiod characteristics in contiguous wetland and watercourse systems where fish habitat is present. In addition, where up-gradient alteration is occurring, but a direct hydrological flow is being maintained, potential exists for indirect impacts to down-gradient water quality conditions.

Maintaining water quality and quantity downstream in the PA and LAA is paramount for limiting broader fish and fish habitat impacts within each affected watershed associated with the ~~Beaver Dam Mine Haul Road~~ PA.

The removal of wetlands and watercourses also has the potential to alter surface flows and downgradient hydrology. Water quality could be further affected from an increase in Total Suspended Solids (TSS) associated with potential siltation and release of substances to downstream receiving surface water systems adjacent to mine infrastructure (LAA).

Beaver Dam Mine Site

Within the Beaver Dam Mine Site ~~footprint PA~~, areas of heightened risk of these indirect impact types to fish and fish habitat include wetlands (and associated watercourses) bordering Crusher Lake (e.g. Wetlands 4, 8, 10, 11, WC-3, WC-4 and WC-5) and Crusher Lake itself due to them directly receiving water from up gradient wetlands and watercourses which are subject to alteration (i.e. headwater and throughflow wetlands and associated watercourses). Similarly, Wetlands 20, 14 and 17, all of which act as throughflow wetlands that intercept water prior to it draining into Mud Lake, and Mud Lake itself, are also at potential risk of indirect hydrological and water quality impacts as a result of up-gradient alteration activities. At the eastern extent of the ~~Mine Site PA~~ Beaver Dam Mine Site, alteration to Wetland 57, a headwater wetland, has the potential to indirectly impact its down-gradient aquatic receptors and fish habitat which include Watercourse 14, the eastern extent of Wetland 59, Wetland 61 and Cameron Flowage. ~~At the southern extent of the Mine Site PA alteration to Wetland 29 has the potential to indirectly impact lower lying portions of the same wetland system and headwater stream system, as it extends beyond the southern footprint PA boundary.~~ The division and micro-siting of the waste rock stockpile has removed this infrastructure from Wetland 29 and Watercourse 11 which reduces the potential indirect impact to lower lying portions of this wetland system and headwater stream system, south of the Beaver Dam Mine Site.

Potential also exists for up-gradient hydrological alteration as a result of down-gradient hydrological alteration. Examples include altered outflow (i.e. faster or slower outflows due to Mine Site drainage infrastructure), causing either dewatering (drying hydrological trend) or flooding conditions in up-gradient wetlands that support fish.

Site specific detailed information (such as habitat quality and quantity, permanent or temporary impacts) will be included in permitting applications in order for DFO to determine the level of risk and potential permitting requirements related to project impacts. These could include the need for a *Fisheries Act* authorization and the requirement for offsetting. There will be opportunities to further redesign the project to avoid/minimize the impacts.

The development of the waste rock stockpiles and low grade ore stockpiles within the contributing area to Crusher Lake and Mud Lake will directly reduce the overall size of the drainage area and will directly impact several watercourses that empty into Crusher Lake, and eventually drain to Mud Lake. Additionally, the waste rock stockpiles will require storm water ditching. This ditching collects and directs water through the north settling pond and eventually into Cameron Flowage, bypassing Crusher and Mud Lake. The result of this is a reduction of water in Crusher Lake, a reduction of flow in watercourse 5 (WC-5, between Crusher and Mud Lake), and a reduction of water in Mud Lake.

The reductions to Crusher Lake are on the order of 52% (at EOM and PC). The reduction in flows to Crusher represent decreases in annual runoff from baseline conditions.

Crusher Lake is approximately 4 ha in size. It is described in Section 6.7.3. Crusher Lake is known to support banded killifish, golden shiner, and brown bullhead, though abundance is suspected to be low based on catch rates and habitat quality. It is classified as providing poor juvenile salmonid rearing habitat based on sluggish flow, substrate, and depth, in addition to providing foraging, passage and likely overwintering habitat. Electrofishing surveys conducted upstream of (south) Crusher Lake in WC-5 and WC-3 did not identify any fish. Ninespine stickleback, however, were observed upstream of Crusher Lake in WC-4.

WC-5, north flowing between Crusher Lake and Mud Lake, will have a reduction of approximately 43% (at EOM) based on the losses to its contributing area. This proposed reduction of flow is predicted to impact the ecological maintenance flow within this portion of WC-5 during low flow periods. This alteration of flow will occur in the operations phase and continue through post-closure.

WC-5 has been surveyed extensively through multiple seasons. WC-5 exits Crusher Lake as a narrow channel flowing over a historic, man-made dam. As such, the gradient is relatively steep, and the substrate is dominated by small boulders. As it flows into Wetland 14 and continues toward Mud Lake, the gradient decreases, and the substrate is characterized by a mixture of small boulders, gravel, and muck. Coarse woody debris is abundant within and overhanging the watercourse, resulting in occasional small pools approximately 1 m deep. The average depth of the watercourse is approximately 30 cm, though the depth increases gradually as the watercourse approaches Mud Lake. Here, the substrate is entirely dominated by mud, with emergent vegetation along the banks. Following heavy rainfall, the water level has been observed to increase by approximately 50 cm overnight. In the spring, temperatures have been measured to exceed 15˚C by the end of May. Late summer temperatures are on the order of 20˚. pH, measured during a fish survey completed on September 18, 2015 was 4.16. Abundance and species richness of benthic invertebrates is considered moderate. Immature brook trout (n=1) and mature northern red-belly dace (n=3) were observed within WC-5 (north). This confirms fish presence and fish usage, despite less than favorable temperatures and pH conditions. Fish habitat within WC-5 (north) is classified as providing rearing, feeding and passage. A reduction in fish habitat quality is expected based on this reduction in flow, particularly the passage of fish from Mud Lake to Crusher Lake and associated tributaries. Reduction in flow rates below the ecological maintenance flow within WC-5 (north) may restrict passage, therefore restricting access to habitats in Crusher Lake and tributaries to WC-5.

Mud Lake exists as an open water body within Wetland 17. This wetland is a complex comprised of tall shrub swamp, coniferous treed bog, and low shrub fen communities Within Mud Lake, the substrate is dominated by mud, with emergent vegetation along the edges when the water level is high. While bathymetry data was not collected for Mud Lake, the depth is not believed to exceed 3 m. Early in the spring, water levels are high and emergent vegetation is abundant. Through the summer, much of the water dries up, leaving exposed natural mud flats. Thermal stress in the summer is expected to be a limiting factor on habitat quality for some species of fish, given the shallow depth, low flow and lack of vegetative cover. The proposed Project would result in diversion of water from WC-5 and a 43.0% reduction in volume discharged into Mud Lake during EOM and 35.5% reduction during PC conditions (Appendix G.5). This is predicted to correspond to an approximately 7 cm of vertical drop in water levels year-round in Mud Lake. Given the natural seasonal variability in water levels and relatively poor fish habitat currently available within Mud Lake, it is not expected that this decrease in water level would result in serious harm to fish, as this habitat has demonstrated resilience to natural water level fluctuations. Small scale, local decreases in fish habitat quality may occur in microhabitats, but it is expected to be minor.

There is a predicted increase in runoff volume discharged to the Killag River of 0.91% and 0.03% during EOM and PC, respectively. Additionally, a 5 to 7% reduction in baseflow is predicted for the Killag River (Appendix G.5). Together, the impact to fish and fish habitat within the Killag River was deemed negligible.

Water discharged into the Killag River from the north settling pond (EOM) and the pit lake (PC) are not expected to affect fish and fish habitat as a result of proposed water treatment. Treatment will ensure discharge meets MDMER, and that CCME, background or site specific water quality objectives are met within the 100 m mixing zone in the Killag River. Discharge from the till stockpiles does not require treatment because it is not anticipated to have any water quality concerns.

Haul Road

The potential for indirect fish and fish habitat impacts as a result of upgrading and new construction of the proposed Haul Road also exists. However, due to the limited alteration footprint to up-gradient wetlands from Haul Road infrastructure, and mitigation methods that will be employed as part of the construction process, down-gradient, indirect impacts are not expected. As is consistent with alteration to all surface water systems associated with the Project, protection and viability of connected, unaltered areas of surface water and associated fish habitat are considered as part of the provincial and federal permitting for wetlands and watercourses. Design of suitable hydrological connectivity structures (i.e. culverts), the implementation of a Project EPP, and ESC methods will be employed to ensure that indirect impacts to upstream or downstream surface water and fish habitat will not occur as a result of the activities associated with the Haul Road. In addition, however, post construction monitoring will be performed at alteration locations as discussed in Section 6.7.10 to ensure this expectation.

However, indirect impacts to down-gradient watershed water quality and quantity within the PA and LAA that may affect fish and fish habitat are not expected from the road infrastructure (re-alignment and widening) once standard construction methods for culvert installation and mitigation strategies are implemented during road widening and re-alignment.

There is an increase, however, of 53.1% in the predicted annual runoff volume discharged to Tent Lake due to mine development. Runoff at the crusher location, within the Beaver Dam Mine Site, is directed to a collection pond before being released south into Wetland 64. Wetland 64 is located at the northern extent of the Haul Road, at its connection to the Beaver Dam Mine Site. Runoff discharged into this wetland will flow to Wetlands 66, 68, and 69 via WC-B prior to entering Tent Lake. Watercourse B provides rearing, feeding, refuge, and passage for fish and was classified as having Type II salmonid habitat. Flooding of WC-B and adjacent wetlands may have a positive impact and increase suitable fish habitat. The expected flow increase will effect Wetland 64 and will have limited effect on WC-B, and associated fish habitat in either system.

Additionally, no residual effect is expected on fish and fish habitat based on water quality because discharge from Tent Lake outfall does not require treatment as it is not anticipated to have water quality concerns. Widening and upgrade efforts to the Haul Road will require a combination of new culverts where new sections of road are required, and replacement of culverts where road upgrades and/or widening is required to support Project development. During evaluation of culverts within the Haul Road ~~PA~~ in 2015 and 2016, many culverts along the Haul Road were observed to be in disrepair. The Project will allow for re-installation of many culverts to replace those that are currently present that are installed improperly (hung or buried), or that have deteriorated (crushed), where appropriate. Table 6.9-29 describes each watercourse crossing within the Haul Road ~~PA~~ and the current condition of the culvert where applicable, and the general plan for upgrading each crossing during Project construction. This table also provides a general commentary on the effect on fish habitat during culvert upgrades and installation of new culverts.

Table 6.9-29 Watercourse Locations within Haul Road PA and Culvert Condition and Plan for Upgrade

Watercourse Location	Current Crossing and Condition	Plan for Upgraded Haul Road	Estimated Direct Impacts to Confirmed or Potential Fish Habitat
WC-A	buried	improvement - remove buried culvert and replace with new at same location	Proposed upgraded road alignment perpendicular to WC. Replace buried culvert. Standard mitigation will apply to limit impact to fish habitat and overall improve fish habitat through removal of buried culvert. No direct impact expected to watercourse footprint.
WC-B	crushed	improvement - new culvert and removal of crushed culvert along existing road	Proposed upgraded road alignment perpendicular to WC. Remove crushed culvert and install new culvert upstream at new crossing location. Standard mitigation will apply to limit impact to fish habitat and overall improve fish habitat through removal of crushed culvert. No direct impact expected to watercourse footprint.
WC-C	functioning	net zero - new culvert. Functioning culvert along existing road can stay	Proposed upgraded road alignment perpendicular to WC. Existing culvert can remain. Install new culvert upstream at new crossing location. Standard mitigation will apply to limit impact to fish habitat. No direct impact expected to watercourse footprint.
WC-D	no culvert	net zero - new culvert	Proposed upgraded road alignment perpendicular to WC. Install new culvert at new crossing location. Standard mitigation will apply to limit impact to fish habitat. No direct impact expected to watercourse footprints.
WC-E	blocked	improvement - new culvert and removal of debris/barrier along existing road	Proposed upgraded road alignment perpendicular to WC. Remove blocked culvert and install new culvert downstream at new crossing location. Standard mitigation will apply to limit impact to fish habitat and overall improve fish habitat through removal of crushed culvert. A short inlet tributary to WC-E may be altered by Haul Road upgrades Total Linear Length 29.3 m; Total Area 52.7 m^2.
WC-F	crushed	improvement - new culvert and removal of one hung and one collapsed culvert along existing road	Proposed upgraded road not fully perpendicular to WC. WC travels along length of proposed road for 29.2 m. This short length of watercourse may be altered by Haul Road upgrades resulting in alteration of fish habitat. Total Area 49.6 m^2.
WC-G	crushed	improvement - new culvert and removal of crushed culvert along existing road	Proposed upgraded road alignment perpendicular to WC. Remove crushed culvert and install new culvert just upstream at new crossing location. Standard mitigation will apply to limit impact to fish habitat and overall improve fish habitat through removal of crushed culvert. No direct impact expected to watercourse footprint.
WC-H	bridge- no barrier	net zero - new bridge (or culvert)	Proposed upgraded road alignment will allow for new bridge (or culvert) to be installed downstream of current crossing. Standard mitigation will apply to limit impact to fish habitat. No direct impact expected to watercourse footprint.
WC-I	buried	improvement - new culvert and removal of buried culvert along existing road	Proposed upgraded road alignment will allow for these two watercourses to join and be culverted under the new road together at this location. Removal of two buried culverts and installation of a new culvert will result in an improvement to fish habitat. Standard mitigation will apply to limit impact to fish habitat and no direct impact is expected to watercourse footprint.
WC-J	buried	improvement - new culvert and removal of buried culvert along existing road	
WC-K	no culvert	net zero - new culvert	Proposed upgraded road alignment is not perpendicular to WC. However, the upgraded road is proposed to align with current road at this location. There is no culvert present. Installation of a new culvert with widened road will result in improvement in fish habitat. Standard mitigation will apply to limit impact to fish habitat.
WC-L	functioning	net zero - new culvert. Functioning culvert along existing road can stay	WC runs parallel to the current road in a roadside ditch. Proposed road upgrade will allow for a new culvert installation to funnel the WC directly across the road to the east side and away from the ditch network associated with the road. Standard mitigation will apply to limit impact to fish habitat. Total Area of 89.0 m^2 of watercourse (as ditch) will be removed during road upgrades.
WC-M	functioning	net zero - culvert extension to support widening efforts	Proposed upgraded road alignment is perpendicular to WC and will require an extension to existing culvert which is functioning well. Standard mitigation will apply to limit impact to fish habitat. No direct impact to fish habitat expected to watercourse footprint.
WC-N- West River	bridge	net zero - upgrade of bridge	Proposed upgraded road alignment will allow for upgraded bridge at current crossing location. Standard mitigation will apply to limit impact to fish habitat. No direct impact expected to watercourse footprint.
WC-O	no culvert	net zero - new culvert	Proposed new road will be designed to run perpendicular to the WC. Standard mitigation will apply to limit impact to fish habitat. No direct impact expected to watercourse footprint.
WC-P	no culvert	n/a	Proposed new road does not overlap with WC.
WC-Q	no culvert	n/a	Proposed new road does not overlap with WC.
WC-R	no culvert	n/a	Proposed new road does not overlap with WC.
WC-S	hung	improvement - new culvert and removal of hung culvert along existing road	Proposed upgraded road alignment perpendicular to WC. Replace hung culvert. Standard mitigation will apply to limit impact to fish habitat and overall improve fish habitat through removal of hung culvert. No direct impact expected to watercourse footprint.

Watercourse Location	Current Crossing and Condition	Plan for Upgraded Haul Road	Estimated Direct Impacts to Confirmed or Potential Fish Habitat
WC-T	buried	improvement - remove buried culvert and replace with new at same location	Proposed upgraded road alignment perpendicular to WC. Replace buried culvert. Standard mitigation will apply to limit impact to fish habitat and overall improve fish habitat through removal of buried culvert. No direct impact expected to watercourse footprint.
WC-U	functioning	culvert extension to support widening efforts	Proposed upgraded road not fully perpendicular to WC. WC travels along length of proposed road for 17.3 m. This short length of watercourse may be altered by Haul Road upgrades resulting in alteration of fish habitat. Total Area 17.3 m^2.
WC-V	buried	improvement - new culvert and removal of hung/buried culvert along existing road	Proposed upgraded road alignment perpendicular to WC. Replace buried culvert. Standard mitigation will apply to limit impact to fish habitat and overall improve fish habitat through removal of buried culvert. No direct impact expected to watercourse footprint.
WC-W	hung	improvement - new culvert and removal of hung culvert along existing road	Proposed upgraded road alignment perpendicular to WC. Replace hung culvert. Standard mitigation will apply to limit impact to fish habitat and overall improve fish habitat through removal of hung culvert. No direct impact expected to watercourse footprint.
WC-X	no culvert	net zero - new culvert	Proposed upgraded road alignment is perpendicular to WC and will require a new culvert installation. Standard mitigation will apply to limit impact to fish habitat. No direct impact expected to watercourse footprint.
WC-Y	no culvert	net zero - new culvert	Proposed upgraded road alignment is perpendicular to WC and will require a new culvert installation. Standard mitigation will apply to limit impact to fish habitat. No direct impact expected to watercourse footprint.
WC-Z	buried	net benefit - re-establish wetland hydrology	Proposed new road does not overlap with WC. However, culvert present at wetland crossing is buried and re-installment of a new culvert will re-establish proper hydrologic connection for wetland habitat.
WC-AA	hung	improvement - new culvert and removal of hung culvert along existing road	Proposed upgraded road alignment perpendicular to WC. Replace hung culvert. Standard mitigation will apply to limit impact to fish habitat and overall improve fish habitat through removal of hung culvert. No direct impact expected to watercourse footprint.
WC-AB	no culvert	net zero to WC - wetland impacts only	Proposed upgraded road alignment does not overlap with WC.
WC-AC	no culvert	net zero to WC - wetland impacts only	Proposed upgraded road alignment does not overlap with WC.
WC-AD- Morgan River	bridge	net zero - upgrade of bridge	Proposed upgraded road alignment will allow for upgraded bridge at current crossing location. Standard mitigation will apply to limit impact to fish habitat. No direct impact expected to watercourse footprint.
WC-AE	buried	improvement - new culvert and removal of buried culvert along existing road	Proposed upgraded road alignment perpendicular to WC. Replace buried culvert. Standard mitigation will apply to limit impact to fish habitat and overall improve fish habitat through removal of buried culvert. No direct impact expected to watercourse footprint
WC-AF	no culvert	n/a	Proposed new road does not overlap with WC.
WC-AG	no culvert	n/a	Proposed upgraded road alignment overlaps with the top end of this watercourse. A total area of 2.9 m^2 may be altered to support road upgrades. Standard mitigation will apply to limit impact to fish habitat.
WC-AH	no culvert	n/a	Proposed new road does not overlap with WC.

Along the existing Haul Road at locations where the proposed road upgrade alignment will fall, the current summary of culvert conditions is as follows: 7 buried, 3 crushed, 1 blocked, 3 hung, 3 operating bridges, 4 functioning culverts, 4 locations with no culvert - new required, 8 locations with no culvert - none required as the watercourse doesn't fall within proposed alignment for upgraded road. During construction and upgrades of the Haul Road necessary to support the Project, the Project team anticipates that there will be up to 13 opportunities to improve fish habitat with new culvert installation and removal of the current hung/buried/crushed culvert currently acting as a barrier to fish passage. There will be up to 12 net zero scenarios involving new culvert installation where either no culvert is present currently (new construction), or the culvert that is present is functioning well. There are 9 watercourses that have been identified within the Haul Road ~~PA~~ and overlap with the existing road layout that will not be affected by the proposed alignment for the upgraded Haul Road.

Touquoy Mine Site

The ~~Touquoy facility is currently under construction~~ Touquoy Mine Site is currently operational. Potential impacts to surface water quality and quantity as a result of the storage of Beaver Dam tailings in the exhausted Touquoy open pit mine were examined. ~~but it should be noted that these are restricted to the surface water in the exhausted pit only. The flooded pit will be a lake setting physically disconnected from other nearby natural surface water bodies. Due to this disconnection, potential for direct or indirect effects to fish or fish habitat are not anticipated due to the processing of ore and the management of tailings from the Beaver Dam Mine Site.~~ The Touquoy Mine Site open pit will naturally fill which will result in water covering the tailings surface. Pit water will be treated via the existing Touquoy effluent treatment plant and downstream treatment discharge facilities and once the water meets MDMER discharge criteria it will be naturally released via a spillway into Moose River (Appendix G.6, Stantec, 2018). ~~The use of the Touquoy facility for the processing of Beaver Dam ore will not involve construction, alteration of fish or fish habitat, or discharge of effluent into surface water bodies; therefore, no effects are anticipated at the Touquoy facility related to the processing of Beaver Dam ore, with the exception of the continued potential for accidents and malfunctions and continued environmental monitoring.~~ At the end of the mixing zone within the Moose River, 100 m downstream of the spillway, predicted concentrations of aluminum are expected to be lower than background levels but still above the NSE Tier 1 EQS and CCME limits. Arsenic will require treatment before release because it is also predicted to exceed NSE Tier 1 EQS and CCME limits at the end of the mixing zone (Appendix G.6, Stantec, 2018). Monitoring (Environmental Effects Monitoring Program (Appendix O.1)) will ensure MDMER is met and that there is no impact to fish from changes in water quality. In relation to groundwater seepage from the Touquoy Mine Site open pit to Moose River, no parameters are predicted to exceed NSE Tier 1 EQS or CCME guidelines (Appendix G.6 Stantec, 2018).

Under climate normal conditions the average predicted monthly open pit overflow into Moose River varies seasonally from 0.9 L/s in July to 44.2 L/s in April. The average effluent flow rate is 13.9 L/s (Appendix G.6 Stantec, 2018). Additionally, through the completion of groundwater modelling, it was determined that seepage from the open pit to Moose River is predicted at 3.6 L/s (Appendix F.6, Stantec, 2018).

Within Moose River, there is a predicted increase in flow from both open pit overflow and groundwater seepage of 3.89%, during August (when Moose River flows are the lowest). No impacts to fish and fish habitat are expected from this minor increase in flow.

During all project phases there is a risk of malfunctions and accidents (e.g. spills) to occur throughout the PA in upgrade areas. Spills have the potential to be transported into downgradient surface water systems and negatively impact fish and fish habitat. An evaluation of potential accidents and malfunctions can be found in Section 6.18.

6.9.7 Preferred Alternative Haul Road

6.9.7.1 Rationale for Valued Component Selection

Same rationale for valued component selection as indicated in Section 6.9.1.

6.9.7.2 Baseline Program Methodology

Fish habitat characterization was completed for each linear watercourse, wetland, and waterbody identified within the Preferred Alternative Haul Road PA. The methods to complete habitat characterization were adopted from the *Standard Methods Guide for Freshwater Fish and Fish Habitat Surveys in Newfoundland and Labrador: Rivers and Streams* (Sooley et al., 1998). Information collected included the identification of physical units (i.e., run, riffle, or pool), designation of substrate type, and depth and width (wetted and bankfull) of the linear section of the watercourse. The presence or absence of over-head cover, undercut banks, and woody debris was also recorded since these habitat features affect the ability of the watercourse and associated wetland habitat to support fish communities. Refer to fish habitat descriptions in Table 6.9-2.

No fish collection, electrofishing, or benthic macroinvertebrate sampling was conducted within the watercourses of the Preferred Alternative Haul Road PA because these watercourses are located upstream of and are contiguous with watercourses that cross the current Haul Road. Methodologies and baseline conditions of fish collection, electrofishing, and benthic macroinvertebrate sampling on the Haul Road are presented within Section 6.9.2 and 6.9.3.

6.9.7.3 Baseline Conditions

Seven linear watercourses and portions of three waterbodies (Prest Lake, Miller Lake and Big Pond) were identified within the Preferred Alternative Haul Road PA, all of which were expected to support fish. Three of the watercourses, WC-AI, AL, and AM, are named Morgan River, Duck Lake Brook, and Middle Brook, respectively. The remaining watercourses are all unnamed.

In addition to the water features, 19 wetlands were evaluated across the Preferred Alternative Haul Road PA. Fish habitat potential and physical characteristics of each watercourse and wetland were determined during field surveys that occurred from September 4 to 6, 2018.

6.9.7.3.1 Fish Habitat Assessment

Table 6.9-30 describes the fish habitat potential at each identified watercourse within the Preferred Alternative Haul Road PA.

Table 6.9-30 Fish Habitat Potential within Linear Watercourses in the Preferred Alternative Haul Road PA.

Watercourse	Tertiary Watershed	Easting	Northing	Fish Habitat Type	Habitat Potential
AI	Rocky Lake	511500	4979993	III	Rearing, overwintering, forage, passage
AJ	Rocky Lake	511509	4979956	IV	Forage, passage
AK	Duck Lake	512967	4980482	IV	Rearing, passage

Watercourse	Tertiary Watershed	Easting	Northing	Fish Habitat Type	Habitat Potential
AL	Duck Lake	513233	4980739	IV	Passage, forage
AM	Duck Lake	513356	4980790	IV	Passage, forage
AN	Otter Lake	514312	4980803	IV	Passage
AO	Otter Lake	515326	4980250	IV	Rearing, forage, passage

Six of the seven watercourses are classified as having poor juvenile salmonid rearing habitat with no spawning capability. The remaining watercourse, WC-AI, is classified as having poor rearing habitat with no spawning capabilities and is used for migratory purposes.

Based on depth, substrate, and connectivity to other water features; Prest Lake, Miller Lake and Big Pond have the potential to offer shelter, forage, and overwintering opportunities for larger brook trout. No brook trout or other fish species were observed within these waterbodies or any of the watercourses within the Preferred Alternative Haul Road PA.

The following table outlines the availability of potential habitat for non-salmonid species (salmonids are discussed in detail above) within the watercourses and waterbodies of the Preferred Alternative Haul Road PA. Descriptions of habitat requirements for non-salmonid species are presented in Section 6.9.3.1.

Table 6.9-31 Availability of Suitable Habitat for Non-Salmonid Fish Species within the Preferred Alternative Haul Road

Watercourse ID	American Eel	Alewife	Yellow Perch	White Perch	White Sucker
AI	✓	✓	✓	✓	
AJ	✓				
AK	✓				✓
AL	✓				✓
AM	✓				✓
AN	✓				
AO	✓		✓	✓	✓
Prest Lake	✓	✓	✓	✓	
Miller Lake	✓	✓	✓	✓	
Big Pond	✓	✓	✓	✓	

The availability of fish habitat within wetlands of the Preferred Alternative Haul Road is presented within Table 6.9-32.

Table 6.9-32 Fish Habitat within Wetlands of the Preferred Alternative Haul Road

WL ID	Hydrological Regime	Associated Watercourse	Potential Fish habitat	Qualitative Description	Habitat Potential
182	Throughflow	WC-AJ	Fish habitat confined to watercourse	Forage, passage	Direct connectivity to downstream fish resource
186	Lentic	Prest Lake	Open water and vegetated habitat along lake edge	Forage, refuge	Open water, direct connectivity to

WL ID	Hydrological Regime	Associated Watercourse	Potential Fish habitat	Qualitative Description	Habitat Potential
					downstream fish resource
187	Lentic	Miller Lake	Fish habitat within standing and open water in wetland	Rearing, Feeding, Refuge, and Passage	Open Water, direct connectivity to downstream fish resource
190	Throughflow	WC-AK	Fish habitat confined to watercourse	Rearing, passage	Direct connectivity to downstream fish resource
192	Throughflow	WC-AM	Fish habitat confined to watercourse	Passage, forage	Direct connectivity to downstream fish resource
193	Throughflow	WC-AL	Fish habitat confined to watercourse	Passage, forage	Direct connectivity to downstream fish resource
194	Throughflow	WC-AN	No fish habitat present. WC-AN is not channelized within Wetland 194.	Passage	N/A
199	Lentic	WC-AO and Big Pond	Open water and vegetated habitat along lake edge	Rearing, forage, passage	Open Water, direct connectivity to downstream fish resource

6.9.7.3.2 **Electrofishing**

No electrofishing surveys were conducted within the Preferred Alternative Haul Road, however, all the watercourses within the Preferred Alternative Haul Road are tributaries to watercourses that are present within the Haul Road, to the south. Table 6.9-33 describes contiguity between watercourses.

Table 6.9-33 Preferred Alternative Haul Road Watercourses Contiguity with Haul Road Watercourses

Preferred Alternative Haul Road WC	Haul Road WC
AI, AJ	AH
AK, AL, AM	AD
AN, AO	AA

Electrofishing was completed within WC-AA and AH, along the Haul Road, and since these watercourses are contiguous with watercourses present within the Preferred Alternative Haul Road, it was concluded that these fish have the potential to be present within the Preferred Alternative Haul Road PA.

Fish identified from electrofishing within the Haul Road WC-AA (contiguous with WC-AI and AJ) include banded killifish, golden shiner, lake chub, and white sucker. Fish captured from electrofishing within the Haul Road WC-AH (contiguous with WC-AN and AO) include brook trout and American eel. No electrofishing was conducted in the Haul Road WC-AD (contiguous with WC-AK, AL, and AM). For more information pertaining to fish captured during electrofishing within the Haul Road refer to Section 6.9.3.2.

Brook trout and American eel are both priority fish species. They are discussed in further detail within Section 6.13.

Haul Road WC-AA, AD, and AH do not have a topographically mapped connection to a documented salmon river, therefore, Atlantic salmon are not expected to inhabit the tributaries to these watercourses within the Preferred Alternative Haul Road PA.

6.9.7.3.3 **Water Quality**

Table 6.9-34 Preferred Alternative Haul Road Watercourses Water Quality Sampling

Watercourse	Sampling Date	Water Temp. (°C)	pH
AI	September 4, 2018	22.9	6.04
AJ	September 4, 2018	20.3	5.53
AK	September 5, 2018	17.2	4.91
AL	September 5, 2018	17.4	4.55
AM	September 5, 2018	18.3	5.19
AN	September 5, 2018	17.3	5.18
AO	September 6, 2018	22.4	5.42

Temperatures of the Preferred Alternative Haul Road watercourses ranged from 17.2 to 22.9 °C. Temperatures were recorded in September 2018, a month where high water temperatures are expected. Trout and salmon are cold water fish species, meaning they require cold water to live and reproduce. The optimal temperature range for these species (growth of juvenile) is 10-20°C (The Stream Steward, n.d.) to 16-20°C (Fisheries and Oceans Canada, 2012) (trout and salmon, respectively). Other CAR species have higher temperature ranges: Yellow Perch 21-24°C (Brown, Runciman, Bradford, & Pollard, 2009), and white sucker 19-26°C (Kelly, 2014). American eels have a broader temperature range and can tolerate temperatures from 4 to 25 ºC ("American eel Fact Sheet," 2006). Generally, the range of temperatures within watercourses is within the required ranges for the species that have the potential to inhibit these watercourses.

The CCME guidelines for the Protection of Aquatic Life establish that a range of pH from 6.5 to 9.0 is suitable within freshwater habitat. All watercourses measured in September 2018 within the Preferred Alternative Haul Road has pH levels below the range suitable for fish within freshwater habitat.

6.9.7.4 Considerations of Consultation and Engagement Results

The Preferred Alternative Haul Road is the result of consultation and engagement on the Primary Haul Road. Refer to Section 6.9.4 for key issues raised during public consultation and Mi'kmaq engagement relating to fish and fish habitat.

6.9.7.5 Effects Assessment Methodology

6.9.7.5.1 Boundaries

Spatial Boundaries

The spatial boundaries used for the assessment of effects to fish and fish habitat along the Preferred Alternative Haul Road are defined below:

The Preferred Alternative Haul Road PA (Figure 5.4-1) encompasses 50 m on either side of a 5.7 km long center line. The eastern and western extent of the Preferred Alternative Haul Road PA connects to the Haul Road at a pre-existing forestry road and to Mooseland Road, respectively. The Preferred Alternative Haul Road PA runs north of Sandy Pond and Miller Lake.

The LAA (Figure 6.8-2) consists of portions of downstream aquatic habitats and headwaters where appropriate, depending on project activities, up to the maximum size of the tertiary watershed(s). The LAA boundaries were defined considering the maximum expected extent of direct and indirect impacts to the aquatic environment as well as the location of project activities across all three project components.

The RAA (Figure 6.8-3) encompasses the two secondary watersheds that the PA is located within. These watersheds are the Tangier River secondary watershed, and the Fish River secondary watershed. The RAA is broader than expected project impacts and considers other project boundaries as per the cumulative effects methodology.

As the Project has the potential to cause direct and indirect effects to fish and fish habitat outside of the Preferred Alternative Haul Road PA, the LAA is the appropriate boundary for evaluation of this VC.

Temporal Boundaries

The temporal boundaries used for the assessment of effects to flora are the construction phase, operational phase, and decommissioning and reclamation phase.

Technical Boundaries

No technical boundaries were identified for the effects assessment of habitat and flora.

Administrative Boundaries

The Project Team evaluated fish and fish habitat for the Project within the framework offered by the Fisheries Act (1985) and supporting policy statements and documents from Fisheries and Oceans Canada, including those referenced herein. DFO interpretation of serious harm to fish and species of CAR interest support the evaluation of this Valued Component for the purpose of this EIS.

6.9.7.5.2 Thresholds for the Determination of Significance

The thresholds for determination of significance regarding fish and fish habitat within the Preferred Alternative Haul Road are identical to the thresholds for determination of significance for this VC throughout the entire PA, as presented within Section 6.9.5.2.

6.9.7.6 Project Activities and Fish Interactions and Effects

The assessment of potential adverse interactions and effects of the Project on this VC takes into account the potential for the Project to result in changes to:

- Permanent and temporary habitat alteration and/or loss
- Potential for direct and indirect mortality to individuals

Table 6.9-35 present the potential interactions of the Project with fish and fish habitat.

Table 6.9-35 Potential Fish Interactions with Project Activities along the Preferred Alternative Haul Road

Project Phase	Duration	Relevant Project Activity

Site Preparation and Construction	1 year	• Clearing, grubbing, and grading in preparation of construction
		• Rock blasting in preparation of construction
		• Watercourse and wetland alteration in preparation of construction
		  ○ Haul Road construction and upgrades and new culvert installation
		  ○ Culvert removal along current road where possible to re-establish fish passage (where hung or crushed culverts are present)

Operation and Maintenance	3-4 years	• Haul Road maintenance and repairs
Decommissioning and Reclamation		N/A[1]
1 Decommissioning and Reclamation of the Haul Road is not expected. The Haul Road will be returned to owner for forestry industry		

Development of the Preferred Alternative Haul Road can directly affect fish and fish habitat during the construction phase of the Project through activities such as clearing, grubbing, blasting and construction. The impacts associated with the construction of the Preferred Alternative Haul Road are likely to occur from sedimentation and have the potential to affect the downstream reaches of the Preferred Alternative Haul Road respective watercourses, within the LAA.

In addition, the construction of the Preferred Alternative Haul Road will limit the overall number of damaged culvert replacements anticipated along the Haul Road. This is disadvantageous for fish and fish habitat connectivity.

Continuing impacts that affect fish and fish habitat through changes in water quality and quantity are possible during the operational phase. Both water quality and quantity can be affected by the removal of wetlands and watercourses. This has the potential to alter surface flows and downgradient hydrology. Water quality could be further affected from an increase in Total Suspended Solids (TSS) associated with potential siltation and release of substances to downstream receiving surface water systems adjacent to the Preferred Alternative Haul Road (LAA).

During all project phases there is a risk of malfunctions and accidents (e.g. spills) to occur throughout the PA in upgrade areas. Spills have the potential to be transported into downgradient surface water systems and negatively impact fish and fish habitat.

6.9.8 Mitigation ~~and Monitoring~~

In order to mitigate and reduce overall loss of fish and fish habitat, the actions provided in Table 6.9-36 will be implemented.

Table 6.9-36 Mitigation for Fish and Fish Habitat

VC	Project Phase	Mitigation Measure
Fish and Fish Habitat	PC, CON, OP, DEC	Complete site meetings with relevant staff/contractors to educate and confirm policies related to working around fish bearing surface water systems including schedule of construction activities to minimize unauthorized disturbance and limit vegetation clearing
	PC	Provide signage on fish habitat streams
	PC	Complete detailed design of Haul Road and micro siting of mine infrastructure to avoid or minimize fish habitat impact
	PC, CON	Complete fish rescue within Beaver Dam Mine Site prior to commencement of mine development with DFO approval if required
	CON	Implement construction methods that reduce potential interaction with fish habitat and limit vegetation clearing around watercourses
	CON	Complete culvert installations and upgrades in accordance with the NSE Watercourse Standard (2015) or as updated at time of construction. Limit vegetation clearing
	CON, OP	Maintain 30 m riparian wetland and watercourse buffers, where practicable
	CON	Minimize the removal of vegetation upgradient of watercourses
	CON, OP	Follow DFO-advised *Measures to avoid causing harm to fish and fish habitat including aquatic species at risk* pertaining to blasting
	CON, OP	Select appropriate type of explosive that will minimize nitrogen release to surface water and groundwater
	CON, OP	Use clean, non-ore-bearing, non-watercourse derived and non-toxic materials for erosion control methods

VC	Project Phase	Mitigation Measure
	CON, OP	Incorporate drainage structures, where necessary, to dissipate hydraulic energy and maintain flow velocities sufficiently low to prevent erosion of native soil material
	CON, OP	Limit clearing within confirmed fish habitat outside of approved alteration areas
	CON, OP	Acquire and follow watercourse alteration permits
	CON, OP	Adhere to applicable timing windows, as directed by DFO, for construction where infilling has been approved in wetlands and watercourses where fish habitat is present.
	CON, OP	Ensure fueling areas are a minimum of 30 m from waterbodies
	CON, OP	Use and maintain properly sized screens on any water intakes or outlet pipes to prevent entrainment or impingement of fish
	CON, OP	Implement Surface Water Management Plan
	CON, OP, DEC	Implement Sediment and Erosion Control Plan
	CON, OP, DEC	Maintain pre-construction hydrological flows into and out of down-stream surface water habitats, to the extent practicable, to limit indirect impacts to fish habitat
	DEC	Complete offsetting for serious harm including for permanent loss of fish habitat through fish habitat restoration activities, subject to DFO approval, based on the *Fisheries Act* current at time of the Project construction

6.9.9 Residual Effects and Significance

The predicted residual environmental effects of Project development and production on fish and fish habitat are assessed to be adverse, but not significant. The overall residual effect of the Project on fish and fish habitat is assessed as not significant after mitigation measures have been implemented.

Table 6.9-37 Residual Environmental Effects for Fish and Fish Habitat

Project VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Significance Criteria for Residual Environmental Effects						Residual Effect	Significance
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Beaver Dam Mine Site and Haul Road (direct watercourse alteration)	Sediment and erosion control, best management practices, spill preparedness, and engagement in the watercourse permitting process.	A	L VC interaction causes direct loss of fish habitat, no serious harm to fish	LAA Potential adverse effect to fish habitat outside of the PA	A Watercourse alteration will occur outside of sensitive periods for fish, however, other interactions may seasonally affect VC	P VC unlikely to recover to baseline conditions	O Effects occur once during the construction phase	IR VC will not recover to baseline conditions	Habitat loss and disturbance	Not Significant
Construction – Beaver Dam Mine Site and Haul Road (clearing and grubbing, altered hydrology, and altered surface water quality)	Sediment and erosion control, best management practices, spill preparedness, and engagement in the watercourse permitting process.	A	N Change in baseline conditions to a small degree	LAA Potential adverse effect to fish habitat outside of the PA	A Seasonal habitat provisions may affect VC	MT Effects can occur beyond 12 months and up to 3 years	S Effects occur at irregular intervals	PR Mitigation cannot guarantee a return to baseline conditions	Disturbance	Not significant
Construction – Haul Road (Haul Road culvert repairs/replacement)	Sediment and erosion control, best management practices, spill preparedness, and engagement in the watercourse permitting process.	P	H Increasing habitat connectivity	RAA Potential for fish habitat to extend beyond LAA	N/A Seasonal habitat provisions will not affect VC	P Increased habitat connectivity is permanent	O Effects occur once during the construction phase	PR Within the life of the culvert, fish habitat will be restored	Increased habitat connectivity	Significant
Operational – Beaver Dam Mine Site (indirect impacts including: groundwater drawdown, altered surface water hydrology, altered surface water quality)	Sediment and erosion control, best management practices, and spill preparedness.	A	L Minor change from baseline conditions	LAA Potential adverse effect to fish habitat outside of the PA	A Seasonal habitat provisions may affect VC	P VC unlikely to recover to baseline conditions	R Effects occur at regular intervals throughout the project	IR VC will not recover to baseline conditions	Habitat loss and disturbance	Not significant
Operational – Beaver Dam Mine Site (indirect impacts to WC-5, Mud Lake, and Crusher Lake from adjusted surface water flow)	Predicted reduction in flow based on modelling. Monitoring will be required to confirm predictions.	A	M Moderate change from baseline conditions	PA Effect to fish and fish habitat is confined to the PA	A Seasonal habitat provisions may affect VC	P VC unlikely to recover to baseline conditions	O Effects occur once at the beginning of the operational phase of the Project	IR VC will not recover to baseline conditions	Loss of habitat and disturbance	Not significant

Project VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Significance Criteria for Residual Environmental Effects						Residual Effect	Significance
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Operational – Haul Road (surface water quality)	Sediment and erosion control, best management practices, and spill preparedness.	A	N Negligible change from baseline conditions	LAA Potential adverse effect to fish habitat outside of the PA	A Seasonal aspects may affect VC	LT Effects may extend beyond 3 years	S Effects occur at irregular intervals throughout the Project	R VC will recover to baseline condition	Disturbance	Not significant
Post Closure – Beaver Dam Mine Site (surface water quality)	Water treatment (as required)	A	N VC interaction will remain below appropriate guidelines	LAA VC interaction will extend beyond PA	A Seasonal aspects will affect VC	P Permanent discharge	R Effects are expected to occur over a regular interval	R VC will recover to baseline conditions	Water quality	Not significant
Operational and Post Closure – Touquoy Mine Site (altered surface water hydrology and surface water quality)	Water treatment (as required)	A	N VC interaction will remain below appropriate guidelines	LAA VC interaction will extend beyond PA	A Seasonal aspects will affect VC	P Permanent discharge	R Effects are expected to occur over a regular interval	R VC will recover to baseline conditions	Water quality	Not significant
Reclamation – Beaver Dam Mine Site (wetland restoration)	Sediment and erosion control, best management practices, and spill preparedness.	P	N VC interaction will remain below appropriate guidelines	PA Potential adverse effect confined to the PA	A Seasonal aspects may affect VC	ST Effects are limited to occur from as little as 1 day to 12 months	O Effects occur once during the reclamation phase	R VC will recover to baseline condition	N/A	Not Significant

Legend (refer to Table 5.10-1 for definitions)

Nature of Effect	Geographic Extent	Duration	Frequency
A Adverse P Positive **Magnitude** N Negligible L Low M Moderate H High	PA Project Area LAA Local Assessment Area RAA Regional Assessment Area **Timing** N/A Not Applicable A Applicable	ST Short-Term MT Medium-Term LT Long-Term P Permanent	O Once S Sporadic R Regular C Continuous **Reversibility** R Reversible IR Irreversible PR Partially Reversible

A significant adverse environmental effect for fish and fish habitat has not been predicted for the Project for the following reasons, with consideration of the ecological and social context of the LAA surrounding the Project:

- During construction, direct impacts to fish and fish habitat will occur. However, these losses are limited to first order streams with limited fish habitat quality and low spawning habitat potential. These losses are not predicted to trigger serious harm to fish and are not expected to require a Fisheries Authorization. There is limited accessibility to these streams from potential recreational or Mi'kmaq users, and fishing potential is considered negligible in these watercourses.
- During Operations, indirect impacts are expected to the watercourse system between Crusher Lake and Mud Lake (WC-5). The predicted reduction in flow may result in a change in this system where during low flow periods, fish passage may be limited from Mud Lake upstream to Crusher Lake. These predicted seasonal losses in fish passage will be confirmed through monitoring, and if confirmed, may result in a Serious Harm to Fish and require a Fisheries Authorization. Replacement of lost habitat will allow for this adverse effect to be considered not significant. This watercourse system is removed from roads and access is limited.
- During operations and closure, impacts to fish and fish habitat with Crusher Lake, Mud Lake and the Killag River are predicted to be low, and a low level of recreational and Mi'kmaq fisheries activities within these three waterbodies has been documented.
- During operations, limited impact to fish and fish habitat is predicted based on control of surface water flows to mimic baseline hydrologic conditions, implementation of sediment and erosion control measures, and water treatment as required.
- During Closure, limited impact to fish and fish habitat is predicted based on control of surface water flows to mimic baseline hydrologic conditions, implementation of sediment and erosion control measures, and water treatment as required both at the Beaver Dam Mine Site and the Touquoy Mine Site.

6.9.9.1 Residual Effects and Significance of the Preferred Alternative Haul Road

Table 6.9-38 Residual Environmental Effects for Fish and Fish Habitat within the Preferred Alternative Haul Road

Project VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Significance Criteria for Residual Environmental Effects						Residual Effect	Significance
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Preferred Alternative Haul Road (direct watercourse alteration)	Sediment and erosion control, best management practices, spill preparedness, and engagement in the watercourse permitting process.	A	L VC interaction causes direct loss of fish habitat, no serious harm to fish	LAA Potential adverse effect to fish habitat outside of the PA	A Watercourse alteration will occur outside of sensitive periods for fish, however, other interactions may seasonally affect VC	P VC unlikely to recover to baseline conditions	O Effects occur once during the construction phase	IR VC will not recover to baseline conditions	Habitat loss and disturbance	Not Significant
Construction – Preferred Alternative Haul Road (clearing and grubbing, altered hydrology, and altered surface water quality)	Sediment and erosion control, best management practices, spill preparedness, and engagement in the watercourse permitting process.	A	N Change in baseline conditions to a small degree	LAA Potential adverse effect to fish habitat outside of the PA	A Seasonal habitat provisions may affect VC	MT Effects can occur beyond 12 months and up to 3 years	S Effects occur at irregular intervals	PR Mitigation cannot guarantee a return to baseline conditions	Disturbance	Not significant
Operational – Preferred Alternative Haul Road (surface water quality)	Sediment and erosion control, best management practices, and spill preparedness.	A	N Negligible change from baseline conditions	LAA Potential adverse effect to fish habitat outside of the PA	A Seasonal aspects may affect VC	LT Effects may extend beyond 3 years	S Effects occur at irregular intervals throughout the Project	R VC will recover to baseline condition	Disturbance	Not significant

Legend (refer to Table 5.10-1 for definitions)

Nature of Effect	Geographic Extent	Duration	Frequency
A Adverse P Positive **Magnitude** N Negligible L Low M Moderate H High	PA Project Area LAA Local Assessment Area RAA Regional Assessment Area **Timing** N/A Not Applicable A Applicable	ST Short-Term MT Medium-Term LT Long-Term P Permanent	O Once S Sporadic R Regular C Continuous **Reversibility** R Reversible IR Irreversible PR Partially Reversible

Table 6.9-37 was reviewed and it was determined that the construction (direct and indirect impacts) and operation (water quality) of the Haul Road were the only three VC interactions applicable to fish and fish habitat within the Preferred Alternative Haul Road. There are no changes in significance criteria or overall significance for VC interactions specific to the Preferred Alternative Haul Road.

Within the PA there is an expected direct loss of fish habitat, however, there is no direct loss of fish habitat anticipated within the Preferred Alternative Haul Road. Six watercourses crossings are required and the remaining watercourses can be avoided by road micrositing. Since there is no impact from this VC interaction it was not carried forward.

A 15.4 km portion of the existing Haul Road will receive improvements to fish habitat connectivity via the replacement of poorly installed or damaged culverts, having a positive effect for fish and fish habitat within the PA. No culverts currently exist on forestry road watercourse crossings within the Preferred Alternative Haul Road, therefore, no improvements to fish habitat are anticipated. The selection of the Preferred Alternative Haul Road would limit the potential upgrades to the poorly installed culverts that are currently present along the existing Haul Road.

To mitigate the potential impacts of Project activities on fish, best management practices will be adhered to and mitigations presented in Table 6.9-36 will be established.

6.9.10 Proposed Compliance and Effects Monitoring Program

Surface water monitoring will be completed to verify the accuracy of the predicted environmental effects and the effectiveness of the mitigation measures for fish and fish habitat. Mitigations are outlined in Table 6.9-36. A Surface Water Monitoring Plan will be established through the life cycle of the permitting process and will commit to monitoring during baseline/pre-construction to establish baseline conditions, and through the operational phase, reclamation and post closure (as determined to be required). Surface water monitoring will be completed for the Project on selected representative watercourses that have been predicted to have direct or indirect effects on fish and fish habitat from project development.

The Preliminary Environmental Effects Monitoring Plan (EEM), located in Appendix O.1, outlines the proposed preliminary methods, timing, frequency, and locations for fish and fish habitat monitoring. This document will evolve through regulatory permitting, as well as public and Mi’kmaw engagement.

6.10 Habitat and Flora

6.10.1 Rationale for Valued Component Selection

Flora species and ~~communities~~ ecosystem habitats, and the fauna species which rely upon these communities, may be altered, either directly or indirectly, by proposed Project activities. Field programs were developed to identify priority species, in particular SAR, which are protected under federal and provincial SAR legislation.

6.10.2 Baseline Program Methodology

Methodology of habitat and flora surveys within the Beaver Dam Mine Site and Haul Road are discussed below. Information pertaining to Touquoy Mine Site has been brought forward from the EARD and Focus Report. Methods and results are summarized in subheadings within the applicable sections and are carried forward into the effects assessment where deemed appropriate. For further information regarding Touquoy Mine Site, refer to the EARD (CRA 2007) and Focus Report (CRA 2007a).

6.10.2.1 Priority Species List Methodology and Desktop Evaluation

A detailed desktop study to examine potential for presence of and effects on SAR within the vicinity of the PA was completed. This desktop evaluation for SAR and SOCI was completed in advance of field programs to advise the detailed methodologies outlined in Section 6.13. SAR and SOCI are collectively referred to as priority species.

Through consultation with NSE and Environment and Climate Change Canada, the Project Team has developed the following definitions for SAR and SOCI:

- A SAR is any species which is designated under the federal Species at Risk Act (Government of Canada, 2015) and any species designated under the provincial Nova Scotia Endangered Species Act (Province of Nova Scotia, 2015).
- A SOCI is one which is listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC, 2015) to be considered for federal protection under SARA but does not yet have designation under SARA. In addition, a SOCI includes those listed as S1-S3 (provincial rarity rankings) by the Atlantic Canadian Conservation Centre (ACCDC, 2015).

A priority species list was compiled to identify potential SAR and SOCI which may be using the PA and surrounding lands for each taxonomic group. This priority species list was compiled in accordance with the requirements outlined in the NSE Guide to Addressing Wildlife Species and Habitat in an EA Registration Document (NSE, 2009b). Additional guidance was provided by ~~NSDNR~~ NSL&F SAR biologist, Mark Elderkin. As per conversations with Mr. Elderkin during the early spring of 2015, it was requested that all priority species lists be built using status ranks (S-Ranks, S1, S2, S3) rather than general status ranks (GS-Ranks Red and Yellow). Table 6.10-1 provides the definitions of provincial status ranks (S-Ranks) (ACCDC 2017).

Table 6.10-1 Provincial Status Ranks Definitions

S-rank	Definition
SX	**Presumed Extirpated** - Species or community is believed to be extirpated from the province. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.
S1	**Critically Imperiled** - Critically imperiled in the province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.
S2	**Imperiled** - Imperiled in the province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province.
S3	**Vulnerable** - Vulnerable in the province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.

S-rank	Definition
S4	**Apparently Secure** - Uncommon but not rare; some cause for long-term concern due to declines or other factors.
S5	**Secure** - Common, widespread, and abundant in the province.
SNR	**Unranked** - Nation or state/province conservation status not yet assessed.
SU	**Unrankable** - Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
SNA	**Not Applicable** - A conservation status rank is not applicable because the species is not a suitable target for conservation activities.
S#S#	**Range Rank** - A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species or community. Ranges cannot skip more than one rank (e.g., SU is used rather than S1S4).
Not Provided	Species is not known to occur in the province.
Breeding Status Qualifiers	
Qualifier	Definition
B	Breeding - Conservation status refers to the breeding population of the species in the province.
N	Nonbreeding - Conservation status refers to the non-breeding population of the species in the province.
M	Migrant - Migrant species occurring regularly on migration at particular staging areas or concentration spots where the species might warrant conservation attention. Conservation status refers to the aggregating transient population of the species in the province.

As outlined in the EA guidance documented cited above, the compilation of a priority species list is <u>habitat driven</u>, rather than <u>observation driven</u> (based on information provided in reports from ACCDC or the Maritime Breeding Brid Atlas (MBBA), for example). This is based on the recognition that observation based datasets are not comprehensive lists of species identified in any given area. As such, the information provided observation driven sources are supplementary to the priority species list, rather than forming the basis of the priority species list.

The Project Team compiled a list of all SAR and SOCI as defined above with habitat preferences and geographic distribution (if known) included. To complete the Project-specific priority species list, the province-wide list was narrowed based on:

- Broad geographic area (for this Project, the broad geographic area considered is central mainland Nova Scotia);
- Habitat preferences; and,
- Presence of preferred habitat within the PA based on habitat survey results.

The final priority list of species used for field assessments is attached in **Appendix I.5.**

Once the priority species list was completed, the Project Team reviewed a series of additional data sources. Sightings of priority species recorded within 5 km and 100 km by ACCDC are reviewed (reports included in **Appendix I.1; I.2, I.3**). One report was prepared for the Beaver Dam Mine Site ~~footprint PA~~ on September 8, 2014, ~~and an additional~~ one report was prepared for the Haul Road ~~PA~~ on June 3, 2016, and an additional report was prepared for the Touquoy Mine Site on September 10, 2015. Those species which have been documented within 5 km of the PA ~~of the are underlined~~ are identified in Tables 6.10-2 below. If there were no species observed within 5km of the PA, by either ACCDC report, this was also stated.

When the ACCDC prepares a rare species report, they provide the user with georeferenced shapefile points of rare species records within 5 km of the center of the study area. However, ~~NSDNR~~ NSL&F has classified several species as ‘location sensitive’, meaning that ACCDC is not permitted to provide specific location data for these species in their reports. Concern about exploitation of location-sensitive species precludes inclusion of coordinates in the rare species reports. Location sensitive species in Nova Scotia include black ash (*Fraxinus nigra*), Blandings turtle (*Emydoidea blandingii*), wood turtle (*Glyptemys insculpta*), peregrine falcon anatum/tundrius populations (*Falco peregrinus, pop.1*), and any bat hibernaculum. If any of these species are present within 5 km of the center of the study area, the ACCDC report will simply identify that they are present, but will not provide specific location data. No location sensitive species were documented within 5 km of the PA in ~~either~~ any of the ACCDC reports ~~(Haul Road mine footprint).~~

The Nova Scotia Museum of Natural History provided a list of flora and fauna SAR and SOCI documented by their staff within the vicinity of the PA, and the ~~NSDNR~~ NSL&F Significant Species and Habitats Database was reviewed as well. The NS Museum report is provided in **Appendix I.4** and species identified in that report are highlighted in Tables 6.7-2. Two additional datasets were reviewed for priority invertebrates. These include the Maritime Butterfly Atlas and Odonata Central. These datasets provide records of butterfly and odonate observations, respectively.

The compilation of the priority species list and the review of all other available desktop resources for priority species observations is done primarily to advise field methodology, and they inform field staff to the species they are likely to encounter during field surveys. The desktop review for priority species provided the study team with information that directly guided the methods and the timing of all field programs. All field staff reviewed the desktop evaluation for priority species prior to commencing field work. This allowed field staff to review field identification guides and ensured that they were familiar with priority species identification and their status ranks.

6.10.2.2 Habitat Survey

Habitat assessments were completed in October 2014 and May 2015 within the Beaver Dam Mine Site ~~footprint PA~~, and in May 2016 within the Haul Road ~~PA~~. Using available forestry and wetland databases, habitat survey routes were created with the goal of assessing all of the major habitat types and landscape features throughout the PA.

The habitat survey methods and results are presented with the acknowledgment of three biases built into the survey methods.

- One bias is towards upland habitat. This bias was purposefully built into the survey methods with the understanding that all wetlands within the PA will be delineated and described in detail and their function as habitats within the landscape of the PA would be captured in the wetland program (Section 6.8).
- The second bias is towards forested landscape as opposed to non-forested landscapes. In this context, clear cut lands, or those which have experienced timber harvesting of any sort, are still considered forested because the removal of timber is only a temporary disturbance. Non-forested portions of the landscape, such as roads or extensive gravel areas, often associated with historic mine workings, were not assessed during the habitat survey simply because they lack forest cover to be described and their capability for supporting forest cover in the foreseeable future is low based on the level of disturbance.
- The third bias in this survey is that habitat surveys were completed at discrete points and no effort was made to delineate the extent of that habitat type around those points. As such, the ability to extrapolate habitat survey results across the entire PA is limited. These habitat survey points are meant to describe habitat in 'snapshots' of specific locations. The results of the habitat survey are meant to describe the diversity of habitat types present throughout the PA and the relative abundance thereof, rather than absolute percent cover of each habitat type throughout the PA.

Two surveyors walked the habitat survey routes. Habitat survey points (HSPs) were established along the survey route based on anticipated and observed habitat types. The distance between habitat survey points was dependent upon the complexity of major habitat types across the landscape, approximately 250 m for the Beaver Dam Mine Site ~~mine footprint~~ and approximately 1 km along the Haul Road.

The Forest Ecosystem Classification (FEC) for Nova Scotia guide book was used to describe habitat characteristics within the habitat survey points. The following information was collected at each habitat survey point:

- Vegetation type was determined using Part 1 of the FEC guide (Neily et al., 2011). Each stand was classified by overall forest group code and vegetation type using the keys provided in the guide book. Forest groups are general groupings of vegetation types. Within each forest group (open woodland or tolerant hardwood, for example), there are several specific vegetation types. Vegetation types are recurring and identifiable plant communities which reflect differences in site conditions, natural disturbance regimes, and successional stage. For example, TH4 is a tolerant hardwood forest group dominated by sugar maple and white ash vegetation type, while TH6 is a tolerant hardwood forest group dominated by red oak and yellow birch vegetation type.
- Ecosite was determined using Part 3 of the FEC guide (Keys et al., 2011). This guide provides keys to identify ecosites using an edatopic grid, which is a two-dimensional diagram used to plot ecosystems and ecosites based on their relative moisture and nutrient regimes. Ecosites are units

which represent ecosystems that have developed under a particular nutrient and moisture regime. A finite range of vegetation types will naturally grow in any given ecosite.

- An approximation of forest stand age was determined using broad classifications for stand age (regenerating, immature, mature, over mature). This approximation is based on a combination of factors, such as total basal area, level of canopy coverage, senescence of older trees and presence of cavity trees, and species composition of the canopy, shrub and understory vegetation.
- Natural or anthropogenic disturbance is recorded in each site. The level and type of disturbance is identified and the timing of the disturbance is noted as well if it is apparent. Examples of natural disturbances include timber harvesting or road development. Natural disturbance regimes include fire, pests, wind throw, and natural senescence.
- Representative photos were taken of each site.

Habitat survey results were purposefully biased towards upland habitats, based on the fact that the wetland program would collect detailed information about each individual wetland within the PA. The habitat surveys were completed early in the field evaluation (October 2014 in the ~~mine footprint PA~~ and May 2015 in the Haul Road ~~PA~~). These surveys provide valuable insight into the overall habitat composition of the PA, while helping to inform methodologies of other field programs.

Touquoy Mine Site

Habitat surveys were completed at the Touquoy Mine Site from 2004 to 2006 as part of the EARD process.

6.10.2.3 Vascular Plant Surveys

As described in the Guide to Addressing Wildlife Species and Habitat in an EA Registration Document (NSE, 2009b) and the Beaver Dam Mine Project ~~Draft~~ EIS Guidelines (CEAA, 2015), a complete vascular plant inventory is not typically required for an environmental assessment. In accordance with the documents referenced above, the vegetation survey focused on the identification of vegetative communities, with particular attention to identifying priority species. Priority species methodologies, including desktop review, are described in detail in Section 6.13.2.

Habitat types were identified on a broad scale within the PA and then meander transects through each habitat type were conducted in order to ensure that a variety of habitat types were surveyed for vegetation. One search was completed on September 8th, 12th, and October 9th, 2014 to assess the Beaver Dam Mine Site ~~mine footprint PA~~ for late season phenology. The following spring, a search was completed to evaluate the Beaver Dam Mine Site ~~mine footprint PA~~ for spring ephemerals on June 22-23, 2015. Early phenology surveys were completed within the Haul Road ~~PA~~ on June 22-23 2016, followed by late season surveys, which were completed on September 11-12, 2016. An additional vascular plant surveys was conducted within the western extension to the Beaver Dam Mine Site on September 18, 2018. The Beaver Dam Mine Site was extended west to allow for the micro siting of the waste rock stockpile.

For these surveys, a list of all rare species records found within 100 km of the PA was assembled prior to the survey being undertaken (from ACCDC and NS Museum data results) to provide additional information and support the priority species list regarding the potential presence of priority species within the PA. Two ACCDC reports were requested to cover observations within the Beaver Dam Mine Site ~~mine footprint~~ and along the Haul Road. The ACCDC and NS Museum data reports are provided in

Appendix I.1-I.4. The specific timing of field surveys was determined based on the identification of priority species that were documented within 20 km of the Project Area by the ACCDC.

Touquoy Mine Site

Vascular plant surveys were conducted in August 2004, May and June 2005, and September 2006 as part of the EARD process.

6.10.2.4 Lichen Surveys

Specific methods for lichen surveys were determined based on identification of SAR and SOCI lichens. The Project Team did not complete a comprehensive list of all lichen species within the PA. The lichenologist did record several opportunistic observations of lichen species during the focused surveys for lichen SAR and SOCI at the Beaver Dam Mine Site, surrounding area, and Haul Road. Detailed methods for lichen SAR and SOCI field surveys and desktop evaluation are presented in Section 6.13.2 and all lichen results are described in Section 6.10.3.4.

Touquoy Mine Site

Lichen surveys were conducted at the Touquoy Mine Site in 2004 and 2005 as part of the EARD process (refer to CRA 2007 for further methodological details). An additional survey, at the request of DNR, was conducted in February 2007 at the Touquoy Mine Site in areas where blue felt lichen (*Degelia plumbea*) was previously observed.

6.10.2.5 Old Forest (Mature Forest) and Interior Forest Desktop Analysis

A desktop mapping exercise was conducted to identify mature forest and interior forest habitat in relation to Project infrastructure. The NSDNR Old Forest Policy 2012 definition of old forest and interior forest were used to determine these habitat types.

Interior forest is defined as area within a forest sheltered from edge effects. The Old Forest Policy uses an edge effect distance of 200 meters from disturbance. Any patch that is suitably outside of this edge effect but is under 15 ha is considered as incapable of supporting interior forest. In reality, interior forest is dependent on the condition being measured and the nature of the edge interface (Old Forest Policy, 2012). For this review, patches of interior forest were identified by buffering the NSL&F road and rail layer by 200 m to represent existing disturbance and associated edge effect. Any patch outside this buffer, greater than 15 ha, and within the LAA was considered potential interior forest habitat.

Old Forest is defined as a stand or collection of stands containing old growth and/or mature climax conditions (Old Forest Policy, 2012). Mature climax is a forest stand of trees aged 80 – 125 years old and old grown forest is a stand with trees 125 years or older. Old Forest was used as a representation of mature forest for this review. Stands of Old Forest were identified using the Nova Scotia Old Forest Layer. This dataset identifies crown land forest stands that meet the Old Forest criteria under the Old Forest Policy. (Open Data Nova Scotia 2016).

To determine potential Project impact on interior forest and Old Forest, Project infrastructure and the Haul Road centerline were buffered by 200 m to represent the extent of edge effect influence from disturbance. This area was referred to as the Project Impact Area.

6.10.3 Baseline Conditions

Updates to vascular plants and lichens (total number, location etc.) reflected within this section are as a result of additional surveys required by changes to the PA in order to incorporate the micrositing of Project infrastructure.

6.10.3.1 Desktop Evaluation

Based on a visual review of a 2014 aerial photograph and the NSL&F Forest Inventory, approximately 78.6% of the PA is currently disturbed. Disturbed areas consist of clearcutting (4.6%), forested less than 40 years (51.3%), forested between 40 and 100 years (5.7%), mining and exploration activities (14.5%), and road corridors (2.5%). The remaining 21.4% of the PA is considered to be undisturbed wetlands (10.4%) and forests (11.1%) (NSDNR 2017). As such, the level of new fragmentation associated with the Beaver Dam Mine Site is anticipated to be moderate, given the current level of disturbance.

No priority vascular plants have been observed within 5 km of the PA according to the ACCDC reports for the Beaver Dam Mine Site, Haul Road, and Touquoy Mine Site. In regard to lichens; boreal felt lichen (*Erioderma pedicellatum*) was cited within 5 km of the PA in all three ACCDC reports. Additionally, frosted glass-whiskers (*Sclerophora peronella*), blue felt lichen (*Degelia plumbea*), and rimmed shingles lichen (*Fuscopannaria leucosticta*) were observed within 5 km of the Touquoy Mine Site according to the ACCDC (Appendix I.1 to I.3).

Nova Scotia Museum of Natural History (Communities, Culture, and Heritage) provided a list of flora and fauna SAR and SOCI documented by their staff within the vicinity of the PA. The priority flora species are as follows; Michaux's dwarf birch (*Betula michauxii*), showy lady's slipper (*Cypripedium reginae*), flat-stemmed pondweed (*Potamogeton zosteriformis*), alder-leaved buckthorn (*Rhamnus alnifolia*), northern bog violet (*Viola nephrophylla*), and golden alexanders (*Zizia aurea*) (Appendix I.4)

Table 6.10-2 Desktop Identified Priority Vascular Plants and Lichens

Common name	Scientific name	COSEWIC	SARA	NSESA	S-Rank	Source
Priority Lichen Species						
Boreal felt lichen	*Erioderma pedicellatum*	E	E	E	S1	ACCDC
Frosted glass-whiskers	*Sclerophora peronella*	SC	SC		S1?	ACCDC
Blue felt lichen	*Degelia plumbea*	SC	SC	V	S3	ACCDC
Rimmed shingles lichen	*Fuscopannaria leucosticta*	-	-	-	S2S3	ACCDC
Priority Vascular Plant Species						
Michaux's dwarf birch	*Betula michauxii*	-	-	-	S2S3	CCH

Common name	Scientific name	COSEWIC	SARA	NSESA	S-Rank	Source
Priority Lichen Species						
Showy lady's slipper	*Cypripedium reginae*	-	-	-	S2	CCH
Flat-stemmed pondweed	*Potamogeton zosteriformis*	-	-	-	S3	CCH
Alder-leaved buckthorn	*Rhamnus alnifolia*	-	-	-	S3	CCH
Northern bog violet	*Viola nephrophylla*	-	-	-	S2	CCH
Golden alexanders	*Zizia aurea*	-	-	-	S1	CCH

6.10.3.2 Habitat Survey Results

The Beaver Dam Mine Project is located in the Eastern Ecoregion of the Acadian Ecozone. Ecoregions are subdivisions of the larger ecozones and express macroclimate as a distinctive ecological response to climate through soils and vegetation (Neily et al., 2005).

Ecoregions are further subdivided into ecodistricts, which reflect macroelements of the physical and biological attributes of ecosystems which will ultimately influence biodiversity. The PA is ~~three primary Project locations are~~ spread across the further subdivided Eastern Interior and Eastern Drumlin Ecodistricts. The Eastern Interior Ecodistrict is generally characterized by highly visibly bedrock where glacial till is very thin, exposing the ridge topography. Where till is thicker, ridged topography is masked and thick softwood forests occur. There are a few drumlins and hills scattered throughout the ecodistrict and fine textured soils are derived from slates. The Eastern Drumlin ecodistrict are underlain by Meguma Group greywacke and slate, blanketed by fine-textured till derived from these underlying and adjacent rocks. Drumlins are derived from carboniferous rocks from the north, as well as material from the Cobequid Hills and Pictou-Antigonish Highlands.

Ecosites are units which represent ecosystems that have developed under a variety of conditions and influences, but which have similar moisture and nutrient regimes. An ecosite is associated with a finite range of soil and site conditions and a finite range of vegetation types that grow naturally under those conditions. Ecosites represent general productivity units and provide an ecological setting through which vegetation and soil types can be grouped and compared. In this application, the value in ecosite classification lies in wildlife habitat analysis and biodiversity considerations. For example, ecosite classification can be used to help determine the likelihood of finding particular rare plants that prefer specific moisture or nutrient regimes.

Within the Beaver Dam Mine Site ~~footprint PA~~, habitat survey points confirmed six different ecosites. Ecosites identified within the Beaver Dam Mine Site ~~footprint PA~~ were within the moist to fresh moisture regime, with poor to medium nutrient regimes. These ecosites generally support vegetation types from the spruce-pine and spruce-hemlock forest groups. Generally, spruce-pine forest groups are associated with a natural disturbance regime of fire, which leads to stands dominated by spruce, pine, and understorey vegetation tolerant of acidic, nutrient poor conditions. Spruce-hemlock forest groups are characterized by red spruce (*Picea rubens*), white pine (*Pinus strobus*), and eastern hemlock (*Tsuga canadensis*). These species have high shade tolerance and are long lived species, which can support old growth conditions. Spruce-hemlock forest groups generally do not support many species of rare plants, but provide good quality habitat for a diversity of mammals and birds.

Of the 17 established habitat survey points within the Beaver Dam Mine Site ~~footprint PA~~, the most abundant ecosite was AC10, accounting for 53% of all habitat survey points (see Figure 6.10-1). The next most abundant ecosite within the Beaver Dam Mine Site ~~footprint~~ is AC11, followed by AC6.

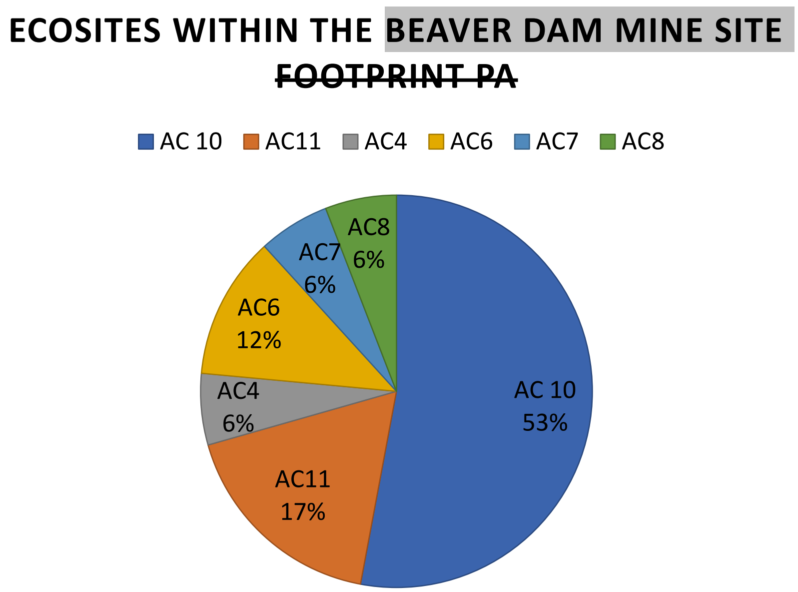

Figure 6.10-1 Relative Abundance of Ecosites within the Beaver Dam Mine Site ~~Footprint~~

Within the Haul Road ~~PA~~, habitat survey points fell within nine different ecosites. Ecosites identified within the Haul Road ~~PA~~ were within the very dry to wet moisture regime, with very poor to rich nutrient regimes. These ecosites generally support a broader variety of vegetation types from the spruce-pine, intolerant and tolerant hardwood, mixed wood, open woodland, spruce-hemlock and intolerant hardwood forest groups.

Of the 20 established habitat survey points within the Haul Road ~~PA~~, the most abundant ecosite was AC6, accounting for 30%. The next most abundant ecosite within the Haul Road ~~PA~~ is AC10 at 15%, followed by AC1, AC5, AC7, and AC10 at 10% each (see Figure 6.10-2 and 6.10-3).

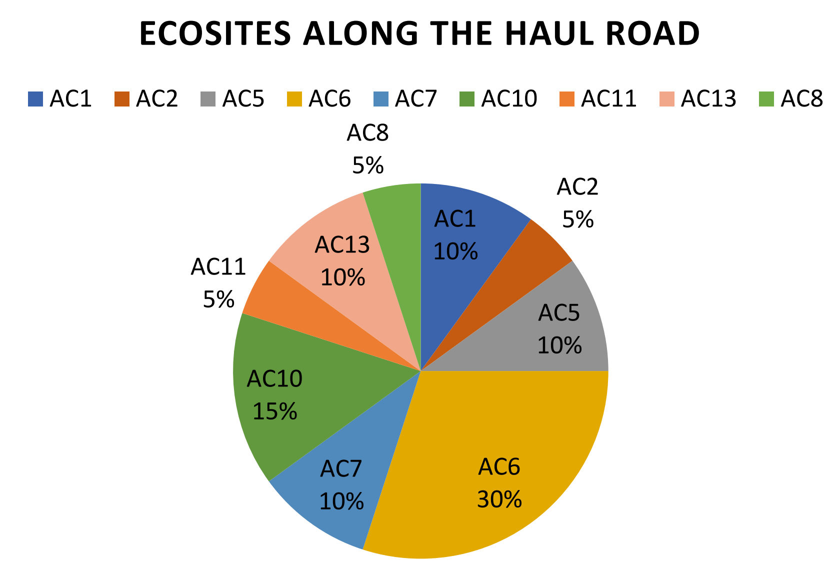

Figure 6.10-2 Relative Presence of Ecosites within the Haul Road

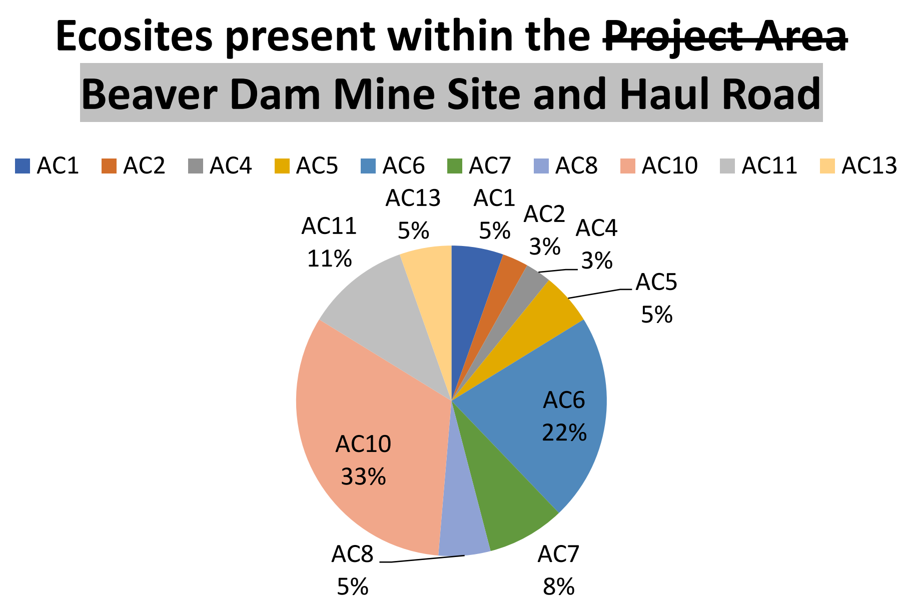

Figure 6.10-3 Ecosites present within the ~~Project Area~~ Beaver Dam Mine Site and Haul Road

Table 6.10-3 Habitat Survey results within the ~~PA~~ Beaver Dam Mine Site and Haul Road

Habitat Survey Point	Ecosite	VT*	Stand age	Level and type of disturbance	Comments
HP001	AC10	SH4	Regenerating	Moderate - harvested	Overstory dominated by red spruce and balsam fir with white pine, yellow birch, and red maple. Understory dominated by sapling red spruce and balsam fir with velvet-leaved blueberry, bracken fern, bunchberry, and goldthread groundcover.
HP002	AC7	SP6	Immature	Low	Overstory dominated by balsam fir and black spruce with tamarack, red maple, and white birch. Understory dominated by regenerating balsam fir and black spruce with raisin, bracken fern, sheep laurel, goldthread, and creeping snowberry.
HP003	AC6	SP4	Regenerating	Moderate - harvested	Some remnant mature white pine in overstory with black spruce, tamarack, black spruce, balsam fir, and red maple. Understory dominated by regenerating balsam fir and bracken fern with black spruce, red maple, wild raisin, mountain holly, sheep laurel, bunchberry, and velvet-leaved blueberry.
HP004	AC11	SH3	Immature	Low	Softwood stand. Overstory dominated by red spruce and balsam fir with red maple, yellow birch, and white pine. Understory dominated by regenerating balsam fir and hay-scented fern with red spruce, bunchberry, evergreen wood fern, and lady fern.
HP005	AC11	SH5	Regenerating	Harvested	Disturbed stand. Overstory dominated by red spruce and red maple with yellow birch and white birch. Understory dominated regenerating balsam fir with red maple and wild raisin.

Habitat Survey Point	Ecosite	VT*	Stand age	Level and type of disturbance	Comments
HP006	AC8	WC7	Immature	Low	Treed coniferous swamp. Overstory dominated by tamarack with red maple, balsam fir, black spruce, and white birch. Understory dominated by spinulose wood fern, balsam fir, speckled alder, bunchberry, and creeping snowberry.
HP007	AC10	MW1	Regeneratin g	Harvested	Disturbed stand. Overstory dominated by red spruce with yellow birch, red maple, and white birch. Understory dominated by regenerating balsam fir and strawberry with red spruce, red maple, yellow birch, sheep laurel, Labrador tea, creeping snowberry, and white meadowsweet.
HP008	AC10	TH7	Regeneratin g	Harvested	Disturbed stand. Overstory dominated by yellow birch with balsam fir and white birch. Understory dominated by regenerating yellow birch and balsam fir. Mature trees are entirely absent, as is herb layer due to leaf litter/canopy cover.
HP009	AC10	SH8	Immature	Low	Softwood stand. Overstory dominated by balsam fir with red maple and yellow birch. Understory dominated by balsam fir, red maple, and bunchberry.
HP010	AC11	SH4	Immature	Low	Softwood stand. Overstory dominated by white pine with red spruce, balsam fir, and red maple. Understory dominated by bunchberry with sheep laurel and balsam fir.
HP011	AC10	MW2	Regeneratin g	Harvested	Disturbed stand. Overstory dominated by red spruce with white pine, balsam fir, red maple, and white birch. Understory dominated by red spruce saplings and sheep laurel with red maple saplings, wild raisin, bunchberry, mayflower, and bracken fern.

Habitat Survey Point	Ecosite	VT*	Stand age	Level and type of disturbance	Comments
HP012	AC10	MW2	Regeneratin g	Harvested	Disturbed stand. Overstory dominated by red spruce with red maple, balsam fir, white birch, white pine, and yellow birch. Understory dominated by regenerating balsam fir and bunchberry with pin cherry, tamarack, sheep laurel, bracken fern, mayflower, and velvet-leaved blueberry.
HP013	AC10	MW2	Regeneratin g	Harvested	Disturbed stand. Overstory dominated by red maple with white birch, red spruce, and yellow birch. Understory dominated by regenerating balsam fir with twinflower, bunchberry, low-bush blueberry, red raspberry, and New York fern.
HP014	AC10	MW2	Regeneratin g	Harvested	Disturbed stand. Overstory dominated by balsam fir with red spruce, red maple, yellow birch, and white birch. Understory dominated by regenerating balsam fir, red maple, and bunchberry with red spruce, yellow birch, bracken fern, and twinflower.
HP015	AC10	SH5	Mature	Low	Balsam fir and black spruce. Very little understory vegetation.
HP016	AC4	WC2	Immature	Low	Treed coniferous swamp. Overstory dominated by black spruce with tamarack, red maple, and balsam fir. Understory dominated by wild raisin and Labrador tea with red maple, black spruce, tamarack, sheep laurel, bunchberry, twinflower, cinnamon fern, and steeplebush.
HP017	AC6	SP4a	Regeneratin g	Harvested	Disturbed stand with remnant mature white pine in overstory. Overstory dominated by black spruce, balsam fir, white pine, and red maple. Understory dominated by regenerating balsam fir and sheep laurel with wild raisin, bunchberry, bracken fern, velvet-leaved blueberry, mountain holly, and teaberry.

Habitat Survey Point	Ecosite	VT*	Stand age	Level and type of disturbance	Comments
HP018	AC6	SP4a	Regeneratin g	Harvested	Disturbed- cut. Overstory dominated by balsam fir, black spruce, red maple, white pine. Understory dominated by sheep laurel, wild raisin, bracken fern, and teaberry.
HP019	AC1	SP3a	Immature	Low	Overstory dominated white birch and balsam fir, red and black spruce, white pine. Understory dominated mayflower, bracken fern, and sheep laurel.
HP020	AC6	IH6	Regeneratin g	Harvested	Disturbed. Overstory dominated by red maple and white birch.
HP021	AC10	MW4	Immature to mature	Low	Overstory dominated white birch, yellow birch.
HP022	AC7	SH5	Immature to mature	Harvested	Disturbed. Overstory dominated by red spruce.
HP023	AC13	IH7	Immature to mature	Low	Overstory is abundant yellow birch and red maple.
HP024	AC13	IH7	Mature	Low	Overstory dominated red maple.
HP025	AC8	WC6	Mature	Low	Overstory dominated by red spruce. Understory dominated by cinnamon fern, bracken fern, sheep laurel, and Labrador tea.
HP026	AC5	SP4	Mature	Low	Overstory dominated by white pine and red spruce. Understory dominated by red maple and balsam fir, occasionally.
HP027	AC2	OW2	Mature	Low	Overstory has abundant cover of red spruce. Shrub layer dominated by white birch. Understory dominated by sheep laurel, teaberry, and bracken fern.

Habitat Survey Point	Ecosite	VT*	Stand age	Level and type of disturbance	Comments
HP028	AC7	SP4	Mature	Low	Overstory dominated by white pine.
HP029	AC10	TH7	Mature	Low	Overstory dominated by yellow birch. Understory dominated by evergreen wood fern.
HP030	AC6	SH5	Mature	Low	Overstory dominated by balsam fir.
HP031	AC10	MW1	Immature to mature	Low	Overstory has abundant cover of balsam fir, white birch, and yellow birch.
HP032	AC6	SH5	Immature to mature	Low	Overstory has abundant red spruce. Understory dominated by cinnamon fern.
HP033	AC1	OW2	Mature	Low	Overstory dominated by black spruce. Understory dominated by teaberry and bracken fern.
HP034	AC5	SH5	Mature to over mature	Low	Overstory dominated by black spruce. Understory dominated by sheep laurel and bracken fern.
HP035	AC6	SH5	Mature to over mature	Low	Overstory dominated by red spruce and red maple. Understory dominated by sheep laurel.
HP036	AC6	SP5	Mature	Low	Overstory dominated by black spruce. Understory dominated by bracken fern.
HP037	AC11	SH4	Mature	Low	Overstory dominated by red spruce and black spruce. Understory dominated by sheep laurel.

*VT: Vegetation Type.
HP01-HP17 are within the Beaver Dam Mine Site ~~mine footprint PA~~, HP18-37 are within the Haul Road ~~PA~~

The ecosites identified throughout the ~~PA~~ Beaver Dam Mine Site and Haul Road are described herein, grouped by predominant nutrient regime.

6.10.3.2.1 **Very Poor Nutrient Regime**

Ecosites with very poor nutrient regimes encountered within the Beaver Dam Mine Site and Haul Road ~~PA~~ include AC1, AC2, and AC4. These ecosites represent very dry, fresh, and moist/wet moisture regimes, respectively. Ecosite AC1 was observed twice within the Haul Road ~~PA~~. At the survey points, the Beaver Dam Mine Site and Haul Road ~~PA~~ supported open woodland and spruce-pine vegetation types, typical of dry moisture regimes within the very poor nutrient regime. This ecosite occurs mainly on upper slopes or crests of exposed bedrock. Ecosite AC2, also observed within the Haul Road ~~PA~~, supported an open woodland forest type as well. One of the habitat survey points assessed was classified as ecosite AC4, which occurs mainly on poorly to very poorly drained level areas and depressions with coarse textured glacial till and/or organic deposits. This ecosite has wet, very nutrient poor to very poor soils, which generally support poorly stocked stands of black spruce with tamarack (sometimes stunted).

6.10.3.2.2 **Poor Nutrient Regime**

Forty percent of habitat survey points were classified under a very poor nutrient regime. Ecosites AC5, AC6, AC7, and AC8 represent dry, fresh, moist, and wet moisture regimes, respectively.

Ecosite AC5 occurs on well- to rapidly-drained sites and generally supports a canopy of white pine, red spruce, black spruce, or red maple. Within the Beaver Dam Mine Site and Haul Road ~~PA~~, this ecosite supported spruce-pine and spruce-hemlock vegetation types. Ecosites AC6 and AC7 occur primarily on well drained to imperfectly-drained slopes with coarse textured glacial till deposits and fresh to moist, nutrient poor soils. These conditions generally support closed canopy stands of white pine and black spruce. When balsam fir is present, it is generally intermediate in the canopy and of low vigor. Early successional stands are dominated by large-toothed aspen (*Populus grandidentata*), red oak (*Quercus rubra*), and red maple. Within the Beaver Dam Mine Site and Haul Road ~~PA~~, habitat survey points within these ecosites were identified to be within the spruce-pine, intolerant hardwood, and spruce-hemlock forest groups.

Ecosite 8 typically occurs in depressions or areas with poorly or very poorly drained soils, generally supporting wetland habitat. Typical canopy coverage within this ecosites can range from spruce, balsam fir, and larch, and occasionally red maple and white ash. Within the Beaver Dam Mine Site and Haul Road ~~PA~~, this ecosite supported a wet coniferous forest group.

6.10.3.2.3 **Medium Nutrient Regime**

Within the Beaver Dam Mine Site and Haul Road ~~PA~~ specifically, and within Nova Scotia more generally, the majority of Acadian climax softwood and mixed wood forests are found on AC10 and AC11 sites. Occurring mainly on well-drained slopes with medium textured glacial till deposits, AC10 has fresh, nutrient-medium soils which generally support late successional forests dominated by red spruce, eastern hemlock, and yellow birch. Earlier successional forests contain balsam fir, white birch, red maple, and trembling aspen (*Populus tremuloides*). Within the ~~PA~~ Beaver Dam Mine Site and Haul Road, a variety of vegetation types and forest groups were found within AC10 ecosites, including mixed wood, spruce-hemlock, and tolerant hardwood forest groups.

Occurring mainly on imperfectly drained lower slopes and level areas with medium textured glacial till deposits, AC11 ecosites have moist, nutrient-medium soils which generally support mixed wood climax communities dominated by red spruce, hemlock and yellow birch. Earlier successional forests are similar in nature to those found in AC10. Within the ~~PA~~ Beaver Dam Mine Site and Haul Road, four of the habitat survey points within ecosite AC11 were identified within the spruce-hemlock forest group, while a single site was identified within the spruce-pine forest group.

6.10.3.2.4 **Rich Nutrient Regime**

Ecosite AC13 was observed in two locations within the Haul Road ~~PA~~. This ecosite occurs on well drained slopes with a fresh to moist water regime. This ecosite typically supports late successional forests dominated by sugar maple, American beech, yellow birch, white ash, and red maple. Early successional stands may be dominated by aspen or white birch. In each location observed within the Haul Road ~~PA~~, this ecosite supported an intolerant hardwood vegetation type, dominated by mature red maple and yellow birch.

6.10.3.2.5 **Habitat Survey Conclusions**

The current condition of the Beaver Dam Mine Site is disturbed and fragmented habitat based on timber harvesting and historic mining activity. The level of disturbance within the Beaver Dam Mine Site disproportionately affects uplands over wetlands. Large, natural, undisturbed wetland habitats do exist within the Beaver Dam Mine Site (particularly Wetlands 2 and 29). A network of roads and trails is present throughout the site, with parts of the Beaver Dam Mine Site characterized by un-vegetated gravel and crushed stone, and a large fabricated settling pond used during mining activities (wetland 59) exists in the Beaver Dam Mine Site.

Upland forests in the Beaver Dam Mine Site ~~PA~~ have experienced relatively high levels of disturbance from timber harvesting. Fifty-eight percent of locations surveyed experienced some level of disturbance, typically timber harvesting, within the recent past. While mature, undisturbed habitats are present in the Beaver Dam Mine Site ~~PA~~, particularly in large wetland complexes, generally, the Beaver Dam Mine Site ~~footprint~~ has experienced significant levels of disturbance. As mentioned in the methodology section, portions of the Beaver Dam Mine Site ~~footprint PA~~ have experienced significant levels of disturbance from historic mining practices as well.

The level of disturbance identified within the Haul Road ~~PA~~ is significantly lower, with only 15% of points surveyed having experienced timber harvesting. However, 80% of the survey was completed within approximately 50 m of an existing road. This means that many natural forest stands are present, but the overall landscape is still somewhat disturbed, based on habitat fragmentation by the presence of an existing road. The effect of habitat fragmentation and disturbance to terrestrial fauna is described in further detail in Section 6.10.6.

In areas affected by natural or anthropogenic disturbance (e.g., wind throw or tree harvesting, respectively), early successional stands were determined to be in the mixed wood forest group. The dominant disturbance regime in the PA is timber harvesting, which is present in patches throughout upland forests. Generally speaking, uplands within the PA contain immature or unevenly aged coniferous stands or mixed wood stands. Several pockets of mature coniferous forests are scattered throughout the PA, but over-mature stands were generally uncommon. Pure deciduous stands (including both tolerant and intolerant hardwood forests) are infrequent within the Beaver Dam Mine Site ~~footprint PA~~, though they do occur occasionally within the Haul Road ~~PA~~.

The ecosites and vegetation types observed are representative of the Eastern Ecoregion of the Acadian Ecozone as described in Section 6.10.3.2 The habitat survey results indicate a greater diversity of ecosites and vegetation types within the Haul Road ~~PA~~ compared with the Beaver Dam Mine Site ~~footprint PA~~. This is to be expected given the broader geographic extent of the Haul Road and the relatively disturbed nature of the Beaver Dam Mine Site ~~footprint~~. None of the ecosites or vegetation types across the Beaver Dam Mine Site and Haul Road ~~PA~~ are unique or rare in the local or regional context. Furthermore, none of the ecosites observed are known to have an elevated potential to support rare vegetation species (for instance, ecosites AC14, AC16 and AC17 are all documented as having higher potential to support rare and at risk vegetation species).

Overall, current and historic land use throughout the PA has resulted in a patchwork of mature, immature, regenerating, and disturbed stands. The PA contains a diversity of habitat types and landscape features, but has experienced a considerable amount of disturbance and habitat fragmentation as a result of historic mine operations and current and historic timber harvesting practices.

Touquoy Mine Site

Habitat present within the Touquoy Mine Site include coniferous forest, deciduous forest, mixed forest, cutover forest, wetlands, rural residential areas, and areas to be cleared (CRA 2007).

6.10.3.3 Vascular Plants

A total of 294 species of vascular plants were identified within the Beaver Dam Mine Site and the Haul Road. The diversity of species is moderate to high, especially considering the low fertility of soils within the PA; however, this is attributed to the range of habitat types encountered, from natural aquatic systems, a variety of wetland types, and both intact and disturbed upland habitats. The vegetation species observed are largely native species, with relatively low diversity and abundance of roadside exotic or invasive species. The species and communities of vascular plants encountered were typical given the eco-regional context, nutrient regimes, moisture regimes, and disturbance regimes. Of the 294 species identified, five are considered priority species (S-Ranks of S3 and S3S4). These will be discussed further in Section 6.13.

Upland habitat throughout the PA is characterized by exposed granite boulders and coarse-textured, well-drained soil. The soil shows evidence of an impoverished condition, with low nutrient levels. This is evident in the forest groups and vegetation types that are found, as outlined in Section 6.10.2.5 (habitat survey results). Ericaceous shrub species such as sheep laurel (*Kalmia angustifolia*) and black huckleberry (*Gaylussacia baccata*) are frequent, along with other species which thrive in impoverished soil, such as mountain holly (*Nemopanthus mucronatus*), wild raisin (*Viburnum nudum*), and black spruce (*Picea mariana*). Where somewhat richer, finer soil till deposits are present, mixed wood to tolerant hardwood forests occur and include dominant species such as yellow birch (*Betula alleghaniensis*), red maple (*Acer rubrum*) and occasionally large-toothed aspen (*Populus grandidentata*).

Overall, understory vegetation layers are characteristic of low to medium soil fertility forest ecosystems described in Nova Scotia's Forest Ecosystem Classification system. Indicator species occurring in medium fertility sites include northern long beech fern (*Phegopteris connectilis*) and Christmas fern (*Polystichum arctostichoides*), while species occurring in poorer conditions include trailing arbutus (*Epigaea repens*), bracken fern (*Pteridium aquilinum*), and pink lady's-slippers (*Cypripedium acaule*). Large portions of the PA, particularly within the Beaver Dam Mine Site ~~footprint~~, have undergone large-scale anthropogenic disturbance in the form of clearcutting, which has resulted in a much younger forest landscape with less valued, more shade-intolerant and opportunistic tree species. Much of the diversity of vascular plants is attributed to wetland habitat. Wetlands have been described in detail in Section 6.8. The wetlands encountered generally supported vascular plant communities typical of nutrient poor peatlands and treed swamps, such as leatherleaf (*Chamaedaphne calyculata*), Atlantic sedge (*Carex atlantica*) and tussock sedge (*Carex stricta*) dominated low shrub bogs, and black spruce (*Picea mariana*), mountain holly (*Nemopanthus mucronatus*), and cinnamon fern (*Osmunda cinnamomea*) swamps. Open wetlands are primarily dominated by sphagnum moss with scattered and dwarfed black spruce, red maple (*Acer rubrum*), and speckled alder (*Alnus incana*). Several common species of Atlantic coastal plain flora were observed within wetlands throughout the Beaver Dam Mine Site and the Haul Road ~~PA~~. These include species such as branched bartonia (*Bartonia paniculata*), Atlantic sedge, dwarf huckleberry (*Gaylussacia bigeloviana*), bog fern (*Thelypteris simulata*), and purple bladderwort (*Utricularia purpurea*). Vegetation communities identified throughout the PA generally exhibit low fertility and low potential for rare species. Rare species identified throughout the PA will be discussed in detail in Section 6.13. A complete plant list of all vascular plants identified within the Beaver Dam Mine Site and the Haul Road ~~PA~~ is included in **Appendix K.1**.

Touquoy Mine Site

Coniferous forest is the most common forest habitat type within the Touquoy Mine Site. These forests are dominated by red spruce, balsam fir, bunchberry (*Cornus canadensis*) and goldthread (*Coptis trifolia*). No SOCI plants were observed during vascular plant surveys conducted in August 2004, May and June 2005, and September 2006 as part of the EARD process (CRA 2007). One black ash (*Fraxinus nigra*) was discovered within the Touquoy Mine Site incidentally during wetland surveys in September 2015. It is discussed in further detail within Section 6.13.

6.10.3.4 Lichens

The lichen survey study area shown on Figure 6.11-1 was established based on increased potential for rare lichens in the general vicinity of the Beaver Dam Mine Site ~~footprint~~ and the level of proposed ground disturbance within the Beaver Dam Mine Site ~~footprint~~. Both the Beaver Dam Mine Site and the lichen survey study area (LSA) are located within the LAA. The goal of the expanded study area for lichens around the Beaver Dam Mine Site ~~footprint PA~~ was to determine, if rare lichens were identified within the Beaver Dam Mine Site ~~mine footprint~~, whether these species were unique to that specific location or whether they were present within the broader geographical context.

A comprehensive list of lichen species was not completed, as the primary focus was in identifying rare or at-risk lichen species. However, common lichen species observed opportunistically during rare lichen surveys were recorded and are presented in the table below. Twenty-three species were recorded within the lichen study area (Beaver Dam Mine Site ~~mine footprint~~, surrounding area, and Haul Road). Of these species, eleven ~~seven~~ are listed as SAR or SOCI. More details on rare species results, including location details and habitat associations, are presented in Section 6.13. Table 6.10-4 below provides a list of species observed within the Beaver Dam Mine Site, Haul Road and LSA ~~study area~~.

Table 6.10-4 Lichen Species Observed within the Lichen Study Area

Common name	Scientific name	COSEWIC	SARA	NSESA	SRank**	BDMS/HR or LSA*
Boreal felt lichen***	*Erioderma pedicellatum*	E	E	E	~~S1S2~~ S1	LSA
Blue felt lichen	*Degelia plumbea*	SC	SC	V	~~S2~~ S3	Both
Frosted glass-whiskers lichen	*Sclerophora peronella*	SC	SC	-	S1?	Both
Blistered tarpaper lichen	*Collema nigrescens*	-	-	-	~~S2S3~~ S3	~~PA~~ BDMS/HR
Blistered jellyskin lichen	*Leptogium corticola*	-	-	-	~~S2S3~~ S3	~~PA~~ BDMS/HR
Eastern candlewax lichen	*Ahtiana aurescens*	-	-	-	S2S3	BDMS/HR
Peppered moon lichen	*Sticta fuliginosa*	-	-	-	S3	BDMS/HR ~~PA~~
Powdered fringe lichen	*Heterodermia speciosa*	-	-	-	S3	BDMS/HR
Salted shell lichen ~~Coccocarpia Lichen~~	*Coccocarpia palmicola*	-	-	-	S3S4 ~~S4S5~~	Both
Slender monk's hood lichen	*Hypogymnia vittata*	-	-	-	S3S4	BDMS/HR
Fringe lichen	*Heterodermia neglecta*	-	-	-	S3S4	BDMS/HR
Jelly lichen	*Collema subflaccidum*	-	-	-	S5 ~~S4S5~~	Both
Blue jellyskin lichen	*Leptogium cyanescens*	-	-	-	S5 ~~S4S5~~	Both
Pink-earth lichen	*Diabaeis baemoyces*	-	-	-	S5 ~~S4S5~~	BDMS/HR ~~PA~~
Star-tipped reindeer lichen	*Cladonia stellaris*	-	-	-	S5 ~~S4S5~~	BDMS/HR ~~PA~~
Gray reindeer lichen	*Cladonia rangiferina*	-	-	-	~~S4S5~~ S5	BDMS/HR ~~PA~~

Common name	Scientific name	COSEWIC	SARA	NSESA	SRank**	BDMS/HR or LSA*
British soldiers	*Cladonia cristatella*	-	-	-	~~S4S5~~ S5	Both
Beard lichen	*Usnea sp.*	-	-	-		Both
Yellow specklebelly	*Pseudocyphellaria perpetua*	-	-	-	S5 ~~S4S5~~	Both
Lungwort lichen	*Lobaria pulmonaria*	-	-	-	S5 ~~S4S5~~	Both
Textured lungwort	*Lobaria scrobiculata*	-	-	-	S5 ~~S4S5~~	Both
Smooth lungwort	*Lobaria quercizans*	-	-	-	S5 ~~S4S5~~	Both
Crumpled rag lichen	*Platismatia tuckermanii*	-	-	-	S5 ~~S4S5~~	BDMS/HR ~~PA~~

*~~PA: observed within the Project Area~~ BDMS/HR: observed within the Beaver Dam Mine Site or Haul Road. LSA: Identified within the broader lichen study area only.

**S-Ranks have been updated to reflect changes in rankings since original submission.

***A follow up survey conducted in the fall of 2016 determined that all three BFL thalli were no longer present. Their absence was reconfirmed on December 4, 2017.

While the specific habitat requirements of each of priority lichen species varies slightly, they all require mature to over-mature forests. Stand age is one of the greatest determinants of lichen diversity (McMullin, Duinker, Cameron, Richardson, & Brodo, 2008). Within the Beaver Dam Mine Site ~~footprint PA~~ and broader LSA, small to moderate scale disturbance is abundant in the form of timber harvesting, particularly to the north and east ~~of the PA~~; however, where mature, intact natural stands within the Beaver Dam Mine Site ~~footprint PA~~ support several rare species of lichen. According to lichen specialist, Chris Pepper, the habitat along the Haul Road ~~PA~~ generally lacked over-mature red maple and balsam fir required to support rare lichen species. This habitat is present within and surrounding the Beaver Dam Mine Site ~~footprint PA~~, where forest stands supported a diversity of cyanolichen species. According to Mr. Pepper, the diversity and abundance of lichen species observed within the ~~entire PA~~ Beaver Dam Mine Site and Haul Road, including priority species is typical of similar habitats in this part of Halifax County.

Touquoy Mine Site

Lichen surveys conducted in the Touquoy Mine Site in 2004 and 2005 as part of the EARD process found the presence of blue felt lichen (*Degelia plumbea*). An additional lichen survey in 2007 found 20 additional species (CRA 2007). Eight of the 21 species identified in 2007 are priority species, they are discussed in further detail within Section 6.13.

6.10.3.5 <u>Old Forest and Interior Forest Desktop Analysis</u>

Figure 6.10-4 shows the Old Forest stands in close proximity to the LAA. The Haul Road bisects one Old Forest stand (Lake Alma) indicated in the Old Forest layer. The Old Forest stand is 437.4 ha but it should be noted that this area is an estimate based on the Old Forest layer and the stand boundaries were not field delineated. This stand also provides interior forest habitat.

The LAA is covered with a network of roads and forestry trails creating a largely disturbed forest landscape. Figure 6.10-4 shows the extent of the existing edge effect largely covering the majority of the LAA including most of the Haul Road. Potential interior forest patches that fall within the Project Impact Area within the Lake Alma Old Forest stand, and three patches within the Beaver Dam Mine Site. Within the Beaver Dam Mine Site, there is a patch of potential interior forest to the north of the western waste rock stockpile including parts of Wetland 17 and 207 (interior patch 1); one to the south of infrastructure including parts of Wetland 29 (interior patch 2); and one between the eastern waste rock stockpile and the crusher pad surrounding most of Wetland 2 (interior patch 3). No other areas of interior forest will be impacted by the Haul Road as the rest of the alignment follows existing roads. There were no other patches within the Beaver Dam Mine Site that were large enough (>15 ha) to support interior forest conditions.

6.10.4 Consideration of Consultation and Engagement Results

Key issues raised during public consultation and Mi'kmaq engagement relating to habitat and flora include potential effect on biodiversity and permanent loss of habitat associated within the ~~footprint of the~~ Beaver Dam Mine Site and Haul Road. Potential effects on traditional uses of land and resources by the Mi'kmaq were noted, including medicinal food and plants.

The results of the public consultation and Mi'kmaq engagement have been considered in the environmental effects assessment, including the Proponent's commitments on mitigation and monitoring measures and proposed compliance and effects monitoring programs, as well as the Proponent's broader commitment to ongoing public consultation and Mi'kmaq engagement. Specific to evaluating the effect on habitat and flora, these are found within the following environmental effects assessment.

6.10.5 Effects Assessment Methodology

6.10.5.1 Boundaries

Spatial Boundaries

The spatial boundaries used for the Project EIS ~~the assessment of effects to habitat and flora are the mine footprint and the Haul Road PA~~ described below:

The PA (Figure 5.4-1) consists of the three project components; Beaver Dam Mine Site, Touquoy Mine Site, and the Haul Road and extends from Marinette to Moose River Gold Mines, Halifax County, NS. The Beaver Dam Mine Site is located at the eastern end of the Beaver Dam Mines Road and has been extended to the east and west in order to encompass the micro siting of the till stockpile and the waste rock stockpile, respectively. The Haul Road spans from the Beaver Dam Mine Site to Moose River Gold Mines, where the Touquoy Mine [processing and exhausted pit (to be used to dispose Beaver Dam tailings)] is located.

~~The LAA consists of any habitat contiguous and consistent with habitat available within the PA.~~ The LAA (Figure 6.10-6) includes a 500m buffer from the Beaver Dam Mine Site and the Haul Road (excluding Moose River Road) plus a focused lichen survey area surrounding the Beaver Dam Mine Site. This area encompasses the maximum expected extent of Project direct and indirect impacts to habitat and flora. The Touquoy Mine Site and the Mooseland Road portion of the Haul Road were not included in the LAA because there is not expected to be a change to habitat and flora from current conditions.

The RAA (Figure 6.10-7) encompasses NSL&F's Ecological Land Classification Ecodistricts: 420 (Eastern Drumlins) and 440 (Eastern Interior) within Halifax Regional Municipality (HRM), east and north of Lake Charlotte. These Ecodistricts span an area broader than the expected project impacts and considers other project boundaries as per cumulative effects methodology. These spatial boundaries will help to identify the direct or indirect impacts to flora species and critical habitats, and the effects of the Project on distribution and abundance of these species.

As the Project has the potential to cause direct and indirect effects to habitat and flora outside of the PA, the LAA is the appropriate boundary for evaluation of this VC.

Temporal Boundaries

The temporal boundaries used for the assessment of effects to flora are the construction phase, operational phase, and decommissioning and reclamation phase.

Technical Boundaries

No technical boundaries were identified for the effects assessment of habitat and flora.

Administrative Boundaries

There are no administration boundaries (specific legislation) that guided the evaluation of flora and habitat for this EIS.

6.10.5.2 Thresholds for Determination of Significance

A significant adverse effect from the Project on habitat and flora is defined as an effect that is likely to cause a permanent alteration to any flora species distribution or abundance or habitat. An adverse effect that does not cause a permanent alteration in distribution or abundance of any floral species or habitat is considered to be not significant.

6.10.6 Project Activities and Habitat and Flora Interactions and Effects

Table 6.10-5 Potential Flora Interactions with Project Activities at Beaver Dam Mine Site

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Till and waste rock from site preparation transport and storage • ~~Existing settling pond dewatering in preparation of construction~~ • Watercourse and wetland alteration in preparation of construction • Mine Site road construction • Surface infrastructure installation and construction • Collection and settling pond construction • Sedimentation and erosion from construction activities • Generation of dust from construction activities • ~~General management of wastes derived from preparation and construction activities~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, settling pond overflow, slope failure, an unplanned explosive event, and a mobile equipment accident~~
Operation and Maintenance	3-4 years	• Sedimentation and erosion from mining activities • Generation of dust from mining activities • ~~Surface mine dewatering to facilitate access to and extraction of ore~~ • ~~Petroleum products management~~ • ~~Environmental monitoring of adjacent wetlands~~ • ~~General management of wastes derived from operation and maintenance activities~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, settling pond overflow, slope failure, an unplanned explosive event, and a mobile equipment accident~~
Decommissioning and Reclamation	1-2 years	• Site reclamation activities • Sedimentation and erosion from mining activities • Generation of dust from mining activities • ~~Environmental monitoring of adjacent wetlands~~ • ~~General management of wastes derived from decommissioning and reclamation activities~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and mobile equipment accidents~~

Table 6.10-6 Potential Flora Interactions with Project Activities along Haul Road

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Watercourse and wetland alteration in preparation of construction • Haul Road construction and upgrades • Sediment and erosion from Haul Road activity • Dust from Haul Road activity • ~~Environmental monitoring of adjacent wetlands~~ • ~~General management of wastes derived from preparation and construction activities~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and a haul truck accident~~
Operation and Maintenance	3-4 years	• Haul Road maintenance and repairs including sanding for traction control and snow removal • Sediment and erosion from Haul Road activity • Dust from Haul Road activity • ~~Environmental monitoring of adjacent wetlands~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and a haul truck accident~~
Decommissioning and Reclamation		N/A[1]

1 Decommissioning and Reclamation of the Haul Road is not expected. The Haul Road will be returned to owner for forestry industry

Table 6.10-7 Potential Flora Interactions with Project Activities at ~~Touquoy Processing and Tailings Management Facility~~ Touquoy Mine Site

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Tailings pipeline, make-up water pipeline alteration, and relocation of reclaim infrastructure • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and mobile equipment accidents~~
Operation and Maintenance	3-4 years	• Generation of dust • ~~Environmental monitoring~~ • ~~General management of waste derived from processing activities~~

Project Phase	Duration	Relevant Project Activity
		• ~~Accidents and malfunctions to include fuel and other spills, forest fires, and a haul truck accident~~
Decommissioning and Reclamation	1-2 years	• Generation of dust • ~~Environmental monitoring~~ • ~~Accidents and malfunctions to include fuel and other spills, and forest fires~~

Development of the Beaver Dam Mine Site and the Haul Road will cause direct impacts to habitat and flora, including upland forested habitat and wetlands. This will occur within the construction phase of the Project. Habitat within the PA and surrounding landscape currently exhibits fragmented conditions based on historic mine operations, existing road and trail networks, and current and historic forestry activity. Project activities are likely to result in increased habitat fragmentation and a decrease in habitat quality. A portion of this disturbance is expected to impact interior forest and Old Forest.

Direct impacts to Old Forest will occur where the new section of the Haul Road (Section 3B; Figure 2.2-2) is to be constructed. This area is unavoidable as the Haul Road was re-routed through this area to avoid impacts to the Beaver Lake IR and has been placed to avoid the waterbodies in the area. The Haul Road will be designed along the southern side of this stand, keeping the core area of this stand intact. This stand also has interior forest properties. One hundred and sixteen hectares of interior forest would be directly impacted or face edge effects from this new section of Haul Road.

As mentioned above, the landscape in this region is a patchwork mosaic of different levels of disturbance dominated by varying successional ages of regrowth from forestry activities. A large network of trails and roads have resulted from this forestry and other anthropogenic activity throughout this region. The LAA has largely been affected from these disturbances, as well as historical mining activities, which has reduced the amount of interior forest present within the LAA.

The Project Impact Area interacts with four potential interior forest patches within the LAA. The first is within the Lake Alma Old Forest polygon and has been discussed in Section 6.10.3.5. The other three patches are within the Beaver Dam Mine Site: one to the north of the western waste rock stockpile including parts of Wetland 17 and 207 (interior patch #1); one to the south of infrastructure including parts of Wetland 29 (interior patch #2); and one between the eastern wasterock stockpile and the crusher pad surrounding most of Wetland 2 (interior patch #3). There is 13.7 ha of interior patch #1, 3.1 ha of interior patch #2 and 25.2 ha of interior patch #3 within 200 m of infrastructure that will be directly impacted or face edge effects from the Project.

Micrositing of Project infrastructure has reduced the impact to interior forest within the Beaver Dam Mine Site. The waste rock stockpile has been microsited and divided to avoid Wetland 29 and reduce impact to interior patch #2. The impact to interior patch #3 within and surrounding Wetland 2 has also been significantly reduced by the micro siting of these waste rock stockpiles.

While the baseline quantity of interior forest unaffected by edge effects from roads and other anthropogenic disturbance within the PA may be limited, there is still documented Old Forest available within the region, especially to the southwest of the PA. Overall, the increase in physical fragmentation is expected to be low, based on the current high level of disturbed habitat as discussed.

The ~~Touquoy facility is currently under construction~~ Touquoy Mine Site is currently operational. Based on work completed as part of the 2007 Focus Report, lichens are not anticipated to be affected by the continued use of the ~~Touquoy facility~~ Touquoy Mine Site for the processing of Beaver Dam ore. Lichens are susceptible to air pollution, including deposition of contaminants in air emissions and particulate matter. It was concluded in the Focus Report that total suspended particulate from the processing facility at Touquoy Mine Site will not have a significant adverse effect on any listed lichen species in the region.

There are no direct or indirect effects to flora or habitat from the Project anticipated to be caused by the processing of ore and the management of tailings (exhausted pit) from the Beaver Dam Mine Site ~~Project~~. The use of the ~~Touquoy facility~~ Touquoy Mine Site for the processing of Beaver Dam ore will not involve construction ~~of~~ at the Touquoy Mine Site or any new disturbances. ~~and as~~ identified above, air emissions are not anticipated to have an adverse effect on flora; therefore, no effects are anticipated at the ~~Touquoy facility~~ Touquoy Mine Site related to the processing of Beaver Dam ore, with the exception of the continued potential for accidents and malfunctions and continued environmental monitoring.

Development of the Beaver Dam Mine Site ~~footprint~~ and upgrading and construction of new sections of the Haul Road (Figure 2.2-2; Section 3B;) will result in direct impacts to vascular and non-vascular individuals and to flora communities at the full or partial forest stand level. The effects of the Project on flora encompass vascular and non-vascular flora in aquatic, wetland, and upland habitats. As such, many of the effects described in Section 6.8 specific to wetland habitat will directly relate to effects on flora. The majority of direct mortality to flora will occur during site preparation and construction.

Project activities have the ability to indirectly affect flora in the construction, operational, and decommissioning phases of the Project. The vast majority of Project interactions with flora will occur during construction, specifically during clearing, grubbing, and grading. Indirect impacts could include altered hydrology as a result of activity (including dewatering) in close proximity to wetland habitat; erosion and sedimentation from Project activities; dust accumulation on vegetation smothering and stressing plants; accidental spills involving deposition of a deleterious substance, including fuel oil, lubricants, or engine oil, and impoundment of up-gradient wetlands if inadvertent dams are built as part of the mine development (roads can act as dams if not constructed properly to allow water flow through them).

Movement of equipment during site preparation, operation, and maintenance can result in deposition of dust on vegetation within close proximity of roads when conditions are dry. This affects flora through the deposition of dust on leaves, which temporarily reduces evapotranspiration and photosynthesis. Over time this may reduce overall growth rates. Similarly, winter maintenance of the Haul Road and site roads can affect plant growth adjacent to roads by placement of sand or stockpiling of snow. ~~Road salt will not be used, thereby reducing potential impact to vegetation.~~

An evaluation on the potential effects of dust deposition from haul truck activity on soils, berries, and vegetation was completed by Intrinsik in 2018 (Appendix C.2). The evaluation and report focus on the potential implications of harvesting and consuming vegetation for traditional purposes by Indigenous peoples in the area of the Project and aims to assess the potential human health impacts related to compounds released via ore dust deposition.

The Intrinsik report concluded that metals will be released from dust deposition along the Haul Road, and have the potential to accumulate in soils, and thus vegetation. The effect of the dust deposition and accumulation in vegetation are likely to be localized to areas most impacted by dust loadings, and deposition would decrease with increasing distance from the Haul Road. It is important to note that metals occur naturally in the environment and are present within existing soils and vegetation. All metals considered in the assessment, with the exception of aluminum and boron, are predicted to be below provincial and federal soil quality guidelines. Aluminum and boron soil concentrations are elevated above soil quality guidelines in baseline, likely due to natural enrichment. The additional incremental contribution from the Project to existing soil aluminum and boron concentrations is predicted to be minimal. Based on the estimated future soil concentrations of metals considered, some accumulation of metals within vegetation is anticipated to occur but would likely be localized to areas most affected by dust loadings which are generally limited in their spatial extent. Future berry concentrations were predicted to remain within the baseline berry concentrations ranges, with the exception of aluminum, and future leafy vegetation were predicted to remain within baseline leafy vegetation concentrations, with the exception of vanadium.

Additional indirect impacts to native plant communities include the potential for introduction of invasive species. Seeds and roots of invasive species can be transferred from construction equipment, transportation vehicles, or workers (footwear and clothing) into adjacent habitat during construction and operational activities. Introduction of invasive species can occur when equipment or people enter vascular plant communities, or indirectly via runoff or dust from the roads. Invasive species, such as purple loosestrife (*Lythrum salicaria*), can severely degrade habitat quality and outcompete many native species, particularly along roadsides. Construction of the Project within the Beaver Dam Mine Site ~~footprint~~, upgrades to the Haul Road, and operations/trucking along the Haul Road will result in increased traffic levels. As a result, the likelihood of introduction of invasive species is elevated within the Beaver Dam Mine Site ~~footprint~~ and along the entire length of the Haul Road, including the section of the Mooseland Road to the Touquoy Mine Site, where although no road upgrades are necessary, truck traffic will increase. No purple loosestrife was noted during field surveys in the Beaver Dam Mine Site ~~footprint~~ or Haul Road ~~PA~~. Routine inspections and cleaning of equipment that is brought from a different area can help identify and reduce potential spread of invasive species.

Table 6.10-8 Direct and Indirect Impacts on Habitat and Flora

Impact Type	Direct Impact	Project Phase	Indirect Impact	Project Phase
Vegetative and Habitat Integrity	Direct loss of individual vegetation (vascular and non-vascular) and the habitats which support them. In some cases (particularly in the Beaver Dam Mine Site ~~footprint~~) whole forest stands (upland and wetland) will be removed.	C	Hydrologically connected upstream wetlands may also be at risk of indirect impacts as a result of downstream alteration activities (e.g., water outflow changes, land elevation changes, blasting, etc. causing dewatering). Inadvertent damming of up-gradient wetlands from construction related infrastructure (e.g., roads with lack of flow through infrastructure). Removal of tree cover in one area can increase risk of wind damage in immediately adjacent habitats.	C O D
	Extensive ground works, including activities such as blasting in and adjacent to wetlands has the potential to destabilize land surfaces and the root zone of vegetative areas, including wetland buffers.	C D	Introduction of invasive species can occur indirectly into wetlands when equipment or people move around the PA or via runoff or dust from the roads. Introduction of mine and Haul Road traffic during construction and operation can elevate this risk. Invasive species, such as purple loosestrife (Lythrum salicaria), can severely degrade wetland habitat and function. No purple loosestrife was noted during field surveys in the Beaver Dam Mine Site ~~mine footprint~~ or Haul Road ~~PA~~.	C O D
	Introduction of invasive species. Seeds and roots of invasive species can be transferred from construction equipment, transportation vehicles, or workers into adjacent wetland habitat during construction and operational activities.	C O D	Dust accumulation on vegetation can smother and stress plants and provide minerals and nutrients into the wetland habitat.	C O D

6.10.7 Preferred Alternative Haul Road

6.10.7.1 Rationale for Valued Component Selection

Same rationale for valued component selection as indicated in Section 6.10.1.

6.10.7.2 Baseline Program Methodology

6.10.7.2.1 Desktop Evaluation

The desktop evaluation methods conducted for the broader PA (Section 6.10.2.1) remained the same for the Preferred Alternative Haul Road PA. The priority species list (**Appendix I.5**) also remained the same because habitat present within the Preferred Alternative Haul Road PA is also present within the PA. Additionally, the Haul Road ACCDC report encompasses the Preferred Alternative Haul Road PA and therefore was used within this desktop evaluation following the methods cited above.

6.10.7.2.2 Vascular Plant Surveys

Vascular plant surveys were conducted as per methods cited in Section 6.10.2.3. Vascular plant surveys were conducted on September 19, 20, and 21, 2018.

6.10.7.2.3 Lichen Surveys

Lichen surveys within the Preferred Alternative Haul Road PA followed the methodologies outlined in Section 6.13.2. Lichen surveys were conducted in conjunction with vascular plant surveys and were completed on September 19, 20, and 21, 2018.

6.10.7.3 Baseline Conditions

6.10.7.3.1 Desktop Evaluation

An evaluation of the ACCDC report for the Haul Road indicated the presence of Boreal Felt Lichen within 5 km of the Preferred Alternative Haul Road PA. No other lichen and/or vascular plant species were listed within the report.

According to the Amended Recovery Strategy for the Boreal Felt Lichen (*Erioderma pedicellatum*), Atlantic Population, in Canada (ECCC, 2018) a ‘detailed unit in which critical habitat is found’ is located north of the Preferred Alternative Haul Road and does not overlap with the proposed road development.

Based on the presence of the Prest Lake polygon within the Nova Scotia Old Forest Layer (2006), 0.62 ha of this old forest polygon (total 420 ha) falls within the Preferred Alternative Haul Road PA (Figure 6.10-5). It should be noted that these areas are an estimate based on the Nova Scotia Old Forest Layer (2006) and the patches were not field delineated. The quantity of interior forest unaffected by edge effects from roads and other anthropogenic disturbance within the Preferred Alternative Haul Road PA is limited and is confined to the western extent, east of its connection with Mooseland Road.

6.10.7.3.2 Vascular Plant Surveys

No SAR/SOCI vascular plants were observed within the Preferred Alternative Haul Road PA during dedicated vascular plant surveys or incidentally.

6.10.7.3.3 Lichen Surveys

A comprehensive list of lichen species was not completed, as the primary focus was in identifying rare or at-risk lichen species. However, common lichen species observed opportunistically during rare lichen surveys were recorded and are also presented in the table below. Twenty-nine species were recorded within the Preferred Alternative Haul Road PA. Of these species, nine are listed as SAR or SOCI. More details on rare species results, including location details and habitat associations, are presented in Section 6.13.7.1.2.3.

Table 6.10-9 Lichen Species Observed within the Preferred Alternative Haul Road

Common name	Scientific name	COSEWIC	SARA	NSESA	S-Rank
Frosted glass-whiskers lichen	*Sclerophora peronella*	SC	SC	-	S1?
Blue felt lichen	*Degelia plumbea*	SC	SC	V	S3
Corrugated shingles lichen	*Fuscopannaria ahlneri*	-	-	-	S3
Powdered fringe Lichen	*Heterodermia speciosa*	-	-	-	S3
Blistered jellyskin lichen	*Leptogium corticola*	-	-	-	S3
Salted shell lichen	*Coccocarpia palmicola*	-	-	-	S3S4
Slender monk's hood lichen	*Hypogymnia vittata*	-	-	-	S3S4
Shaggy fringed lichen	*Anaptychia palmulata*	-	-	-	S3S4
Fringe lichen	*Heterodermia neglecta*	-	-	-	S3S4
Mealy-rimmed shingle lichen	*Pannaria conoplea*	-	-	-	S4
Short-bearded jellyskin lichen	*Leptogium laceroides*	-	-	-	S4
Brown-eyed shingle lichen	*Pannaria rubiginosa*	-	-	-	S4
Methuselah's beard lichen	*Usnea longissimia*	-	-	-	S4
Fringed kidney lichen	*Nephroma helveticum*	-	-	-	S4S5

Common name	Scientific name	COSEWIC	SARA	NSESA	S-Rank
Lattice tube lichen	*Hypogymnia incurvoides*	-	-	-	S4S5
Blistered tarpaper lichen	*Collema furfuraceum*	-	-	-	S4S5
Lungwort lichen	*Lobaria pulmonaria*	-	-	-	S5
Crumpled rag lichen	*Platismatia tuckermanii*	-	-	-	S5
Textured lungwort	*Lobaria scrobiculata*	-	-	-	S5
Varied rag lichen	*Platismatia glauca*	-	-	-	S5
Monk's hood lichen	*Hypogymnia physodes*	-	-	-	S5
Powder-headed tube lichen	*Hypogumnia tubulosa*	-	-	-	S5
Blue jellyskin lichen	*Leptogium cyanescens*	-	-	-	S5
Smooth lung lichen	*Lobaria quercizans*	-	-	-	S5
Dragon lichen	*Cladonia squamosa*	-	-	-	S5
Salted ruffle lichen	*Parmotrema crinitum*	-	-	-	S5
Common freckle pelt lichen	*Peltigera apthosa*	-	-	-	S5
Giant cladonia lichen	*Cladonia maxima*	-	-	-	S5
British soldiers lichen	*Cladonia cristatella*	-	-	-	S5

The Preferred Alternative Haul Road PA consists primarily of clear cut habitat with scattered conifer and mixed wood stands. In the eastern extent of the Preferred Alternative Haul Road PA, Wetland 199 contains a mixed wood stand with an open canopy with pit and mound topography and two priority lichen species (frosted glass-whiskers lichen and corrugated shingles lichen). Within the Preferred Alternative Haul Road PA, salted shell lichen (a BFL indicator) was observed in Wetlands 194 and 198 in balsam fir swamps. Although salted shell lichen was present and BFL habitat was suitable, no BFL was observed. Hardwood stands were present in Wetland 187 and dominated by yellow birch and red maple.

6.10.7.4 Considerations of Consultation and Engagement Results

The Preferred Alternative Haul Road is the result of consultation and engagement on the Primary Haul Road. Refer to Section 6.10.4 for key issues raised during public consultation and Mi'kmaq engagement relating to habitat and flora.

6.10.7.5 Effects Assessment Methodology

6.10.7.5.1 Boundaries

Spatial Boundaries

The Preferred Alternative Haul Road PA (Figure 5.4-1) encompasses 50 m on either side of a 5.7 km long center line. The eastern and western extent of the Preferred Alternative Haul Road PA connects to the Haul Road at a pre-existing forestry road and to Mooseland Road, respectively. The Preferred Alternative Haul Road PA runs north of Sandy Pond and Miller Lake.

The LAA (Figure 6.10-8) includes a 500m buffer from the Preferred Alternative Haul Road. This area encompasses the maximum expected extent of project direct and indirect impacts to habitat and flora.

The RAA (Figure 6.10-9) encompasses NSL&F's Ecological Land Classification Ecodistrict: 420 (Eastern Drumlins). This Ecodistrict spans an area broader than the expected project impacts and considers other project boundaries as per cumulative effects methodology. These spatial boundaries will help to identify the direct or indirect impacts to flora species and critical habitats, and the effects of the Project on distribution and abundance of these species.

As the Project has the potential to cause direct and indirect effects to habitat and flora outside of the PA, the LAA is the appropriate boundary for evaluation of habitat and flora within the Preferred Alternative Haul Road.

Temporal Boundaries

The temporal boundaries used for the assessment of effects to flora are the construction phase, operational phase, and decommissioning and reclamation phase.

Technical Boundaries

No technical boundaries were identified for the effects assessment of habitat and flora.

Administrative Boundaries

There are no administration boundaries (specific legislation) that guided the evaluation of flora and habitat for this EIS.

6.10.7.5.2 Thresholds for Determination of Significance

The thresholds for determination of significance regarding habitat and flora within the Preferred Alternative Haul Road are identical to the thresholds for determination of significance for this VC throughout the entire PA, as presented within Section 6.10.5.2.

6.10.7.6 Project Activities and Habitat and Flora Interactions and Effects

Table 6.10-10 Potential Flora Interactions with Project Activities along the Preferred Alternative Haul Road

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Watercourse and wetland alteration in preparation of construction • Haul Road construction and upgrades • Sediment and erosion from Haul Road activity • Dust from Haul Road activity
Operation and Maintenance	3-4 years	• Haul Road maintenance and repairs including sanding for traction control and snow removal • Sediment and erosion from Haul Road activity • Dust from Haul Road activity
Decommissioning and Reclamation		N/A[1]
1 Decommissioning and Reclamation of the Haul Road is not expected. The Haul Road will be returned to owner for forestry industry		

Development of the Preferred Alternative Haul Road will cause direct impacts to habitat and flora, including upland forested habitat and wetlands. This will occur within the construction phase of the Project. Habitat within the Preferred Alternative Haul Road and surrounding landscape currently exhibits fragmented conditions based on existing road and trail networks, and current and historic forestry activity. Project activities are likely to result in increased habitat fragmentation and a decrease in habitat quality. Only a very small portion of the Prest Lake Old Forest layer is within the Preferred Alternative Haul Road PA (Figure 6.10-5) and with road micrositing during the detailed construction phase of the Project, no disturbance is expected to impact old forest.

The quantity of interior forest unaffected by edge effects from roads and other anthropogenic disturbance within the Preferred Alternative Haul Road PA is limited and is confined to the western extent, east of its connection with Mooseland Road. There will be impact to the interior forest at this location and within Wetland 182 and Wetland 183 during road construction (Figure 6.10-5). This is unavoidable because no preexisting roads are present near this section of the Preferred Alternative Haul Road. Detailed design planning will take road placement into consideration and small shifts in infrastructure placement may be possible to limit impacts in this area during the detailed design phase. Similar habitat is largely available in the greater surrounding area.

Overall, the increase in physical fragmentation is expected to be low, based on the current high level of disturbed habitat as discussed.

The direct and indirect impacts expected for the Preferred Alternative Haul Road will be similar to those anticipated for the Haul Road, as described in Section 6.10.6. In general, the Haul Road has an overall larger footprint but the majority of that road construction is road upgrades. In contrast, the Preferred Alternative Haul Road will require new construction.

6.10.8 Mitigation and Monitoring

In order to mitigate and reduce overall loss of function of habitat used by terrestrial flora, the following actions will be implemented where direct loss of habitat is expected to support mine and Haul Road and/or Preferred Alternative Haul Road development:

- Intact forest stands and wetlands will be avoided wherever possible during detailed Project planning and design in favor of previously disturbed areas (e.g., stands disturbed by timber harvesting, roads, or other development);
- Topsoil will be salvaged and stored for use in site restoration where possible. Upland and wetland soils should be stockpiled separately;
- Where natural, intact habitat cannot be avoided, minimization of total Project footprint will be considered during detailed planning;
- Erosion and sediment control planning will be completed to ensure site runoff is not directed towards unaltered habitat where possible to ensure existing drainage patterns are maintained;
- The effect of dust accumulation on adjacent undisturbed vegetation can be mitigated by monitoring dust conditions and when normal precipitation levels are not enough to suppress fugitive dust, water trucks can be used to suppress dust. This reduces potential impact on flora and improves safety and visibility for other vehicular traffic as well. In addition to water suppression, provincially approvable chemical dust suppressants will be used along the Haul Road.
- Winter road maintenance will include conventional snow clearing and deposition of sand for traction control where necessary. ~~Road salt will not be used;~~
- Haul trucks will be equipped with spill kits and instructed on their use and spill prevention and appropriate site personnel will be trained in spill isolation, containment, and recovery;
- A wetland alteration application will be submitted during Project planning and design to request an authorization to alter wetland habitat. Loss of function will be addressed in this wetland alteration application; and,
- Compensation for permanent loss of wetland function will be completed through wetland restoration activities to support no net loss of wetland function, subject to NSE approval.

Project activities will result in direct mortality of vascular and non-vascular flora within the PA, in both upland and wetland habitat. Compensation and mitigation for vegetation related to wetland habitat are described in Section 6.8. The long-term reclamation and remediation will involve re-vegetation of the Touquoy Mine Site and Beaver Dam Mine Site at the end of the life of the mine. Revegetation will involve establishment of native vegetation communities. Stockpiled soils will be used in reclamation efforts. This soil will contain a seedbank of native species to increase the establishment of native communities. Loss of individual plants within the Haul Road ~~PA~~ is expected to be permanent, as the Haul Road will not be decommissioned or reclaimed at the completion of the Project.

Construction of the Haul Road will involve decommissioning remnant pieces of the existing road, where appropriate. These remnant pieces of original road will be barricaded to prevent access and encouraged to revegetate through re-grading the soil and seeding with native seed mix, where necessary. Wetland restoration or creation will be incorporated into these areas, where appropriate.

Table 6.10-11 Mitigation for Habitat and Flora

VC	Mitigation Category	Project Phase	Mitigation Measure
Habitat and Flora	**N/A**	CON, OP	Maintain existing vegetation cover whenever practicable and minimize overall areas of disturbance
		CON, OP	Implement Erosion and Sediment Control Plan
		CON, OP	Avoid frequent or unnecessary travel over erosion prone areas through communication with personnel and project planning
		CON, OP	Conduct vegetation management by cutting (e.g., no use of herbicides)
		CON, OP	Implement dust suppression mitigation (refer to Atmospheric Environment Mitigation)
		CON, OP	Employ measures to reduce the spread of invasive species (such as cleaning and inspecting vehicles) to maintain the quality of remaining habitat
		DEC	Hydroseed areas that have erosion potential to return the area to pre-disturbance conditions in a timely fashion upon final reclamation
		REC	Implement reclamation program within the Beaver Dam Mine Site to re-establish native vegetation communities

6.10.9 Residual Effects and Significance

The predicted residual environmental effects of Project development and production on habitat and flora are assessed to be adverse, but not significant. The overall residual effect of the Project on habitat and flora is assessed as not significant after mitigation measures have been implemented.

Table 6.10-12 Residual Environmental Effects for Habitat and Flora

Project VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Significance Criteria for Residual Environmental Effects						Residual Effect	Significance
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Beaver Dam Mine Site and Haul Road (clearing and grubbing, and Haul Road widening and construction)	Sediment and erosion control, best management practices, spill preparedness, and dust control.	A	H VC interaction causes direct loss of habitat and flora.	PA Effect is confined to the PA	N/A VC is not expected to be affected by timing	P VC unlikely to return to baseline conditions	O Effects occur once during the construction phase	PR Mitigation cannot guarantee a return to baseline conditions	Disturbance and loss of habitat	Not significant
Operational – Beaver Dam Mine Site, Haul Road and Touquoy Mine Site (dust from haul trucks, heavy machinery, and crushing of ore)	Dust control, sediment and erosion control, best management practices, and spill preparedness.	A	M Moderate change from baseline conditions	LAA Potential adverse effect flora and habitat outside of the PA	N/A VC is not expected to be affected by timing	LT Effects may extend beyond 3 years	S Effects occur at irregular intervals throughout the Project	R VC will recover to baseline condition	Disturbance	Not significant
Reclamation – Beaver Dam Mine Site (grubbing piles spread)	Sediment and erosion control, best management practices, spill preparedness, and dust control.	P	N Negligible change from baseline conditions	LAA Potential adverse effect flora and habitat outside of the PA	N/A VC is not expected to be affected by timing	MT Effects can occur beyond 12 months and up to 3 years	O Effects occur once during the reclamation phase	R VC will recover to baseline condition	Disturbance, habitat gained	Not significant

Legend (refer to Table 5.10-1 for definitions)

Nature of Effect		Geographic Extent		Duration		Frequency	
A	Adverse	PA	Project Area	ST	Short-Term	O	Once
P	Positive	LAA	Local Assessment Area	MT	Medium-Term	S	Sporadic
		RAA	Regional Assessment Area	LT	Long-Term	R	Regular
Magnitude				P	Permanent	C	Continuous
N	Negligible	**Timing**					
L	Low	N/A	Not Applicable			**Reversibility**	
M	Moderate	A	Applicable			R	Reversible
H	High					IR	Irreversible
						PR	Partially Reversible

A significant adverse environmental effect for habitat and flora has not been predicted for the Project for the following reasons, with consideration of the ecological and social context of the LAA surrounding the Project:

- During construction, direct impacts to habitat and flora will occur. However, these impacts are limited to the construction phase (12 months) and will be limited for Haul Road constructed as a result of the planned upgrade of an existing logging road for the majority of the route. The majority of the habitat present within the Beaver Dam Mine Site is considered poor habitat as a result of historical and current forestry activities. The intact forest system associated with wetland 2 has been largely avoided with micro-sighting of the waste rock piles.
- Micro-sighting of the Project waste rock piles has allowed for avoidance of the critical function zone for the historical locations of the boreal felt lichen present south of the Project.
- During Operations, indirect impacts to habitat and flora will be reduced through erosion and sediment control measures and dust mitigation.
- During Closure, reclamation will allow for site restoration of a native assemblage of plant communities.

6.10.9.1 Residual Effects and Significance of the Preferred Alternative Haul Road

Table 6.10-13 Residual Environmental Impacts for Habitat and Flora within the Preferred Alternative Haul Road

Project VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Significance Criteria for Residual Environmental Effects						Residual Effect	Significance
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Preferred Alternative Haul Road (clearing and grubbing, and Haul Road and construction)	Sediment and erosion control, best management practices, spill preparedness, and dust control.	A	H VC interaction causes direct loss of habitat and flora.	PA Effect is confined to the PA	N/A VC is not expected to be affected by timing	P VC unlikely to return to baseline conditions	O Effects occur once during the construction phase	PR Mitigation cannot guarantee a return to baseline conditions	Disturbance and loss of habitat	Not significant
Operational – Preferred Alternative Haul Road (dust from haul trucks)	Dust control, sediment and erosion control, best management practices, and spill preparedness.	A	M Moderate change from baseline conditions	LAA Potential adverse effect flora and habitat outside of the PA	N/A VC is not expected to be affected by timing	LT Effects may extend beyond 3 years	S Effects occur at irregular intervals throughout the Project	R VC will recover to baseline condition	Disturbance	Not significant

Legend (refer to Table 5.10-1 for definitions)

Nature of Effect A Adverse P Positive **Magnitude** N Negligible L Low M Moderate H High	**Geographic Extent** PA Project Area LAA Local Assessment Area RAA Regional Assessment Area **Timing** N/A Not Applicable A Applicable	**Duration** ST Short-Term MT Medium-Term LT Long-Term P Permanent	**Frequency** O Once S Sporadic R Regular C Continuous **Reversibility** R Reversible IR Irreversible PR Partially Reversible

Table 6.10-12 was reviewed and it was determined that the construction and operation of the Haul Road were the only two VC interactions applicable to habitat and flora within the Preferred Alternative Haul Road. There were no changes in the significance criteria or overall significance for either of these, therefore, justification cited for the PA are applicable for the Preferred Alternative Haul Road.

Mitigations presented in Table 6.10-11 will be established to reduce the impact of Project activities on flora and habitat.

6.10.10 Proposed Compliance and Effects Monitoring Program

The monitoring of vascular plants will be encompassed within the Wetland Monitoring Plan. This plan will be established through the life cycle of the permitting process and will commit to monitoring during baseline/pre-construction to establish baseline conditions, and through the operational phase, reclamation and post closure (as determined to be required). Wetland monitoring will be completed for the Project on selected representative wetlands that have been predicted to have direct or indirect effects from project development to determine the effect on wetland plants.

The Preliminary Environmental Effects Monitoring Plan (EEM), located in Appendix O.1, outlines the proposed preliminary methods, timing, frequency, and locations for wetland monitoring. This document will evolve through regulatory permitting, as well as public and Mi'kmaw engagement. In addition to the EEM, a Dust Control Plan (Appendix C.3) has been developed.

6.11 Terrestrial Fauna

6.11.1 Rationale for Valued Component Selection

Terrestrial fauna, and the habitat upon which they rely, may be altered either directly or indirectly by proposed Project activities. While this valued component includes understanding the potential effects of the Project on all fauna, the specific survey methods are mainly driven by identification of SAR and SOCI.

6.11.2 Baseline Program Methodology

Data collection on various fauna species was from targeted field surveys and incidental observations. Beaver Dam Mine Site and Haul Road methods are discussed below. Information pertaining to Touquoy Mine Site has been brought forward from the EARD and Focus Report. Methods and results are summarized in subheadings within the applicable sections and are carried forward into the effects assessment where deemed appropriate. For further information regarding Touquoy Mine Site, refer to the EARD (CRA 2007) and Focus Report (CRA 2007a).

Targeted surveys were completed for bats, mainland moose, and wood turtles. Incidental observations were recorded for all other fauna species including other mammals, reptiles and amphibians, and invertebrates (including freshwater molluscs, lepidopterans, and odonates). The goal of both targeted surveys and incidental observations was to understand which species are present within the PA and how they are using the PA to allow for a discussion of Project interactions and mitigation measures.

Incidental observations of mammals and various signs of mammals across the PA were documented and photographed during all field surveys. Signs included features such as dens and nests, scat, tracks, and forage evidence. Mammal observations were collected throughout the field season in 2014, 2015, and 2016. Incidental observations for priority invertebrates occurred during all field programs, particularly wetland and watercourse delineation, and fish habitat surveys. Incidental observations of odonates and lepidopterans included live adults or larvae, or cast skins. Signs of molluscs included live or dead individuals, or shells. Other than surveys associated with the mainland moose and potential bat hibernacula (e.g., AMOs) described in the following sections, no targeted mammal surveys were undertaken. Terrestrial biota methods for mainland moose and wood turtle surveys are outlined in Section 6.13.2.4 and section 6.13.2.6, respectively (Figures 6.13-2 and 6.13-2A to 6.13-2L). An initial habitat assessment was completed throughout the ~~PA~~ Beaver Dam Mine Site and Haul Road in October 2014 and May 2015. This initial assessment combined with a desktop analysis of priority species and ACCDC data, determined that additional specialized surveys (i.e., in addition to those mentioned above) for priority fauna species would not be required within the PA.

Touquoy Mine Site

Field surveys for terrestrial fauna were conducted concurrently with vegetation, birds, and wetlands and occurred from 2004-2006 (CRA 2007). Refer to the Touquoy Mine Site EARD for detailed methodology.

6.11.3 Baseline Conditions

6.11.3.1 Mammals

Incidental observations of mammal species were documented during all field surveys during 2014, 2015, and 2016 across the ~~PA~~ Beaver Dam Mine Site and Haul Road. Specific focus was given to priority species identified as having appropriate habitat within the PA. Table 6.11-1 lists those species that were confirmed within the ~~PA~~ Beaver Dam Mine Site and Haul Road either visually or by sign (scat, footprints, etc.). The presence of mainland moose, bats, and herpetofauna in the PA is described in Section 6.13.

Table 6.11-1 Confirmed Mammalian Species During 2014 – 2016 Field Surveys

Common Name	Scientific Name	Sign	COSEWIC, SARA, NSESA	S Rank
Coyote	*Canis latrans*	Tracks, scat	-	S5
American black bear	*Ursus americanus*	Tracks, scat, digs	-	S5
White-tailed deer	*Odocoileus virginianus*	Tracks, scat, browse	-	S5
Mainland moose	*Alces americana*	Tracks	NSESA Endangered	S1
American red squirrel	*Tamiasciursus hudsonicus*	Seen, tracks, middens	-	S5
American porcupine	*Erethizon dorsatum*	Seen, tracks, browse	-	S5
Snowshoe hare	*Lepus americanus*	Seen, tracks, scat	-	S5
American beaver	*Castor canadensis*	Seen, tracks, dams, lodges, felled trees	-	S5

Common Name	Scientific Name	Sign	COSEWIC, SARA, NSESA	S Rank
Eastern chipmunk	*Tamias striatus*	Seen, tracks, middens	-	S5
Raccoon	*Procyon lotor*	Tracks	-	S5

Note: *The ACCDC works with provincial and federal experts to develop rarity ranks (i.e. S-ranks) for species in Nova Scotia, as well as the other Maritime Provinces, see http://www.accdc.com/en/rank-definitions.html for more information. An S-rank of S5 means that the species is Secure - Common, widespread, and abundant in the province.*

Other common mammal species, such as red fox (*Vulpes vulpes*), bobcat (*Lynx rufus*), raccoon (*Procyon lotor*), short-tailed weasel (*Mustela erminea*), American mink (*Neovison vison*), muskrat (*Ondatra zibethicus*), and striped skunk (*Mephitis mephitis*) are likely to inhabit the PA or surrounding areas, at least periodically.

Touquoy Mine Site

Evidence of red fox, American red squirrel (*Tamiasciursus hudsonicus*), coyote (*Canis latrans*), snowshoe hare (*Lepus americanus*), American black bear, and white-tailed deer (*Odocoileus virginianus*) were observed during field surveys in 2004, 2005, and 2006. Although not observed, suitable habitat was recognized for racoon, striped skunk, bobcat, meadow vole (*Microtus pennsylvanicus*), Southern red-backed vole (*Myodes gapperi*), Eastern chipmunk (*Tamias striatus*), and short-tailed shrew (*Blarina brevicauda*) (CRA 2007).

6.11.3.1.1 **Mainland Moose**

Mainland moose have been recorded within 4.7 km of the ~~mine footprint~~ Beaver Dam Mine Site, and within 14.1 km of the Haul Road (ACCDC). Tracking surveys were completed for the purpose of determining the presence of moose within the ~~PA~~ Beaver Dam Mine Site and Haul Road (~~both mine footprint and Haul Road)~~ as per methodology described ~~above~~ in Section 6.13.

No mainland moose signs were observed incidentally or during dedicated moose surveys along the Haul Road.

Mainland moose tracks were observed within the ~~mine footprint PA~~ Beaver Dam Mine Site during the dedicated PGI survey on May 24, 2015 in disturbed roadside habitat north of Wetland 56. Moose tracks were also observed incidentally in two locations~~ just outside the mine footprint PA to the northwest~~ on September 9, 2014. One set of tracks was observed in Wetland 210 and a second set of tracks was observed just north of the Beaver Dam Mine Site. These findings will be discussed further in Section 6.13.

Touquoy Mine Site

Mainland moose tracks were observed within the Touquoy Mine Site in a bog during field surveys to support the Touquoy EARD in 2006. Moose are known to the Tangier Grand Lake Wilderness Area, and evidence of moose is reported every year by NSL&F in the Moose River Gold Mines area during deer pellet surveys (CRA, 2007).

6.11.3.1.2 **Bats**

According to the ACCDC reports, no known bat hibernaculum are present within 5 km of the Haul Road or ~~mine footprint PA~~ Beaver Dam Mine Site. The closest known bat hibernacula is located at the Lake Charlotte Gold Mine, approximately 25 km southeast of the intersection of the proposed Haul Road and Mooseland Road (approximately 45 km from the ~~mine footprint PA~~ Beaver Dam Mine Site) (Moseley, 2007).

Provincial government records of AMOs were reviewed within the boundary of the ~~PA~~ Beaver Dam Mine Site and Haul Road, as these AMOs potentially provide bat hibernacula. Eighteen ~~Twelve~~ AMOs were identified within the ~~PA~~ Beaver Dam Mine Site and 99 were identified within a 10 km buffer of the Haul Road. A desktop review (described above) identified that the cluster of 99 AMOs located 6.4 km from the Haul Road ~~PA~~ do not provide potential bat hibernacula. Eighteen ~~Twelve~~ AMOs within the ~~mine footprint PA~~ Beaver Dam Mine Site were evaluated for their potential to provide bat hibernacula on September 18, 2014. Of the eighteen ~~20~~ AMOs evaluated at the site, all were either in-filled, contained a concrete cap blocking access, or were flooded, with the exception of one (BED-1-003), which was identified during the desktop evaluation as a potential bat hibernaculum. This AMO known as the J.H. Austin Main Shaft (AMO Database BED-1-003; NSDNR, 2010) is located on Beaver Dam Road, Halifax County at UTM Zone 20, 522256 Easting and 4990298 Northing. It is located just east of the Beaver Dam Mine Access Road at the western end of the existing settling pond southwest of Cameron Flowage. The locations of AMOs are shown on Figure 2.1-5. It was determined to be inaccessible to bats, as described further in Section 6.13.3.4.

Touquoy Mine Site

According to CRA (2007), NSL&F has extensively surveyed more than 100 AMOs mapped in close proximity to the Touquoy Mine Site (within 500 m of the Moose River Gold Mines Provincial Park). As per communications cited with E. Hennick; NSL&F, these openings are either blocked or filled with water, therefore, suitable habitat for bat hibernacula is not present.

6.11.3.2 Herpetofauna

Herpetofauna species were inventoried within the ~~PA~~ Beaver Dam Mine Site and Haul Road through both targeted searches of appropriate habitats and through incidental observations. Specialized survey methods used to identify wood turtles and their habitat are described above.

Species that have been observed, either directly or indirectly (through vocalizations, egg masses, cast snake skins, etc.) within the ~~PA~~ Beaver Dam Mine Site and Haul Road during the various field programs completed throughout the site, (primarily wetland and watercourse assessments) are provided in the table below.

Table 6.11-2 Observed Herpetofauna Species During 2014 – 2016 Field Surveys

Scientific Name	Common Name	SRank
Bufo americanus	Eastern American toad	S5
Lichlorophis vernalis	Eastern smooth green snake	S5
Notophthalmus viridescens	Red-spotted newt	S5

Scientific Name	Common Name	SRank
Plethodon cinereus	Red-backed salamander	S5
Pseudacris crucifer	Spring peeper	S5
Rana catesbeiana	Bull frog	S5
Rana clamitans melanota	Green frog	S5
Rana pipiens	Northern leopard frog	S5
Rana sylvatica	Wood frog	S5
Thamnophis sirtalis pallidulus	Maritime garter snake	S5

Though not observed, it is likely that other common herpetile species use habitat within the PA, at least periodically. These species include the painted turtle (*Chrysemys picta picta*), mink frog (*Rana septentrionalis*), pickerel frog (*Rana palustris*), yellow-spotted salamander (*Ambystoma maculatum*), northern red-bellied snake (*Storeria occipitomaculata occipitomaculata*), and northern ring-necked snake (*Diadophis punctatus edwardsii*).

The snapping turtle (*Chelydra serpentina,* SARA Special Concern, NSESA Vulnerable, S3) was not observed within the ~~mine footprint PA~~ Beaver Dam Mine Site. It was, however, observed within the vicinity of the PA and along the current road to the Touquoy Mine Site within the Haul Road ~~PA~~ (See Figures 6.13-2 and 6.13-2A to 6.13-2L).

The snapping turtle found on the Haul Road was observed incidentally on June 26, 2016 during bird surveys. This snapping turtle was observed along Mooseland Road near PC45 (UTM: 20T 507085E, 4981506N).

Suitable habitat for the snapping turtle was observed within the PA. This species will be discussed further in Section 6.13.

Touquoy Mine Site

No wood turtle or suitable habitat were observed within the Touquoy Mine Site during wood turtle habitat surveys conducted in 2004 (CRA 2007). No snapping turtles were recorded within the Touquoy Mine Site during the EARD process, however, on the June 26, 2016 a snapping turtle was observed within the LAA, north of the Touquoy Mine Site, on Moose River Road (20T 504304E, 4981602N). From June 19 to mid July, 2017 two snapping turtles were frequently observed. One was found along Moose River Road (20T 504304E, 4981602N), at the location identified above. The second snapping turtle was observed on Higgins Mines Road (20T 504380E, 4980699N) west of the PA but within the LAA.

6.11.3.3 Summary of Fauna and Habitat within the PA

The variety of both upland and wetland habitats identified throughout the PA support a range of terrestrial fauna. The PA is located in a relatively remote, undeveloped landscape. Timber harvesting and associated forestry roads form the dominant disturbance regime within the landscape surrounding the PA. This land use within and surrounding the PA has created edge habitats and openings in the canopy coverage to provide foraging opportunities for species such as white-tailed deer, black bears, and coyote.

Evidence of these species, along with snowshoe hare and porcupine, were abundant in disturbed habitats throughout the ~~PA~~ Beaver Dam Mine Site. Beavers and beaver activity has been observed in multiple waterbodies within the PA, particularly within Crusher Lake. All of the mammal species identified within the PA are presumed to use parts of the PA for foraging, breeding, denning, and raising young, at least periodically.

Herpetofauna species were observed throughout the PA, generally in association with an aquatic ecosystem, such as wetlands, waterbodies, and watercourses. Where improperly installed culverts are present along the existing Haul Road, many wetlands have standing water which has backed up as a result of improper culvert installation. These open-water wetlands, and natural wetlands with similar hydrologic regimes, are known to support breeding and overwintering populations of a variety of herpetofauna observed within the PA.

Incidental sightings of fauna were recorded during all field programs throughout the PA during all seasons. Aside from mainland moose tracks and a sighting of ~~a~~ snapping turtles, no priority fauna species or signs thereof were observed. Given the mobility of fauna species, the absence of observation does not confirm absence of the species within the PA. The size of a species and a species' behavior can result in a bias against detection. For instance, very small species, such as the maritime shrew (S3) and the rock vole (S2) have been documented within 5 km of the PA, but were not observed by the Project Team within the PA. As another example, the fisher (*Martes pennanti,* S2) is a largely nocturnal hunter, with large home ranges and elusive behavior. They prefer dense, mature to over-mature coniferous stands with large hollow snags for den sites. Their preferred habitat and prey items (porcupine, rabbits, squirrels and other small mammals) are present within the PA. The lack of observed evidence of fisher does not confirm absence of the species. Furthermore, weather conditions can affect the detectability of species. Rain or snow can wash away or cover animal tracks and scat, while temperature affects the activity levels of herpetofauna and, therefore, their detectability. When there is a thermal advantage to staying under water or immersed in wetland vegetation, herpetofauna can be more difficult to detect, compared with warmer days when they can be found basking in the sun.

Aside from direct habitat loss within the ~~mine footprint PA~~ Beaver Dam Mine Site and from the widening of the Haul Road, the Project may affect terrestrial fauna through the increase in traffic along the Haul Road during operation. According to Fahrig and Rutwinski (2009), road construction can have relatively high negative impacts on amphibians and reptiles, and large mammals, compared with small mammals and birds. Road infrastructure and traffic have a negative impact on those species which are attracted to roads, but lack the speed or cognitive ability to avoid traffic (e.g., turtles attracted to gravel roadsides for nesting). Small mammals and birds, on the other hand, are able to avoid collisions with vehicles in general. Amphibians in particular can benefit from culvert installation where wetlands and watercourses intersect roads, as an alternative to crossing the roads, because this group can experience high mortality (Bouchard et al., 2009).

Road construction can decrease habitat quality through direct habitat loss, degradation, and fragmentation (Underhill and Angold, 2000). For some species (e.g., porcupine), the construction of a road can be beneficial by providing new foraging opportunities. Species that rely on interior forest conditions (e.g., fisher) are likely to avoid areas with new road construction in favor of more undisturbed habitats. Local level changes in abundance and distribution of species may occur as the result of Project activities, but it is not anticipated than any of these changes will result in changes in overall fauna populations. While some direct loss of habitat will occur, the PA is located in an undeveloped, natural landscape with a diversity of habitats. Habitat present within the PA is not unique or rare in the local or regional context.

6.11.4 Consideration of Consultation and Engagement Results

Key issues raised during public consultation and Mi'kmaq engagement relating to terrestrial fauna include potential effects on fauna from permanent loss of habitat associated with the footprint of the Beaver Dam Mine Site and Haul Road, as well as direct mortality associated with the hauling operation. Potential effects on traditional uses of land and resources by the Mi'kmaq were noted, including hunting and trapping of small game and deer.

The results of the public consultation and Mi'kmaq engagement have been considered in the environmental effects assessment, including the Proponent's commitments on mitigation and monitoring measures and proposed compliance and effects monitoring programs, as well as the Proponent's broader commitment to ongoing public consultation and Mi'kmaq engagement. Specific to evaluating the effect on terrestrial fauna, these are found within the following environmental effects assessment.

6.11.5 Effects Assessment Methodology

6.11.5.1 Boundaries

Spatial Boundaries

The spatial boundaries used for the assessment of effects to terrestrial fauna are defined below: ~~the PA, for the mine footprint and the Haul Road. The LAA consists of any habitat contiguous and consistent with habitat available within the PA.~~

The PA (Figure 5.4-1) consists of the three project components; Beaver Dam Mine Site, Touquoy Mine Site, and the Haul Road and extends from Marinette to Moose River Gold Mines, Halifax County, NS. The Beaver Dam Mine Site is located at the eastern end of the Beaver Dam Mines Road and has been extended to the east and west in order to encompass the micro siting of the till stockpile and the waste rock stockpile, respectively. The Haul Road spans from the Beaver Dam Mine Site to Moose River Gold Mines, where the Touquoy Mine Site [processing and exhausted pit (to be used to dispose Beaver Dam tailings)] is located.

The LAA (Figure 6.10-6) consists of a 2 km buffer surrounding the Beaver Dam Mine Site and a 500 m buffer surrounding the Haul Road and Touquoy Mine Site components of the PA. The LAA boundaries were defined considering the maximum expected extent of direct and indirect impacts to terrestrial fauna.

The RAA (Figure 6.10-7) encompasses NSL&F's Ecological Land Classification Ecodistricts: 420 (Eastern Drumlins) and 440 (Eastern Interior) within Halifax Regional Municipality (HRM), east and north of Lake Charlotte. These Ecodistricts span an area broader than the expected Project impacts and considers other project boundaries as per cumulative effects methodology. These spatial boundaries will help to identify the direct or indirect impacts to terrestrial fauna species and habitats.

As the Project has the potential to cause direct and indirect effects to terrestrial fauna outside of the PA, the LAA is the appropriate boundary for evaluation of this VC.

Temporal Boundaries

The temporal boundaries used for the assessment of effects to terrestrial fauna are the construction phase, operational phase, and decommissioning and reclamation phase.

Technical Boundaries

No technical boundaries were identified for the effects assessment of terrestrial fauna.

Administrative Boundaries

Administrative boundaries for management of terrestrial fauna include the Nova Scotia Wildlife Act, which protects wild species diversity and abundance, and the Canada Wildlife Act. Further protection is offered to SAR through the provincial Nova Scotia Endangered Species Act and the federal SARA.

6.11.5.2 Thresholds for Determination of Significance

A significant adverse effect from the Project on terrestrial fauna is defined as an effect that is likely to cause a permanent alteration to any fauna species distribution or abundance, or alteration of core habitat. An adverse effect that does not cause a permanent alteration in distribution or abundance of terrestrial fauna species is considered to be not significant.

6.11.6 Project Activities and Fauna Interactions and Effects

Table 6.11-3 Potential Terrestrial Fauna Interactions with Project Activities at Beaver Dam Mine Site

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Rock blasting in preparation of construction • Till and waste rock from site preparation transport and storage • Watercourse and wetland alteration in preparation of construction • Mine Site road construction • Surface infrastructure installation and construction • Collection and settling pond construction • General noise from construction activities • Wildlife vehicle collisions • Project lighting • ~~Environmental monitoring of surface water discharges and adjacent wetlands~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, settling pond overflow, slope failure, an unplanned explosive event, and a mobile equipment accident~~
Operation and Maintenance	3-4 years	• Rock blasting to access and extract ore • Management of waste rock produced from crushing and preparing ore for transport • General noise from mining activity • Wildlife vehicle collisions

Project Phase	Duration	Relevant Project Activity
		• Project Lighting • ~~Treatment of site surface water runoff and surface mine pumped water~~ • ~~Environmental monitoring of surface water discharges and adjacent wetlands~~ • ~~General management of wastes derived from operation and maintenance activities~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, settling pond overflow, slope failure, an unplanned explosive event, and a mobile equipment accident~~
Decommissioning and Reclamation	1-2 years	• Site reclamation activities • General noise from decommissioning activities • Wildlife vehicle collisions • Project lighting • ~~Environmental monitoring of adjacent wetlands~~ • ~~General management of wastes derived from decommissioning and reclamation activities~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and mobile equipment accidents~~

Table 6.11-4 Potential Terrestrial Fauna Interactions with Project Activities along Haul Road

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Rock blasting in preparation of construction • Till and waste rock from site preparation transport and storage • Watercourse and wetland alteration in preparation of construction • Haul Road construction and upgrades • General noise from construction • Wildlife vehicle collisions • ~~Environmental monitoring of adjacent wetlands~~ • ~~General management of wastes derived from preparation and construction activities~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and a haul truck accident~~
Operation and Maintenance	3-4 years	• Ore transport • Haul Road maintenance and repairs, including snow removal and deposition of sand for traction control • General noise from Haul Road activity • ~~Environmental monitoring of adjacent wetlands~~ • Trucking ore from ~~mine footprint~~ Beaver Dam Mine Site to ~~Touquoy Processing Facility~~ Touquoy Mine Site ○ Wildlife vehicle collisions • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and a haul truck accident~~
Decommissioning and Reclamation	-	N/A[1]

[1] Decommissioning and Reclamation of the Haul Road is not expected. The Haul Road will be returned to owner for forestry industry

Table 6.11-5 Potential Terrestrial Fauna Interactions with Project Activities at ~~Touquoy Processing and Tailings Management Facility~~ Touquoy Mine Site

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Tailings pipeline, make-up water pipeline alteration, and relocation of reclaim infrastructure • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and mobile equipment accidents~~

Project Phase	Duration	Relevant Project Activity
Operation and Maintenance	3-4 years	• Environmental monitoring • General management of waste derived from processing activities • Accidents and malfunctions to include fuel and other spills, forest fires, and a haul truck accident • Heavy machinery operation • Vehicle activity • Project lighting
Decommissioning and Reclamation	1-2 years	• Environmental monitoring • Accidents and malfunctions to include fuel and other spills, and forest fires • Heavy machinery operation • Vehicle activity • Project lighting

Development of the mine infrastructure and upgrades to the Haul Road will cause direct impacts to habitat used by terrestrial fauna, including upland forested habitat and wetlands. This will occur mostly within the construction phase of the Project. Habitat within the PA and surrounding landscape currently exhibits fragmented conditions based on historic mine operations, existing road and trail networks, and current and historic timber harvesting activity within and adjacent to the PA. Project activities are likely to result in increased habitat fragmentation and a decrease in habitat quality for those species which rely especially on interior forest conditions, where intact interior forest remains. This decrease in habitat quality for species relying on interior forest condition is based on increased activity and sensory disturbance, along with increased physical fragmentation. Increase in physical fragmentation is expected to be low, based on the current high level of disturbed habitat as discussed.

Sensory disturbance to terrestrial fauna would result from rock blasting, clearing and grubbing, infrastructure construction, and overall increased traffic along the entire ~~haul route~~ Haul Road during operations. This will likely result in the localized wildlife avoidance of the PA. Overall, Project activities will likely cause a change in usage of the PA by wildlife, with some species tending to avoid the area, while others may be attracted to the increased activity, including opportunistic species such as coyotes, raccoons, skunks, or black bears. Sensory disturbance related to Project activity will occur within the ~~mine footprint PA~~ Beaver Dam Mine Site, Haul Road ~~PA~~, and within the ~~Touquoy Processing Facility~~ Touquoy Mine Site, as the addition of material from the Beaver Dam mine will extend the life of the ~~Touquoy Processing Facility~~ Touquoy Mine Site by four years.

Existing ambient noise (measured in 2014) around the Beaver Dam Mine Site had an average value of 33 dBA ±. The predicted noise levels at the boundaries of the Beaver Dam Mine Site during operations are expected to range between 51.5 to 65.6 dBA (Appendix B.1). It should be noted that the findings within the Noise Impact Study are worst case (most conservative) predictions.

The Environment Code of Practice for Metal Mines (Environment Canada, 2012) has established parameters for ambient noise levels for wildlife. These parameters indicate that ambient noise observed above 55 dBA during the day and 45 dBA at night can affect wildlife. The predicted noise levels presented in the Noise Impact Study (Appendix B.1) exceed the levels outlined by Environment Canada (2012). Additionally, a literature review conducted by Shannon et al. (2016) found that an increase in stress and decrease in reproductive success in terrestrial mammals has the potential to occur at noise levels ranging from 52 to 68 dBA, levels significantly higher than those cited by Environment Canada (2012).

According to the results of the Noise Impact Study, noise generated from Project activities diminishes to 45 dBA (the most conservative guideline) at approximate ranges of 0 – 1000 m outside of the Beaver Dam Mine Site. At the Haul Road, noise at that same sound level is predicted to travel approximately 180 - 350 m from the center line of the road and at the Touquoy Mine Site noise at 45 dBA is predicted to travel approximately 0 - 850 m outside of this component of the PA. These ranges of noise distribution are due to changes in local topography. Terrestrial fauna within these approximate ranges of noise distribution surrounding the PA have the potential to be affected by noise during the day and overnight.

Although the auditory capabilities of fauna species varies (Shannon et al. 2016) and fauna behavior in response to noise is largely related to perceived threats not noise intensity (Bowles 1995) changes to ambient noise levels and the presence of periodic vibrations from blasting have the potential to adversely affect fauna. ~~and birds by influencing migration and behavioral patterns~~. Noise can affect behavioral patterns (Patthey et al. 2008), stress fauna (Knight and Swaddle, 2011), cause avoidance behavior (Ware et al. 2015), and reduce the ability for communication and hunting success (Barber et al. 2009). Combined, these effects can negatively impact the overall population health of a particular species (Ware et al. 2015).

~~Noise and vibration is provincially regulated via the *Workplace Health and Safety Regulations* and the *Pit and Quarry Guidelines*, which protect the health of site workers and the general public at PA boundaries, respectively. If blasting is required near fish-bearing watercourses or waterbodies, guidelines identified by Wright and Hopky (1998) will be provided to site personal and contractors and adhered to as part of the Beaver Dam EPP.~~

The calculated light levels at the residential receptors outlined within the Light Impact Assessment (Appendix D.1) are below the limits recommended by the Institute of Lighting Engineers (ILE) guidelines. Light impacts from trucks on the Haul Road are expected to be insignificant compared to baseline daylight illuminance and the amount of light blocked by the surrounding woodland and topographic changes at the Beaver Dam Mine Site will likely be >90%.

Light impacts terrestrial fauna by potentially causing disorientation or by causing attraction or avoidance (Langcore and Rich, 2004). In turn, these behavioral changes can affect the success of foraging, reproduction, and communication of wildlife (Langcore and Rich, 2004) and can disrupt habitat connectivity (Bliss-Ketchum et al. 2016). Light levels within close proximity to the PA may cause sensory disturbance to fauna.

Direct mortality of fauna species could result from Project activities, particularly due to the increase in traffic during construction and operation of the facility. Increased traffic poses a risk to wildlife along the entire length of the Haul Road between the Beaver Dam ~~mine footprint~~ Mine Site and the ~~Touquoy processing facility~~ Touquoy Mine Site. Indirect mortality could result from exposure to contaminants or spills from unplanned incidents.

Table 6.11-6 Project Interactions for Fauna

Impact Type	Direct Impact	Project Phase	Indirect Impact	Project Phase
Vegetative and Habitat Integrity	Loss of vegetative cover through clearing and grubbing decreases wildlife habitat availability and Project development also has the potential to reduce natural surface water drainage.	C	Habitat fragmentation may alter habitat suitability for those species which rely on interior forest conditions. Within the Haul Road ~~PA~~, this change in habitat is expected to be permanent.	C O D
Sensory Disturbance	Extensive ground works, including activities such as blasting will increase noise levels. Increase in vehicular traffic will add to sensory disturbance through increased noise. This has the potential to reduce habitat for fauna.	C O D	Sensory disturbance (both lights and sounds) may result in further avoidance of the PA by some species. Predicted noise impact distances from the PA: • Beaver Dam Mine Site = 0 – 1000 m • Haul Road = 180 – 350 m • Touquoy Mine Site = 0 – 850 m	C O
	Project infrastructure and roads will have lights which are operational at all times, which can alter habitat quality and sleep/wake cycles within the immediate vicinity of the PA. This may decrease efficiency of nocturnal hunters.	C O	Some opportunistic wild species may be attracted to the site as a result of increased access and available food sources (natural prey or anthropogenic food sources), potentially increasing interactions between site personnel and wildlife.	C O
Direct Mortality	Increased traffic and general activity within the PA may result in direct mortality to wild species through vehicular collisions and construction.	C O D	Improved access throughout the PA may increase hunting activity of licensed hunters and/or illegal poachers.	C O D

The current condition of the ~~mine footprint~~ Beaver Dam Mine Site is disturbed and fragmented habitat based on timber harvesting and historic mining activity. The level of disturbance within the ~~mine footprint PA~~ Beaver Dam Mine Site disproportionately affects uplands over wetlands. Large, natural, undisturbed wetland habitats do exist within the ~~mine footprint PA~~ Beaver Dam Mine Site (particularly wetlands 2 and 29). A network of roads and trails is present throughout the site, with parts of the ~~mine footprint PA~~ Beaver Dam Mine Site characterized by un-vegetated gravel and crushed stone, and a large fabricated settling pond used during mining activities (wetland 59) exists in the ~~mine footprint PA~~ Beaver Dam Mine Site. Based on a visual review of a 2014 aerial photograph and the NSL&F Forest Inventory, approximately 78.6% of the PA is currently disturbed. Disturbed areas consist of clearcutting (4.6%), forested less than 40 years (51.3%), forested between 40 and 100 years (5.7%), mining and exploration activities (14.5%), and road corridors (2.5%). The remaining 21.4% of the PA is considered to be undisturbed wetlands (10.4%) and forests (11.1%) (NSDNR 2017). As such, the level of new fragmentation associated with the ~~mine footprint PA~~ Beaver Dam Mine Site is anticipated to be moderate, given the current level of disturbance. Those species which prefer interior forest conditions (e.g., fisher) are likely already avoiding the ~~mine footprint PA~~ Beaver Dam Mine Site, while those species which prefer fragmented habitat (e.g., coyote, snowshoe hare, white-tailed deer) are not expected to be adversely affected by additional habitat fragmentation.

Construction of the Haul Road will involve a combination of new road construction (4.0 km) and upgrades to the existing logging road. The majority of the proposed Haul Road (99%) follows an existing road corridor, thereby limiting new habitat fragmentation. The existing Haul Road is used by lumber trucks, but the level of traffic varies seasonally and annually depending on which areas are undergoing timber harvesting. One 4 km portion of new road construction is required. The section of road immediately southwest of Highway 224 will add new habitat fragmentation to an area that has very little, if any, evidence of anthropogenic disturbance. The construction of this section of the Haul Road will decrease the habitat quality for those species that rely on interior forest.

The effect of the Project on wildlife can largely be attributed to sensory disturbance. ~~Traffic volumes on the existing Haul Road are unknown and variable both seasonally and annually. Project activities will increase the traffic levels by an average of 20 trucks per day for 12-16 hours of the day during the operational phase of the Project (an annual average of approximately 185 return truck trips per day). Additionally, b~~Blasting will occur 1-2 times per week within the ~~mine footprint~~ Beaver Dam Mine Site during the operational phase. This along with other construction and operational activities will ~~represents a considerable~~ increase ~~in~~ sensory disturbance above current conditions and will, as described above, ~~likely~~ reduce the habitat quality for some species.

Traffic volumes will also increase (refer to Section 6.16.3.7) due to haul truck traffic and traffic from site personnel. The Project expects 185 return trips along the length of the Haul Road over 16 hours a day during the operational phase. The increased level of traffic poses an increased risk to wildlife collisions, particularly along the Haul Road, where the speed limit is proposed to be 70 km/hr. The risk of collisions within the ~~mine footprint~~ Beaver Dam Mine Site will be lower, as the speed limit will be reduced to ~~50~~ 40 km/hr., giving both drivers and wildlife more reaction time to avoid collisions. While no obvious wildlife corridors were observed within the PA, it is anticipated that some wild species (e.g., herpetofauna) will use watercourses and wetland complexes as travel corridors, thereby increasing the risk of collisions with wildlife along these systems where they interact with the Haul Road and interior mining roads. The risk of collisions with wildlife will vary depending on the season and the species. For instance, during winters with deep snow conditions, white-tailed deer are more likely to use roads and trails, putting them at an elevated risk of collisions. During spring and summer, porcupine and skunks forage on roadside vegetation at dawn and dusk, increasing the risk of collisions with those species, and turtles are drawn to the roadside to nest in the gravelly shoulders in June. As such, the risk of wildlife collisions is present at any time of year.

According to Fahrig and Rutwinski (2009), road construction can have relatively high negative impacts on amphibians and reptiles, and large mammals, compared with small mammals and birds. Road infrastructure and traffic have a negative impact on those species which are attracted to roads but lack the speed or cognitive ability to avoid traffic (e.g., turtles attracted to gravel roadsides for nesting). Small mammals and birds, on the other hand, are able to avoid collisions with vehicles in general. Amphibians in particular can benefit from culvert installation where wetlands and watercourses intersect roads, as an alternative to crossing the roads, because this group can experience high mortality (Bouchard et al., 2009).

Road construction can decrease habitat quality through direct habitat loss, degradation, and fragmentation (Underhill and Angold, 2000). For some species (e.g., porcupine), the construction of a road can be beneficial by providing new foraging opportunities. Species that rely on interior forest conditions (e.g., fisher) are likely to avoid areas with new road construction in favor of more undisturbed habitats. Local level changes in abundance and distribution of species may occur as the result of Project activities, but it is not anticipated than any of these changes will result in changes in overall fauna populations. Portions of old forest are present within the Preferred Alternative Haul Road PA and are unique or rare in the local or regional context. All efforts will be made during the detailed planning of the road layout to minimize impact to this habitat.

The ~~Touquoy facility is currently under construction~~ Touquoy Mine Site is currently operational. There are no direct or indirect effects to terrestrial fauna anticipated to be caused by the processing of ore and the management of tailings (exhausted pit) from the Beaver Dam Mine Project as no increase in footprint is proposed beyond the approved construction now underway. No effects are anticipated at the ~~Touquoy facility~~ Touquoy Mine Site related to the processing of Beaver Dam ore, with the exception of the continued potential for accidents and malfunctions and continued environmental monitoring.

6.11.7 Preferred Alternative Haul Road

6.11.7.1 Rationale for Valued Component Selection

Same rationale for valued component selection as indicated in Section 6.11.1.

6.11.7.2 Baseline Program Methodology

Incidental observations and various signs of terrestrial fauna within the Preferred Alternative Haul Road PA were documented and photographed during all field surveys. Signs included features such as dens and nests, scat, tracks, and forage evidence. Observations were collected throughout the field season in 2018. Incidental observations for priority species occurred during all field programs, particularly wetland and watercourse delineation. No targeted terrestrial fauna surveys were undertaken within the Preferred Alternative Haul Road.

6.11.7.3 Baseline Conditions

Table 6.11-7 Confirmed Terrestrial Fauna Species Observed During 2018 Field Surveys

Common Name	Scientific Name	Sign	COSEWIC, SARA, NSESA	S Rank
Eastern coyote	*Canis latrans*	Scat	-	S5
White-tailed deer	*Odocoileus virginianus*	Tracks, scat	-	S5
American red squirrel	*Tamiasciursus hudsonicus*	Seen, middens	-	S5
American porcupine	*Erethizon dorsatum*	Seen	-	S5
Snowshoe hare	*Lepus americanus*	Scat	-	S5

Although not observed, other common mammal and herpetofauna species are likely to inhabit the Preferred Alternative Haul Road PA. These mammalian species include; American black bear, red fox, bobcat, raccoon, short-tailed weasel, American mink, muskrat, and striped skunk. Examples of herpetofauna species likely to inhabit the Preferred Alternative Haul Road include; eastern American toad, eastern smooth green snake, maritime garter snake, wood frog, northern leopard frog, green frog, bull frog, painted turtle, mink frog, pickerel frog, yellow-spotted salamander and red-backed salamander.

No signs or observations of any SAR/SOCI terrestrial fauna (e.g. Mainland moose, snapping turtle) were identified within the Preferred Alternative Haul Road.

6.11.7.3.1 Summary of Fauna and Habitat within the Preferred Alternative Haul Road PA

In general, the habitat available for terrestrial fauna within the Preferred Alternative Haul Road is similar to the habitat available within the majority of the PA. The variety of both upland and wetland habitats identified throughout the Preferred Alternative Haul Road PA support a range of terrestrial fauna. The Preferred Alternative Haul Road is located in a relatively remote area with timber harvesting and associated forestry roads as the dominant disturbance regime within the landscape and surrounding area. This land use within and surrounding the Preferred Alternate Haul Road has created edge habitats and openings in the canopy coverage to provide foraging opportunities for species such as white-tailed deer, black bears, and coyote.

No herpetofauna species were observed within the Preferred Alternative Haul Road PA, but are generally associated with an aquatic ecosystem, such as wetlands, waterbodies, and watercourses, which are present. Nineteen wetlands and seven watercourses exist within the Preferred Alternative Haul Road PA. Wetlands with open water and watercourses are known to support breeding and overwintering for of a variety of herpetofauna species that have the potential to inhibit the Preferred Alternative Haul Road PA.

No priority fauna species or signs were observed during surveys within the Preferred Alternative Haul Road PA. Given the mobility of fauna species, the absence of observation does not confirm absence of the species. Additionally, the size of a species and a species' behavior can result in a bias against detection.

6.11.7.4 Considerations of Consultation and Engagement Results

The Preferred Alternative Haul Road is the result of consultation and engagement on the Primary Haul Road. Refer to Section 6.11.4 for key issues raised during public consultation and Mi'kmaq engagement relating to terrestrial fauna.

6.11.7.5 Effects Assessment Methodology

6.11.7.5.1 Boundaries

Spatial Boundaries

The spatial boundaries used for the assessment of effects to terrestrial fauna along the Preferred Alternative Haul Road are the PA, LAA, and RAA. The Preferred Alternative Haul Road PA (Figure 5.4-1) encompasses 50 m on either side of a 5.7 km long center line. The eastern and western extent of the Preferred Alternative Haul Road PA connects to the Haul Road at a pre-existing forestry road and to Mooseland Road, respectively. The Preferred Alternative Haul Road PA runs north of Sandy Pond and Miller Lake.

The LAA (Figure 6.10-8) includes a 500m buffer from the Preferred Alternative Haul Road. This area encompasses the maximum expected extent of project direct and indirect impacts to terrestrial fauna.

The RAA (Figure 6.10-9) encompasses NSL&F's Ecological Land Classification Ecodistricts: 420 (Eastern Drumlins). This Ecodistrict spans an area broader than the expected Project impacts to terrestrial fauna and considers other Project boundaries as per cumulative effects methodology. These spatial boundaries will help to identify the direct or indirect impacts to terrestrial fauna and the effects of the Project on distribution and abundance of these species.

As the Project has the potential to cause direct and indirect effects to terrestrial fauna outside of the PA, the LAA is the appropriate boundary for evaluation of this VC.

Temporal Boundaries

The temporal boundaries used for the assessment of effects to flora are the construction phase, operational phase, and decommissioning and reclamation phase.

Technical Boundaries

No technical boundaries were identified for the effects assessment of habitat and flora.

Administrative Boundaries

Administrative boundaries for management of terrestrial fauna include the Nova Scotia Wildlife Act, which protects wild species diversity and abundance, and the Canada Wildlife Act. Further protection is offered to SAR through the provincial Nova Scotia Endangered Species Act and the federal SARA.

6.11.7.5.2 Thresholds for Determination of Significance

The thresholds for determination of significance regarding terrestrial fauna within the Preferred Alternative Haul Road are identical to the thresholds for determination of significance for this VC throughout the entire PA, as presented within Section 6.11.5.2.

6.11.7.6 Project Activities and Terrestrial Fauna Interactions and Effects

The assessment of potential adverse interactions and effects of the Project on this VC takes into account the potential for the Project to result in changes to:

- Permanent and temporary habitat alteration and fragmentation
- Disturbance and/or displacement
- Potential for direct and indirect mortality to individuals
- Attraction and disorientation resulting from night-lighting

Table 6.11-8 presents the potential interactions of the Project with terrestrial fauna and habitat.

Table 6.11-8 Potential Terrestrial Fauna Interactions with Project Activities along the Preferred Alternative Haul Road

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Rock blasting in preparation of construction • Till and waste rock from site preparation transport and storage • Watercourse and wetland alteration in preparation of construction • Haul Road construction and upgrades • General noise from construction • Wildlife vehicle collisions
Operation and Maintenance	3-4 years	• Ore transport • Haul Road maintenance and repairs, including snow removal and deposition of sand for traction control • General noise from Haul Road activity • Wildlife vehicle collisions
Decommissioning and Reclamation	-	N/A[1]

[1] Decommissioning and Reclamation of the Haul Road is not expected. The Haul Road will be returned to owner for forestry industry

Development of the Preferred Alternative Haul Road will cause direct impacts to habitat used by terrestrial fauna, including upland forested habitat and wetlands. This will occur within the construction phase of the Project. Habitat within the Preferred Alternative Haul Road PA and surrounding landscape currently exhibits fragmented conditions based on existing road and trail networks, and current and historic timber harvesting activity. Project activities are likely to result in increased habitat fragmentation and a decrease in habitat quality for those species which rely especially on interior forest conditions, where intact interior forest remains.

Sensory disturbance to terrestrial fauna would result from rock blasting, clearing and grubbing, road construction and from haul truck traffic occurring in an area without a preexisting road network. This will likely result in the localized avoidance of the Preferred Alternative Haul Road PA by terrestrial fauna. Overall, Project activities will likely cause a change in usage of the Preferred Alternative Haul Road PA by fauna, with some species tending to avoid the area, while others may be attracted to disturbed habitat (e.g. white-tailed deer).

Changes to ambient noise levels, light levels and the presence of periodic vibrations from blasting have the potential to adversely affect terrestrial fauna by influencing behavioral patterns. The expected noise and light levels as well as their impact to terrestrial fauna are discussed in detail within Section 6.11.6.

Direct mortality of terrestrial fauna species could result from Project activities, particularly due to the increase in haul traffic during the operational phase. Increased traffic increases the likelihood of incidents and accidents which can result in direct mortality to wildlife species.

6.11.8 Mitigation ~~and Monitoring~~

In order to mitigate and reduce overall loss of function of habitat used by terrestrial fauna, and reduce direct impacts on fauna, the following actions will be implemented where direct loss of habitat is expected to support ~~mine~~ Beaver Dam Mine Site and Haul Road development:

- Intact forest stands and wetlands will be avoided wherever possible during detailed Project planning and design in favor of previously disturbed areas (e.g., stands disturbed by timber harvesting);
- Where natural, intact habitat cannot be avoided, minimization of total Project footprint will be considered during planning;
- Minimization of impact to old forest;
- Habitat fragmentation will be reduced by limiting the area of new roads, favoring upgrading of existing roads where possible instead;
- Site infrastructure will be fenced in, where practical, to reduce interactions between Project infrastructure and wildlife;
- A speed limit of ~~50~~ 40 km/hr within the ~~mine footprint~~ Beaver Dam Mine Site and 70km/hr. along the Haul Road (or not exceeding posted speed limits) will be implemented to reduce likelihood of collisions with fauna;
- An un-vegetated buffer along roadsides will be maintained, where possible, to improve visibility along roadsides and reduce the potential for collisions with wildlife;
- Clearing and construction will be limited within wetlands that could support snapping turtles during winter hibernation period;
- Culverts installed within wetlands and watercourses will provide an alternative crossing location to amphibians and reptiles, thereby reducing direct mortality of species attempting to cross a road;
- ~~Watering of~~ Water and/or a provincially approvable chemical dust suppressant will be used on roads during dry conditions ~~will occur~~ to improve safety and visibility and reduce likelihood of collisions between vehicular traffic and wildlife;
- Site-specific measures to protect wildlife will be addressed in the EPP;
- Waste must be managed to reduce attractants to opportunistic wildlife species;

- Proper handling of hazardous wastes will reduce exposure to contaminants as a result of unplanned incidents;
- Erosion and sediment control planning will be completed to ensure site runoff is not directed towards unaltered habitat;
- For those species reliant on wetland habitat, a wetland alteration application will be submitted during Project planning and designed to request an authorization to alter wetland habitat. Loss of function and habitat will be addressed in this wetland alteration application; and
- Compensation for permanent loss of wetland function will be completed through wetland restoration activities to support no net loss of wetland function, subject to NSE approval (Appendix H.3 Preliminary Wetland Compensation Plan).

Where direct impacts to habitat are not expected, the ~~mine~~ Beaver Dam Mine Site and Haul Road development may be potentially affected by indirect impacts from construction, operation, and decommissioning ~~of the mine~~. The following actions will be implemented to reduce the potential for indirect impacts to adjacent undisturbed habitat:

- For species which rely on wetland habitat, maintain pre-construction hydrological flows into and out of downstream wetland habitats, to the extent possible (post alteration wetland monitoring may be required as a result of the provincial permitting process);
- In order to protect adjacent habitats from accidental spills, ensure that spill control and contingency planning is in effect, and its procedures fully communicated to staff;
- Vegetation management will be conducted by cutting (i.e., no use of herbicides);
- Ensure all development related activity (construction areas, access roads, etc.) are located within areas where biophysical field evaluations have been completed and approvals/written authorizations are in place as required;
- Erosion control materials shall be clean, non-ore-bearing, non-watercourse derived and non-toxic materials;
- Machinery and personnel will be instructed not to enter the habitats outside of approved Project footprint; and
- Slopes will be re-vegetated to stabilize them and limit erosion and sedimentation into adjacent habitats.

Table 6.11-9 Mitigation for Terrestrial Fauna

VC	Mitigation Category	Project Phase	Mitigation Measure
Fauna	**N/A**	PC, CON, OP	Provide wildlife awareness training to site personnel to reduce interactions between site personnel and wildlife
		PC	Reduce habitat fragmentation by minimizing new road construction wherever practicable

VC	Mitigation Category	Project Phase	Mitigation Measure
		PC	Complete detailed design of Haul Road and micro siting of mine infrastructure to avoid major faunal habitat
		CON	Upgrade culverts to improve habitat and connectivity
		CON, OP	Maintain existing vegetation cover whenever practicable and minimize overall areas of disturbance
		CON, OP	Implement Erosion and Sediment Control Plan
		CON, OP	Implement Emergency Response and Spill Contingency Plans to protect fauna and their habitat from accidental spills
		CON, OP	Store hazardous and non-hazardous waste in designated locations, in appropriate containers to reduce potential for spills, and to prevent attracting wildlife (e.g., food waste in bear proof containers)
		CON, OP	Vehicles will yield to wildlife on roads
		CON, OP	Implement speed limits within the Beaver Dam Mine Site and Haul Road at 40 km/hr and 70 km/hr, respectively, to reduce potential collisions with fauna
		CON, OP	Install signage where specific wildlife concerns have been identified
		CON, OP	Monitor and manage road conditions through dust suppression and traction control (sand on icy roads) to reduce potential for collisions with wildlife
		CON, OP	Clear vegetation within a 10 m buffer of roadsides, where needed, to improve visibility and reduce wildlife collisions
		CON, OP	Install fencing, where practical, to prevent wildlife from accessing areas with increased risk of injuries to wildlife
		CON, OP	Monitor in and around site infrastructure for wildlife and if present work to relocate in accordance with the Wildlife Management Plan
		CON, OP	Implement Wildlife Management Plan
		CON, OP	Follow the *Pit and Quarry Guidelines* to reduce impact of noise and vibration on wildlife
		CON, OP	Limit use of lights to the amount necessary to ensure safe operation within the PA, with the recognition that excessive lighting can be disruptive to wildlife
		CON, OP	Restrict blasting to a specific and regular daytime schedule during weekdays to allow time for wildlife to recover from potential noise disturbance
		REC	Implement remediation plans to restore natural habitat and food source re-establishment to support fauna

6.11.9 Residual Effects and Significance

The predicted residual environmental effects of Project development and production on terrestrial fauna are assessed to be adverse, but not significant. The overall residual effect of the Project on terrestrial fauna is assessed as not significant after mitigation measures have been implemented.

Table 6.11-10 Residual Environmental Effect for Fauna

Project VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Significance Criteria for Residual Environmental Effects						Residual Effect	Significance
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Beaver Dam Mine Site and Haul Road (habitat loss and fragmentation from clearing and grubbing and disturbance (noise, light, and wildlife vehicle collisions) from construction activities)	Implement speed limits, install fences where necessary, and minimize lighting.	A	M VC interaction causes direct loss of habitat for fauna.	LAA Potential adverse effect to fauna outside of the PA	A VC interaction may affect seasonal aspects of fauna.	LT Effects can occur beyond 3 years	O Effects occur once during the construction phase	PR Mitigation cannot guarantee a return to baseline conditions	Disturbance and loss of habitat	Not significant
Operational – Beaver Dam Mine Site, Haul Road and Touquoy Mine Site (disturbance (light and wildlife vehicle collisions) from haul trucks and heavy machinery)	Implement speed limits, install fences where necessary, and minimize lighting.	A	L Minor change from baseline conditions	LAA Potential adverse effect to fauna outside of the PA	A VC interaction may affect seasonal aspects of fauna.	LT Effects may extend beyond 3 years	R VC interaction will occur at regular intervals	R VC will recover to baseline conditions	Disturbance	Not significant
Operational – Beaver Dam Mine Site, Haul Road and Touquoy Mine Site (Noise disturbance from haul trucks, heavy machinery, and, crushing of ore)	Implement speed limits, install fences where necessary, and minimize lighting.	A	H Large change from baseline conditions	LAA Potential adverse effect to fauna outside of the PA	A VC interaction may affect seasonal aspects of fauna.	LT Effects may extend beyond 3 years	R VC interaction will occur at regular intervals	R VC will recover to baseline conditions	Disturbance	Not significant
Reclamation – Beaver Dam Mine Site (disturbance (noise, light, and wildlife vehicle collisions) from construction activities)	Implement speed limits, install fences where necessary and minimize lighting.	P	L Minor change from baseline conditions	LAA Potential effect on fauna outside of the PA	A VC interaction may affect seasonal aspects of fauna.	MT Effects can occur beyond 12 months and up to 3 years	O Effects occur once during the reclamation phase	R VC will recover to baseline condition	Disturbance, habitat gained	Not significant

Legend (refer to Table 5.10-1 for definitions)

Nature of Effect	Geographic Extent	Duration	Frequency
A Adverse P Positive	PA Project Area LAA Local Assessment Area RAA Regional Assessment Area	ST Short-Term MT Medium-Term LT Long-Term P Permanent	O Once S Sporadic R Regular C Continuous
Magnitude N Negligible L Low M Moderate H High	**Timing** N/A Not Applicable A Applicable		**Reversibility** R Reversible IR Irreversible PR Partially Reversible

A significant adverse environmental effect for fauna has not been predicted for the Project for the following reasons, with consideration of the ecological and social context of the LAA surrounding the Project:

During Construction:

- Direct impacts to fauna habitat is expected, however, impacts will be minimized through on-going Project design and micro-sighting of infrastructure footprints where ever practicable.
- The baseline habitat of the Beaver Dam Mine Site and Haul Road is a network of existing fragmentation due to historical and present forestry activities, and the presence of the logging road that is proposed for upgrade.
- Micrositing has reduced the impact to interior forest patches within the Beaver Dam Mine Site.
- The majority of Haul Road construction is road upgrades, minimizing the loss of habitat for fauna.
- Construction work will be considerate of the breeding patterns for fauna, wherever practicable.
- Construction noise and light will be limited to a 12 month window.

During Operations:

- Noise will be elevated above baseline during this period and may cause a displacement of fauna in close proximity to the Haul Road and Mine Sites.

During Closure:

- Noise will be elevated above baseline during reclamation activities (2-3 years) involving mobile equipment and then drop to baseline for the post-closure period.

6.11.9.1 Residual Effects and Significance of the Preferred Alternative Haul Road

Table 6.11-11 Residual Environmental Effects for Terrestrial Fauna within the Preferred Alternative Haul Road

Project VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Significance Criteria for Residual Environmental Effects						Residual Effect	Significance
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Preferred Alternative Haul Road (habitat loss and fragmentation from clearing and grubbing and disturbance (noise, light, and wildlife vehicle collisions) from construction activities)	Implement speed limits, install fences where necessary, and minimize lighting.	A	M VC interaction causes direct loss of habitat for fauna.	LAA Potential adverse effect to fauna outside of the PA	A VC interaction may affect seasonal aspects of fauna.	LT Effects can occur beyond 3 years	O Effects occur once during the construction phase	PR Mitigation cannot guarantee a return to baseline conditions	Disturbance and loss of habitat	Not significant
Operational – Preferred Alternative Haul Road (disturbance (light and wildlife vehicle collisions) from haul trucks and heavy machinery)	Implement speed limits, install fences where necessary, and minimize lighting.	A	L Minor change from baseline conditions	LAA Potential adverse effect to fauna outside of the PA	A VC interaction may affect seasonal aspects of fauna.	LT Effects may extend beyond 3 years	R VC interaction will occur at regular intervals	R VC will recover to baseline conditions	Disturbance	Not significant
Operational – Preferred Alternative Haul Road (Noise disturbance from haul trucks, heavy machinery, and, crushing of ore)	Implement speed limits, install fences where necessary, and minimize lighting.	A	M Moderate change from baseline conditions	LAA Potential adverse effect to fauna outside of the PA	A VC interaction may affect seasonal aspects of fauna.	LT Effects may extend beyond 3 years	R VC interaction will occur at regular intervals	R VC will recover to baseline conditions	Disturbance	Not significant

Legend (refer to Table 5.10-1 for definitions)

Nature of Effect	Geographic Extent	Duration	Frequency
A Adverse P Positive **Magnitude** N Negligible L Low M Moderate H High	PA Project Area LAA Local Assessment Area RAA Regional Assessment Area **Timing** N/A Not Applicable A Applicable	ST Short-Term MT Medium-Term LT Long-Term P Permanent	O Once S Sporadic R Regular C Continuous **Reversibility** R Reversible IR Irreversible PR Partially Reversible

Table 6.11-10 was reviewed and it was determined that the construction and operation (direct and indirect impacts) of the Haul Road were the only VC interactions applicable to terrestrial fauna within the Preferred Alternative Haul Road. There only change in the significance criteria is the reduction of magnitude of impact from high to moderate for the operation (noise) of the Preferred Alternative Haul Road. This is due to Haul Trucks being the only generator of noise along the Preferred Alternative Haul Road. There were no changes to the overall significance for any of these VC interactions.

To mitigate the potential impacts of Project activities on terrestrial fauna, best management practices will be followed and mitigations presented in Table 6.11-9 will be established.

6.11.10 Proposed Compliance and Effects Monitoring Program

Monitoring of terrestrial fauna will be completed to verify the accuracy of the predicted environmental effects and the effectiveness of the mitigation measures specific to terrestrial fauna. Mitigations are outlined in Table 6.11-9. A Wildlife Management Program will be established through the life cycle of the permitting process. As part of the Wildlife Management Program, a Mainland Moose Management Plan (MMMP) will be developed and will commit to monitoring mainland moose during baseline/pre-construction to establish baseline conditions, and through the operational phase, reclamation and post closure (as determined to be required). Monitoring associated with the MMMP will be completed for the Project on selected transects within suitable mainland moose habitat.

The Preliminary Environmental Effects Monitoring Plan (EEM), located in Appendix O.1, outlines the proposed preliminary methods, timing, frequency, and locations for mainland moose monitoring. This document will evolve through regulatory permitting, as well as public and Mi’kmaw engagement.

In addition to the EEM, a Wildlife Management Plan (WMP) will be developed in order to outline protocols to minimize interactions between wildlife (e.g. snapping turtles) and Project activities.

6.12 Birds

6.12.1 Rationale for Valued Component Selection

Bird habitat may be altered or lost as a result of direct or indirect disturbances from the Project. Migratory birds and SAR are protected under federal legislation by the Migratory Birds Convention Act (MBCA) (Government of Canada, 1994) and SARA (Government of Canada, 2002). The *Nova Scotia Wildlife Act* protects all birds within the province by stating that, except with a permit issued by the minister, *no person shall destroy, take, possess, buy or sell any egg of a bird or turtle or disturb the nest of a bird or turtle; or use a snare, net or trap to take any bird* (Government of Nova Scotia, 1989, Section 51).

6.12.2 Desktop Review

A background review of potential avian species that could occur within the PA was completed prior to the start of the baseline monitoring programs. Table 6.12.1 presents the data sources that were used. Results and sources for the Priority Species Assessment will be discussed in Section 6.13.

Table 6.12-1 Data Sources for the Background Review

Task	Source(s)	Product
Breeding Bird Identification	• Second MBBA	Identification of bird species considered confirmed breeders within 10 km of the PA.
Priority Species Assessment*	• ACCDC • Committee on the Status of Endangered Wildlife in Canada (COSEWIC) • SARA • Nova Scotia Endangered Species Act (NS ESA) • Museum of Natural History report • Habitat mapping for the site	A priority list for SAR and SOCI with suitable habitat inside the PA and a list of species identified near the PA by ACCDC.
Important Bird Areas	• Important Bird Areas of Canada	Description of nearest Important Bird Area to the Beaver Dam PA.

Note: *Priority species and the associated desktop analyses will be discussed in Section 6.13.

6.12.2.1 Maritime Breeding Bird Atlas

The ~~PA~~ Beaver Dam Mine Site and Haul Road encompasses four MBBA squares: 20NQ17, 20NQ18, 20NQ28, and 20NQ29 (Stewart et al., 2015). Table 6.12-2 presents a summary of results for the four 10 km x 10 km MBBA (2006-2010) squares:

Table 6.12-2 Results Summary for MBBA Squares 20NQ17, 20NQ18, 20NQ28 and 20NQ29

Atlas Square*	Approximate Location in Project Area	Species (2nd Atlas)			
		No. Possible Breeders	No. Probable Breeders	No. Confirmed Breeders	Total
20NQ17	Southern end of the Haul Road ~~PA~~, including Mooseland Road and the unnamed road that goes up to Highway 224, but only until near Rum Lake.	31	16	26	73
20NQ18	Includes Haul Road ~~PA~~ from near Rum Lake until	11	19	52	82

Atlas Square*	Approximate Location in Project Area	Species (2nd Atlas)			
		No. Possible Breeders	No. Probable Breeders	No. Confirmed Breeders	Total
	Highway 224, about half of the new road section (western) and half the length of Highway 224 (western) between the unnamed road and Beaver Dam Mines Road.				
20NQ28	Includes the eastern halves of Highway 224 and the new road section, as well as Beaver Dam Mines Road until mid-way through the ~~Mine Footprint PA~~ Beaver Dam Mine Site.	20	28	21	69
20NQ29	Includes the northern half of the ~~Mine Footprint PA~~ Beaver Dam Mine Site.	20	22	35	77

Note: Data is from the 2nd atlas (2006-2010).

The MBBA data summaries for squares 20NQ17, 20NQ18, 20NQ28, and 20NQ29 can be found in **Appendix L.1**, along with bird species codes and breeding evidence codes.

6.12.2.2 Important Bird Areas

The nearest (IBA) is the Eastern Shore Islands, located approximately 22 km southeast of the PA. The Eastern Shore Islands are situated along the southeast coast of central Nova Scotia, between 60 and 120 km east of Halifax. The site includes inshore islands roughly located between Clam Harbour and Ecum Secum. Within this rock-strewn stretch of sea are many low islands, islets, and reefs located between 2 and 15 km offshore. The vegetation on these islands varies from mostly wooded to treeless. The Eastern Shore Islands IBA supports large congregations of common eiders (*Somateria mollissima*), representing more than 2.5% of the subspecies population, as well as a wintering population of harlequin ducks (*Histrionicus histrionicus*). Other waterfowl frequent the site during spring migration, including thousands of scoters, and Leach's storm-petrels (*Oceanodroma leucorhoa*) also breed on some of the islands. (IBA Canada, n.d.). Habitat present within the PA is not consistent with habitat present on the Eastern Shore Islands. Furthermore, the PA is located a sufficient distance from the nearest IBA and is not located within a significant migratory flyway for species which rely on the Eastern Shore Islands.

6.12.3 Baseline Program Methodology

Avian baseline monitoring programs were completed by MEL and included the surveys outlined in table below.

Table 6.12-3 Avian Baseline Monitoring within the ~~PA~~ Beaver Dam Mine Site and Haul Road

Survey Type	PA	
	Beaver Dam Mine Site	Haul Road
Fall migration monitoring	September 17 - October 19, 2014 Thirty-two (32) point count stations Four (4) visits - weekly	N/A
Winter wildlife survey (including birds)	February 18, 2015 Incidental observations One (1) visit	March 2 and 31, 2016 Incidental observations Two (2) visits
Spring diurnal migrating raptor	April 15, 2015 One (1) watch count station One (1) visit	N/A
Spring nocturnal owl	April 15, 2015 Four (4) call playback stations One (1) visit	April 11, 2016 Eight (8) call playback stations One (1) visit
Spring migration monitoring	April 21 - June 4, 2016 Twelve (12) point count stations Six (6) visits - weekly	May 12-27, 2016 Forty-five (45) point count stations Three (3) visits - weekly
Breeding bird	June 2015 Twenty-four (24) point count stations Two (2) visits - early and late	June 2016 Fifty (50) point count stations Two (2) visits - early and late
Common Nighthawk	June 2015 Three (3) call playback stations Two (2) visits	June 2016 Twelve (12) call playback stations Two (2) visits

Detailed descriptions of the survey methodologies for each of these baseline monitoring programs for the Beaver Dam Mine Site and Haul Road are provided in the following sections.

The boundary of the Beaver Dam Mine Site has been adjusted to facilitate the micro-siting of Project infrastructure (e.g. western extension to include the western waste rock stockpile and eastern extension to include the till stockpiles). These adjustments occurred after the completion of the bird surveys outlined in Table 6.12-3. No additional bird surveys were completed because a review of the NSL&F Forestry Database and aerial imagery indicated that the additional areas now included within the Beaver Dam Mine Site are comprised of similar cover and stand types present throughout the Beaver Dam Mine Site. These general cover types include natural cover (mixed and soft wood), wetlands, clear cut and forestry roads.

Information pertaining to Touquoy Mine Site has been brought forward from the EARD and Focus Report. Methods and results are summarized in subheadings within the applicable sections and are carried forward into the effects assessment where deemed appropriate. For further information regarding Touquoy Mine Site, refer to the EARD (CRA 2007) and Focus Report (CRA 2007a).

6.12.3.1 Fall Migration

Fall migration surveys were completed by MEL biologists in accordance with the methods outlined by the Canadian Wildlife Service (CWS) in the *Migratory Birds Environmental Assessment Guidelines* (Milko, 1998). Thirty-two point count stations were established through all representative habitat types within the ~~mine footprint PA~~ Beaver Dam Mine Site.

Four additional point count locations were established and surveyed during fall 2015 (Crusher Point count numbers 1-4, or CPC1-CPC4). At this time, the ~~Project Footprint within the mine footprint PA~~ Beaver Dam Mine Site consisted of two main areas: the pit and waste-rock stockpile were proposed in the current ~~mine footprint PA~~ Beaver Dam Mine Site, but the crusher was proposed to be in a separate area, approximately 4 km south of the ~~mine footprint~~ Beaver Dam Mine Site along the Beaver Dam Mines Road. Through further detailed design of the Project layout, the separate crusher area was incorporated into the current ~~mine footprint PA~~ Beaver Dam Mine Site. As such, the data collected in the crusher point count locations were not included in the analysis of fall 2015 migration data. Any priority species which were observed at these locations are included in the summary of priority species as incidental observations. Fall bird migration surveys were not conducted within the Haul Road ~~PA~~ because habitat types were generally similar to those observed within the ~~mine footprint~~ Beaver Dam Mine Site. Point count locations are presented on Figures 6.11-1 and 6.11-1A to 6.11-1L.

Surveys began at, or within, half an hour of sunrise and were completed within four-and-a-half hours or by 10:00 a.m., whichever came first. Weather conditions (e.g., precipitation and visibility) were monitored and confirmed to be within the parameters required by monitoring programs such as Environment and Climate Change Canada's Breeding Bird Survey. Ten-minute point counts were conducted weekly between September 17 and October 19, 2014, during peak migration. Bird observations were recorded at four distance categories, within a 50 m radius, 50 to 100 m radius, outside the 100 m radius, and flyovers. For each point count, a record was made of the start time and a hand held GPS unit was used to geo-reference its location. General observations, including the temperature, visibility, wind speed, date, start and end time, and location (UTM NAD83) were also recorded. Species recorded outside of the 100 m radius, between point counts, outside of the 10-minute survey window, and flyovers were recorded as incidentals. Bearings (in degrees) were taken for SOCI and SAR observed during dedicated survey periods and incidentally.

6.12.3.2 Winter birds

No dedicated surveys for winter birds took place within the PA; however, incidental observations of birds were recorded during winter wildlife (primarily moose) surveys.

6.12.3.3 Spring Diurnal Raptor Migration

The objectives of the baseline spring migrating raptor survey were to determine species composition and relative abundance and to record incidental observations of other SOCI and SAR. The survey was not conducted if visibility was reduced by rain, fog, or snow.

On April 15, 2015, two observers surveyed for migrating raptors at a fixed monitoring station within the ~~mine footprint PA~~ Beaver Dam Mine Site using the double-observer method (Nichols et al., 2000). Observers used binoculars and the naked-eye to scan for migrating raptors. A map of the PA, including the location of the monitoring station and a compass were used to document flight paths and estimate distances. The survey started at 12:30 p.m. and ended at 4:30 p.m. The spring raptor migration survey location is presented on Figures 6.11-1 and 6.11-1A to 6.11-1L.

Before a raptor was officially tallied, it had to demonstrate a migratory pattern as opposed to a behavior indicative of a local bird. Raptors are counted as migrants if they are: using thermals, flying a straight course northeast, or are at a very high altitude. Raptors are not counted as migrants if they are: in view for extended periods of time, actively hunting, or flying the “wrong way”.

All birds considered migratory were tallied by date and hour using the *Hawk Monitoring Association of North America (HMANA) Daily Report Form* (HMANA, 1998). In addition to count totals of each species, observers recorded the following data hourly on the *HMANA Daily Report Form*: temperature, maximum visibility, sky conditions (cloud cover, precipitation), wind speed and direction, flight speed, direction and altitude, number of observers, and minutes of observation. Categories and codes for these data and brief instructions for gathering the data are available on the back of the *HMANA Daily Report Form*.

6.12.3.4 Spring Nocturnal Owl

The objectives of the nocturnal owl survey were to gather information on the presence and distribution of owl species within the ~~mine footprint~~ Beaver Dam Mine Site and Haul Road ~~PA~~, determine the location of active nests, and record incidental observations of other SOCI and SAR.

Wind can limit the ability of owls to hear a call broadcast and/or the ability of the observer to hear an owl calling. It is recommended that a survey be suspended if wind speed is Beaufort 4 or higher (i.e., > 20 km/hr.; Takats et al., 2001). However, if there are other circumstances affecting detection, it may be necessary to reduce the wind threshold; this is at the discretion of the observer. If conditions were not suitable for surveying, then the survey was deferred or moved to a more suitable location.

Owls have been observed to be less vocal when temperatures are significantly lower than average for the season, thus surveys were also delayed in this circumstance (Takats et al., 2001). Surveys were stopped in the case of heavy precipitation; light drizzle and flurries are not likely to reduce calling rates or detectability (Takats et al., 2001).

The methods for monitoring nocturnal owls followed the *Guideline for Nocturnal Owl Monitoring in North America* (Takats et al., 2001). The nocturnal owl surveys took place on April 15, 2015 (~~mine footprint PA;~~ Beaver Dam Mine Site n=4) and April 11, 2016 (Haul Road ~~PA~~; n=8), once per year when vocal activity of the majority of owl species is greatest (Takats et al., 2001), for a total of 12 call playback stations throughout the PA. According to Greg Campbell (Senior Project Biologist with the Atlantic Chapter of Bird Studies Canada), in Nova Scotia, data collected through the *Nova Scotia Nocturnal Owl Survey* program shows peaks in barred (*Strix varia*) and great horned (*Bubo virginiatus*) owls in early April, while northern saw-whet owls (*Aegolius acadicus*) are late April to mid-May. Other owl species have been observed at numbers that are too low to determine peak calling periods (G. Campbell, pers. comm., 9 April, 2015).

Prior to starting the survey, the broadcaster being used (Pyle-Pro Pwma50db 50 watt portable waist band PA system) was tested to ensure that the owl calls being broadcasted from it were audible and recognizable at a distance of 400 m (Takats et al., 2001). Ensuring that the broadcast could be heard beyond 400 m minimizes bias at the next survey station due to owls hearing the recording from the previous station (Takats et al., 2001). The aforementioned test was carried out under weather and noise conditions similar to those that were likely to be encountered during the survey.

The broadcast used by the Bird Studies Canada Nova Scotia Nocturnal Owl Survey program was used for the survey. It consists of a 9.5 minute broadcast, which includes alternating owl calls with silent listening periods (BSC Atlantic Region, 2007). Only the calls of two owl species, the boreal (*Aegolius funereus*) and barred owls, are used in the BSC Nova Scotia Nocturnal Owl Survey program broadcast because they are particularly rare and sensitive, respectively. To date, the boreal owl has only been reported as breeding in Nova Scotia four times (Lauff, 2009). The barred owl is targeted because it has been used as an indicator of ecosystem health due to its dependence on cavities in large trees for nesting (Allen, 1987).

playback stations were spaced at least 1.6 km apart in order to reduce the chances of detecting the same owl at multiple stations (Takats et al., 2001). Some of the louder owls, such as the barred owl, can be heard at distances of two kilometers or more (Takats, 1998, as cited in Takats et al., 2001). However, most of the smaller owls cannot be heard as far or as clearly (Takats et al., 2001). Surveys were conducted between half an hour after sunset and midnight (Takats et al., 2001). There are five species of nocturnal owls that could potentially breed at the Project site: the great horned, barred, long-eared (*Strix varia*), boreal, and northern saw-whet owls. Nocturnal owl point count locations are presented on Figures 6.11-1 and 6.11-1A to 6.11-1L.

6.12.3.5 Spring Migration

Weekly spring migration surveys were conducted at 12 point count stations within the ~~mine footprint PA~~ Beaver Dam Mine Site by MEL biologists from April 21 to June 4, 2015 (six visits), and 45 point count stations within the Haul Road ~~PA~~ were completed May 12-27, 2016 (three visits), for a total of 57 point count stations within the PA. The scope of the spring migration survey within the ~~mine footprint PA~~ Beaver Dam Mine Site was reduced because poor weather conditions and a late spring melt restricted access within the PA that season.

The surveys were conducted using the same methodology as the fall migration survey. Early morning point count surveys were conducted from 30-minutes before sunrise until 10:00 a.m. Species and number of birds observed at each point count location were recorded. Point count stations are presented on Figures 6.11-1 and 6.11-1A to 6.11-1L

6.12.3.6 Breeding Birds

Surveys for breeding birds were conducted in June 2015 at 24 point count stations within the ~~mine footprint PA~~ Beaver Dam Mine Site and at 50 point count stations within the Haul Road ~~PA~~ in June 2016. The breeding bird survey within the ~~mine footprint PA~~ Beaver Dam Mine Site was reduced to 24 point count stations (i.e., from 32 in the fall) because of minor modifications to the PA. Five additional point count stations were added for breeding bird surveys along the Haul Road (i.e., up from 45 in the fall) in order to cover additional area. Targeted surveys for common nighthawk were also conducted. The methodologies for these surveys are described in the following sections.

Touquoy Mine Site

Breeding bird surveys were conducted in June 2005 at 11 point count stations within the Touquoy Mine Site as part of the EARD process. Full details on methodology can be found in the EARD document (CRA 2007).

6.12.3.6.1 **Point Counts**

Two rounds of surveys for breeding birds were conducted by MEL biologists from June 8-11 (early) and June 25-26 (late), 2015, at 24 point count stations within the ~~mine footprint PA~~ Beaver Dam Mine Site. Two rounds of surveys for breeding birds were conducted by MEL from June 13-17 (early) and June 22-28 (late), 2016, at 50 point count stations within the Haul Road ~~PA~~. The surveys were conducted using the same methods as the fall and spring migration surveys. Early morning point count surveys were conducted from 30-minutes before sunrise until 10:00 a.m. Species and number of birds observed at each point count location were recorded.

6.12.3.6.2 **Common Nighthawk**

The common nighthawk prefers to nest in gravelly substrates and is best detected while foraging for insects shortly after sunset. Suitable habitat is available for this species within the PA, therefore, dedicated surveys for the common nighthawk were conducted from mid- to end of June at either dawn (1 hour before sunrise to 30 minutes after sunrise) or dusk (30 minutes before sunset to an hour after sunset), as described in the Common Nighthawk Survey Protocol (Saskatchewan Ministry of Environment, 2015). Stations were spaced at least 800 m apart and a point count survey with call playback was used to detect the presence of common nighthawk within the PA. A three-minute passive point count was conducted at each station, followed by a call playback which includes 30-seconds of the conspecific common nighthawk call followed by 30-seconds of silence (or passive surveying), repeated for three-minutes (i.e., three times). The total time spent at each survey point was a minimum of six-minutes. Three call playback stations were surveyed within the ~~mine footprint PA~~ Beaver Dam Mine Site and 12 call playback stations were surveyed within the Haul Road ~~PA~~, for a total of 15 call playback stations ~~within the PA~~.

Common nighthawks require open ground or clearings for nesting. The species breeds in a wide range of open habitats, including sandy areas (e.g., dunes, eskers, and beaches), open forests (e.g., mixed wood and coniferous stands, burns, and clear cuts), grasslands (e.g., short-grass prairies, pastures, and grassy plains), wetlands (e.g., bogs, marshes, lakeshores, and riverbanks), gravelly or rocky areas (e.g., outcrops, barrens, gravel roads, gravel rooftops, railway beds, mines, quarries, and bare mountain tops and ridges), and some cultivated or landscaped areas (e.g., parks, military bases, airports, blueberry fields, orchards, cultivated fields) (New Hampshire Fish and Wildlife Department, 2015; Campbell et al., 2006; and COSEWIC, 2007).

Within both the ~~mine footprint PA~~ Beaver Dam Mine Site and the Haul Road ~~PA~~, habitats surveyed for common nighthawk breeding activity were located at widened roadsides with expansive gravel areas and clear-cuts. Point count locations and common nighthawk survey points are presented on Figures 6.11-1 and 6.11-1A to 6.11-1L.

6.12.4 Baseline Conditions

Baseline assessments for birds were completed from September 2014 through June 2016 by MEL biologists. A total of 4,726 minutes (79 hours) of surveys were completed over five seasons. These surveys resulted in the observation of 6,193 individuals, representing 103 species within the PA. Within each seasonal survey, observations determined to be 'incidental' were not included in the analysis. These included individuals observed at a distance greater than 100 m, those which simply flew over the point count location, those observed outside of the 10-minute survey window, and those observed outside of a designated point count location.

During the fall 2014 surveys, individuals observed at any of the four crusher point count locations (CPC1-4) were determined to be incidental observations. Those point count locations are outside of the current ~~mine footprint PA~~ Beaver Dam Mine Site and are not relevant to the current design of the Project. As such, the proportion of incidentals in the fall 2014 survey is relatively higher than in other seasons. Priority species observed at these locations are still included in the priority species summaries (Section 6.13.3.7). Table 6.12-4 below identifies the total number of individuals and species observed in each season, the number carried forward to analysis in the upcoming sections (column titled 'Included in Analysis'), and a list of species that were only observed incidentally.

Table 6.12-4 Summary of bird observations for each monitoring period

Season	Total # of Individuals	Total # of Species	Included in Analysis	Incidentals: Not Included in Analysis	Species Observed Only Incidentally
Fall 2014	832	47	414	418	American black duck, Canada goose, common loon, great horned owl, pine siskin, purple finch, red crossbill, rusty blackbird
Spring 2015	887	63	563	324	common raven, wood duck, common merganser, American crow
Breeding 2015	422	52	330	92	Canada goose, northern parula, olive-sided flycatcher
Spring 2016	2274	73	1707	567	American crow, barn swallow, common goldeneye, common loon, red crossbill, mourning dove, northern waterthrush, pine siskin, ring-necked pheasant
Breeding 2016	1778	68	1545	233	Northern harrier, common loon, eastern wood-pewee, olive-sided flycatcher.

Across all survey seasons, a total of 25 priority species were observed either during dedicated survey periods or incidentally:

- Common nighthawk (*Chordeiles minor*)
- Chimney swift (*Chaetura pelagica*)

- Wilson's snipe (*Gallinago delicate*)
- Greater yellowlegs (*Tringa melanoleuca*)
- Northern harrier (*Circus cyaneus*)
- Northern goshawk (*Accipiter gentilis*)
- Black-backed woodpecker (*Picoides arcticus*)
- Peregrine falcon (*Falco peregrinus*)
- Eastern wood-pewee (*Contopus virens*)
- Olive-sided flycatcher (*Contopus cooperi*)
- Yellow-bellied flycatcher (*Empidonax flaviventris*)
- Gray jay (*Perisoreus canadensis*)
- Barn swallow (*Hirundo rustica*)
- Boreal chickadee (*Poecile hudsonicus*)
- Red-breasted nuthatch (*Sitta canadensis*)
- Ruby-crowned kinglet (*Regulus calendula*)
- Swainson's thrush (*Catharus ustulatus*)
- Gray catbird (*Dumetella carolinensis*)
- Red crossbill (*Loxia curvirostra*)
- Pine siskin (*Spinus pinus*)
- Tennessee warbler (*Oreothlypis peregrine*)
- Bay-breasted warbler (*Setophaga castanea*)
- Blackpoll warbler (*Setophaga striata*)
- Canada warbler (*Cardellina canadensis*)
- Rusty blackbird (*Euphagus carolinus*)

These species are discussed in detail in the SAR Section 6.13.

Bird species were identified based on functional bird groups to understand how each group of birds is using the PA. These functional groups include passerines (songbirds), non-passerine landbirds, raptors, shorebirds, and waterfowl. Table 6.12-5 presents all species observed during baseline assessments (excluding incidental observations), including seasonal and total abundance. The relative abundance of avian species is also provided in **Appendix L.2**.

Table 6.12-5 Seasonal and total abundances of avian species identified during the 2014 to 2016 baseline assessments for dedicated fall, spring, and breeding bird surveys

Common name	Scientific name	Fall (2014)	Spring (2015)	Breeding (2015)	Spring (2016)	Breeding (2016)	Total
Alder flycatcher	*Empidonax alnorum*	0	5	7	1	39	52
American black duck	*Anas rubripes*	0	1	0	1	11	13
American coot	*Fulica Americana*	0	0	0	1	0	1
American crow	*Corvus brachyrhynchos*	3	0	0	0	5	8
American goldfinch	*Spinus tristis*	0	6	1	21	50	78
American kestrel	*Falco sparverius*	0	0	0	1	0	1
American redstart	*Setophaga ruticilla*	0	6	17	46	13	82
American robin	*Turdus migratorius*	3	22	3	23	25	76
Bald eagle	*Haliaeetus leucocephalus*	0	0	0	0	0	0
Barn swallow*	*Hirundo rustica*	0	0	0	0	0	0
Barred owl	*Strix varia*	0	0	0	0	1	1
Bay-breasted warbler*	*Setophaga castanea*	0	0	0	19	2	21
Belted kingfisher	*Megaceryle alcyon*	4	1	0	0	5	10
Black-and-white warbler	*Mniotilta varia*	0	19	22	111	60	212
Black-backed woodpecker*	*Picoides arcticus*	0	0	0	3	2	5

Common name	Scientific name	Fall (2014)	Spring (2015)	Breeding (2015)	Spring (2016)	Breeding (2016)	Total
Blackburnian warbler	*Setophaga fusca*	0	0	0	4	13	17
Black-capped chickadee	*Poecile atricapillus*	69	2	4	23	40	138
Blackbird sp.		0	5	0	0	0	5
Blackpoll warbler*	*Setophaga striata*	11	0	0	2	11	24
Black-throated blue warbler	*Setophaga caerulescens*	0	0	0	3	3	6
Black-throated green warbler	*Setophaga virens*	0	18	20	153	80	271
Blue jay	*Cyanocitta cristata*	7	0	1	8	8	24
Blue-headed vireo	*Vireo solitarius*	6	6	1	79	41	133
Boreal chickadee*	*Poecile hudsonicus*	9	4	0	2	0	15
Brown creeper	*Certhia Americana*	0	0	0	3	7	10
Brown-headed cowbird	*Molothrus ater*	0	1	0	0	0	1
Canada goose	*Branta canadensis*	0	0	0	2	0	2
Canada warbler*	*Cardellina canadensis*	0	0	2	10	4	16
Cedar waxwing	*Bombycilla cedrorum*	5	0	2	0	10	17
Chestnut-sided warbler	*Setophaga pensylvanica*	0	1	0	0	12	13
Chipping sparrow	*Spizella passerina*	0	1	1	0	6	8

Common name	Scientific name	Fall (2014)	Spring (2015)	Breeding (2015)	Spring (2016)	Breeding (2016)	Total
Common goldeneye	*Bucephala clangula*	0	0	0	0	0	0
Common grackle	*Quiscalus quiscula*	7	110	15	12	2	146
Common loon	*Gavia immer*	0	1	1	0	0	2
Common nighthawk*	*Chordeiles minor*	0	0	0	0	1	1
Common raven	*Corvus corax*	8	0	0	3	2	13
Common yellowthroat	*Geothlypis trichas*	4	25	31	93	141	294
Dark-eyed junco	*Junco hyemalis*	21	38	8	62	104	233
Downy woodpecker	*Picoides pubescens*	1	1	0	0	2	4
Duck sp.	.	0	2	0	0	0	2
Eastern phoebe	*Sayornis phoebe*	0	0	2	0	0	2
European starling	*Sturnus vulgaris*	0	0	0	0	4	4
Evening grosbeak	*Coccothraustes vespertinus*	0	0	0	2	0	2
Golden-crowned kinglet	*Regulus satrapa*	68	14	2	63	53	200
Gray catbird*	*Dumetella carolinensis*	0	0	0	0	1	1
Gray jay*	*Perisoreus canadensis*	28	0	1	11	0	40
Great horned owl	*Bubo virginianus*	0	0	0	1	0	1

Common name	Scientific name	Fall (2014)	Spring (2015)	Breeding (2015)	Spring (2016)	Breeding (2016)	Total
Greater yellowlegs*	*Tringa melanoleuca*	0	13	2	3	5	23
Hairy woodpecker	*Picoides villosus*	3	1	0	6	3	13
Hermit thrush	*Catharus guttatus*	6	11	4	62	99	182
Hooded merganser	*Lophodytes cucullatus*	0	2	1	0	0	3
Least flycatcher	*Empidonax minimus*	0	17	14	9	13	53
Lincoln's sparrow	*Melospiza lincolnii*	0	4	1	21	4	30
Magnolia warbler	*Setophaga magnolia*	0	46	34	167	95	342
Mallard	*Anas platyrhynchos*	6	0	0	0	0	6
Mourning dove	*Zenaida macroura*	1	0	0	0	3	4
Mourning warbler	*Geothlypis philadelphia*	0	0	0	0	5	5
Nashville warbler	*Oreothlypis ruficapilla*	0	3	8	12	0	23
Northern flicker	*Colaptes auratus*	8	9	4	11	8	40
Northern goshawk*	*Accipiter gentilis*	0	0	0	1	0	1
Northern harrier*	*Circus cyaneus*	0	0	1	0	0	1
Northern parula	*Setophaga americana*	0	1	0	8	27	36
Northern waterthrush	*Parkesia noveboracensis*	0	1	2	9	2	14

Common name	Scientific name	Fall (2014)	Spring (2015)	Breeding (2015)	Spring (2016)	Breeding (2016)	Total
Olive-sided flycatcher*	*Contopus cooperi*	0	0	0	0	2	2
Ovenbird	*Seiurus aurocapilla*	0	0	1	33	29	63
Palm warbler	*Setophaga palmarum*	18	17	22	134	52	243
Peregrine falcon*	*Falco peregrinus*	1	0	0	0	0	1
Pileated woodpecker	*Dryocopus pileatus*	3	3	0	6	1	13
Pine siskin*	*Spinus pinus*	0	0	0	0	0	0
Purple finch	*Haemorhous purpureus*	0	0	0	11	4	15
Red crossbill*	*Loxia curvirostra*	0	0	0	0	0	0
Red-breasted nuthatch*	*Sitta canadensis*	1	1	0	6	14	22
Red-eyed vireo	*Vireo olivaceus*	0	5	9	0	40	54
Red-tailed hawk	*Buteo jamaicensis*	3	0	0	0	2	5
Red-winged blackbird	*Agelaius phoeniceus*	0	8	0	0	0	8
Ring-necked duck	*Aythya collaris*	2	3	0	0	0	5
Ring-necked pheasant	*Phasianuas colchicus*	0	0	0	0	0	0
Ruby-crowned kinglet*	*Regulus calendula*	5	23	8	70	71	177
Ruffed grouse	*Bonasa umbellus*	7	9	5	19	2	42

Common name	Scientific name	Fall (2014)	Spring (2015)	Breeding (2015)	Spring (2016)	Breeding (2016)	Total
Savannah sparrow	*Passerculus sandwichensis*	0	0	1	2	0	3
Sharp-shinned hawk	*Accipiter striatus*	0	0	0	1	0	1
Shorebird spp.			2				2
Song sparrow	*Melospiza melodia*	4	5	3	2	1	15
Spotted sandpiper	*Actitis macularius*	0	2	0	0	0	2
Spruce grouse	*Falcipennis canadensis*	6	4	1	7	0	18
Swainson's thrush*	*Catharus ustulatus*	0	3	10	32	16	61
Swamp sparrow	*Melospiza georgiana*	8	2	5	33	11	59
Tennessee warbler*	*Oreothlypis peregrina*	0	0	1	0	0	1
Tree swallow	*Tachycineta bicolor*	0	19	8	15	2	44
Warbler sp.	.	0	0	0	0	0	0
White-throated sparrow	*Zonotrichia albicollis*	12	29	18	66	133	258
White-winged crossbill	*Loxia leucoptera*	0	0	0	13	1	14
Wilson's snipe*	*Gallinago delicata*	0	3	1	1	0	5
Winter wren	*Troglodytes hiemalis*	0	2	2	23	15	42
Wood duck	*Aix sponsa*	1	0	0	1	0	2

Common name	Scientific name	Fall (2014)	Spring (2015)	Breeding (2015)	Spring (2016)	Breeding (2016)	Total
Woodpecker sp.	.	2	5	0	5	6	18
Yellow warbler	*Setophaga petechia*	6	1	3	1	33	44
Yellow-bellied flycatcher*	*Empidonax flaviventris*	0	1	8	14	37	60
Yellow-bellied sapsucker	*Sphyrapicus varius*	0	1	0	0	2	3
Yellow-rumped warbler	*Setophaga coronata*	57	18	12	140	49	276
Total	**100 species****	**414**	**563**	**330**	**1707**	**1545**	**4559**

Notes: *Species numbers in the table are only for those observed within the 100 m point count radius and within the dedicated point count periods. Birds observed during owl, common nighthawk, diurnal migrating raptor, and winter wildlife surveys are not included, but discussed below.*

6.12.4.1 Winter Birds

Seven confirmed species and two unidentified species (i.e., a woodpecker and a sparrow) were observed incidentally during winter wildlife surveys along the Haul Road ~~PA~~: black-capped chickadee (*Poecile atricapillus*), ruffed grouse (*Bonasa umbellus*), dark-eyed junco (*Junco hyemalis*), cedar waxwing (*Bombycilla cedrorum*), black duck (*Anas rubripes*), common grackle (*Quiscalus quiscula*), and golden-crowned kinglet (*Regulus satrapa*). Five species were observed within the ~~mine footprint PA~~ Beaver Dam Mine Site during winter wildlife surveys: black-capped chickadee, cedar waxwing, northern saw-whet owl (*Aegolius acadicus*), downy woodpecker (*Picoides pubescens*), and American crow (*Corvus brachyrhynchos*). No priority overwintering bird species were observed.

6.12.4.2 Spring Diurnal Raptor Migration

Three raptors were observed during the dedicated spring migrating raptor survey that took place on April 15, 2015 within the ~~mine footprint PA~~ Beaver Dam Mine Site. The first raptor was a migrating adult bald eagle (*Haliaeetus leucocephalus*), which was observed flying southeast at high altitude, though it could still be identified easily with the unaided eye. The other two raptors, which were determined to be local non-migrating birds due to their behaviours (actively hunting and in view for extended periods of time), were an adult male northern harrier (*Circus cyaneus*) and an adult female American kestrel (*Falco sparverius*). None of the species observed were priority species. The northern harrier is considered a priority species when observed during breeding season surveys (S-Rank is S3S4B). A targeted survey for spring diurnal raptor migration was not conducted within the Haul Road ~~PA~~. Targeted surveys within the ~~mine footprint PA~~ Beaver Dam Mine Site completed in 2015 suggest that the broader Project Area does not fall within a major migration route for spring migrating raptors, and thus targeted surveys for raptors were not necessary within the Haul Road ~~PA~~ in 2016.

6.12.4.3 Nocturnal Owl

No owls were observed during the dedicated nocturnal owl call playback surveys within the ~~mine footprint~~ Beaver Dam Mine Site or along the Haul Road. However, owls were observed in the PA (see Table 6.12 5) during other avian surveys, including the great horned owl (*Bubo virginianus*), northern saw-whet owl (*Aegolius acadicus*), and barred owl (*Strix varia*).

6.12.4.4 Fall Migration

The fall bird migration survey consisted of 32 point count stations and dedicated surveys were conducted weekly from September 17th to October 19th, 2014, for a total of four visits within the ~~mine footprint PA~~ Beaver Dam Mine Site. During fall migration, 832 individuals representing 47 species were observed. Incidental observations were removed (including all individuals identified in the CPC1-2 point counts), resulting in 414 individuals of 39 species. See Figures 6.11-1 and 6.11-1A to 6.11-1L for relative species abundance. An additional eight species were observed incidentally, listed in Table 6.12-4. In total, six priority species were observed during fall migration surveys.

The most commonly observed species were black-capped chickadee (*Poecile atricapillus*; n=69), followed by golden-crowned kinglet (*Regulus satrapa*; n=68), and yellow-rumped warbler (*Setophaga coronata*; n=57). Most observations documented groups of up to two individuals, though there were a few groups ranging between three and six individuals. Two observations of obvious migrants were documented on September 30, 2014. On this date, one flock of 50 pine siskins and another flock of 25 were observed at PC24 and PC26, respectively. These observations are the only obvious migrants noted based on their abundance. These observations are recorded as incidentals and not included in the analysis provided herein because they were identified as flyovers. The most abundant group observed on site during the fall migration period was passerines (songbirds), which accounted for 62.2% of species and 88.4% of individuals. Non-passerine land birds were the next most abundant group on-site, followed by waterfowl.

Fall bird migration surveys were not conducted within the Haul Road ~~PA~~ because habitat types identified within this section of the PA were generally similar to those observed within the ~~mine footprint PA~~ Beaver Dam Mine Site. Overall Project interactions with migrating birds are expected to be low along the Haul Road ~~footprint~~ due to the linear nature of the Haul Road and its proposed upgrade to support mine development and trucking of ore from ~~Beaver Dam~~ Beaver Dam Mine Site to ~~Touquoy~~ Touquoy Mine Site for processing. There are no known significant migratory flyways, nor were there any observed during surveys along the Haul Road or the ~~mine footprint PA~~ Beaver Dam Mine Site. Wetlands, often habitat considered important for birds, are also consistent in type and habitat characteristics along the Haul Road and within the ~~mine footprint~~ Beaver Dam Mine Site.

6.12.4.5 Spring Migration

Due to poor weather conditions (delayed spring thaw and melt), significant snow cover, and access challenges, the 2015 spring bird migration survey had a reduced scope of 12 point count stations within the ~~mine footprint PA~~ Beaver Dam Mine Site. Spring bird migration surveys were conducted weekly from April 21st to May 24th, 2015, for a total of five visits. During spring migration, 887 individuals, representing 63 species were observed. Incidental observations were removed as described earlier. A total of 563 individuals, representing 56 species, were carried forward for analysis. Four priority species were observed during spring migration surveys within the ~~mine footprint PA~~ Beaver Dam Mine Site.

During spring migration surveys completed in 2015 within the ~~mine footprint PA~~ Beaver Dam Mine Site, common grackle was the most commonly observed species (*Quiscalus quiscula,* n= 110), followed by magnolia warbler (*Setophaga magnolia,* n=46), Dark-eyed Junco (*Junco hyemalis*, n=38), and white-throated sparrow (*Zonotricha albicollis*, n= 29). The most abundant and diverse group of birds observed during spring surveys in the ~~mine footprint PA~~ Beaver Dam Mine Site was passerines, which accounted for 88.8% of individuals, followed by non-passerine land birds (5.86%), and shorebirds (3.55%).

Within the Haul Road ~~PA~~, 45 point count stations were surveyed during the spring bird migration period. Spring bird migration surveys were conducted from May 12 to 27, 2016, for a total of three visits. During spring migration, 2,274 individuals representing 73 species were observed. Once incidental observations were removed, 1,773 individuals, representing 63 species, were carried forward into the analysis. Nine priority species were observed during spring migration surveys completed within the Haul Road ~~PA~~. Priority species observed during spring migration monitoring is discussed in Section 6.13.

The species most commonly observed was magnolia warbler (*Setophaga magnolia*; n=167), followed by black-throated green warbler (*Setophaga virens;* n= 153), and yellow-rumped warbler (*Setophaga coronata*; n=140). No obvious concentration of ducks or shorebirds was observed. The most abundant and diverse group of birds observed in spring migration surveys within the Haul Road ~~PA~~ is passerines, which accounted for 95.9% of individuals, followed by non-passerine land birds (3.34%).

The majority of observations were of single individuals and the largest groups of birds observed were two flocks of common grackle in 2015. One flock contained 50 individuals and was observed on June 4th and the second flock contained 30 individuals and was observed on May 1st, both in 2015 within the ~~mine footprint PA~~ Beaver Dam Mine Site. No obvious migrants were documented within the Haul Road ~~PA~~. See Figures 6.11-1 and 6.11-1A to 6.11-1L for the abundances of species observed during spring migration surveys completed in 2015 and 2016 within the ~~mine footprint PA~~ Beaver Dam Mine Site and the Haul Road ~~PA~~.

6.12.4.6 Breeding Season

The 2015 breeding bird survey consisted of 24 point count stations, which were surveyed twice in the month of June 2015 within the ~~mine footprint PA~~ Beaver Dam Mine Site. A total of 442 species representing 52 species were recorded during breeding season in the ~~mine footprint PA~~ Beaver Dam Mine Site. Once incidentals were removed, as described earlier, 330 individuals of 47 species were carried forward for analysis. Thirteen priority species were observed during the breeding season surveys completed within the ~~mine footprint PA~~ Beaver Dam Mine Site, which are discussed in detail in Section 6.13.3.7.

The most abundant species observed was the magnolia warbler (*Setophaga magnolia*, n=34), followed by the common yellowthroat (*Geothylpis trichas,* n=31), the black-and-white warbler (*Mniotilta varia*, n = 22), and the palm warbler (*Setophaga palmarum*, n=22). Passerines represented the most abundant and diverse group of birds observed, accounting for 95.2% of all individuals, followed by non-passerine land birds (3.0% of individuals). In June 2016, 50 point count stations were surveyed within the Haul Road ~~PA~~. A total of 1,178 individuals representing 68 species were observed during the breeding season within the Haul Road ~~PA~~. When incidental observations were removed, a total of 1,707 individuals representing 65 species were carried forward for analysis. Fourteen priority species were observed during breeding season surveys within the Haul Road ~~PA~~, which are discussed in detail in Section 6.13.3.7.

The most commonly observed species in the breeding season of 2016 was the common yellowthroat (*Geothylpis trichas,* n=141), followed by the white-throated sparrow (*Zonotricha albicollis*, n=133), and the dark-eyed junco (*Junco hyemalis,* n=104). Similar to results obtained in the breeding season in 2015, passerines represented the greatest abundance and diversity of all bird groups in the breeding season of 2016. Passerines accounted for 96.5% of individuals, followed by non-passerine land birds, which accounted for 1.9% of individuals.

Breeding evidence was recorded for all species observed during 2015 and 2016 breeding season surveys, in accordance with guidance provided by the Maritime Breeding Bird Atlas (see breeding codes, **Appendix L.1**). Since the site surveyed is a relatively small part of the surrounding area, it is not possible to confirm that all species listed were actually nesting within the boundaries of the PA. For instance, if a bird was observed carrying food (i.e., example of confirmed breeding evidence, based on MBBA, Bird Studies Canada, n.d.), it is possible that the bird was nesting on an adjacent parcel of land. A summary table is presented below, which identifies the highest breeding evidence recorded for each species in surveys completed in 2015 and 2016 in the ~~mine footprint PA~~ Beaver Dam Mine Site and Haul Road ~~PA~~, respectively. Breeding evidence codes were determined for all species observed during each annual survey, including those observed incidentally during bird surveys.

Table 6.12-6 Breeding Summary within the Beaver Dam Mine Site ~~PA~~

Code	Common Name	2015 Breeding Evidence	2016 Breeding Evidence
ABDU	American black duck	.	Confirmed
ALFL	Alder flycatcher	Probable	Probable
AMCR	American crow	.	Possible

Code	Common Name	2015 Breeding Evidence	2016 Breeding Evidence
AMGO	American goldfinch	Possible	Probable
AMRE	American redstart	Probable	Probable
AMRO	American robin	Probable	Probable
BADO	Barred owl	.	Possible
BAWW	Black-and-white warbler	Probable	Probable
BBWA	Bay-breasted warbler	.	Possible
BBWO	Black-backed woodpecker	.	Possible
BCCH	Black-capped chickadee	Possible	Probable
BEKI	Belted kingfisher	.	Possible
BHVI	Blue-headed vireo	Possible	Probable
BLBW	Blackburnian warbler	.	Possible
BLJA	Blue jay	Possible	Possible
BPWA	Blackpoll warbler	.	Possible
BRCR	Brown creeper	.	Possible
BTBW	Black-throated blue warbler	.	Possible
BTNW	Black-throated green warbler	Probable	Probable
CAGO	Canada goose	Confirmed	.
CAWA	Canada warbler	Probable	Probable
CEDW	Cedar waxwing	Possible	Possible
CHSP	Chipping sparrow	Possible	Possible
COGR	Common grackle	Probable	Probable
COLO	Common loon	Possible	Possible
CONI	Common nighthawk	.	Possible
CORA	Common raven	.	Possible
COYE	Common yellowthroat	Probable	Probable
CSWA	Chestnut-sided warbler	.	Possible

Code	Common Name	2015 Breeding Evidence	2016 Breeding Evidence
DEJU	Dark-eyed junco	Possible	Probable
DOWO	Downy woodpecker	.	Possible
EAPH	Eastern phoebe	Possible	.
EUST	European starling	.	Possible
GCKI	Golden-crowned kinglet	Possible	Probable
GRCA	Gray catbird	.	Possible
GRJA	Gray jay	Possible	.
GRYE	Greater yellowlegs	Probable	Probable
HAWO	Hairy woodpecker	.	Possible
HETH	Hermit thrush	Possible	Probable
HOME	Hooded merganser	Possible	.
LEFL	Least flycatcher	Probable	Possible
LISP	Lincoln's sparrow	Possible	Possible
MAWA	Magnolia warbler	Probable	Probable
MODO	Mourning dove	.	Possible
MOWA	Mourning warbler	.	Possible
NAWA	Nashville warbler	Probable	.
NOFL	Northern flicker	Probable	Probable
NOHA	Northern harrier	Possible	Possible
NOPA	Northern parula	Possible	Probable
NOWA	Northern waterthrush	Possible	Possible
OSFL	Olive-sided flycatcher	Possible	Possible
OVEN	Ovenbird	Possible	Probable
PAWA	Palm warbler	Probable	Probable
PIWO	Pileated woodpecker	.	Possible
PUFI	Purple finch	.	Possible

Code	Common Name	2015 Breeding Evidence	2016 Breeding Evidence
RBNU	Red-breasted nuthatch	.	Probable
RCKI	Ruby-crowned kinglet	Probable	Probable
REVI	Red-eyed vireo	Probable	Probable
RTHA	Red-tailed hawk	.	Probable
RUGR	Ruffed grouse	Probable	Confirmed
SAVS	Savannah sparrow	Possible	.
SOSP	Song sparrow	Probable	Possible
SPGR	Spruce grouse	Probable	.
SWSP	Swamp sparrow	Probable	Possible
SWTH	Swainson's thrush	Confirmed	Probable
TEWA	Tennessee warbler	Possible	.
TRES	Tree swallow	Probable	Possible
UNBB	Blackbird spp.	Possible	.
UNWO	Woodpecker sp.	Possible	Probable
WISN	Wilson's snipe	Possible	.
WIWR	Winter wren	Possible	Probable
WTSP	White-throated sparrow	Probable	Confirmed
WWCR	White-winged crossbill	.	Possible
YBFL	Yellow-bellied flycatcher	Probable	Probable
YBSS	Yellow-bellied sapsucker	.	Confirmed
YEWA	Yellow warbler	Probable	Possible
YRWA	Yellow-rumped warbler	Probable	Probable

All of the species identified are native species expected to be found in this area of Nova Scotia and the province in general, and within the typical and common habitat associated with the Project and surrounding landscape. The majority of observations were of a single individual. The largest flock of birds observed was common grackle (n=10). The most abundant group observed on site during the breeding bird period was passerines (songbirds), non-passerine land birds were the next most abundant group on-site, followed by waterfowl, shorebirds, and raptors, which were all observed in small numbers. See

Figures 6.11-1 and 6.11-1A to 6.11-1L for the abundance of species observed during the breeding season. No incidental observations of raptor nests were made on either the ~~mine~~ Beaver Dam Mine Site or Haul Road ~~footprints~~.

Results of spring and fall migration and breeding bird surveys are shown on Figures 6.11-1 and 6.11-1A to 6.11-1L and are provided in **Appendix L.2**.

Touquoy Mine Site

The 2005 breeding bird surveys of the Touquoy Mine Site found 398 birds representing 52 species over 11 point count stations. The most abundant species were the magnolia warbler (*Setophaga magnolia*, 7.5% of the total) and the common grackle (*Quiscalus quiscula*, 7.3%) (CRA 2007). Ten of the 52 species observed are priority species. They are as follows; pine grosbeak (*Pinicola enucleator*), willow flycatcher (*Empidonax traillii*), yellow-bellied flycatcher, barn swallow, boreal chickadee, ruby-crowned kinglet, rusty blackbird, bay-breasted warbler, Swainson's thrush, and pine siskin.

6.12.4.7 Common Nighthawk

Four common nighthawks were observed within the Haul Road ~~PA~~. One observation was recorded during a breeding bird survey at Haul Road PC26, while three were observed during dedicated call playback surveys along the Haul Road. None were observed within the ~~mine footprint PA~~ Beaver Dam Mine Site. Common nighthawks were observed calling, but no evidence of breeding behavior was documented (i.e., booming, or displaying females). Common nighthawks were observed within the Haul Road ~~PA~~, in habitats with expansive gravelly areas adjacent to clear cuts, or disturbed areas (Haul Road PC26, CONI1, CONI9). Suitable habitat is present within the PA for this species, so their presence during the breeding season indicates that breeding is likely to be occurring within the PA.

6.12.4.8 Discussion

Of the 100 avian species observed during dedicated surveys (i.e., fall migration, spring migration, and breeding, excluding incidentals) within the PA, 77 (75% of species) are protected under the *Migratory Bird Convention Act* (1994). Ninety-eight percent (98%) of all individual birds observed during dedicated surveys (i.e., fall migration, spring migration, and breeding) are migratory birds. Birds observed that are not protected under the *Migratory Bird Convention Act* (1994) were from the Accipitridae (e.g., harriers and hawks), Alcedinidae (e.g., kingfisher), Corvidae (e.g., jays, crows and ravens), Phasianidae (e.g., grouse and pheasants), and Strigidae (e.g., owls) families.

Avian diversity was relatively higher along the Haul Road ~~PA~~ than within the ~~mine footprint PA~~ Beaver Dam Mine Site. This is likely attributable to the fact that the ~~mine footprint PA~~ Beaver Dam Mine Site is more extensively disturbed and fragmented as a result of historic mine operations and current and historic timber harvesting practices. Overall, avian diversity and abundance was moderate and fell within expectations for the habitats available and for forests in Halifax County in general.

Passerines were the dominant species group across all seasons within the PA, which is expected based on the variety of suitable habitats present within the PA. The order Passeriformes includes more than half of all bird species, so their relative abundance within the PA falls within expectation. Furthermore, the Passerine family contains the highest diversity of species. The landscape across the PA is dominated by forest cover (both deciduous and coniferous of different maturity levels) with harvested areas at different stages of regeneration and wetlands interspersed throughout.

Non-passerine land birds were the second most abundant species group observed within the PA and consisted primarily of grouse and woodpecker species. Habitats for these species are present throughout the PA. Woodpecker habitat preferences differ depending on the species; therefore, the variety of species observed (n=6) is an indicator of habitat types and diversity within the PA. For example, northern flickers (*Colaptes auratus*) are ground feeders and favour woodland edges near open areas, downy woodpeckers (*Picoides pubescens*) favour riparian woodlands, and pileated woodpeckers (*Dryocopus pileatus*) prefer mature hardwood and coniferous forests. Two species of grouse, the ruffed (*Bonasa umbellus*) and spruce grouse (*Falcipennis canadensis*), were observed within the PA. The ruffed grouse is considered to be dependent on subclimax deciduous forests, whereas the spruce grouse is considered dependent on climax coniferous forests (Pietz and Tester, 1982).

No large congregations of waterfowl or shorebirds were observed roosting or staging within the PA during either the spring or fall migration periods. Wetland habitats suitable for migrating shorebirds and waterfowl were limited within the PA (open water wetlands with shallow areas for foraging). The only shorebird that was likely breeding within the PA was the greater yellowlegs; this species breeds in muskeg, wet bogs with small wooded islands, and forests with abundant clearings (Elphick and Tibbits, 1998). The only waterfowl species observed during the breeding season within the PA was the American black duck (*Anas rubripes*) and its habitat preferences during the breeding season are influenced by wetland fertility, cover, and invertebrate densities (Merendino and Ankney, 1994). In Nova Scotia, American black ducks commonly nest along streams and contiguous freshwater marshes (Seymour, 1984), as well as coastal salt marsh (Reed and Moisan, 1971).

Raptors, both diurnal and nocturnal, were observed in low numbers within the PA throughout the year. Throughout the migration period, this suggests that there are no major migration corridors over the PA. As for the breeding season, suitable breeding habitat is present for several forest raptors, including northern goshawk, Cooper's hawk, sharp-shinned hawk, red-tailed hawk, merlin, American kestrel, great horned owl, barred owl, and northern saw-whet owl. Many of these forest raptor species are difficult to census; therefore, it is not surprising that documented species richness and abundance were low within the PA.

6.12.5 Consideration of Consultation and Engagement Results

Key issues raised during public consultation and Mi'kmaq engagement relating to birds include potential for direct mortality associated with the hauling operation and indirect effects on other VCs, such as dust, noise and light, as well as potential effects on birds associated with permanent loss of habitat from construction of the Beaver Dam Mine and the Haul Road. Potential effects on traditional uses of land and resources by the Mi'kmaq were noted, including fowling.

The results of the public consultation and Mi'kmaq engagement have been considered in the environmental effects assessment, including the Proponent's commitments on mitigation and monitoring measures and proposed compliance and effects monitoring programs, as well as the Proponent's broader commitment to ongoing public consultation and Mi'kmaq engagement. Specific to evaluating the effect on birds, these are found within the following environmental effects assessment.

6.12.6 Effects Assessment Methodology

6.12.6.1 Boundaries

Spatial Boundaries

The spatial boundaries for this VC are defined below: ~~used for the assessment of effects to birds are the mine footprint, Haul Road PA, and the LAA which consists of any habitat contiguous and consistent with habitat available within the PA~~.

The PA (Figure 5.4-1) consists of the three project components; Beaver Dam Mine Site, Touquoy Mine Site, and the Haul Road and extends from Marinette to Moose River Gold Mines, Halifax County, NS. The Beaver Dam Mine Site is located at the eastern end of the Beaver Dam Mines Road and has been extended to the east and west in order to encompass the micro siting of the till stockpile and the waste rock stockpile, respectively. The Haul Road spans from the Beaver Dam Mine Site to Moose River Gold Mines, where the Touquoy Mine Site [processing and exhausted pit (to be used to dispose Beaver Dam tailings)] is located.

The LAA (Figure 6.10-6) consists of a 2 km buffer surrounding the Beaver Dam Mine Site and a 500 m buffer surrounding the Haul Road and Touquoy Mine Site components of the PA. The LAA boundaries were defined considering the maximum expected extent of direct and indirect impacts to birds.

The RAA (Figure 6.10-7) encompasses NSL&F's Ecological Land Classification Ecodistricts: 420 (Eastern Drumlins) and 440 (Eastern Interior) within Halifax Regional Municipality (HRM), east and north of Lake Charlotte. These Ecodistricts span an area broader than the expected Project impacts to birds and considers other Project boundaries as per cumulative effects methodology. ~~These spatial boundaries will help to identify the direct or indirect impacts to bird species and the effects of the Project on distribution and abundance of these species.~~

As the Project has the potential to cause direct and indirect effects to birds outside of the PA, the LAA is the appropriate boundary for evaluation of this VC.

Temporal Boundaries

The temporal boundaries used for the assessment of effects to birds are the construction phase, operational phase, and decommissioning and reclamation phases.

Technical Boundaries

No technical boundaries were identified for the effects assessment of Birds.

Administrative Boundaries

Administrative boundaries for evaluation and management of birds include the *Nova Scotia Wildlife Act*, which protects all birds within the province and the *Migratory Birds Convention Act (MBCA)* which offers protection for migratory birds. Further protection is offered to SAR through the provincial *Nova Scotia Endangered Species Act* and the federal SARA.

A significant adverse effect from the Project on birds is defined as an effect that is likely to cause a permanent alteration to any bird species distribution or abundance. An adverse effect that does not cause a permanent alteration in distribution or abundance of any bird species is considered to be not significant.

6.12.6.2 Thresholds for Determination of Significance

A significant adverse effect from the Project on birds is defined as an effect that is likely to cause a permanent alteration to any bird species distribution or abundance, or alteration of core habitat. An adverse effect that does not cause a permanent alteration in distribution or abundance of bird species is considered to be not significant.

6.12.7 Project Activities and Birds Interactions and Effects

The assessment of potential adverse interactions and effects of the Project on this VC takes into account the potential for the Project to result in changes to:

- Permanent and temporary habitat alteration and fragmentation
- Disturbance and/or displacement
- Potential for direct and indirect mortality to individuals
- Attraction and disorientation resulting from night-lighting

Table 6.12-7 presents the potential interactions of the Project with birds and bird habitat.

Table 6.12-7 Potential Bird Interactions with Project Activities at Beaver Dam Mine Site

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Rock blasting in preparation of construction • Lighting of construction areas • Till and waste rock from site preparation transport and storage • ~~Existing settling pond dewatering in preparation of construction~~ • Watercourse and wetland alteration in preparation of construction • Mine Site road construction • Surface infrastructure installation and construction • Collection and settling pond construction • General noise from construction activities • Wildlife vehicle collisions • ~~General management of wastes derived from preparation and construction activities~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, settling pond overflow, slope failure, and an unplanned explosive event~~
Operation and Maintenance	3-4 years	• Rock blasting to access and extract ore • Surface mine dewatering to facilitate access to and extraction of ore

Project Phase	Duration	Relevant Project Activity
		• Management of waste rock produced from crushing and preparing ore for transport • Treatment of site surface water runoff and surface mine pumped water • Site maintenance and repairs • General management of wastes derived from operation and maintenance activities • Lighting of facilities and roads • General noise from mine operations • Wildlife vehicle collisions • Accidents and malfunctions to include fuel and other spills, forest fires, settling pond overflow, slope failure, and an unplanned explosive event
Decommissioning and Reclamation	1-2 years	• Infrastructure demolition • Site reclamation activities • General noise from decommissioning activities • Project lighting • Wildlife vehicle collisions • ~~General management of wastes derived from decommissioning and reclamation activities~~ • ~~Accidents and malfunctions to include fuel and other spills, and forest fires~~

Table 6.12-8 Potential Bird Interactions with Project Activities along Haul Road

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Rock blasting in preparation of construction • Lighting of construction areas • ~~Till and waste rock from site preparation transport and storage~~ • Watercourse and wetland alteration in preparation of construction • Haul Road construction and upgrades • General noise from construction activities • Wildlife vehicle collisions • ~~General management of wastes derived from preparation and construction activities~~ • ~~Accidents and malfunctions to include fuel and other spills, and forest fires~~

Project Phase	Duration	Relevant Project Activity
Operation and Maintenance	3-4 years	• Haul Road maintenance and repairs • ~~Lighting of roads~~ • General noise from mining activity • Wildlife vehicle collisions • ~~Accidents and malfunctions to include fuel and other spills, and forest fires~~
Decommissioning and Reclamation	1-2 years	N/A[1]

1 Decommissioning and Reclamation of the Haul Road is not expected. The Haul Road will be returned to owner for forestry industry

Table 6.12-9 Potential Bird Interactions with Project Activities at ~~Touquoy Processing and Tailings Management Facility~~ Touquoy Mine Site

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Tailings pipeline, make-up water pipeline alteration, and relocation of reclaim infrastructure • ~~Accidents and malfunctions to include fuel and other spills and forest fires~~
Operation and Maintenance	3-4 years	• Management of tailings produced from processing ore • Lighting of facilities and Mine Site roads • Noise associated with haul truck activity and the processing of ore • Water fowl and other birds landing in pit lake • ~~Environmental monitoring~~ • ~~General management of waste derived from processing activities~~ • ~~Accidents and malfunctions to include fuel and other spills and forest fires~~
Decommissioning and Reclamation	1-2 years	• Water fowl and other birds landing in pit lake • ~~Environmental monitoring~~ • ~~Accidents and malfunctions to include fuel and other spills and forest fires~~

Development of the mine infrastructure and upgrades to the Haul Road will cause direct impacts to habitat used by avifauna, including upland forested habitat and wetlands. This will occur mostly within the construction phase of the Project. Habitat within the PA and surrounding landscape currently exhibits fragmented conditions based on historic mine operations, existing road and trail networks, and current and historic timber harvesting activity within and adjacent to the PA. Project activities are likely to result in increased habitat fragmentation and a decrease in habitat quality for those species which rely on interior forest conditions, where intact interior forest remains. Interior and mature forest mapping is discussed in Section 6.10.2.5, 6.10.3.5, and 6.10.6.

This decrease in habitat quality for species relying on interior forest condition is based on increased activity and sensory disturbance, along with increased physical fragmentation. As described in Section 6.10.3.5, there is a mapped old forest patch along the Haul Road and interior forest scattered around the PA (Figure 6.10-4)

Common migratory bird species that require old forest or interior forest habitats include; ovenbird, wood thrush, hermit thrush, magnolia warbler, black-throated blue warbler, black-throated green warbler, and white-throated sparrow. Additionally, bird species identified within the priority species list (**Appendix I.5**) that prefer mature or interior forest are outlined in the table below.

Table 6.12-10 Bird Species within the Priority Species List that Rely on Mature and Interior Forest

Common Name	SARA	COSEWIC	NSESA	SRank	Habitat Requirements
Black-backed woodpecker				S3S4	Coniferous forest
Boreal chickadee				S3	Coniferous forest
Cape may warbler				S2B	Northern coniferous forest, mature spruce
Canada warbler	T	T	E	S3B	Dense understory vegetation of mature to mid-aged mixed forest
Eastern wood-pewee	SC	SC	V	S3S4B	Interior forests
Evening grosbeak				S3S4B, S3N	Breed in mature and second-growth coniferous forests
Gray jay				S3	Coniferous forest
Northern goshawk		NAR		S3S4	Nest in mature mixed hardwood forests
Pine grosbeak				S2S3B, SN5	Open coniferous forests.
Pine siskin				S2S3	Open coniferous forests, mixed forest and deciduous forests
Red-breasted nuthatch				S3	Deciduous and coniferous forests
Red crossbill				S3S4	Mature coniferous forests
Ruby-crowned kinglet				S3S4B	Coniferous and deciduous forests
Rusty blackbird	SC	SC	E	S2B	Wet coniferous and mixed wood forests
Swainson's thrush				S3S4B	Closed canopy forests, breeding habitat includes deciduous and coniferous forests
Yellow-bellied flycatcher				S3S4B	Conifer forests and peatlands. It nests in typically cool, moist conifer or mixed forests, bogs, swamps, and muskegs

Field observations have confirmed that some of the species listed in the above table (red-breasted nuthatch, black-backed woodpecker, ruby-crowned kinglet, boreal chickadee, yellow-bellied flycatcher, and Swainson's thrush) were observed at bird survey locations (Figures 6.11-1 and 6.11-1A to 6.11-1L) in close proximity to the old forest polygon. None of these species were reported exclusively within this old forest habitat.

Sensory disturbance to avifauna would result from rock blasting, clearing and grubbing, infrastructure construction, and overall increased traffic along the upgraded and new ~~haul route~~ Haul Road during operations. These project components will likely result in the localized avifauna avoidance of the PA. Overall, project activities will likely cause a change in usage of the PA by avifauna, with some species tending to avoid the area, while others may be attracted to the increased activity. Sensory disturbance related to Project activity will occur within the ~~mine footprint PA~~ Beaver Dam Mine Site, Haul Road ~~PA~~, and within the Touquoy Mine Site, as the addition of material from the Beaver Dam mine will extend the life of the Touquoy Mine Site by four years.

Changes to ambient noise levels and the presence of periodic vibrations from blasting have the potential to adversely affect fauna and birds by influencing migration and behavioral patterns. Noise and vibration are provincially regulated via the Workplace Health and Safety Regulations and the Pit and Quarry Guidelines, which protect the health of site workers and the general public at PA boundaries, respectively.

Existing noise (measured in 2014) around the Beaver Dam Mine Site had an average value of 33 dBA ±. The predicted noise levels at the boundaries of the Beaver Dam Mine Site are expected to range between 51.5 to 65.6 dBA (Appendix B.1).

The Environment Code of Practice for Metal Mines (Environment Canada, 2012) has established parameters for ambient noise levels for wildlife. These parameters indicate that ambient noise observed above 55 dBA during the day and 45 dBA at night can affect wildlife. The predicted noise levels presented in the Noise Impact Study (Appendix B.1) exceed the levels outlined by Environment Canada (2012). Additionally, a literature review conducted by Shannon et al. (2016) found that birds have the potential to exhibit changes in song characteristics, reproduction, abundance, stress levels, and species richness at levels greater than 45 dBA.

According to the results of the Noise Impact Study, noise generated from Project activities diminishes to 45 dBA (the most conservative guideline) at approximate ranges of 0 – 1000 m outside of the Beaver Dam Mine Site. At the Haul Road, noise at that same sound level is predicted to travel approximately 180 - 350 m from the center line of the road and at the Touquoy Mine Site noise at 45 dBA is predicted to travel approximately 0 - 850 m outside of this component of the PA. These ranges of noise distribution are due to changes in local topography. Birds within these approximate ranges of noise distribution surrounding the PA have the potential to be affected by noise during the day and overnight.

Light impacts from trucks on the Haul Road are expected to be insignificant compared to baseline daylight illuminance and the amount of light blocked by the surrounding woodland and topographic changes at the Beaver Dam Mine Site will likely be >90% (Appendix D.1). Within the Beaver Dam Mine Site, light impacts on birds will be reduced by installing lights facing downward and wherever practicable using motion-sensing lights.

Light can impact birds by potentially causing disorientation or by causing attraction or avoidance (Langcore and Rich, 2004). In turn, these behavioral changes can affect the success of foraging, reproduction, and communication of wildlife (Langcore and Rich, 2004) and can disrupt habitat connectivity (Bliss-Ketchum et al. 2016).

Direct mortality of avifauna species could result from Project activities, particularly due to the increase in traffic during construction and operation of the facility. Increased traffic poses a risk to avifauna along the length of the Haul Road between the ~~Beaver Dam mine footprint~~ Beaver Dam Mine Site and the Touquoy Mine Site. Indirect mortality could result from exposure to contaminants or spills from incidents and accidents.

Migratory birds may be indirectly impacted as a result of the surface water quality in the ~~shallow~~ pit lake created in the Touquoy Mine Site open pit to store tailings from Beaver Dam Mine Site. if they were to land in the water. ~~However, as discussed in Section 6.3.6, water quality in the shallow lake is not anticipated to be affected by the deposition of Beaver Dam tailings. The majority of the cyanide reagent introduced to the tailings during ore processing will be degraded and hydrolyzed to carbon dioxide and ammonium during storage in the tailings pond. Similarly, this will be expected to occur for the Beaver Dam tailings being stored in the Touquoy open pit. Detoxification of the effluent will also result in levels of copper and cyanide that are below the MMER limits (Ausenco 2015).~~ Mitigation measures, such as bird deterrents are currently in place at Touquoy Mine Site and they will be applied to reduce the potential environmental impacts of the Project on migratory birds at the Touquoy facility as per existing approvals.

Table 6.12-11 Impacts of the Project on Birds

Impact Type	Direct Impact	Project Phase	Indirect Impact	Project Phase
Vegetative and Habitat Integrity	Loss of vegetative cover through clearing and grubbing decreases bird habitat availability and Project development also has the potential to reduce natural surface water drainage.	C	Habitat fragmentation may alter habitat suitability for those species which rely on interior forest conditions. Within the Haul Road ~~PA~~, this change in habitat is expected to be permanent.	C O D
Sensory Disturbance	Extensive ground works, including activities such as blasting will increase noise levels. Increase in vehicular traffic will add to sensory disturbance through increased noise. This has the potential to reduce habitat for fauna.	C O D	Sensory disturbance (both lights and sounds) may result in further avoidance of the PA by some species. Predicted noise impact distances from the PA: • Beaver Dam Mine Site = 0 – 1000 m • Haul Road = 180 – 350 m • Touquoy Mine Site = 0 – 850 m	C O
	Birds may become attracted to or disoriented by open pit lighting at night, particularly during periods of migration, which could lead to mortality (Jones and Francis, 2003).	C O	Artificial lighting at night has been shown to influence the seasonal start of bird vocalizations, which could affect individual fitness (Da Silva et al., 2014).	C O
Direct Mortality	Increased traffic and general activity within the PA may result in direct mortality to wild species through vehicular collisions and construction.	C O D	Improved access throughout the PA may increase hunting activity of licensed hunters and/or illegal poachers.	C O D

Note: C = Site Preparation and Construction Phase O = Operation and Maintenance Phase D = Decommissioning and Reclamation

6.12.8 Preferred Alternative Haul Road

6.12.8.1 Rationale for Valued Component Selection

Same rationale for valued component selection as indicated in Section 6.12.1.

6.12.8.2 Baseline Program Methodology

6.12.8.2.1 Desktop Evaluation

The desktop evaluation methods conducted for the broader PA (Section 6.12.2) remained the same for the Preferred Alternative Haul Road PA. The priority species list (**Appendix I.5**) also remained the same because habitat present within the Preferred Alternative Haul Road PA is also present within the PA. Additionally, the Haul Road ACCDC report encompasses the Preferred Alternative Haul Road PA and therefore was used within this desktop evaluation following the methods cited above.

6.12.8.2.2 Breeding Bird Surveys

Two rounds of surveys for breeding birds were conducted by MEL biologists from June 18-19 (early) and June 28-30 (late), 2018, at 20 point count stations within and directly adjacent to the Preferred Alternative Haul Road PA (note: not all BBS point count stations are within Preferred Alternative Haul Road PA because of minor changes to the proposed road layout). The surveys were conducted using the same methods as the breeding bird surveys completed throughout the broader PA (Section 6.12.2.9.). Early morning point count surveys were conducted from 30-minutes before sunrise until 10:00 a.m. Species and number of birds observed at each point count location were recorded.

6.12.8.3 Baseline Conditions

6.12.8.3.1 Desktop Evaluation

6.12.8.3.1.1 ACCDC Report

An evaluation of the ACCDC report for the Haul Road indicated the presence of 18 SAR/SOCI Birds within 5 km.

Table 6.12-12 SAR/SOCI Birds within 5 km of the Haul Road

Common name	Scientific name	COSEWIC	SARA	NSESA	S-Rank
Rusty blackbird	*Euphagus carolinus*	SC	SC	E	S2B
Common nighthawk	*Chordeiles minor*	SC	T	T	S2B
Olive-sided flycatcher	*Contopus cooperi*	SC	T	T	S2B
Pine siskin	*Spinus pinus*				S2S3
Barn swallow	*Hirundo rustica*	T	T	E	S2S3B

Common name	Scientific name	COSEWIC	SARA	NSESA	S-Rank
Pine grosbeak	*Pinicola enucleator*				S2S3B,S5N
Boreal chickadee	*Poecile hudsonicus*				S3
Gray jay	*Perisoreus canadensis*				S3
Canada warbler	*Cardellina canadensis*	T	T	E	S3B
Gray catbird	*Dumetella carolinensis*				S3B
Wilson's snipe	*Gallinago delicata*				S3B
Greater yellowlegs	*Tringa melanoleuca*				S3B,S3S4M
Northern goshawk	*Accipiter gentillis*				S3S4
Eastern wood-pewee	*Contopus virens*	SC	SC	V	S3S4B
Spotted sandpiper	*Actitis macularis*				S3S4B
Yellow-bellied flycatcher	*Empidonax flaviventris*				S3S4B
Tennessee warbler	*Leiothypis peregrina*				S3S4B
Bay-breasted warbler	*Setophaga castanea*				S3S4B

6.12.8.3.1.2 Maritime Breeding Bird Atlas

The Preferred Alternative Haul Road PA encompasses two MBBA squares: 20NQ17 and 20NQ18 (Stewart et al., 2015). The following table presents a summary of results for the two 10 km x 10 km MBBA (2006-2010) squares:

Table 6.12-13 Results Summary for MBBA Squares 20NQ17 and 20NQ18.

Atlas Square*	Approximate Location in Project Area	Species (2nd Atlas)			
		No. Possible Breeders	No. Probable Breeders	No. Confirmed Breeders	Total
20NQ17	Southwestern extent of the Preferred Alternative Haul Road at its connection with Mooseland Road.	31	16	26	73
20NQ18	Includes Preferred Alternative Haul Road north of Miller Lake and Sandy Pond.	11	19	52	82

6.12.8.3.1.3 Important Bird Areas

The nearest IBA is the Eastern Shore Islands IBA. Further details regarding this IBA are discussed in Section 6.12.2.2.

6.12.8.3.2 **Breeding Bird Survey**

A total of 480 individuals representing 44 species were recorded during breeding season in the Preferred Alternative Haul Road. Seven priority species were observed and include; eastern wood-pewee (NSESA V, S3S4B), olive-sided flycatcher (SARA T, S2B), blackpoll warbler (S3S4B), red-breasted nuthatch (S3), ruby-crowned kinglet (S3S4B), Swainson's thrush (S3S4B), and yellow-bellied flycatcher (S3S4B). SAR/SOCI birds are discussed in detail in Section 6.13.3.7.

The most abundant species observed were the dark-eyed junco (*Junco hyemalis*, n = 48), hermit thrush (*Catharus guttatus*, n = 42), and the white-throated sparrow (*Zonotrichia albicollis*, n = 29). Overall, passerines represented the most abundant and diverse group of birds observed, accounting for 97.5% of all individuals, followed by non-passerine land birds (1.4% of individuals). Water fowl and other water birds comprised the remaining 1.0% if individuals.

Breeding evidence was recorded for all species observed during the 2018 breeding season surveys, in accordance with guidance provided by the Maritime Breeding Bird Atlas (see breeding codes, **Appendix L.1**). Since the site surveyed is a relatively small part of the surrounding area, it is not possible to confirm that all species listed were actually nesting within the boundaries of the PA. For instance, if a bird was observed carrying food (i.e., example of confirmed breeding evidence, based on MBBA, Bird Studies Canada, n.d.), it is possible that the bird was nesting on an adjacent parcel of land. A summary table is presented below, which identifies the highest breeding evidence recorded for each species in surveys completed in 2018 within the Preferred Alternative Haul Road. Breeding evidence codes were determined for all species observed during each annual survey, including those observed incidentally during bird surveys.

Table 6.12-14 Breeding Summary within the Preferred Alternative Haul Road

Code	Common Name	2018 Breeding Evidence
ABDU	American black duck	Possible

Code	Common Name	2018 Breeding Evidence
ALFL	Alder flycatcher	Possible
AMCR	American crow	Possible
AMRE	American redstart	Possible
AMRO	American robin	Possible
BAWW	Black-and-white warbler	Possible
BCCH	Black-capped chickadee	Possible
BEKI	Belted kingfisher	Possible
BHVI	Blue-headed vireo	Possible
BLBW	Blackburnian warbler	Possible
BLJA	Blue jay	Possible
BPWA	Blackpoll warbler	Possible
BTBW	Black-throated blue warbler	Possible
BTNW	Black-throated green warbler	Possible
COLO	Common loon	Possible
CORA	Common raven	Possible
COYE	Common yellowthroat	Confirmed
CSWA	Chestnut-sided warbler	Possible
DEJU	Dark-eyed junco	Possible
EAWP	Eastern wood-pewee	Possible
GCKI	Golden-crowned kinglet	Possible
HAWO	Hairy woodpecker	Probable
HETH	Hermit thrush	Possible
LISP	Lincoln's sparrow	Possible
MAWA	Magnolia warbler	Possible
MODO	Mourning dove	Possible
MOWA	Mourning warbler	Possible

Code	Common Name	2018 Breeding Evidence
NOFL	Northern flicker	Possible
NOPA	Northern parula	Possible
OSFL	Olive-sided flycatcher	Possible
OVEN	Ovenbird	Possible
PAWA	Palm warbler	Possible
PIWO	Pileated woodpecker	Possible
PUFI	Purple finch	Possible
RBNU	Red-breasted nuthatch	Possible
RCKI	Ruby-crowned kinglet	Possible
REVI	Red-eyed vireo	Possible
SWTH	Swainson's thrush	Possible
UNDU	Duck sp.	Possible
WIWR	Winter wren	Possible
WTSP	White-throated sparrow	Possible
YBFL	Yellow-bellied flycatcher	Possible
YEWA	Yellow warbler	Possible
YRWA	Yellow-rumped warbler	Possible

All of the species identified are native species expected to be found in this area of Nova Scotia and the province in general, and within the typical and common habitat associated with the Project and surrounding landscape. The majority of observations were of a single individual; however, American redstart, dark-eyed junco, and hermit thrush were observed in groups of four. The most abundant group observed on site during the breeding bird period were passerines (songbirds), non-passerine land birds were the next most abundant group on-site, followed by other water birds and waterfowl, which were all observed in small numbers. See Figures 6.11-1 and 6.11-1A to 6.11-1L for the abundance of species observed during the breeding season. Raptors, both diurnal and nocturnal, were not observed during breeding bird surveys along the Preferred Alternative Haul Road and there were no incidental observations of raptor nests.

6.12.8.4 Considerations of Consultation and Engagement Results

The Preferred Alternative Haul Road is the result of consultation and engagement on the Primary Haul Road. Refer to Section 6.12.4 for key issues raised during public consultation and Mi’kmaq engagement relating to birds.

6.12.8.5 Effects Assessment Methodology

6.12.8.5.1 Boundaries

Spatial Boundaries

The spatial boundaries used for the assessment of effects to birds along the Preferred Alternative Haul Road are described below:

The Preferred Alternative Haul Road PA (Figure 5.4-1) encompasses 50 m on either side of a 5.7 km long center line. The eastern and western extent of the Preferred Alternative Haul Road PA connects to the Haul Road at a pre-existing forestry road and to Mooseland Road, respectively. The Preferred Alternative Haul Road PA runs north of Sandy Pond and Miller Lake.

The LAA (Figure 6.10-8) includes a 500m buffer from the Preferred Alternative Haul Road. This area encompasses the maximum expected extent of project direct and indirect impacts to birds.

The RAA (Figure 6.10-9) encompasses NSL&F's Ecological Land Classification Ecodistricts: 420 (Eastern Drumlins). This Ecodistrict spans an area broader than the expected Project impacts to birds and considers other Project boundaries as per cumulative effects methodology. These spatial boundaries will help to identify the direct or indirect impacts to bird species and the effects of the Project on distribution and abundance of these species.

As the Project has the potential to cause direct and indirect effects to birds outside of the Preferred Alternative Haul Road PA, the LAA is the appropriate boundary for evaluation of this VC.

Temporal Boundaries

The temporal boundaries used for the assessment of effects to flora are the construction phase, operational phase, and decommissioning and reclamation phase.

Technical Boundaries

No technical boundaries were identified for the effect's assessment of habitat and flora.

Administrative Boundaries

Administrative boundaries for evaluation and management of birds include the *Nova Scotia Wildlife Act*, which protects all birds within the province and the *Migratory Birds Convention Act (MBCA)* which offers protection for migratory birds. Further protection is offered to SAR through the provincial *Nova Scotia Endangered Species Act* and the federal SARA.

6.12.8.5.2 Thresholds for Determination of Significance

The thresholds for determination of significance regarding birds within the Preferred Alternative Haul Road are identical to the thresholds for determination of significance for this VC throughout the entire PA, as presented within Section 6.12.6.2.

6.12.8.6 Project Activities and Bird Interactions and Effects

The assessment of potential adverse interactions and effects of the Project on this VC considers the potential for the Project to result in changes to:

- Permanent and temporary habitat alteration and fragmentation

- Disturbance and/or displacement
- Potential for direct and indirect mortality to individuals
- Attraction and disorientation resulting from night-lighting

Table 6.12-15 present the potential interactions of the Project with birds and bird habitat.

Table 6.12-15 Potential Bird Interactions with Project Activities along the Preferred Alternative Haul Road

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Rock blasting in preparation of construction • Lighting of construction areas • Watercourse and wetland alteration in preparation of construction • Haul Road construction and upgrades • General noise from construction activities • Wildlife vehicle collisions
Operation and Maintenance	3-4 years	• Haul Road maintenance and repairs • General noise from mining activity • Wildlife vehicle collisions
Decommissioning and Reclamation	1-2 years	N/A[1]

1 Decommissioning and Reclamation of the Haul Road is not expected. The Haul Road will be returned to owner for forestry industry

Development of the Preferred Alternative Haul Road will cause direct impacts to habitat used by avifauna, including upland forested habitat and wetlands. This will occur mostly within the construction phase of the Project. Habitat within the Preferred Alternative Haul Road PA and surrounding landscape currently exhibits fragmented conditions based on existing road and trail networks, and current and historic timber harvesting activity. Project activities are likely to result in increased habitat fragmentation and a decrease in habitat quality for those species which rely especially on interior forest conditions, where intact interior forest remains, Refer to Section 6.10.3.5 for additional information on interior and old forest.

The quantity of interior forest unaffected by edge effects from roads and other anthropogenic disturbance within the Preferred Alternative Haul Road PA is limited and is confined to the western extent, east of its connection with Mooseland Road. There will be impact to the interior forest at this location and within Wetland 182 and Wetland 183 during road construction. This is unavoidable because no preexisting roads are present near this section of the Preferred Alternative Haul Road. Detailed design planning will take into consideration this important habitat and small shifts in infrastructure placement may be possible to limit impacts in this area during the detailed design phase. Similar habitat is largely available in the greater surrounding area.

As mentioned above, a large percentage of the Preferred Alternative Haul Road PA is characterized by cut blocks and networks of roads and trials. This activity has reduced the amount of interior forest present. Overall, the increase in physical fragmentation is expected to be low, based on the current high level of disturbed habitat as discussed.

Sensory disturbance to avifauna would result from rock blasting, clearing and grubbing, and from haul truck traffic occurring in an area without a preexisting road network. This will likely result in the localized avoidance of the Preferred Alternative Haul Road PA by avifauna. Overall, Project activities will likely cause a change in usage of the Preferred Alternative Haul Road PA by avifauna, with some species tending to avoid the area, while others may be attracted to disturbed habitat (e.g. common nighthawk).

Changes to ambient noise levels, light levels and the presence of periodic vibrations from blasting have the potential to adversely affect birds by influencing migration and behavioral patterns. The expected noise and light levels as well as their impact to avifauna are discussed in detail within Section 6.12.7.

Direct mortality of avifauna species could result from Project activities, particularly due to the increase in haul traffic during the operational phase. Increased traffic increases the likelihood of incidents and accidents which can result in direct mortality to avifauna.

6.12.9 Mitigation ~~and Monitoring~~

The potential effects related to migratory birds and that are associated with the different phases of the Beaver Dam Mine Project are outlined in Table 6.12-16.

In order to verify the accuracy of the environmental assessment and the effectiveness of mitigation measures, a follow-up monitoring program is recommended. It is recommended that monitoring be conducted from the start of construction until the end of the decommissioning phase.

- Verify the effectiveness of mitigation measures related to light and, based on advice from appropriate jurisdictions, implement adaptive measures, if appropriate;
- Reduce impact of light pollution on birds by minimizing on-site lighting while still allowing for safe operation and by installing lighting which faces the ground, thereby minimizing overall light pollution in the PA;
- Conduct routine inspections as directed by regulators. Inspections are anticipated to be conducted daily by operators, and as required by qualified avian experts during construction, operation and pit re-filling of the open pit area to remove any trapped or injured birds; and
- Notify Environment and Climate Change Canada within 24 hours in the event of the mortality or injury of ten or more migratory birds in a single event or in the event of the mortality or injury of a migratory bird SAR.

The mitigation measures outlined above are also applicable to the ~~Touquoy facility~~ Touquoy Mine Site for the processing of Beaver Dam ore. Mitigation measures will be applied to reduce the potential environmental impacts of the Project on migratory birds at the ~~Touquoy facility~~ Touquoy Mine Site as per existing operational approvals. Audio (Bird Gard Super Pro Amp:S4657) and visual deterrents (reflector tape) are currently being utilized at Touquoy Mine Site to dissuade birds from landing in the TMF. Each of the two audio deterrents employed has an effective range of 12 ha and is equipped with customizable calls from birds of prey. Due to the success of these deterrents, their use will continue when the tailings from Beaver Dam Mine Site are deposited in the Touquoy Mine Site open pit.

Regarding mature and interior forest; there is no significant impact expected from the Project to these habitat types, overall and in the greater adjacent area.

In instances where mature and interior forest cannot be avoided the following mitigation measures are proposed to identify and reduce indirect impacts to migratory birds that rely on this habitat throughout the PA:

- Grubbing and clearing activities will be avoided during nesting season if possible;
- The Project will limit further disruptions to interior forests by utilizing existing roads and disturbed sites where possible;
- Where possible, to avoid this habitat, adjustments will be made to infrastructure locations during detailed design phase; and
- Monitoring of the effectiveness of mitigation is recommended as noted in 6.10.7.4 of the EIS.

Table 6.12-16 Project Mitigation for Birds

VC	Mitigation Category	Project Phase	Mitigation Measure
Birds	**N/A**	PC, CON	Avoid construction on native vegetation during the regional breeding season for migratory birds where practicable (beginning of April to end of August for migratory birds; ECCC 2015). Where this is not practicable, a bird nest mitigation plan will be developed
		PC, CON	If a raptor nest is found within the forested areas to be cleared, a buffer zone appropriate to the species (as determined in consultation with NSL&F) would be placed around the nest
		CON, OP	Limit the amount of exposed soil during nesting season
		CON, OP	Discourage ground-nesting or burrow-nesting species (such as common nighthawk and bank swallows), by limiting large piles or patches of bare soil during the breeding season, wherever practicable
		CON, OP	Should any ground- or burrow-nesting species initiate breeding activities on stockpiles or exposed areas, the Proponent will work with ECCC and NSE to develop buffer zones that incorporate adaptive management
		CON, OP	Maintain speed limits on mine roads (max. 40 km/hr. within Beaver Dam Mine Site, 70 km/hr. along Haul Road) to minimize collisions with birds
		CON, OP	Implement dust suppression mitigation (refer to Atmospheric Environment Mitigation)
		CON, OP	Install downward-facing lights on site infrastructure and haul roads. Wherever practicable, install motion-sensing lights to ensure lights are not turned on when they are not necessary
		CON, OP	Conduct mobile refueling at least 30 m from any identified breeding locations
		CON, OP	Monitor known nests around stockpiles and exposed areas from a distance with a spotting scope or binoculars to verify the effectiveness of an identified buffer until the nests are inactive

VC	Mitigation Category	Project Phase	Mitigation Measure
		CON, OP	Conduct routine inspections of the open pit area to remove any trapped or injured birds. If identified, determine a plan for removal in consultation with an avian expert
		CON, OP	Notify ECCC within 24 hours in the event of the mortality or injury of ten or more migratory birds in a single event or in the event of the mortality or injury of a migratory bird SAR

6.12.10 Residual Effects and Significance

The predicted residual environmental effects of the Project on birds and bird habitat are assessed to be adverse, but not significant. The overall residual effect of the Project on birds and bird habitat is assessed as not significant after mitigation measures have been implemented.

Table 6.12-17 Residual Environmental Effects for Birds

Project VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Significance Criteria for Residual Environmental Effects						Residual Effect	Significance
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Beaver Dam Mine Site and Haul Road (loss of habitat from clearing and grubbing and disturbance (noise, light and wildlife vehicle collisions) from construction activities)	Implement speed limits and minimize lighting.	A	M VC interaction causes direct loss of habitat and birds.	LAA Potential adverse effect to birds outside of the PA	A Although clearing and grubbing will occur outside of the sensitive period for birds, other activities will not.	MT Effects can occur beyond 12 months and up to 3 years	O VC interaction will occur once within the construction phase	PR Mitigation cannot guarantee a return to baseline conditions	Disturbance and loss of habitat	Not significant
Operational – Beaver Dam Mine Site and Haul Road (disturbance from light and wildlife vehicle collisions) from haul trucks and heavy machinery)	Implement speed limits minimize and lighting.	A	L Minor change from baseline conditions	LAA Potential adverse effect to birds outside of the PA	A VC interaction may affect seasonal aspects of birds.	LT Effects may extend beyond 3 years	R VC interaction will occur at regular intervals	R VC will recover to baseline conditions	Disturbance	Not significant
Operational – Beaver Dam Mine Site and Haul Road (noise disturbance from haul trucks, heavy machinery, and, crushing of ore)	Implement speed limits and minimize lighting.	A	H Large change from baseline conditions	LAA Potential adverse effect to birds outside of the PA	A VC interaction may affect seasonal aspects of birds.	LT Effects may extend beyond 3 years	R VC interaction will occur at regular intervals	R VC will recover to baseline conditions	Disturbance	Not significant
Operational – Touquoy Mine Site (Tailings deposited in Touquoy Mine Site open pit)	Best management practices	A	L Minor change from baseline conditions	PA VC interaction is confined to the PA.	A VC interaction may occur during sensitive period for birds	LT Effects may extend beyond 3 years	R VC interaction will occur at regular intervals	PR Mitigation cannot guarantee a return to baseline conditions	Contamination	Not Significant
Reclamation – Beaver Dam Mine Site (disturbance (noise, light, dust and wildlife vehicle collisions) from construction activities)	Implement speed limits, minimize lighting, and control dust.	P	L Minor change from baseline conditions	LAA Potential adverse effect birds outside of the PA	A VC interaction may affect seasonal aspects of birds.	MT Effects can occur beyond 12 months and up to 3 years	O Effects occur once during the reclamation phase	R VC will recover to baseline condition	Disturbance, habitat gained	Not significant

Project VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Significance Criteria for Residual Environmental Effects						Residual Effect	Significance
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		

Legend (refer to Table 5.10-1 for definitions)

Nature of Effect		Geographic Extent		Duration		Frequency	
A	Adverse	PA	Project Area	ST	Short-Term	O	Once
P	Positive	LAA	Local Assessment Area	MT	Medium-Term	S	Sporadic
		RAA	Regional Assessment Area	LT	Long-Term	R	Regular
Magnitude				P	Permanent	C	Continuous
N	Negligible	**Timing**					
L	Low	N/A	Not Applicable			**Reversibility**	
M	Moderate	A	Applicable			R	Reversible
H	High					IR	Irreversible
						PR	Partially Reversible

A significant adverse environmental effect for birds has not been predicted for the Project for the following reasons, with consideration of the ecological and social context of the LAA surrounding the Project:

During Construction:

- Direct impacts to bird habitat is expected, however, impacts will be minimized through on-going Project design and micro-sighting of infrastructure footprints where ever practicable.
- The baseline habitat of the Beaver Dam Mine Site and Haul Road is a network of existing fragmentation due to historical and present forestry activities, and the presence of the logging road that is proposed for upgrade.
- Micrositing has reduced the impact to interior forest patches within the Beaver Dam Mine Site.
- The majority of Haul Road construction is road upgrades, minimizing the loss of habitat for birds.
- Construction work will be considerate of the breeding bird season wherever practicable.
- Construction noise and light will be limited to a 12 month window

During Operations:

- Noise will be elevated above baseline during this period and may cause a displacement of birds in close proximity to the Haul Road and Mine Sites.

During Closure:

- Noise will be elevated above baseline during reclamation activities (2-3 years) involving mobile equipment and then drop to baseline for the post-closure period.

6.12.10.1 Residual Effects and Significance of the Preferred Alternative Haul Road

Table 6.12-18 Residual Environmental Effects for Birds within the Preferred Alternative Haul Road

Project VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Significance Criteria for Residual Environmental Effects						Residual Effect	Significance
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Preferred Alternative Haul Road (loss of habitat from clearing and grubbing and disturbance (noise, light and wildlife vehicle collisions) from construction activities)	Implement speed limits and minimize lighting.	A	M VC interaction causes direct loss of habitat and birds.	LAA Potential adverse effect to birds outside of the PA	A Although clearing and grubbing will occur outside of the sensitive period for birds, other activities will not.	MT Effects can occur beyond 12 months and up to 3 years	O VC interaction will occur once within the construction phase	PR Mitigation cannot guarantee a return to baseline conditions	Disturbance and loss of habitat	Not significant
Operational – Preferred Alternative Haul Road (disturbance from light and wildlife vehicle collisions) from haul trucks and heavy machinery)	Implement speed limits minimize and lighting.	A	L Minor change from baseline conditions	LAA Potential adverse effect to birds outside of the PA	A VC interaction may affect seasonal aspects of birds.	LT Effects may extend beyond 3 years	R VC interaction will occur at regular intervals	R VC will recover to baseline conditions	Disturbance	Not significant
Operational – Preferred Alternative Haul Road (noise disturbance from haul trucks, heavy machinery, and, crushing of ore)	Implement speed limits and minimize lighting.	A	M Moderate change from baseline conditions	LAA Potential adverse effect to birds outside of the PA	A VC interaction may affect seasonal aspects of birds.	LT Effects may extend beyond 3 years	R VC interaction will occur at regular intervals	R VC will recover to baseline conditions	Disturbance	Not significant

Legend (refer to Table 5.10-1 for definitions)

Nature of Effect	Geographic Extent	Duration	Frequency
A Adverse	PA Project Area	ST Short-Term	O Once
P Positive	LAA Local Assessment Area	MT Medium-Term	S Sporadic
	RAA Regional Assessment Area	LT Long-Term	R Regular
Magnitude		P Permanent	C Continuous
N Negligible	**Timing**		
L Low	N/A Not Applicable		**Reversibility**
M Moderate	A Applicable		R Reversible
H High			IR Irreversible
			PR Partially Reversible

Table 6.12-17 was reviewed and it was determined that the construction and operation (direct and indirect impacts) of the Haul Road were the only VC interactions applicable to birds within the Preferred Alternative Haul Road. There only change in significance criteria was a reduction of magnitude of impact from noise during operations from high to moderate. Haul trucks are the only generators of noise along the Preferred Alternative Haul Road. There were no changes in overall significance for any of these VC interactions.

Mitigations presented in Table 6.12-16 will be established to reduce the impact of Project activities on birds.

6.12.11 Proposed Compliance and Effects Monitoring Program

A Wildlife Management Program, established as part of the Preliminary Environmental Effects Monitoring Plan (EEM), will be developed through the life cycle of the permitting process. The Wildlife Management Program will outline procedures to be followed should evidence of breeding bird activity be identified during construction activities. The Wildlife Management Program will be developed in order to comply with the Migratory Birds Convention Act, 1994. If construction is required during the active nesting season an avian specialist will monitor for nesting activity.

The EEM (Appendix O.1) will evolve through regulatory permitting, as well as public and Mi'kmaw engagement.

6.13 Species of Conservation Interest and Species at Risk

6.13.1 Rationale for Valued Component Selection

SAR are protected under federal or provincial endangered species legislation. These pieces of legislation outline protection of these species and their habitats in the form of species-specific recovery strategies and action plans. The level of protection offered to a listed species varies depending on its designation. SOCI represent species whose populations are either currently or potentially threatened by natural or anthropogenic factors. These species are found on the ACCDC lists S1-S3. Natural systems and ecological processes often depend on healthy, diverse ecosystems. As such, understanding the distribution and diversity of rare species present within a PA is key to proper risk assessment, Project planning, and mitigation of risks posed to rare species by a given project.

6.13.2 Baseline Program Methodology

Specific field program methodologies for each taxonomic group are outlined in previous sections of this EIS (Fish and Fish Habitat, Flora and Habitat, Terrestrial Fauna, and Birds). These chapters describe the detailed and specific field program methods (if any) to identify SAR and SOCI within the ~~PA~~ Beaver Dam Mine Site and Haul Road. Specific field program methods are shown on Figures 6.11-1 and 6.11-1A to 6.11-1L.

Methods and results from SAR/SOCI surveys at the Touquoy Mine Site are summarized in subheadings within the applicable sections of this EIS, however, the data is not being reevaluated. For further information regarding Touquoy Mine Site, refer to the EARD (CRA 2007) and Focus Report (CRA 2007a).

6.13.2.1 Priority Fish Survey Methods

No targeted methods were employed specifically for priority fish species. The diversity of fish survey methods employed (eel pots, fyke nets, minnow traps, and electrofishing) were used with the goal of capturing the broadest diversity of fish species present within the PA. Section 6.9.2 outlines detailed fish survey methods used in the PA.

6.13.2.2 Priority Vascular Flora Survey Methods

No specific targeted surveys for priority vascular plant species were completed. Botanical surveys were completed in all habitats throughout the PA to compile a comprehensive list of vascular flora species present in the PA. Botanists conducting vascular plant surveys thoroughly reviewed the results of the desktop evaluation for vascular flora priority species. This allowed the botanical surveys to focus on habitats with elevated potential for any priority vascular flora species. Vascular flora survey methods are outlined in Section 6.10.2.

The following information was collected for any priority vegetation species identified during field surveys: site location, date, scientific name, count, size, habitat, location (UTM NAD83 CSRS), along with a photograph and any relevant comments. Any specimens that could not be identified in the field were photographed in order to aid in identification.

6.13.2.3 Priority Lichen Survey Methods

Prior to undertaking the field assessment, a detailed desktop review of known lichen observations and potential habitat for rare lichens within and surrounding the PA was conducted. The desktop review involved three components: a review of the list of priority species, a review of predictive habitat mapping for boreal felt lichen (provided by NSL&F) and reviewing the results of habitat mapping.

To develop the predictive habitat maps for boreal felt lichen, NSL&F used an algorithm which identifies all forest stands in the provincial forestry database in which balsam fir (*Abies balsamea*) is listed as a primary or secondary species and which occur within 80 m of a mapped bog or fen. The model further confines the search to only those forest stands located within 30 km of the Atlantic Coast. This was used to predict areas with a higher potential of locating boreal felt lichen. This data set was reviewed in advance of field assessment and was uploaded onto the GPS units during field assessments. Other habitats identified by the Project team as suitable for rare lichens were surveyed for lichens as well.

While the specific habitat requirements of each of priority lichen species varies slightly, they all require mature to over-mature forests. Stand age is one of the greatest determinants of lichen diversity (McMullin, Duinker, Cameron, Richardson, & Brodo, 2008). Within the PA, mature to over-mature stands are infrequent, with the majority of the PA having been harvested for timber production. Intact, natural, mature stands are more frequent within the Haul Road ~~PA~~ than within the ~~mine footprint PA~~ Beaver Dam Mine Site. Lichen surveys throughout the ~~PA~~ Beaver Dam Mine Site and Haul Road were focused on undisturbed stands, particularly those located near mapped wetlands, as these habitats have elevated potential for identifying priority lichen species.

All suitable habitats within the ~~PA~~ Beaver Dam Mine Site and surrounding area were surveyed in May 2015 ~~(mine footprint PA and surrounding area)~~ and within the Haul Road in May 2016 (~~haul road PA~~) for priority lichen species. The survey area was extended beyond the PA boundary in the vicinity of the ~~mine footprint~~ Beaver Dam Mine Site, so the Project Team could understand the distribution of rare lichens in a broader context. This broadened lichen study area allowed the Project Team to form conclusions based on lichen populations, rather than individual lichens. The lichen study area surrounding the ~~mine footprint~~

~~PA~~ Beaver Dam Mine Site is shown on Figure 6.11-1. An additional lichen survey was conducted in conjunction with vascular plant surveys in the western extension to the Beaver Dam Mine Site on September 18, 2018 and in a small area directly north of the Beaver Dam Mine Site on October 29, 2018. The Beaver Dam Mine Site extended west to allow for the division and micro siting of the waste rock stockpile and to the north for a waterline.

Mature trees that are appropriate for hosting priority lichen species were visually inspected. The visual inspection focused on tree trunks, but included branches and twigs where it was determined to be safe and appropriate. The following information was collected for any priority lichen species identified during field surveys: site location, date, scientific name, count, size, habitat (host tree and general habitat), location (waypoint in UTM NAD83), height of the specimen, direction that the specimen was facing, along with a photograph and any relevant comments. Any specimens that could not be identified in the field were photographed in order to aid in identification.

6.13.2.4 Mainland Moose Survey Methods

To determine the level of concern associated with mainland moose, the Project team commenced by consulting with the Endangered Mainland Moose Special Management Practices report (NSDNR, 2012) and the Status Report on the Eastern Moose (Parker, 2003). In addition, on January 5, 2015, the Project team consulted with Regional Wildlife Biologist, Shavonne Meyer, to request a record of all mainland moose sightings identified within a broad vicinity of the PA.

Tracking surveys were completed to determine if mainland moose are present within the ~~mine footprint PA~~ Beaver Dam Mine Site. Six transects, totaling nine-kilometers in length, were established through representative habitat types. An observer capable of identifying moose and deer tracks, browse and scat completed the moose track surveys. Three winter tracking surveys were completed along these transects on January 14, February 18, and March 17, 2015. One moose pellet group inventory (PGI) survey was completed along these same transects on May 25, 2015.

Winter and spring moose surveys, consisting of eight one-kilometer transects, were completed within the ~~haul road PA~~ Haul Road in March and April 2016. Typically, winter track surveys would be completed three times, following the same transects, in suitable winter tracking conditions, followed by a single round of spring PGI surveys. Winter track conditions and a lack of snow cover during the late winter of 2016 prevented the repetition of winter track surveys for Moose. On February 26, 2016, the Project team consulted with the Regional Wildlife Biologist, Shavonne Meyer, the provincial Large Mammal Biologist, Peter MacDonald, and with the provincial SAR Biologist, Mark Elderkin to discuss a change in methodology to reflect the lack of snow cover. Through this consultation, the Project team determined that one winter track survey would be complemented by repeated spring PGI surveys. Each PGI survey would be completed along a different series of transects, thereby increasing the coverage of the surveys, while still obtaining the data that would be necessary to make conclusions related to moose activity within the ~~haul road PA~~ Haul Road. In total, 18 one-kilometer transects were established along the Haul Road. One winter track survey was completed on transects 1-8 on March 2, 2016. This was complemented by two sets of PGI surveys completed on March 16th, 2016 (Transects 9-18) and on April 26th, 2016 (Transects 1-8). Locations of moose and deer tracks, browse, and scat were recorded using a handheld GPS unit. Incidental observations of other wildlife species, tracks, and scat were also recorded. The placement of moose survey transects through the ~~PA~~ Beaver Dam Mine Site and Haul Road reflected a mixture of existing roads and intact forest, and were determined in consultation with NSL&F staff identified above. Mainland moose survey transects are identified on Figure 6.13-1.

6.13.2.5 Bat Survey Methods

A desktop analysis of potential bat habitat was conducted to determine level of concern associated with the Project and to determine whether field assessments were necessary. The desktop analysis started with a review of bat occurrences, as noted in the ACCDC reports. The Significant Species and Habitat Database was also searched for known potential bat hibernacula. According to NSL&F SAR Biologist, Mark Elderkin, bats are sensitive to activity up to 1 km away during hibernation. As such, a minimum of 1 km buffer is recommended when assessing risk to bat SAR. Provincial government records for AMOs were reviewed (Hennick and Poole, 2016) within a 10 km radius of the site, as these AMOs potentially provide bat hibernacula. These records were reviewed for mine shaft type, access, original depth, and presence of water in the shaft to determine likelihood that the AMO is potential bat hibernacula. The records identified ~~twelve~~ eighteen AMOs within the ~~mine footprint~~ Beaver Dam Mine Site. The ~~twelve~~ eighteen AMOs within the ~~mine footprint~~ Beaver Dam Mine Site (Figure 2.1-5) were evaluated in the field on September 18, 2014 for their potential to provide bat hibernacula. During all other surveys completed within the PA by the Project team, biologists were trained to evaluate landscapes for potential hibernacula including natural caves or anthropogenic mine openings or abandoned wells.

6.13.2.6 Priority Herpetofauna Survey Methods

Wood turtles and snapping turtles have been identified as priority species with the potential to be present within the PA based on habitat preference and known distribution. The wood turtle is listed as threatened by COSEWIC, NSESA and SARA. This species prefers clear rivers, streams, or creeks with moderate current and sandy or gravelly substrate (ECCC, 2016c). The snapping turtle is listed as vulnerable in NS and is listed as a species of special concern by COSEWIC and SARA. This species occurs in almost any freshwater habitat, though it is most often found in slow-moving water with a soft mud or sand bottom and abundant vegetation (ECCC, 2016d).

Seven wood turtle surveys were conducted from May 17 to June 4, 2015 along the watercourse that runs between Crusher Lake and Mud Lake (part of watercourse 5) within the ~~mine footprint PA~~ Beaver Dam Mine Site. No other suitable wood turtle habitat was identified across ~~PA (mine footprint and haul road)~~ the Beaver Dam Mine Site and Haul Road that warranted a detailed survey for wood turtles. MEL biologists continued to look for signs of turtle usage during all other site surveys, particularly suitable nesting habitat along watercourse crossings throughout the ~~haul road PA~~ Haul Road.

Wood turtles are often associated with some form of vegetative structure, therefore, MEL field staff searched for turtles at the base of woody shrubs, under or near deadfall, and amongst grasses or leaf litter. The ground and undergrowth was searched from the water's edge inland to 20 meters along one side of the watercourse.

Wood turtles are active in temperatures over 9 °C, but best results are found when temperatures range from 15-20 °C. Wood turtle observations drop off significantly when temperatures exceed 25 °C. Ambient temperature appears to be as good an indicator of the probability of detection as sunlight so surveys can occur on cloudy days. As long as the air temperature is warmer than the water, there is a thermal advantage in basking on land (ECCC, 2016c). Surveys were completed between 10:00 and 18:00 hours.

Opportunistic observations for snapping turtles and suitable habitat were documented through all field programs, particularly wetland and watercourse evaluations. Biologists conducting field assessments searched for snapping turtles in aquatic ecosystems with slow moving water, mucky substrate, and dense vegetation. During June, particular attention was paid to identifying snapping turtles or signs thereof (i.e.

scrapes, depredated nests) along exposed gravel including roadside shoulders, when snapping turtles move to these habitats to nest.

The PA was also surveyed for herpetofauna during other field programs, particularly wetland and watercourse assessments, with special attention paid towards identifying any signs of turtle usage. Signs such as animal sightings, vocalizations, amphibian egg masses, cast snake skins, turtle nest scrapes, or depredated nests were recorded during any field programs by biologists capable of recognizing these signs.

6.13.2.7 Priority Invertebrate Survey Methods

A desktop review for rare invertebrates was completed. This included reviewing species records in the vicinity of the PA provided by Odonata Central, the Maritime Butterfly Atlas, and the ACCDC reports for Odonates, Lepidopterans and all other invertebrates, respectively. Incidental observations for priority invertebrates occurred during all field programs, particularly wetland and watercourse delineation, and fish habitat surveys. Incidental observations of odonates and lepidopterans include live adults or larvae, or cast skins. Signs of molluscs include live or dead individuals and shells.

6.13.2.8 Priority Bird Survey Methods

The second atlas of the MBBA was reviewed to determine possible, probable, and confirmed records of breeding avian SAR and SOCI in proximity to the PA. The PA falls within four 10 km^2 MBBA survey squares (20NQ18, 20NQ19, 20NQ28, 20NQ29). The results of MBBA surveys are presented in Section 6.12.2 and provided in **Appendix L.1.**

Targeted surveys for the common nighthawk were completed throughout the ~~PA~~ Beaver Dam Mine Site and Haul Road, as described in Section 6.12.3.6.2 Suitable habitat is available for this species within the PA, therefore, dedicated surveys for the common nighthawk were conducted from mid- to end of June at either dawn (1 hour before sunrise to 30 minutes after sunrise) or dusk (30 minutes before sunset to an hour after sunset), as described in the Common Nighthawk Survey Protocol (Saskatchewan Ministry of Environment, 2015). Stations were spaced at least 800 m apart and a point count survey with call playback was used to detect the presence of common nighthawk within the PA. A three-minute passive point count was conducted at each station, followed by a call playback which includes 30-seconds of the conspecific common nighthawk call followed by 30-seconds of silence (or passive surveying), repeated for three-minutes (i.e., three times). The total time spent at each survey point was a minimum of six-minutes. Three call playback stations were surveyed within the ~~mine footprint PA~~ Beaver Dam Mine Site and 12 call playback stations were surveyed within the ~~haul road PA~~ Haul Road, for a total of 15 call playback stations ~~within the PA~~.

No other targeted surveys for priority bird species were conducted, as all other species are anticipated to be detectable during standard methods for bird surveys.

6.13.3 Baseline Conditions

Updates to priority species (total number, location etc.) reflected within this section are as a result of additional surveys required by changes to the PA in order to incorporate the micrositing of Project infrastructure.

6.13.3.1 Priority Fish Species

The desktop evaluation for priority fish species revealed that no priority species were documented within 5 km of the PA by the ACCDC reports provided for the ~~mine footprint~~ Beaver Dam Mine Site and for the Haul Road. No location sensitive species of fish have been identified within 5 km of either the mine footprint or the ~~haul road PA~~ Haul Road. The following priority fish species are identified as having an elevated potential to be located within the PA, based on habitat preferences, and broad geographic range.

Table 6.13-1 Priority fish species with elevated potential for being identified within the Project Area

Latin Name	Common Name	SARA, COSEWIC NSA	S-Rank
Anguilla rostrata	American eel	COSEWIC	~~S5~~ S2
Salmo salar	Atlantic salmon – Southern Uplands Population	COSEWIC Endangered	~~S2~~ S1
Culaea inconstans	Brook stickleback		S3
Osmerus mordax (landlocked)	Rainbow smelt		S3
Salvelinus fontinalis	Brook trout		S3
~~Rhinichthys atratulus~~	~~Blacknose Dace~~		~~S3~~

As described in Section 6.9.2, all fish survey methods were designed to identify the diversity of species within the diversity of habitats present within the PA, including any priority species. Field survey locations for various fish programs are shown on Figures 6.7-3 and 6.7-3A to 6.7-3L. No specific targeted surveys were completed for priority fish species. Within the ~~mine footprint PA~~ Beaver Dam Mine Site, ~~no priority fish species were identified during any of the suite of survey methods~~ one priority species, brook trout, was identified during electrofishing and fish collection. Although they were not observed, the American eel and Atlantic salmon, ~~and Blacknose dace~~ have suitable habitat within the ~~mine footprint PA~~ Beaver Dam Mine Site, and therefore may be present.

Two SOCI were identified during electrofishing within watercourses within the Haul Road ~~PA~~. The American eel is currently listed as threatened by COSEWIC. It was identified during electrofishing surveys in watercourses N, V, and AH. ~~A single Blacknose dace was observed in watercourse N within the haul road PA as well.~~ Brook trout, listed as S3 by the ACCDC, were also observed in watercourses N, V, and AH. Atlantic salmon have been documented within the WRSH watershed and are expected to be present within contiguous surface water with the West River Sheet Harbour where suitable habitat is present within the ~~haul road PA~~ Haul Road.

According to the Nova Scotia Salmon Association (pers. comm. 2016), Rainbow smelt and brook stickleback are not known to be present within the WRSH or Tangier River systems. Therefore, the likelihood of these species being present within the PA is very low.

No fish SAR were documented during any fish surveys.

The Project Team received a letter from Lisa Poan, Fisheries Protection Biologist at Fisheries and Oceans Canada on April 20, 2015 (Entitled: DFO response to notification letter pursuant to subsection 79(1) of the Species At Risk Act for the Proposed Beaver Dam Mine Project). This letter indicated that the American eel and the Atlantic salmon (Southern Upland population) are under review for protection under SARA. If designated under Schedule 1 of SARA as proposed, prohibitions would immediately come into effect under Sections 32 and 33 of SARA. As such, the Project Team is moving forward with the Projects' effects assessment, with the assumption that these species may soon be protected under SARA. At the time of submission of this revised EIS, no change in status has been realized for either species.

6.13.3.1.1 **Blacknose Dace**

~~A single Blacknose dace was observed at watercourse N within the haul road PA (West River Sheet Harbour). The single individual had a total length of 9.0 cm and is presumed to be a mature fish. This single fish was identified along with a common assemblage of freshwater species, including yellow perch, white sucker, banded killifish, American eel, and lake chub. The Blacknose dace prefers moderately flowing watercourses with rocky substrate, but can be found in slower moving areas as well, similar to habitat present in West River Sheet Harbour. They feed primarily on aquatic invertebrates and provide a prey source for a variety of species, including salmonids and piscivorous birds (Canadian Rivers Institute, n.d.). The single observation of Blacknose dace does not allow conclusions about abundance or distribution of the population, but it does confirm presence within the West River Sheet Harbour watercourse system.~~

6.13.3.1.2 **Brook Trout**

Brook trout were identified within the Beaver Dam Mine Site during electrofishing surveys and within the Haul Road during both electrofishing and fish collection surveys. Brook trout are listed as S3 by the ACCDC.

Within the Beaver Dam Mine Site, brook trout were confirmed within Watercourse 5 north of Crusher Lake (between Crusher Lake and Mud Lake) (one individual fish), Watercourse 12 (three individual fish) (between Wetlands 56 and 59), and within Watercourse 13, the short tributary leading from Cameron Flowage west into Wetland 59 (6 individual fish). Based on the observed brook trout in WC-5, it is expected that this species would be present and utilizing wetland habitat in Wetland 8 and Wetland 44 on the south side of Crusher Lake, and Wetland 17 adjacent to Mud Lake. Brook trout was confirmed in WC-12, Wetland 56, and WC-13 demonstrating that this species is also present in Wetland 56 (where open water is present) and throughout Wetland 59, which is classified as an open water marsh.

Along the Haul Road one brook trout was captured in a minnow trap within WC-V. Electrofishing surveys identified brook trout within WC-N, V, and AH. There are no wetlands directly associated with any of these watercourses within the Haul Road.

Brook trout require cool water habitat. In the fall, mature individuals migrate to spawn in lakes or streams with a gravel substrate. Brook trout mature in about two to four years within fresh water. If the river habitat is suitable for brook trout and they do not experience any stressors throughout the year, they tend not to travel large distances. Most of the populations existing in larger rivers act this way. They do not move until the fall at the onset of spawning. Even then, if the river has adequate habitat diversity, they tend not to travel large distances. Other populations have adapted to various river conditions. They travel very large distances (>120 km) in search of thermal refuge and/or spawning habitat. Some spawn in the main stem of rivers, while others utilize tributaries (NSDAF, 2005).

6.13.3.1.3 **American Eel**

Thirty-six mature American eels were observed within three watercourses within the Haul Road ~~PA~~, and none were observed within the ~~mine footprint PA~~ Beaver Dam Mine Site. The average length of individuals captured was 24.0 cm (minimum: 10 cm, maximum: 45 cm). American eels were observed in watercourse N (West River Sheet Harbour) along with ~~Blacknose dace~~, yellow perch, white sucker, banded killifish and lake chub, and in watercourses V and AH, along with brook trout. Watercourse V is the West River Sheet Harbour and watercourse AH is a tributary to the Morgan River, within the Tangier River Secondary Watershed. Wetlands contiguous with watercourses, which actually or potentially support American eel, may also support American eel, as outlined in Table 6.9-4 and in Section 6.9.3.

Within the PA, the American eel was observed in watercourses associated with the Haul Road. While no American eel were observed within the ~~mine footprint PA~~ Beaver Dam Mine Site, absence cannot be confirmed. The American eel is listed as ~~special concern~~ threatened under COSEWIC. It is not currently listed under SARA or NSESA, ~~and~~ however, American eel have the Nova Scotia Provincial Status Rank ~~is secure~~ of rare in the province (~~S5~~ S2, according to ACCDC).

As a catadromous species, eels spend the majority of their lives in freshwater, moving to the Sargasso Sea to spawn. Their distribution includes marine waters of the western Atlantic Ocean and some freshwater systems connected to the Atlantic Ocean in South America, North America, and Greenland. Within the freshwater environment, mature American eels are habitat generalists, frequently found in natural watercourses that offer structural complexity and shade in the form of coarse woody debris, varied substrate, in-stream vegetation, and an available food source of forage fish, invertebrates, molluscs, and vegetation.

Fish habitat was assessed for various lifecycles of the American eel. Migration habitat was determined based on a contiguous fresh water system connecting two separate waterbodies. Juvenile habitat requires various benthic substrates, woody debris, and/or vegetation for protection and cover. Overwintering habitat required mud/silt sections of streambeds with depths of a minimum 30 cm to ensure the eels do not freeze to death during winter months.

Potential American eel habitat was found to be within 30 tributary watercourses to the three confirmed eel bearing watercourses. Tributary systems were inferred using both field data and NS topographical watercourse mapping. A review of literature documents that American eels are not restricted to contiguous watercourses and possess the ability to traverse over land in wet, low lying grass habitats (MacGregor et al., 2011). As such, all remaining watercourses within the ~~Beaver Dam Mine Project~~ PA are believed to be potentially accessible to the American eel, even if habitat provision in those watercourses is low.

These classifications are based in some cases on very short sections of watercourses evaluated within the PA only and, therefore, should be considered as preliminary summaries of fish habitat potential, with detailed evaluation necessary during the permitting stages of this Project to confirm fish habitat. Table 6.13-2 below provides a summary of potential American eel bearing watercourses.

Table 6.13-2 Summary of Potential American Eel-bearing Watercourses

American Eel Habitat	Watercourse*	Watershed	Life Cycle		
			Migration	Juvenile	Overwintering
Confirmed: American eel presence has been confirmed through the MEL electrofishing program June 2016.	N (West River Sheet Harbour)	Brandon Lake / Rocky Brook Lake	✓	✓	✓
	V	Lake Alma	✓	✓	✓
	AH	Rocky Lake	✓	✓	✓
High Potential: Watercourses that are confirmed or inferred tributaries to watercourses N, V, and AH, which provide a combination of suitable migration, juvenile, or overwintering habitat.	A	Tent Lake		✓	
	B	Tent Lake		✓	
	C	Tent Lake		✓	
	D	Tent Lake		✓	
	F	Brandon Lake	✓	✓	✓
	G	Brandon Lake	✓	✓	✓
	H	Brandon Lake		✓	✓
	I	Brandon Lake		✓	
	J	Brandon Lake		✓	
	K	Brandon Lake		✓	
	L	Brandon Lake		✓	✓
	M	Brandon Lake		✓	✓
	O	Lake Alma	✓	✓	
	P	Lake Alma		✓	✓
	Q	Lake Alma		✓	
	R	Lake Alma		✓	
	S	Lake Alma		✓	
	T	Lake Alma	✓	✓	
	U	Lake Alma		✓	✓
	W	Lake Alma		✓	

American Eel Habitat	Watercourse*	Watershed	Life Cycle		
			Migration	Juvenile	Overwintering
	X	Lake Alma		✓	✓
	Y	Lake Alma		✓	✓
	Z	Lake Alma		✓	✓
	AA	Eagles Nest	✓	✓	✓
	AB	Eagles Nest		✓	
	AC	Eagles Nest		✓	
	AD	Eagles Nest	✓	✓	✓
	AE	Rocky Lake		✓	
	AF	Rocky Lake		✓	✓
	AG	Rocky Lake		✓	✓
Potential: Watercourses assessed to have a combination of migration, juvenile, or overwintering American eel habitat, but do not have a topographically mapped connection to a watercourse in which American eel were observed (i.e., no mapped connection to watercourses N, V, or AH).	1	Tent Lake		✓	
	2	Cameron Flowage		✓	
	3	Cameron Flowage		✓	
	4	Cameron Flowage		✓	
	5 (top near WL2)	Cameron Flowage		✓	
	5 (lower near WL14)	Cameron Flowage	✓	✓	✓
	6	Cameron Flowage		✓	
	7	Cameron Flowage		✓	
	8	Cameron Flowage		✓	
	9	Cameron Flowage		✓	

American Eel Habitat	Watercourse*	Watershed	Life Cycle		
			Migration	Juvenile	Overwintering
	10	Kent Lake		✓	
	11	Kent Lake		✓	✓
	12	Cameron Flowage		✓	
	13	Cameron Flowage		✓	
	14	Cameron Flowage		✓	✓
	E	Brandon Lake		✓	
*Numbered watercourses lie within the ~~mine footprint~~ Beaver Dam Mine Site; lettered watercourses lie along the Haul Road.					

According to COSEWIC (COSEWIC, 2013), the Maritimes region falls within the American eel's Freshwater Ecological Area 3 (FEA3). This population has had some recorded population level fluctuations, lacking an overall trend between 1989 and 2002. The St. Lawrence River and Great Lakes (FEA1) population has experienced significant reduction in populations since the early 1980s. Given that the entire population spawns in the Sargasso Sea, the reduction of any individual population or reduction in range can affect the total abundance of the species, even if all populations are not experiencing the same decline.

Threats to the abundance and distribution of the American eel include a variety of natural and anthropogenic factors that result in direct mortality or indirect impacts to quality and access to habitat. Some hydroelectric dams can prevent or limit upstream migration of eels, while resulting in direct mortality to downstream migrants. Overfishing has contributed to population reduction, as well as the spread of an introduced parasite (*Anquillicola crassus*), changes to accessibility of habitat through installation of barriers, and potential impact to quality of habitat from land use practices and climate change (COSEWIC, 2013).

6.13.3.1.4 **Atlantic Salmon**

According to COSEWIC (2010), the Southern Uplands Population of Atlantic salmon (*Salmo salar*) is listed as endangered and is considered ~~imperiled~~ extremely rare provincially by the ACCDC (ranked ~~S2~~ S1). This population is not currently protected under SARA or NSESA. Atlantic salmon are divided into unique populations, based on genetic distinction and range. For the purposes of this discussion, we are considering only the Southern Uplands (SU) Population, as outlined by DFO in the Recovery Potential Assessment for the Southern Uplands population of Atlantic salmon (Fisheries and Oceans Canada, 2013).

Atlantic salmon was not observed during any fish sampling programs within the ~~PA (mine footprint and haul road~~) Beaver Dam Mine Site and Haul Road. However, this species has been extensively documented within the West River Sheet Harbour and the Killag River by the Nova Scotia Salmon Association and is presumed to be present in several tributaries to these watercourses, including tributaries found within the PA. Wetlands contiguous with watercourses which potentially support Atlantic salmon may also support Atlantic salmon, as outlined in Table 6.9-4 and in Section 6.9-3.

Southern Upland (SU) Atlantic salmon have been found along the entire coast of Nova Scotia, from the Bay of Fundy to Cape Breton. However, the full extent of the range of SU population is not fully known. The SU Atlantic salmon spawn in fresh water from October to November and spend one to four years as juveniles in the fresh water. The majority of the juveniles migrate to the sea after two years of being in fresh water. In spring, the salmon leave the rivers and by mid-summer migrate to the Atlantic Ocean by Newfoundland and Labrador. They spend one to three years in the Atlantic Ocean before returning as adults to fresh water to spawn. The majority of adults leave the rivers in spring after spawning and recondition out at sea before spawning in freshwater again. Within the freshwater environment, the SU Atlantic salmon is found in cool, clear, well-oxygenated waters which support a reliable food source of aquatic invertebrates. Gravel and cobble is the preferred substrate for spawning (Fisheries and Oceans Canada, 2013; Fisheries and Oceans Canada, 2016a).

The Nova Scotia Salmon Association has documented the presence of Atlantic salmon in three watercourses near the Beaver Dam Mine Project, West River Sheet Harbour, Killag River, and Little River. Fish habitat was assessed within West River Sheet Harbour (watercourse N) as Type I and the Killag River (Cameron Flowage) as Type II within the PA.

Potential Atlantic salmon habitat was found to be within 22 tributary watercourses to the three documented salmon bearing watercourses within the PA. Tributary systems were inferred using both field data and NS topographical watercourse mapping. Only tributaries that were observed to have Type I, Type II, and Type III Fish Habitat were counted.

An additional 10 watercourses in the PA were assessed to have potential Atlantic salmon habitat. Potential Atlantic salmon habitat was determined as watercourses with Type I or Type II Fish Habitat without a confirmed or inferred connection to a documented salmon-bearing watercourse.

Fish habitat potential is described based on the categories identified by Beak (1980) and detailed in the NL Guide referenced herein. These classifications are based in some cases on very short sections of watercourses evaluated within the ~~PA~~ Beaver Dam Mine Site and Haul Road only and, therefore, should be considered as preliminary summaries of fish habitat potential, with detailed evaluation necessary during the permitting stages of this Project to confirm fish habitat. Table 6.13-3 below provides a summary of potential Atlantic salmon bearing watercourses.

Table 6.13-3 Summary of Potential Atlantic Salmon-bearing Watercourses

Atlantic Salmon Habitat	Watercourse*	Watershed	Fish Habitat		
			Type I	Type II	Type III
Documented: Salmon presence has been confirmed through the Atlantic Salmon Association.	N (West River Sheet Harbour)	Brandon Lake / Rocky Brook Lake	✓		
	Cameron Flowage (Killag River)	Cameron Flowage		✓	
High Potential:	4	Cameron Flowage		✓	

Atlantic Salmon Habitat	Watercourse*	Watershed	Fish Habitat		
			Type I	Type II	Type III
Watercourses that are confirmed or inferred tributaries to West River Sheet Harbour or Killag River and were observed to have Type I, II or III Fish Habitat.	5 (lower near WL14)	Cameron Flowage		✓	
	7	Cameron Flowage		✓	
	9	Cameron Flowage		✓	
	14	Cameron Flowage		✓	
	B	Tent Lake		✓	
	C	Tent Lake		✓	
	F	Brandon Lake		✓	
	G	Brandon Lake		✓	
	H	Brandon Lake			✓
	I	Brandon Lake		✓	
	J	Brandon Lake		✓	
	L	Brandon Lake	✓		
	M	Brandon Lake		✓	
	P	Lake Alma	✓		
	Q	Lake Alma	✓		
	T	Lake Alma		✓	
	U	Lake Alma		✓	
	V	Lake Alma			✓
	X	Lake Alma		✓	
	Y	Lake Alma		✓	
	Z	Lake Alma		✓	
Potential:	10	Kent Lake		✓	
Watercourses assessed to have Type I and Type II Fish Habitat, but do	12	Cameron Flowage		✓	
	E	Brandon Lake	✓		

Atlantic Salmon Habitat	Watercourse*	Watershed	Fish Habitat		
			Type I	Type II	Type III
not have a topographically mapped connection to a documented Salmon river.	S	Lake Alma		✓	
	AA	Eagles Nest		✓	
	AC	Eagles Nest		✓	
	AD	Eagles Nest	✓		
	AE	Rocky Lake		✓	
	AF	Rocky Lake		✓	
	AH	Rocky Lake	✓		

*Numbered watercourses lie within the mine footprint Beaver Dam Mine Site, lettered watercourses lie along the Haul Road.

Atlantic salmon are highly sensitive to fluctuations in habitat conditions, particularly pH and temperature. As such, many land use practices and impacts to the freshwater ecosystem can affect the abundance and distribution of salmon. Physical barriers (e.g., dams, improperly installed culverts, etc.) can limit the distribution of the species and fish harvesting can affect their abundance. The Nova Scotia Salmon Association, recognizing the impact low pH on salmon in the West River Sheet Harbour, has been operating an acid mitigation project on the West River for over 10 years. This involves a lime dosing station which increases the pH of the water to a suitable range for juvenile salmon. This project has resulted in significant increase in smolt populations and improved overall habitat quality within the West River Sheet Harbour.

~~According to the Nova Scotia Salmon Association (E. Halfyard, pers. comm. 2016), a second lime dosing station is proposed to be installed along the Killag River, which currently provides significant spawning and rearing habitat for Atlantic salmon.~~ The Nova Scotia Salmon Association is currently using lime dosers in order to offset the acidity of watercourses and improve water quality for Atlantic salmon. Two lime dosers are currently in use, they are located within the West River Sheet Harbour (watercourse N) and the Killag River (Figure 6.7-3; Figure 6.7-1). Maintenance of surface water quality and quantity is imperative to the continued success of ongoing salmon restoration efforts in the West River Sheet Harbour, Killag River and their tributaries. For more information regarding The Nova Scotia Salmon Associations acid rain mitigation project refer to Section 6.9.

6.13.3.1.5 **Fish SAR & SOCI Summary**

No fish SAR were observed within the PA. Two priority species of fish were identified during field surveys, and a third species (SU Atlantic salmon) is expected to be present within the PA. No other fish SAR or SOCI were observed and none are expected based on habitat, species distribution, and survey effort completed within the PA.

Touquoy Mine Site

Moose River, within the Touquoy Mine Site, provides habitat for Atlantic salmon and brook trout. Good juvenile and rearing habitat and potential spawning habitat is available for Atlantic salmon. Several juvenile Atlantic salmon were observed, however, these species were believed to be from the landlocked population known to Scraggy Lake. Good adult and juvenile brook trout feeding habitat, fair rearing habitat, and potential spawning habitat is available within Moose River (CRA 2007).

The Nova Scotia Department of Agriculture and Fisheries conducted a fisheries resource study in Scraggy Lake in July of 1975. Fish captured included; brook trout and American eel. Atlantic salmon smolts were recorded during creel census in 1979. Fingerling landlocked Atlantic salmon and brook trout were stocked in Scraggy Lake between 1998-2000 and 1994-1996, respectively (CRA 2007).

6.13.3.2 Priority Vascular Flora Species

The desktop evaluation for priority species of vascular flora revealed that none were identified within 5 km of the PA by ACCDC reports. NSL&F has classified several species as 'location sensitive', meaning their exact locations cannot be provided to proponents in ACCDC reports. Instead, ACCDC will simply indicate whether a location sensitive species is documented within 5 km of the PA. Black ash (*Fraxinus nigra*), a location sensitive vascular flora species, was not documented within 5 km of the PA in ~~either~~ any of the three ACCDC reports (for the ~~mine footprint or the haul road PA~~ Beaver Dam Mine Site, Haul Road, and Touquoy Mine Site).

Table 6.13-4 below provides a list of vascular plant priority species which have elevated potential to be located within the PA based on habitat preferences and known distribution. Species which have been documented within the vicinity of the PA by the Museum of Natural History are highlighted in bold text.

Table 6.13-4 List of priority species with elevated potential to be located within the Project Area

Latin Name	Common Name	SARA, COSEWIC, NSESA Status	S Rank
Lachnanthes caroliniana	Redroot	SARA & COSEWIC Special Concern, NSESA Vulnerable	S2
Potamogeton pulcher	Spotted pondweed	NSESA Vulnerable	S2S3
Fraxinus nigra	Black ash	NSESA Threatened	S1S2
Agalinis paupercula	Small-flowered agalinis		S1
Allium burdickii	Narrow-leaved wild leek		S1?
Allium schoenoprasum	Wild chives		S2
Allium tricoccum	Wild leek		S1
Amelanchier nantucketensis	Nantucket serviceberry		S1
Anemone Canadensis	Canada anemone		S2
Arabis drummondii	Drummond's rockcress		S2

Latin Name	Common Name	SARA, COSEWIC, NSESA Status	S Rank
Asclepias incarnata ssp. Pulchra	Swamp milkweed		S3?
Barbarea orthoceras	American yellow rocket		S1
Bartonia virginica	Yellow bartonia		S3
Betula borealis	Northern birch		S2
Betula pumila var. pumila	Bog birch		S2S3
Betula pumila var. renifolia	Bog birch		S1?
Betula michauxii	**Michaux's dwarf birch**		**S2**
Botrychium lanceolatum var. angustisegmentum	Lance-leaf grape-fern		S2S3
Botrychium lunaria	Common moonwort		S1
Bromus latiglumis	Broad-glumed brome		S1
Cardamine pratensis var. angustifolia	Cuckoo flower		S1
Carex adusta	Lesser brown sedge		S2S3
Carex alopecoidea	Foxtail sedge		S1
Carex foenea	Fernald's hay sedge		S3?
Carex granularis	Limestone meadow sedge		S1
Carex grisea	Inflated narrow-leaved sedge		S1
Carex haydenii	Hayden's sedge		S1
Carex lapponica	Lapland sedge		S1?
Carex peckii	White-tinged sedge		S2?
Carex plantaginea	Plantain-leaved sedge		S1
Carex rosea	Rosy sedge		S3
Carex tribuloides	Blunt broom sedge		S3?
Carex tribuloides var. tribuloides	Blunt broom sedge		S3?

Latin Name	Common Name	SARA, COSEWIC, NSESA Status	S Rank
Carex vacillans	Estuarine sedge		S1S3
Carex viridula var. elatior	Greenish sedge		S1
Caulophyllum thalictroides	Blue cohosh		S2
Crataegus robinsonii	Robinson's hawthorn		S1?
Crataegus submollis	Quebec hawthorn		S1?
Cyperus lupulinus	Hop flatsedge		S1
Cyperus lupulinus ssp. Macilentus	Hop flatsedge		S1
Cypripedium parviflorum	Yellow lady's-slipper		S2S3
Cypripedium reginae	**Showy lady's-slipper**		**S2**
Dichanthelium acuminatum var. lindheimeri	Woolly panic grass		S1?
Eleocharis erythropoda	Red-stemmed spikerush		S1
Eleocharis ovata	Ovate spikerush		S2?
Empetrum eamesii	Pink crowberry		S3
Empetrum eamesii ssp. Atropurpureum	Pink crowberry		S2S3
Empetrum eamesii ssp. Eamesii	Pink crowberry		S2S3
Epilobium strictum	Downy willowherb		S3
Equisetum hyemale	Common scouring-rush		S3S4
Equisetum hyemale var. affine	Common scouring-rush		S3S4
Equisetum palustre	Marsh horsetail		S1
Equisetum variegatum	Variegated horsetail		S3
Erigeron philadelphicus	Philadelphia fleabane		S2
Eriophorum gracile	Slender cottongrass		S2
Eupatorium dubium	Coastal plain joe-pye-weed		S2

Latin Name	Common Name	SARA, COSEWIC, NSESA Status	S Rank
Festuca prolifera	Proliferous fescue		S1S2
Fraxinus pennsylvanica	Red ash		S1
Galium aparine	Common bedstraw		S2S3
Galium obtusum ssp. Obtusum	Blunt-leaved bedstraw		S2S3
Geocaulon lividum	Northern comandra		S3
Geranium bicknellii	Bicknell's crane's-bill		S3
Goodyera pubescens	Downy rattlesnake-plantain		S2
Halenia deflexa ssp. brentoniana	Spurred gentian		S1?
Hieracium paniculatum	Panicled hawkweed		S3
Hieracium scabrum var. leucocaule	Rough hawkweed		S1
Hordeum brachyantherum	Meadow barley		S1
Humulus lupulus var. lupuloides	Common hop		S1?
Hypericum dissimulatum	Disguised St John's-wort		S2S3
Hypericum majus	Large St John's-wort		S2
Impatiens pallida	Pale jewelweed		S2
Isoetes acadiensis	Acadian quillwort		S3
Juncus dudleyi	Dudley's rush		S3
Juncus subcaudatus	Woods-rush		S3
Juncus subcaudatus var. planisepalus	Woods-rush		S3
Limosella australis	Southern mudwort		S3
Liparis loeselii	Loesel's twayblade		S3S4
Listera australis	Southern twayblade		S3

Latin Name	Common Name	SARA, COSEWIC, NSESA Status	S Rank
Lycopodium complanatum	Northern clubmoss		S3S4
Lycopodium sabinifolium	Ground-fir		S3?
Lysimachia quadrifolia	Whorled yellow loosestrife		S1
Minuartia groenlandica	Greenland stitchwort		S3
Myriophyllum farwellii	Farwell's water milfoil		S2
Ophioglossum pusillum	Northern adder's-tongue		S2S3
Panicum dichotomiflorum var. puritanorum	Fall panic grass		S1?
Panicum tuckermanii	Tuckerman's panic grass		S3S4
Pilea pumila	Dwarf clearweed		S1
Pilea pumila var. pumila	Dwarf clearweed		S1
Piptatherum canadense	Canada rice grass		S2
Plantago rugelii	Rugel's plantain		S2S3
Plantago rugelii var. rugelii	Rugel's plantain		S2S3
Platanthera flava var. herbiola	Pale green orchid		S2
Platanthera grandiflora	Large purple fringed orchid		S3
Polygala sanguinea	Blood milkwort		S2S3
Polygonum careyi	Carey's smartweed		S1
Polypodium appalachianum	Appalachian polypody		S3~~?~~
Potamogeton obtusifolius	Blunt-leaved pondweed		S3
Potamogeton zosteriformis	Flat-stemmed pondweed		S2S3
Potentilla Canadensis	Canada cinquefoil		S2S3
Potentilla canadensis var. Canadensis	Canada cinquefoil		S2S3
Proserpinaca palustris	Marsh mermaidweed		S3
Pyrola asarifolia	Pink pyrola		S3

Latin Name	Common Name	SARA, COSEWIC, NSESA Status	S Rank
Pyrola asarifolia ssp. Asarifolia	Pink pyrola		S3
Ranunculus gmelinii+	Gmelin's water buttercup		S3
Ranunculus pensylvanicus	Pennsylvania buttercup		S1
Ranunculus sceleratus	Cursed buttercup		S1S2
Ranunculus sceleratus var. sceleratus	Cursed buttercup		S1S2
Rhamnus alnifolia	**Alder-leaved buckthorn**		**S3**
Rhinanthus minor ssp. groenlandicus	Little yellow rattle		S1
Rosa acicularis	Prickly rose		S1
Rosa acicularis ssp. Sayi	Prickly rose		S1
Rudbeckia laciniata	Cut-leaved coneflower		S1S2
Rudbeckia laciniata var. gaspereauensis	Cut-Leaved coneflower		S1S2
Rumex persicarioides	Peach-leaved dock		S2?
Salix pedicellaris	Bog willow		S2
Salix sericea	Silky willow		S2
Salix serissima	Autumn willow		S1
Saxifraga cernua	Nodding saxifrage		S1
Schizaea pusilla	Little curlygrass fern		S3
Sisyrinchium atlanticum	Eastern blue-eyed-grass		S3S4
Sisyrinchium fuscatum	Coastal plain blue-eyed-grass		S1
Solidago latissimifolia	Elliott's goldenrod		S3S4
Spiraea septentrionalis	Northern meadowsweet		S1?
Stellaria crassifolia	Fleshy stitchwort		S1
Stellaria crassifolia var. crassifolia	Fleshy stitchwort		S1

Latin Name	Common Name	SARA, COSEWIC, NSESA Status	S Rank
Stellaria longifolia	Long-leaved starwort		S2
Stellaria longifolia var. longifolia	Long-leaved starwort		S2
Symphyotrichum boreale	Boreal aster		S2?
Symphyotrichum undulatum	Wavy-leaved aster		S2
Thalictrum venulosum	Northern meadow-rue		S1
Torreyochloa pallida var. pallida	Pale false manna grass		S1
Trichostema dichotomum	Forked bluecurls		S1
Trisetum spicatum	Narrow false oats		S3S4
Utricularia ochroleuca	Yellowish-white bladderwort		S1
Vaccinium caespitosum	Dwarf bilberry		S3
Vaccinium ovalifolium	Oval-leaved bilberry		S1
Vaccinium uliginosum	Alpine bilberry		S3
Vallisneria Americana	Wild celery		S2
Veratrum viride	Green false hellebore		S1
Veronica serpyllifolia ssp. Humifusa	Thyme-leaved speedwell		S2S3
Viola nephrophylla	**Northern bog violet**		**S2**
Viola sagittata	Arrow-leaved violet		S3S4
Viola sagittata var. ovata	Arrow-leaved violet		S3S4
Zizia aurea	**Golden alexanders**		**S1**

Vascular species observed within the ~~Project Area~~ Beaver Dam Mine Site and Haul Road

A total of 294 species of vascular flora have been identified in field assessments within the Beaver Dam Mine Site and Haul Road. A comprehensive list of species identified is provided in **Appendix K.1** and discussed in Section 6.10.3.3. No SAR vascular plant species were observed. Five plants are priority species (SOCI), based on provincial status ranks (S3 and S3S4). These SOCI identified within the ~~PA~~ Beaver Dam Mine Site and Haul Road are outlined in Table 6.13-5.

Table 6.13-5 SAR and SOCI vascular flora species observed within the Project Area

Scientific name	Common name	COSEWIC, SARA, NSESA	S-Rank	Habitat on Project Area
Carex wiegandii	Wiegand's sedge	-	S3	Observed in three locations, all within the ~~mine footprint PA~~ Beaver Dam Mine Site. Within wetlands 12 and 33, and in one upland location between wetlands 48 and 13.
Goodyera repens	Lesser rattlesnake plantain	-	S3	Observed in one location on the upland margin of wetland 29, within the ~~mine footprint PA~~ Beaver Dam Mine Site.
Listera australis	Southern twayblade	-	S3	Observed in wetlands 80, 115, 127, 129, 135, 137, 147, and north of 136, all within the Haul Road ~~PA~~. Twayblade was typically observed in clumps of 1-5 individuals.
Polypodium appalachianum	Appalachian polypody	-	S3	Observed immediately adjacent to wetland 137 growing on a boulder within the Haul Road ~~PA~~.
Vaccinium corymbosum	Highbush blueberry	-	S3S4	Observed in one location within wetland 157 within the Haul Road ~~PA~~.

6.13.3.2.1 Wiegand's Sedge

Wiegand's sedge (*Carex wiegandii)* was identified in three locations within the ~~mine footprint PA~~ Beaver Dam Mine Site. This species is a member of the Stellulatae section of the genus *Carex*. This species grows in a tuft formation in acidic peatlands, black spruce and larch bogs, and conifer and alder thickets. Within the PA, it was located in two wetlands and one nearby upland area. Wetland 12 is an open treed swamp with mixed canopy coverage and organic soils up to 35 cm deep. The wetland has some disturbance from timber harvesting, resulting in an open canopy. Wetland 33 is a coniferous treed swamp with organic soils exceeding 40 cm depth. This wetland has also experienced some timber harvesting yet has a relatively diverse vegetation community including *Carex Wiegandii*. The upland habitat in which Wiegand's sedge was identified is a disturbed habitat as well, adjacent to a watercourse which connects wetlands 48 and 13. In Nova Scotia, Wiegand's sedge is considered vulnerable by ACCDC (S3). Wiegand's sedge grows in clumps or clusters of many individual plants. Where C*. wiegandii* was observed, the population consisted of 1-5 clumps of individuals, covering approximately 0.5-1 m^2.

6.13.3.2.2 Lesser Rattlesnake Plantain

Lesser rattlesnake plantain (*Goodyera repens*) is a small, inconspicuous member of the orchid family (Orchidaceae), found in coniferous forests throughout Nova Scotia. Within the PA, two individuals were identified on the upland edge of wetland 29, in a coniferous forest, adjacent to recent timber harvesting. Ground cover was sparse, which is typical habitat for this species. Within Nova Scotia, it is infrequent, but can be numerous where found based on its rhizomatous grown pattern. In Nova Scotia, lesser rattlesnake plantain is considered vulnerable by ACCDC (S3).

6.13.3.2.3 **Southern Twayblade**

Southern twayblade (*Listera australis*, syn. *Neottia bifolia*) is a small inconspicuous member of the orchid family (Orchidaceae), which has been found in eight locations (wetlands 80, 115, 129, 137, 135, 147, and 161, and in upland habitat north of wetland 136) within the PA. This species belongs to the Atlantic Coastal Plain Flora community and its primary habitat is shaded sphagnum mosses in bogs or coniferous treed swamps. Within the PA, it was typically found in clusters of 5-10 individual plants at the base of small sphagnum hummocks in treed swamps. Its distribution is scattered throughout Nova Scotia and it is considered vulnerable by the ACCDC (S3).

6.13.3.2.4 **Appalachian Polypody**

Appalachian polypody (*Polypodium appalachianum*) is a member of the Polypody fern family (Polypodiaceae). Its habitat is restricted to cliffs, rocky slopes, bedrock outcrops, and boulders. A population of approximately seven individuals was identified in upland habitat adjacent to wetland 137 (a mixed wood treed swamp) within the Haul Road ~~PA~~. The distribution throughout the province is unclear and it is considered vulnerable by the ACCDC (S3).

6.13.3.2.5 **Highbush Blueberry**

Highbush blueberry (*Vaccinium corymbosum*) is an ericaceous shrub (family Ericaceae) in the Atlantic Coastal Plain Flora community. This species is usually limited to bogs, rock barrens, and lakeshores around Digby and Queens Counties, but it can be found in other locations with remnant populations of Atlantic Coastal Plain Flora. Within the Haul Road ~~PA~~, two individuals were identified in wetland 157. This wetland is a treed swamp which is immediately adjacent to Upper Kidney Lake. This species is considered vulnerable to apparently secure by the ACCDC (S3S4).

6.13.3.2.6 **Vascular Flora SAR & SOCI Summary**

No vascular flora SAR were identified and five vascular plant SOCI were identified within the ~~PA~~ Beaver Dam Mine Site and Haul Road. Three additional species were identified as having elevated potential to be located within the ~~PA~~ Beaver Dam Mine Site and Haul Road based on habitat preference and known distribution. These species, listed in Table 6.13-4, are redroot (*Lachnanthes caroliniana*, SARA & COSEWIC special concern, NSESA vulnerable), spotted pondweed (*Potamogeton pulcher*, NSESA vulnerable), and black ash (*Fraxinus nigra*, NSESA threatened). The preferred habitats for each of these species were focused on during all vegetation, habitat, and wetland delineation surveys. None of these species were identified within the ~~PA~~ Beaver Dam Mine Site and Haul Road. All priority vascular plant species identified in the Beaver Dam Mine Site and Haul Road are shown on Figures 6.13-2 and 6.13-2A to 6.13-2L.

Touquoy Mine Site

No SOCI plants were observed during vascular plant surveys conducted in August 2004, May and June 2005, and September 2006 as part of the EARD process (CRA 2007).

One black ash (*Fraxinus nigra*) was discovered within the Touquoy Mine Site incidentally during wetland surveys in September 2015. The permitted loss of the Black Ash as part of Touquoy Mine Site development occurred in the Spring of 2016, after the Mi'kmaq of Nova Scotia were consulted.

6.13.3.3 Priority Lichen Species

The desktop evaluation for priority species of lichens revealed that boreal felt lichen has been documented within 5 km of the PA in ~~both~~ all ACCDC reports (one for the ~~mine footprint~~ Beaver Dam Mine Site, ~~and~~ one for the Haul Road and one for the Touquoy Mine Site). The boreal felt lichen (*Erioderma pedicellatum*) is listed as endangered by COSEWIC, SARA, and NSESA, and ranked S1S2 by the ACCDC. NSL&F has not determined any lichen species to be 'location sensitive'. Table 6.13-6 below provides a list of lichen priority species which have elevated potential to be located within the PA, based on habitat preferences and known distribution. No lichen species were documented in the report provided by the NS Museum of Natural History.

Table 6.13-6 Lichen species with elevated potential to be located within the Project Area

Latin Name	Common Name	SARA, COSEWIC, NSESA	S-Rank
rioderma mollissimum	Graceful felt lichen	SARA, COSEWIC, NSESA Endangered	S1S2
Erioderma pedicellatum (Atlantic pop.)	Boreal felt lichen - Atlantic pop.	SARA, COSEWIC, NSESA Endangered	~~S1S2~~ S1
Degelia plumbea	Blue felt lichen	SARA Special Concern, COSEWIC Special Concern, NSESA Vulnerable	~~S2~~ S3
Anzia colpodes	Black-foam lichen		S3
Cladina stygia	Black-footed reindeer lichen		~~S2S3~~ S3?
Collema furfuraceum	Blistered tarpaper lichen		~~S3~~ S4S5
Fuscopannaria leucosticte	Rimmed shingles lichen		~~S1S2~~ S2S3
Leptogium corticola	Blistered jellyskin lichen		~~S2S3~~ S3
Physconia detersa	Bottlebrush frost lichen		~~S2S3~~ S3S4
Sticta fuliginosa	Peppered moon lichen		S3

Surveys for lichen were completed on February 19, May 2-5, May 8, and 23, 2015 as well as September 18, 2018 and October 29, 2018 within the ~~mine footprint PA~~ Beaver Dam Mine Site and surrounding Lichen Study Area (LSA) and May 25th and 26th, 2016 within the ~~haul road PA~~ Haul Road. ~~Six~~ Eleven priority lichen species were observed within the broader LSA as described in Section 6.10.3.4. Of the ~~six~~ eleven species, three lichen SAR were observed, as well as ~~three~~ eight SOCI species, as provided in

Table 6.13-7. Of the three SAR identified, two are located within the PA. Blue felt lichen was observed in the ~~mine footprint and haul road PA~~ Beaver Dam Mine Site and Haul Road and in the broader LSA, while frosted glass whiskers was identified within the ~~mine footprint PA~~ Beaver Dam Mine Site. Boreal felt lichen was identified in the LSA originally by the Project Team, but not within the ~~haul road or mine footprint PA~~. However, upon return in 2016 and 2017, the three observed locations of the boreal felt lichen were no longer present.

Locations where lichen SAR and SOCI species were observed are shown on Figures 6.13-2 and 6.13-2A to 6.13-2L. Updates to lichen observations (individual observations and species) within the following table are due to additional surveys required in new portions of the PA due to micro siting of Project infrastructure.

Table 6.13-7 SAR and SOCI Lichen Species Observed within the Lichen Study Area

Common name	*Scientific name*	SARA, COSEWIC, NSESA	S-Rank	Location in the PA
Blistered jellyskin lichen	*Leptogium corticola*	-	~~S2S3~~ S3	**~~Mine Footprint PA~~ Beaver Dam Mine Site:** Four individuals observed within the ~~mine footprint PA~~ Beaver Dam Mine Site (east of wetland 29, upland island in wetland 2, on upland edge west of wetland 61, and in wetland 4). One individual observed north of the PA inside LSA.
Blistered tarpaper lichen	*Collema nigrescens*	-	~~S2S3~~ S3	**Outside Project PA, inside LSA:** Identified in one location northeast of Cameron Flowage, outside the PA, in the LSA.
Blue felt lichen	*Degelia plumbea*	SARA and COSEWIC Special Concern, NSESA Vulnerable	~~S2~~ S3	**~~Mine Footprint~~ Beaver Dam Mine Site and Haul Road ~~PA~~ and LSA:** Identified in ~~26~~ 28 locations within the ~~haul road PA~~ Haul Road (1), ~~mine footprint PA~~ Beaver Dam Mine Site (~~13~~14), ~~and~~ broader LSA (~~12~~ 10), and immediately adjacent the Haul Road (3).
Boreal felt lichen	*Erioderma pedicellatum*	Endangered	~~S1S2~~ S1	**Outside Project PA, inside LSA:** Historically identified by the Project Team in three locations to the southwest of the ~~mine footprint PA~~ Beaver Dam Mine Site, in the LSA, within an un-delineated portion of Wetland 29. Follow up surveys in 2016 and 2017 confirmed its absence.

Common name	*Scientific name*	SARA, COSEWIC, NSESA	S-Rank	Location in the PA
Frosted glass-whiskers lichen	*Sclerophora peronella*	SARA, COSEWIC Special Concern	S1?	**~~Mine Footprint PA~~ Beaver Dam Mine Site:** Identified in ~~seven~~ eight locations within the ~~mine footprint PA~~ Beaver Dam Mine Site, adjacent to Wetlands 2 and 29 and one individual east of Wetland 216.
Peppered moon lichen	*Sticta fuliginosa*	-	S3	**~~Mine Footprint PA~~ Beaver Dam Mine Site, and LSA:** Two individuals north of wetland 2, 1 in eastern end of Wetland 17 and one north of wetland 10 within ~~mine footprint PA~~ Beaver Dam Mine Site. ~~2~~ One additional individual~~s~~ ~~were~~ was observed southwest of the PA in the LSA.
Eastern candlewax lichen	*Ahtiana aurescnes*	-	S2S3	**Beaver Dam Mine Site:** Two locations of three individuals were identified within wetland 10 and 14.
Slender monk's hood lichen	*Hypogymnia vittata*	-	S3S4	**Beaver Dam Mine Site:** Two locations of a total of five individuals were found within Wetland 212.
Salted shell lichen	*Coccocarpia palmicola*	-	S3S4	**Beaver Dam Mine Site and LSA:** Four locations of Salted Shell Lichen were identified within the Beaver Dam Mine Site. Two locations are within wetland 212, one is in wetland 4, and one is on an upland island within wetland 29. Seven other observations were made outside of the Beaver Dam Mine Site yet within the LSA.
Powdered fringe lichen	*Heterodermia speciosa*	-	S3	**Beaver Dam Mine Site:** One individual located east of Wetland 216.

Common name	*Scientific name*	SARA, COSEWIC, NSESA	S-Rank	Location in the PA
Fringe lichen	*Heterodermia neglecta*	-	S3S4	**Beaver Dam Mine Site:** One individual located northeast of Wetland 216.

6.13.3.3.1 **Blistered Jellyskin Lichen**

Blistered jellyskin lichen *(Leptogium corticola*) was observed in five locations growing on red maple along the edges of wetlands and lacustrine habitats. This species is a foliose lichen belonging to the Collemataceae family. This lichen is found primarily on the base of hardwood trees in moist environments, but occasionally can be found growing on rocks and boulders. Four observations occurred within the ~~mine footprint PA~~ Beaver Dam Mine Site while one was observed outside the PA in the broader LSA. Of the four found in the ~~PA~~ Beaver Dam Mine Site, specimens were observed in wetland 4 and in close proximity to wetland 61 which were both a fen-mixed wood swamp wetland and within the mine footprint. Additional observations occurred on the edges of wetlands 2 and 29, which are both mixed-wood swamp – bog complexes. In Nova Scotia, blistered jellyskin lichen is considered ~~imperiled-vulnerable~~ uncommon in the province by the ACCDC (~~S2S3~~ S3). All observations were associated with the ~~mine footprint~~ Beaver Dam Mine Site and broader LSA; none were observed within the ~~haul road PA~~ Haul Road.

6.13.3.3.2 **Blistered Tarpaper Lichen**

Blistered tarpaper lichen (*Collema nigrescens*) was observed at one location spreading over a length of 4 m over a red maple on a slope leading to a lake/clear-cut, approximately 200 m northeast of the northern extent of Cameron Flowage, outside of the PA within the broader LSA. This species is a foliose lichen belonging to the Collemataceae family. This species is typically found growing on the bark of poplar trees and other hardwood trees in mature forests. None were observed within the ~~haul road PA~~ Haul Road. In Nova Scotia, blistered tarpaper lichen is considered ~~imperiled-vulnerable~~ uncommon in the province by the ACCDC (~~S2S3~~ S3).

6.13.3.3.3 **Blue Felt Lichen**

Blue felt lichen (*Degelia plumbea*) was observed in twenty-six locations on mature red maple trees in a variety of habitats, including wetland edges, edges of clear-cut, and lacustrine habitat, which were within and in proximity to the PA. This species is typically found in mature hardwood forests in varying moisture regimes. This species is a foliose lichen and a member of the Pannariaceae family.

Of the ~~26~~ 28 observations, ~~ten~~ fourteen were located within the ~~mine footprint PA~~ Beaver Dam Mine Site and ~~three~~ one ~~were~~ was located within the ~~haul road PA~~ Haul Road in intact forests where new road construction will be required. ~~The additional thirteen~~ Ten observations were in the broader LSA surrounding the ~~mine footprint PA~~ Beaver Dam Mine Site. The remaining three blue felt lichen were observed immediately adjacent the Haul Road, outside of the PA. ~~Six~~ Seven observations of this species were documented on the edge of and within Wetland 14, which is a swamp-bog-fen wetland complex in the ~~mine footprint~~ Beaver Dam Mine Site. ~~Two~~ Three separate observations were documented in Wetland 17, a tall-shrub swamp – treed bog complex and one observation within Wetland 4. Another observation was documented growing in upland habitat, 17 m southwest of Wetland 61, which is a shrub-fen complex, 9 m north of Wetland 2, and an additional observation was documented 5 m south of Wetland 29, which is a large swamp-fen-bog complex. ~~Within the haul road PA~~. The individual observed within the Haul Road was found ~~One population~~ on the edge of Wetland 112, a mixed-wood treed swamp ~~within the haul road PA~~. The blue felt lichen found outside of the Haul Road component of the PA were~~, this species was~~ documented on mature red maple trees in a mature mixed wood forest 350 and 170 m northwest of wetland 126 and 90 m south of wetland 116. This species is listed as special concern by COSEWIC and SARA and vulnerable by NSESA and S3 by the ACCDC.

An At-Risk-Lichens Special Management Practices (SMP) was released by NSL&F on May 23, 2018. The At-Risk-Lichens SMP lists blue felt lichen as a rare and sensitive species (NSRNR, 2018).

6.13.3.3.4 **Boreal Felt Lichen**

Boreal felt lichen (*Erioderma pedicellatum*) was observed in three locations on mature balsam fir stands on wetland edges outside of the ~~mine footprint PA~~ Beaver Dam Mine Site south of wetland 29 and within the broader LSA (within an un-delineated portion of wetland 29) on May 8, 2015. Typically, this species is found on mature balsam fir stands, but it has been documented on spruce, red maple and birch. Habitat within portions of the PA appeared to be suitable for this species as indicated by two foliose lichen species commonly found in boreal felt lichen habitat which were present throughout the LSA and within the PA. These two foliose lichens were salted shell lichen (*Coccocarpia palmicola*) and textured lungwort (*Lobaria scrobiculata*). However, boreal felt lichen was not observed with the ~~mine footprint or haul road~~ PA. Additionally, a follow up survey conducted in the fall of 2016 determined that all three thalli were no longer present. Their absence was reconfirmed on December 4, 2017. Boreal felt lichen is a red-listed, critically endangered species worldwide. It is listed as endangered by COSEWIC, SARA, ~~and~~ NSESA, and S1 by the ACCDC.

The *Amended Recovery Strategy for the Boreal Felt lichen (Erioderma pedicellatum) Atlantic population, in Canada* (ECCC, 2018) was released in 2018. Micro siting of Project infrastructure was completed based on the identification of the species' updated critical habitat as outlined within the Amended Recovery Strategy (ECCC, 2018). Boreal felt lichen is also listed within the NSL&F At-Risk-Lichens SMP (NSDNR, 2018). This SMP updated and replaced the previous SMP (2012).

6.13.3.3.5 **Frosted Glass-whiskers Lichen**

Frosted glass-whiskers lichen (*Sclerophora peronella*) was observed in ~~seven~~ eight locations on red maple trees primarily in upland habitat, adjacent to wetlands 2 ~~and~~ 29 and 216 within the ~~mine footprint PA~~ Beaver Dam Mine Site. This species belongs to the Coniocybaceae family and is a very small (1 mm) fruticose lichen and typically grows in old growth forests with relatively stable humidity levels and usually on the heartwood of hardwood trees. It very rarely grows on bark. Four separate populations were found scattered along the edge of the central inland inclusion within wetland 2. Populations ranged from approximately 10 individual lichens covering less than 0.5 cm^2 to an excess of 200 individuals over an area measuring 240 cm^2. This species was also found west of wetland 2 in upland forests. An additional two observations were documented 20 m east of wetland 29 and 20 m north of the southern wetland/upland boundary of the central upland inclusion in wetland 29. Areas within the ~~mine foot print and haul road PA~~ Beaver Dam Mine Site and Haul Road contained moderately suitable habitat for this species, primarily along the proposed new section of the Haul Road (Section 3B; Figure 2.2-2) where more mature hard wood stands with exposed heartwood were found. Despite the presence of suitable habitat within the ~~haul road PA~~ Haul Road, no specimens were observed. This species is listed as special concern by COSEWIC and SARA.

This species was not identified as having a high likelihood to be present within the PA during the desktop evaluation for rare lichens. This is because it is outside of the previously documented range of this species. According to the Identification and Information Guide to Species at Risk in Nova Scotia (Mersey Tobeatic Research Institute, 2008), Frosted glass whiskers had only been documented in two locations in northwestern Cape Breton Island (Inverness County). This presumed range of this species meant it was excluded from the priority species list, based on known distribution at the time of the desktop review. Since the publication of this Guide, the number of records of this species in Nova Scotia has increased. According to the ACCDC (J. Churchill, Pers. Comm., 2016), this species currently has 30 confirmed records in the database, throughout the province. The Project Team confirmed with the lichen specialist that completed the Beaver Dam surveys that he has submitted another 35 records to ACCDC for inclusion into their database. He also confirmed that this species is largely over looked and under-reported, because of the very small size and cryptic nature of the species.

Similarly to blue felt lichen, The At-Risk-Lichens SMP (NSDNR, 2018) lists frosted glass-whiskers lichen as a rare and sensitive species.

6.13.3.3.6 Peppered Moon Lichen

Peppered moon lichen (*Sticta Fuliginosa*) was observed primarily on mature red maples near the boundary and within wetland habitat. ~~Two~~ Four populations were observed within the ~~mine footprint PA~~ Beaver Dam Mine Site and ~~two were~~ one was observed outside the PA within the broader LSA. Within the PA, *S. fuliginosa* was observed in two locations north of ~~on the boundary of~~ Wetland 2, north of Wetland 10, and inside wetland 17. Wetland 2 is a large complex consisting of a treed-bog, graminoid bog, and low shrub bog, Wetland 10 is a low shrub fen, and Wetland 17 is a complex consisting of a tall-shrub swamp and coniferous treed bog. In Nova Scotia, peppered moon lichen is considered vulnerable by ACCDC (S3). No observations of this species were documented within the ~~haul road PA~~ Haul Road.

6.13.3.3.7 Eastern Candlewax Lichen

Eastern candlewax lichen (*Ahtiana aurescnes*) was observed on balsam fir along the edge habitat of Wetlands 10 and 14, both within the Beaver Dam Mine Site. Wetland 10 is a low shrub fen and Wetland 14 is a complex comprised of shrub bog, mixed wood treed swamp, and low shrub fen. The observation of eastern candlewax lichen in Wetland 14 occurred in the shrub bog portion of this complex. The ACCDC identifies eastern candlewax lichen as S2S3. No observations of this species were documented within the Haul Road.

6.13.3.3.8 Slender Monk's Hood Lichen

Two locations of a total of five individuals of slender monk's hood lichen (*Hypogymnia vittata*) were within Wetland 212 in the Beaver Dam Mine Site. Both populations were found on black spruce within the treed swamp. Slender monk's hood lichen is a foliose lichen ranked as S3S4 by the ACCDC. This lichen was not observed incidentally or during dedicated surveys along the Haul Road.

6.13.3.3.9 Salted Shell Lichen

According to Nash et al. (2002), salted shell lichen (*Coccocarpia palmicola)* inhabit rocks and soil in moist habitats as well as trees. Salted shell lichen was observed within the Beaver Dam Mine Site and outside of the Beaver Dam Mine Site but inside the LSA. No observations of this species were documented within the Haul Road. Within the Beaver Dam Mine Site four locations of salted shell lichen were identified. Two locations are within Wetland 212, one is in Wetland 4, and one is on an upland island within Wetland 29.

One of the two populations within Wetland 212 appeared to be unhealthy and was observed on a dying black spruce. In addition to these observations, seven other specimens were observed within the broader LSA. Salted shell lichen is listed as S3S4 by the ACCDC.

6.13.3.3.10 **Powdered Fringe Lichen**

According to Nash et al. (2002), powdered fringe lichen (*Heterodermia speciosa*) are primarily found on moist rocks or on tree trucks in humid climates. Within Beaver Dam Mine Site, this lichen was found on a mature red maple, east of Wetland 216. No observations of this species were documented within the Haul Road. Powdered fringe lichen is ranked as S3 by the ACCDC.

6.13.3.3.11 **Fringe Lichen**

An individual fringe lichen (*Heterodermia neglecta*) was found northeast of Wetland 216, 13 m south of the Killag River on a red maple. No observations of this species were documented within the Haul Road. Fringe lichen is ranked as S3S4 by the ACCDC.

6.13.3.3.12

6.13.3.3.13 **Lichen SAR & SOCI Summary**

While the specific habitat requirements of each of these priority species varies slightly, the common thread between each of these species' habitat requirements is mature to over-mature forests. Stand age is one of the greatest determinants of lichen diversity (McMullin, Duinker, Cameron, Richardson, & Brodo, 2008). Within the ~~mine footprint PA~~ Beaver Dam Mine Site, mature to over-mature stands are infrequent, with the majority of the PA having been harvested for timber production. Mature to over-mature forests within the ~~mine footprint PA~~ Beaver Dam Mine Site that remain are typically associated with large wetland complexes, which are often avoided during timber harvesting. Mature to over-mature forest suitable for rare lichens is present within the ~~haul road PA,~~ Haul Road, primarily where the proposed route involves new construction. No other species of non-vascular flora were identified within the PA.

In total, ~~six~~ nine priority lichen species were observed during lichen surveys (3 SAR and ~~3~~ 6 SOCI). Of the 3 SAR identified, two are located within the PA. Blue Felt lichen was observed in the ~~mine footprint and haul road PA~~ the Beaver Dam Mine Site, Haul Road and in the broader LSA, while Frosted Glass Whiskers was identified within the ~~mine footprint PA~~ Beaver Dam Mine Site. Boreal Felt Lichen was identified in the LSA, but not within the ~~haul road or mine footprint~~ PA. The locations of all priority lichen species documented within and adjacent to the PA are provided on Figures 6.13-2 and 6.13-2A to 6.13-2L.

Touquoy Mine Site

Lichen surveys conducted in the Touquoy Mine Site in 2004 and 2005 as part of the EARD process found the presence of blue felt lichen (*Degelia plumbea*). An additional lichen survey in 2007 found seven additional SOCI including; salted shell lichen (*Coccocarpia palmicola*), corrugated shingles lichen (*Fuscopannaria ahlneri*), powdered fringe lichen (*Heterodermia speciosa*), blistered jellyskin lichen (*Leptogium corticola*), blue-gray moss shingle lichen (*Moelleropsis nebulosa*), naked kidney lichen (*Nephroma bellum*), and peppered moon lichen (*Sticta fuliginosa*) (CRA 2007).

6.13.3.4 Priority Terrestrial Mammal Species

The desktop evaluation for priority species of terrestrial fauna revealed that mainland moose (*Alces americanus)* has been documented within 5 km of the PA by the ACCDC. Three records were available for moose within 5 km of the ~~mine footprint PA~~ Beaver Dam Mine Site, while the mainland moose was not documented within 5 km of the ~~haul road PA~~ Haul Road or the Touquoy Mine Site. Mainland moose are listed as endangered under the NSESA and is provincially ranked S1.

NSL&F has determined that bat hibernacula sites are location sensitive. No bat hibernaculum were documented within 5 km of the PA by the ACCDC. The Project Team reviewed the Recovery Strategy for Little Brown Myotis, Northern Myotis, and Tri-colored Bat in Canada (2015), which confirmed that no known critical habitat (hibernacula) is located in the vicinity of the PA.

Table 6.13-8 below provides a list mammal priority species which have elevated potential to be located within the PA, based on habitat preferences and known distribution. No mammal species were documented in the report provided by the Museum of Natural History.

Table 6.13-8 Mammal species with elevated potential to be identified within the Project Area

Latin Name	Common Name	SARA, COSEWIC, NSESA Status	S Rank
Perimyotis subflavus	Eastern pipistrelle	Endangered	S1
Lasiurus borealis	Eastern red bat		S1
Lasiurus cinereus	Hoary bat		S1
Myotis lucifugus	Little brown myotis	Endangered	S1
Sorex maritimensis	Maritime shrew		S3
Alces alces americanus	Mainland moose	Endangered	S1
Myotis septentrionalis	Northern long-eared myotis	Endangered	S1
Microtus chrotorrhinus	Rock vole		S2
Lasionycteris noctivagans	Silver-haired bat		S1

6.13.3.4.1 **Mainland Moose**

The mainland moose (*Alces alces americana*) is listed as endangered under NSESA and considered S1, or critically imperiled, by the ACCDC. The moose is the largest member of the deer family (Cervidae), which prefers boreal forest and mixed wood habitats with an abundant food source of young twigs and stems from deciduous trees and shrubs. As a large mammal, they are prone to thermal stress in the summer, often seeking refuge in coniferous forests with full canopy cover. As adept swimmers, they often forage for submerged aquatic vegetation during the summer as well, which provide minerals critical for antler growth. During winter, their long legs and large bodies allow them to move through deep snow, relatively unhindered by cold weather, which may be restrictive to smaller Cervids such as white-tailed deer.

While moose habitat preferences can change as the abundance of available habitat changes (Osko, Hiltz, Hudson, & Wasel, 2004), and habitat selection shows a high degree of variability among individuals (McLaren, Taylor, & Luke, 2009), moose generally require large areas with diverse habitat types (Snaith & Beazley, 2004). Moose habitat preferences are correlated with forage and cover requirements, as well as breeding behaviours (Peek, Urich, & Mackie, 1976). Early successional deciduous vegetation is the main source of moose forage, food types often associated with open or disturbed areas (Snaith, Beazley, MacKinnon, & Duinker, 2002; Snaith & Beazley, 2004; Parker, 2003). The presence of such early successional trees and shrubs is particularly important during the winter months (Parker, 2003). Regenerating vegetation provides good moose browse for 5-40 years following disturbances, such as fire, disease, timber harvest, and wind-throw (Snaith, Beazley, MacKinnon, & Duinker, 2002; Snaith & Beazley, 2004). Fire appears to be the most important disturbance in terms of providing quality moose habitat (Parker, 2003 and references therein). Critical habitat for moose in Alberta was described as open lowlands providing high quality food early in the spring (Hauge & Keith, 1981).

In Nova Scotia, the most important food species are red, sugar, and mountain maple, as well as yellow and white birch (Snaith & Beazley, 2004). In the summer months, particularly in June, aquatic vegetation can be an important component of the diet of moose (Peek, Urich, & Mackie, 1976; Fraser, Arthur, Morton, & Thompson, 1980), but the fact that moose have persisted in areas containing infrequent or unsuitable wetlands suggests that these areas are not essential foraging grounds for moose in Nova Scotia (Snaith & Beazley, 2004). This is supported by the findings of Telfer (1967a) who observed no feeding of moose on aquatic vegetation in the Cobequid region. Water bodies such as streams, ponds, and lake shorelines can be important for relief from heat stress in the summer months (Parker, 2003) because moose are not well adapted for temperatures above 14-20°C (Snaith & Beazley, 2004). Moose have also been shown to preferentially select dense, mature forests with a closed canopy in the summer months (Schwab and Pitt 1991) because the canopy provides shade and heat relief. Dussault et al. (2004) determined that moose showed behavioural adaptations to avoid heat stress in the summer, including using thermal shelters during the day and increasing nocturnal activity.

When female moose give birth to their calves in the spring of the year, they often select islands or peninsulas because of the protection from predators they afford, or areas of high elevation because of visibility in availability of escape routes (Wilton & Garner, 1991). In mountainous regions of British Columbia, however, only 52% of 31 GPS-collared female moose climbed to higher elevations to calve, while the other 48% changed little in elevation (Poole, Serrouya, & Stuart-Smith, 2007). These researchers found that those females that remained at lower elevations preferentially selected areas with increased forage, decreased slope, and in closer proximity to water. Langley & Pletscher (1994) characterized calving areas in Montana and British Columbia as having dense hiding cover and open patches with bare ground. Cederlund, Sandegren, & Larsson (1987) found that all cows returned to the same summer range each spring, and Bogomolova and Kurochkin (2002) determined that cows returned to the same area of the forest every year before giving birth.

Although not considered critical habitat (Balsom, Ballard, & Whitlaw, 1996), mature, conifer forests are extremely important for moose in Nova Scotia during the late winter months (Telfer, 1967a; Peek, Urich, & Mackie, 1976; Parker, 2003) because they provide protection from extreme weather and the canopy prevents snow from accumulating to depths hindering moose movement (Snaith & Beazley, 2004). Travelling in areas where they sink into the snow can cause moose to expend a significant amount of energy (Lundmark and Ball, 2008) at a time when adequate forage may be scarce. Ideal winter habitat also includes regenerating mixed woods that provide both hardwood and softwood browse (Parker, 2003). In the winter months, moose in northern Nova Scotia concentrate in small areas known as “yards” and move very little (winter range of 2.6 km^2), particularly when the yard is contains good browse as in the

Cobequid region (Telfer, 1967a,b). In Quebec, the vast majority of these winter yards were less than 0.5km^2 in area (Guertin, Doucet, & Weary, 1984). Prescott (1968) determined that the use of winter yards by moose in northeastern Nova Scotia was influenced most heavily by having a variety of vegetation types and that food availability was more important than cover in determining the attractiveness of winter habitat to moose (summarized from Parker, 2003). Moose yards in Quebec were characterized by gentle slopes with southern exposure, with pure or mixed stands of black spruce and adjacent patches of white birch, young balsam fir, and alder (Guertin, Doucet, & Weary, 1984). Other important winter food items include willow, which accounted for 35% of the winter diet of moose in northern British Columbia (Goulet, 1985).

A similarly restricted winter range of moose was determined from studies in Minnesota (Ballenberghe and Peek, 1971; Phillips, Berg, & Siniff, 1973). Phillips, Berg, & Siniff (1973) that found that the late winter ranges of all tracked moose were distinct in habitat from the areas used at other time of year and that the summer-fall and early winter ranges were much larger. Furthermore, they determined that most moose returned to the same wintering area each year and that they used similar travel routes each year between seasonal habitats. Geist (1963) suggested that moose return every year to their accustomed summer range. Seasonal movements between winter and summer ranges were reported in moose in Alberta, with individual movement of up to 20 km observed (Hauge & Keith, 1981). Even greater migrations between winter and non-winter ranges of up to 75 km were observed in British Columbia, with non-winter ranges being twice as large as winter ranges (Demarchi, 2003). If the habitat in an area is diverse and provides the necessary interspersion of open areas for foraging and dense, mature forests for cover and relief from snow, seasonal ranges need not be widely separated (Snaith & Beazley, 2004). For example, only 22% and 38% of adult moose in Michigan migrated between distinct summer and winter ranges in 1999 and 2000, respectively. In Alaska, 43% of bulls and cows had distinct winter and summer ranges and distance between ranges were up to 17 km (Bangs, Bailey, & Portner, 1984). In southwestern Nova Scotia, however, the mean home range of moose was found to be large (55.2 km^2) because the rocky, barren conditions mean the moose must range farther to obtain resources (see Snaith & Beazley, 2004). When moving between seasonal ranges, moose use well established routes and travel corridors (Neumann, 2009). In terms of activity within seasons, daily movement rates of moose are higher in the summer than in the winter (McLaren, Taylor, & Luke, 2009).

Two sub-species of moose are present within Nova Scotia. The Cape Breton population (*Alces andersoni)* is an introduced species from Alberta and their population is abundant and stable. According to NSL&F (2007), the mainland moose (*Alces americana*) population has been reduced to approximately 1200 individuals, restricted to small, isolated sub-populations. The Recovery Plan for Moose in Mainland Nova Scotia (NSDNR, 2007) identifies several limiting factors to moose abundance and distribution. These include disease and parasites, poaching, access to habitat, development, forest practices, acid rain, and climate change. Of highest concern are threats related to disease and parasites, poaching, access to moose habitat, and development.

The primary parasite threatening survival of mainland moose is a parasitic worm (*Parelaphostrongylus tenuis*), known as brainworm. Approximately 65% of white-tailed deer in Nova Scotia are carriers of this parasite; however, it is not lethal to deer. According to NSL&F (2007, p.14), “Where moose and deer range overlap, brainworm is a significant mortality factor”. Because the abundance of white-tailed deer can have an influence on the health of mainland moose, signs of white-tailed deer are documented during mainland moose surveys.

The threats of poaching and access to moose habitat are correlated, as increased access to moose habitat can ultimately increase the level of poaching. These threats can result in lowered viability of individual populations of moose by direct mortality and reduction in range. Similarly, land development of various types can result in increased access to moose habitat, fragmentation of habitat, and direct loss of habitat, while (potentially) further isolating sub-populations from one another.

According to the Recovery Plan for Mainland Moose in Nova Scotia (NSDNR, 2007, p. 30), core habitat means “specific areas of habitat essential for the long-term survivability and recovery of endangered or threatened species and that are designated as core habitat” under the Nova Scotia Endangered Species Act. Mainland moose use a wide variety of habitat types, over relatively large home ranges. The specific spatial and temporal use of the landscape and habitat is not well known in Nova Scotia. As such, ‘core habitat’ has not been defined or designated under the Endangered Species Act. The PA lies within a significant Mainland Moose Concentration Area, as identified in Endangered Mainland Moose Special Management Practices (NSDNR, 2012).

Within the PA, mainland moose tracks were observed within the ~~mine footprint PA~~ Beaver Dam Mine Site in disturbed, roadside habitat north of wetland 56 on May 24th, 2015 during a PGI survey. Moose tracks were observed incidentally~~ outside of the PA to the northwest of the mine footprint PA ~~in two locations on September 9th, 2014. One set of tracks was observed in Wetland 210 and a second set of tracks was observed just north of the Beaver Dam Mine Site. No signs of mainland moose were observed during any survey within the ~~haul road PA~~ Haul Road.

6.13.3.4.2 **Bats**

A single abandoned mine opening (AMO) (BED-1-003) was identified as a potential bat hibernaculum. The remaining AMOs when surveyed were either infilled, contained a concrete cap, or were flooded with water, which all limit the potential for bat hibernacula.

The Beaver Dam Gold Mining Company J.H. Austin Main Shaft (BED-1-003) (Hennick et al 2016) is located on the Beaver Dam Road, Halifax County at UTM Zone 20, 522256 east, and 4990298 north. It is located just east of the Beaver Dam Road at the western end of an open historical settling pond (wetland 59) southwest of Cameron Flowage.

The J.H. Austin Main Shaft was originally 67 m deep. It has a concrete collar and cap. The installation date of the collar and concrete cap are unknown, but they have since collapsed and the AMO appears to be filled with rocks. The opening appeared to be less than 5 m deep, with no water observed. The potential for usage of the opening by bats was determined to be very low; however, it could not be visually confirmed because the Project Team could not safely inspect the opening for any internal complexities. A second abandoned mine opening was observed 9 m west of BED-1-003. This opening is described in the NSL&F database as BED-1-002 as an air shaft for the main J.H. Austin Shaft (BED-1-003). This mine opening was clear of debris and backfill and groundwater was observed in BED-1-002 approximately four-meters below the ground surface and one-meter below the top of the mine shaft infrastructure.

As a result of the observed groundwater in the opening nine meters away (BED-1-002), it was hypothesized that groundwater was likely quite close to the surface within BED-1-003 even though it was not observed due to debris and backfill. LiDAR data collected by GHD was used to evaluate the potential of BED-1-003 as a bat hibernaculum. Results derived from LiDAR data (provided on Figure 6.13-5 shows the grade elevation at BED-1-002 (open AMO) to be 134.38 m while the elevation of the BED-1-002 mine shaft opening is 131.43 m. The data also shows the elevation of a pond 40 m downslope of BED-1-002 to be 130.43 m (all elevations are of ±0.15 m accuracy). Based on these elevations and the distance to the pond, the percent grade of the slope on which BED-1-002 and BED-1-003 are located is 9.88%. At this percent slope, the maximum elevation level of the grade at BED-1-003 (located nine-meters from BED-1-002) would be 135.27 m. This would infer that the water is present in BED-1-003 five-meters below

(135.27 m minus 130.43 m) the surface, which places it at or just below the location of the debris in the mine shaft. The inferred proximity of water to the top of the mine shaft (approximately five-meters) reduces the potential of BED-1-003 as a bat hibernaculum.

No AMOs were identified along the Haul Road, although a cluster of 99 AMOs is present approximately 6.4 km southeast of the ~~haul road PA~~ Haul Road, along the Mooseland Road, within the Mooseland Gold District. A desktop evaluation for potential bat hibernacula was completed within this cluster of AMOs. The Project Team screened out AMOs with opening types of trench and pit, and stope, flooded, infilled, and capped AMOs, and those with an original depth of less than 10 m. According to this desktop review, none of the AMOs reviewed (in the cluster of 99) have the potential to support bat hibernacula. As a result, no bat hibernacula were identified within the ~~mine footprint PA or within the haul road PA~~ Haul Road. Additionally, no potential bat hibernacula were identified through desktop evaluation within 10 km of the PA.

6.13.3.4.3 **Terrestrial Fauna SAR & SOCI Summary**

Through all targeted surveys and incidental observations, evidence of a single mammalian priority species was observed. Two sets of mainland moose tracks were observed incidentally ~~to the northwest of the mine footprint PA~~ within and directly adjacent to the Beaver Dam Mine Site ~~outside of the PA~~ in September 2014. One set of moose tracks ~~were~~ was observed within the ~~mine footprint PA~~ Beaver Dam Mine Site in May 2015 during a targeted moose survey. No other moose signs (tracks, scat, browse) were observed during targeted moose track surveys or PGI surveys completed within the ~~proposed mine footprint~~ Beaver Dam Mine Site or the ~~haul road PA~~ Haul Road. Suitable habitat for mainland moose is present within, and adjacent to the PA. Although no core habitat has been defined for mainland moose in Nova Scotia, the PA is located within a Significant Mainland Moose Concentration Area.

Incidental sightings of mammals were completed during all field programs throughout the PA during all seasons. Aside from mainland moose tracks, no priority mammals or signs thereof were observed. Given the mobility of mammal species, the absence of observation does not confirm absence of the species within the PA. The size of a species and a species' behavior can result in a bias against detection. For instance, very small species such as the maritime shrew (S3) and the rock vole (S2) have been documented within 5 km of the PA, but were not observed by the Project Team within the PA. As another example, the fisher (*Martes pennanti,* S2) is a largely nocturnal hunter, with large home ranges and elusive behavior. They prefer dense, mature to over-mature coniferous stands with large hollow snags for den sites. Their preferred habitat and prey items (porcupine, rabbits, squirrels and other small mammals) are present within the PA. The lack of observed evidence of fisher does not confirm absence of the species.

Determination of the presence of several bat SAR was completed and included both desktop and field components. This evaluation for bat SAR determined that the PA does not contain suitable habitat for bat hibernacula, and no evidence was found that indicates any usage of the PA by priority bat species. No bat hibernaculum are known to be present within a 10 km radius of the PA.

~~Snapping turtle habitat is present within the PA, and snapping turtles have been incidentally observed along roads in the vicinity of the PA. It is expected that they use habitat within the PA, at least periodically.~~

Touquoy Mine Site

Mainland moose tracks were observed within the Touquoy Mine Site in a bog during field surveys to support the Touquoy Environmental Assessment in 2006. Moose are known to the Tangier Grand Lake

Wilderness Area, and evidence of moose is reported every year by NSL&F in the Moose River Gold Mines area during deer pellet surveys (CRA, 2007).

No suitable bat hibernating areas were found within the Touquoy Mine Site during environmental screening to support the Touquoy Environmental Assessment (CRA, 2007).

6.13.3.5 Priority Herpetofauna Species

A desktop evaluation for amphibian and reptile priority species revealed that no priority herpetile species have been documented within 5 km of the ~~PA (mine footprint and haul road)~~ Beaver Dam Mine Site and Haul Road by the ACCDC. The following herpetofauna priority species have an elevated potential for being located within the ~~PA~~ Beaver Dam Mine Site and Haul Road based on broad geographic range and habitat preferences. No amphibians or reptiles were documented within the vicinity of the ~~PA~~ Beaver Dam Mine Site and Haul Road by the Museum of Natural History.

Table 6.13-9 Herpetofauna priority species with an elevated potential for being identified within the Project Area

Latin Name	Common Name	SARA, COSEWIC, NSESA	S Rank	Habitat
Chelydra serpentina	Snapping turtle	SARA and COSEWIC Special Concern, NSESA Vulnerable	S3	Southern New Brunswick and parts of mainland Nova Scotia in ponds, lakes, slow-moving streams, and sometimes in brackish water if these water bodies have soft mud bottoms and abundant aquatic vegetation
Glyptemys insculpta	Wood turtle	SARA, COSEWIC, NSESA Threatened	S2	Lives along permanent streams during much of each year, but in summer may roam widely overland and can be found in a variety of terrestrial habitats adjacent to streams, from deciduous woods, cultivated fields, and woodland bogs, to marshy pastures. Use of woodland bogs and marshy fields is most common in the northern part of the range

Targeted surveys for wood turtles within the ~~mine footprint PA~~ Beaver Dam Mine Site did not reveal any sightings of wood turtles or suitable nesting habitat. No opportunistic observations of wood turtles or suitable nesting habitat were documented during any wetland or watercourse surveys throughout the entirety of the PA.

Snapping turtles have been observed opportunistically along roadsides within the Haul Road ~~outside, but within close proximity, of the PA, but not during surveys within the PA.~~ The snapping turtle (*Chelydra serpentina*) is listed as special concern under SARA and COSEWIC (Environment and Climate Change Canada, 2016). Provincially, it is listed as vulnerable under NSESA and ACCDC (S3). Similar to the wood turtle, snapping turtle populations are threatened by low juvenile recruitment and high juvenile mortality.

Snapping turtles have a life span of approximately 50 years, however, sexual maturity it not reached until the age of 15-20 years, and survival rates (form embryo through to sexual maturity) are estimated to be as low as 0.1%. According to Environment and Climate Change Canada (2016), the very low juvenile recruitment means that high adult survivability is required to maintain a viable population. As such, a single adult mortality due to natural or anthropogenic factors can be significant to the population.

Snapping turtles can be found in a variety of freshwater ecosystems, such as slow-moving rivers, wetlands, lakes, streams and ponds. Hibernation occurs in freshwater systems deep enough to prevent freezing through during the winter, with a mucky or muddy substrate. They are the most aquatic of freshwater turtles in Nova Scotia, but they do travel through upland habitat and use gravelly areas to nest. The preference for gravelly substrate during nesting is a threat to turtles, as gravid females are attracted to roadsides to nest in the gravelly shoulders of roads. This can result in direct mortality of reproductive females and emerging hatchlings from vehicular collisions. This type of direct mortality, along with direct loss of freshwater and riparian habitats, poses significant threats to the viability of snapping turtle populations in Nova Scotia. Additional threats include an increase in human-subsidized predators such as foxes, coyotes, raccoons, and skunks (Environment and Climate Change Canada, 2016).

~~Within the PA, no signs of snapping turtles were observed during any field programs. However, Snapping turtles were observed opportunistically along roadsides in close proximity of the PA, and as a result of these observations and habitats present within the PA, they are anticipated to use some parts of the PA, at least periodically.~~ Within the PA, one snapping turtle was incidentally observed along the Haul Road during bird surveys on June 26, 2016. This snapping turtle was observed along Mooseland Road near PC45 (20T 507085E, 4981506N).

Suitable habitat for snapping turtles has been observed in wetlands 8, 10, 17, 29, 59, 61, 66, 68, 69, 159, 168, ~~and~~ 171, and 207. These wetlands all provide standing water to a depth exceeding 0.5 m. As such, it is presumed that the open water portions of these wetlands provide overwintering habitat for snapping turtles.

Touquoy Mine Site

No wood turtle or suitable habitat were observed within the Touquoy Mine Site during wood turtle habitat surveys conducted in 2004 (CRA 2007). No snapping turtles were recorded within the Touquoy Mine Site during the EARD process, however, on the June 26, 2016 a snapping turtle was observed within the LAA, north of the Touquoy Mine Site, on Moose River Road (20T 504304E, 4981602N). From June 19 to mid July 2017 two snapping turtles were frequently observed. One was found along Moose River Road (20T 504304E, 4981602N), at the location identified above. The second snapping turtle was observed on Higgins Mines Road (20T 504380E, 4980699N) west of the PA but within the LAA.

6.13.3.6 Priority Invertebrates

The desktop evaluation for priority species of invertebrate fauna revealed that none were identified within 5 km of the PA by ACCDC reports. NSL&F has not identified any invertebrate species as ‘location sensitive’ species and no invertebrate species were listed as being documented within the vicinity of the PA by the Museum of Natural History. The Maritime Butterfly Atlas was reviewed (Squares 20NQ18, 20NQ28 and 20NQ29) for observations of priority Lepidopterans. A single record of a monarch butterfly was documented within Square 20NQ29. Additionally, Odonata Central (n.d.) was reviewed for records of priority odonates within the vicinity of the PA.

Table 6.13-10 below provides a list of invertebrate fauna priority species which have elevated potential to be located within the PA, based on habitat preferences and known distribution.

Table 6.13-10 Invertebrate priority species with an elevated potential for being identified within the PA

Scientific Name	Common Name	SARA, COSEWIC, NSESA	S Rank	Habitat Preference
Danaus plexippus	Monarch	SARA, COSEWIC, Special Concern	S2B	Almost anywhere during the spring (northward) migration; near the larval food plants during the breeding season; in the fall commonly near the coast, often in large numbers, all heading south. Larvae are found feeding on the following milkweed species: common milkweed and swamp milkweed, neither of which are abundant plants in Nova Scotia. Common milkweed: very common in lower Saint John river valley and possibly north central Nova Scotia.
Gomphus ventricosus	Skillet clubtail	SARA, COSEWIC Endangered	S1	The larvae inhabit large rivers where they burrow in the soft mud of deep pools.
Alasmidonta undulata	Triangle floater		S2S3	Frequently found in stream and rivers in sand and gravel substrates.
Amblyscirtes hegon	Pepper and salt skipper		S2	Found on the edges of forests and streams. Larvae found feeding on a variety of grass species.
Amblyscirtes vialis	Common roadside-skipper		S2	Found in trails, roads in wooded areas, and often near streams. Larvae are found feeding off of a variety of grass species.
Euphydryas phaeton	Baltimore checkerspot		S3	Found in fresh-water marshes, wet roadsides and meadows. Larvae found feeding on turtlehead and has been reported to feed on beardtongue.
Lethe anthedon	Northern pearly-eye		S3	Found in moist woods and dominated by graminoids in the herbaceous layer of forests. Larvae feed off woodland grasses, such as bearded shortgrass and false melic grass.
Pieris oleracea	Mustard white		S2	Found in deciduous woods and bogs. Larvae feed off of various plants belonging to the Brassicaceae (mustard) family.

Scientific Name	Common Name	SARA, COSEWIC, NSESA	S Rank	Habitat Preference
Polygonia progne	Grey comma		S3S4	Found in woods and aspen parklands. Larvae found feeding on currants and gooseberries and sometimes elm.
Satyrium liparops	Striped hairstreak		S3	Found in deciduous forest edges, gardens and roadsides. Larvae found feeding off of members of the Rose family such as plum and cherries. Occurrences with oak, willow, and blueberry.

Surveys for benthic invertebrates were completed as part of the fish habitat assessment, following CABIN protocol methodologies. No priority invertebrate species were identified through sampling for benthic invertebrates (as described in Section 6.9.3.6). Field staff searched for signs of aquatic invertebrates, such as freshwater mussels during all wetland and watercourse related programs. None were observed. According to Fisheries and Oceans Canada (2016b), the brook floater (*Alasmidonta varicosa)* has not been documented in any watersheds within the PA.

The desktop review of damselflies and dragonflies through Odonata Central did not confirm presence of any priority species in the vicinity of the PA nor were any priority species observed during surveys completed within the PA.

A review of data provided by the Maritime Butterfly Atlas confirmed that one monarch butterfly was observed in square 20NQ29. This 10 km x 10 km survey grid covers Mud Lake and Crusher Lake, extending north to Beaver Lake, and east to Smith Lake and Rocky Lake. As the monarch has been recorded in this survey square, it is possible that it uses the ~~mine footprint PA~~ Beaver Dam Mine Site, at least periodically, such as during migration. Monarch butterflies rely on milkweed as a host plant for their larvae; as such, it is a key indicator for presence of the monarch. Surveys for vascular plants were conducted throughout the PA, and staff were instructed to identify any suitable habitat for monarchs based on presence of milkweed. No milkweed was documented during surveys for vascular flora, or opportunistically during any other surveys.

No other targeted surveys were completed for invertebrates; however, no opportunistic observations of priority invertebrate species were recorded. No other priority invertebrate species were identified during the desktop review.

6.13.3.7 Priority Birds

A desktop review for priority species revealed that 33 priority bird species were identified as having the potential to occur within the ~~mine footprint and haul road PA~~ Beaver Dam Mine Site and Haul Road based on habitat availability and geographic distribution. Eighteen species have been documented within 5 km of the ~~PA~~ Beaver Dam Mine Site and Haul Road by ACCDC. These species are underlined in Table 6.13-11.

NSL&F has classified one species, the peregrine falcon, as 'location sensitive', meaning that their exact locations cannot be provided to proponents in ACCDC reports. Instead, ACCDC indicates whether a location sensitive species is documented within 5 km of the PA. The peregrine falcon (*anatum/tundrius* pop.*)* is considered a location sensitive species; however, it has not been documented within 5 km of the PA in either of the ACCDC reports.

A report provided by the Museum of Natural History reported nesting records or probable nesting records for 16 priority species within the vicinity of the PA. These species are highlighted using bold type in the priority bird species list presented in Table 6.13-11.Table 6.13-11 Priority bird species list

Table 6.13-11 Priority bird species list

Common Name	Scientific Name	SARA, COSEWIC, NSESA	SRank
Blue-winged teal	*Anas discors*	-	S3S4B

Common Name	Scientific Name	SARA, COSEWIC, NSESA	SRank
Common nighthawk	*Chordeiles minor*	SARA, COSEWIC, NSESA Threatened	S2B
Killdeer	*Charadrius vociferous*	-	S3B
Wilson's snipe	*Gallinago delicate*	-	S3B
Spotted sandpiper	*Actitis macularius*	-	S3S4B
Greater yellowlegs	*Tringa melanoleuca*	-	S3B, S3S4M
American bittern	*Botaurus lentiginosus*	-	S3S4B
Northern goshawk	*Accipiter gentilis*	-	S3S4
Black-backed woodpecker	*Picoides arcticus*	-	S3S4
American kestrel	*Falco sparverius*	-	S3B
Peregrine falcon - anatum	*Falco peregrinus pop. 1*	SARA, COSEWIC Special Concern, NSESA Vulnerable	S1B, SNAM
Olive-sided flycatcher	*Contopus cooperi*	SARA, COSEWIC, NSESA Threatened	S2B
Eastern wood-pewee	*Contopus virens*	COSEWIC Special Concern, NSESA Vulnerable	S3S4B
Yellow-bellied flycatcher	*Empidonax flaviventris*	-	S3S4B
Willow flycatcher	*Empidonax traillii*	-	S2B
Eastern kingbird	*Tyrannus tyrannus*	-	S3B
Philadelphia vireo	*Vireo philadelphicus*	-	S2?B
Warbling vireo	*Vireo gilvus*	-	S1B
Gray jay	*Perisoreus canadensis*	-	S3
Barn swallow	*Hirundo rustica*	SARA, COSEWIC Threatened, NSESA Endangered	S2S3B
Boreal chickadee	*Poecile hudsonica*	-	S3
Red-breasted nuthatch	*Sitta canadensis*	-	S3

Common Name	Scientific Name	SARA, COSEWIC, NSESA	SRank
Ruby-crowned kinglet	*Regulus calendula*	-	S3S4B
Eastern bluebird	*Sialia sialis*	-	S3B
Swainson's thrush	*Catharus ustulatus*	-	S3S4B
American robin	*Turdus migratorius*	-	S5B, S3N
Gray catbird	*Dumetella carolinensis*	-	S3B
Northern mockingbird	*Mimus polyglottos*	-	S1B
Pine grosbeak	*Pinicola enucleator*	-	S2S3B, SN5
Purple finch	*Haemorhous purpureus*	-	S4S5B, S3S4N
Red crossbill	*Loxia curvirostra*	-	S3S4
Pine siskin	*Carduelis pinus*	-	S2S3
Evening grosbeak	*Coccothraustes vespertinus*	-	S3S4B, S3N
Tennessee warbler	*Vermivora peregrine*	-	S3S4B
Cape May warbler	*Dendroica tigrina*	-	S2B
Bay-breasted warbler	*Dendroica castanea*	-	S3S4B
Canada warbler	*Wilsonia canadensis*	SARA, COSEWIC Threatened, NSESA Endangered	S3B
Wilson's warbler	*Wilsonia pusilla*	-	S3B
Rose-breasted grosbeak	*Pheucticus ludovicianus*	-	S2S3B
Rusty blackbird	*Euphagus carolinus*	SARA, COSEWIC Special Concern, NSESA Endangered	S2B
Baltimore oriole	*Icterus galbula*	-	S2S3B

6.13.3.7.1 **Bird species observed within the Project Area**

During field assessments within the ~~PA~~ Beaver Dam Mine Site and Haul Road, a total of 25 priority bird species, 17 SOCI and eight SAR, were observed. These species are presented in Table 6.13-12.

An additional five species considered SOCI in the breeding season (i.e., ACCDC only ranks these species with a breeding status S-rank) were observed within the ~~PA~~ Beaver Dam Mine Site and Haul Road only during migration periods: common goldeneye, American coot, American kestrel, brown-headed cowbird, and pine grosbeak. Though not observed during the breeding season, the desktop review for priority species found that the Wilson's warbler and pine grosbeak (*Pinicola enucleator*) could be present within the ~~PA~~ Beaver Dam Mine Site and Haul Road during breeding season based on habitat availability and geographic distribution. The remaining three species are not likely to breed within the ~~PA~~ Beaver Dam Mine Site and Haul Road. One pine grosbeak was observed incidentally within the ~~haul road PA~~ Haul Road, also during spring migration.

Table 6.13-12 Priority bird species observed within the ~~PA~~ Beaver Dam Mine Site and Haul Road

Common name	SARA	COSEWIC	NSESA	S-Rank*	Season observed**	Number in the Beaver Dam Mine Site								Number in Haul Road						All PA
						Spring migration		Breeding		Fall migration		Total in ~~Mine Footprint PA~~ Beaver Dam Mine Site		Spring migration		Breeding		Total in Haul Road ~~PA~~		Total
						#	Location	#	Location	#	Location	#	Location	#	Location	#	Location	#	Location	
Barn swallow	-	T	E	S2S3B	SM	.	.	.	.	.	.	0		1	8	.	.	**1**	**8**	**1**
Canada warbler	T	T	E	S3B	SM, B, B-I	.	.	2	33, Inc.	.	.	**2**	**33, Inc.**	10	2, 4, 6, 10, 28, 35, 39, 41, 45	4	16, 25	**14**	**2, 4, 6, 10, 16, 25, 28, 35, 39, 41, 45**	**16**
Chimney swift	T	T	E	S2B, S1M	B-I	.	.	2	23	.	.	**2**	**23**	.	.	.	.	**0**	**.**	**2**
Common nighthawk	T	T	T	S2B	B	.	.	.	.	.	.	**0**		.	.	4	26, CONI1, CONI9	**4**	**26, CONI1, CONI9**	**4**
Olive-sided flycatcher	T	T	T	S2B	B, B-I	.	.	5	3, 22, Inc.	.	.	**5**	**3, 22**	.	.	5	5, 29, 30, 43	**5**	**5, 29, 30, 43**	**10**
Eastern wood-pewee	-	SC	V	S3S4B	B-1	.	.	1	Inc.	.	.	**1**	**Inc.**	.	.	1	Inc.	**1**	**Inc.**	**2**
Peregrine falcon	SC	SC	V	S1B	FM, FM-I	.	.	.	.	2	9, 10	**2**	**9, 10**	.	.	.	.	**0**	**.**	**2**
Rusty blackbird	SC	SC	E	S2B	FM-I	.	.	.	.	1	15	**1**	**15**	.	.	.	.	**0**	**.**	**1**
Bay-breasted warbler	-	-	-	S3S4B	B	.	.	.	.	.	.	**0**		NPS	NPS	2	30, 31	**2**	**30, 31**	**2**
Black-backed woodpecker	-	-	-	S3S4	SM, B, B-I	.	.	.	.	.	.	**0**		3	19, 29	3	18, 22, 39	**6**	**18, 19, 22, 29, 39**	**6**
Blackpoll warbler***	-	-	-	S3S4B	B	.	.	.	.	NPS	NPS	**0**		NPS	NPS	11	1, 2, 5, 24, 33, 36, 38	**11**	**1, 2, 5, 24, 33, 36, 38**	**11**
Boreal chickadee	-	-	-	S3	SM, SM-I, B-I	4	30	2	Inc.	14	14, 21, 23, 25, 26, 30, 31, CPC3, Inc.	**20**	**14, 21, 23, 25, 26, 30, 31, CPC3**	4	20, 23, 35	1	Inc.	**5**	**4, 20, 23, 25, Inc.**	**25**
Gray catbird	-	-	-	S3B	B	.	.	.	.	.	.	**0**		.	.	1	11	**1**	**11**	**1**

Common name	SARA	COSEWIC	NSESA	S-Rank*	Season observed**	Number in the Beaver Dam Mine Site								Number in Haul Road						All PA
						Spring migration		Breeding		Fall migration		Total in ~~Mine Footprint PA~~ Beaver Dam Mine Site		Spring migration		Breeding		Total in Haul Road ~~PA~~		Total
						#	Location	#	Location	#	Location	#	Location	#	Location	#	Location	#	Location	
Gray jay	-	-	-	S3	SM, SM-I, B, FM	.	.	1	22	44	2, 3, 4, 5, 6, 7, 11, 13, 15, 16, 17, 18, 21, 24, 25, 26, 27, 28, 29, 30, 31, CPC1, CPC2	**45**	**2, 3, 4, 5, 6, 7, 11, 13, 15, 16, 17, 18, 21, 22, 24, 25, 26, 27, 28, 29, 30, 31, CPC1, CPC2**	20	4, 5, 12, 18, 27, 28, 29, 32, 39, 44	.	.	**20**	**4, 5, 12, 18, 20, 27, 28, 29, 32, 39, 44**	**65**
Greater yellowlegs	-	-	-	S3B, S3S4M	SM, B, B-I	29	1, 2, 4, 5, 6, 7, 24, 25, 28, 30, 31	6	1, 3, 10, ~~26~~, Inc.	.	.	**35**	**1, 2, 34, 5, 6, 7, 10, 24, 25, ~~26~~, 28, 30, 31**	3	1, 3, 4	5	1, 3	**8**	**1, 3, 4**	**43**
Northern goshawk	-	NAR	-	S3S4	SM	.	.	.	.	.	.	**0**		1	1	.	.	**1**	**1**	**1**
Northern harrier	-	-	-	S3S4B	SM, B	1	MR-1	2	10, Inc.	.	10, MR-1, Inc	**3**	**10**	.	.	.	.	**0**	**.**	**3**
Pine siskin	-	-	-	S2S3	FM, I-FM	.	.	.	.	119	2, 3, 5, 17, 22, 24, 26, 30, 32, CPC2	**119**	**2, 3, 5, 17, 22, 24, 26, 30, 32, CPC2**	1	7	.	.	**1**	**7**	**120**
Red crossbill	-	-	-	S3S4	SM-I	.	.	.	.	.	.	**0**		3	22	.	.	**3**	**22**	**3**
Red-breasted nuthatch	-	-	-	S3	SM, SM-I, B, B-I	3	6, 31	.	.	1	25	**4**	**6, 25, 31**	8	2, 7, 12, 18, 19, 29, 30, 40	24	5, 8, 18, 19, 21, 22, 25, 33, 35, 37, 43, 44, 45, 46, 50	**32**	**2, 5, 7, 8, 12, 18, 19, 21, 22, 25, 29, 30, 33, 35, 37, 40, 43, 44, 45, 46, 50**	**36**

Common name	SARA	COSEWIC	NSESA	S-Rank*	Season observed**	Number in the Beaver Dam Mine Site								Number in Haul Road						All PA
						Spring migration		Breeding		Fall migration		Total in ~~Mine Footprint PA~~ Beaver Dam Mine Site		Spring migration		Breeding		Total in Haul Road ~~PA~~		Total
						#	Location	#	Location	#	Location	#	Location	#	Location	#	Location	#	Location	
Ruby-crowned kinglet***	-	-	-	S3S4B	B	NPS	NPS	14	4, 7, 10, 16, 21, 25, 26, 29, 30, 31	NPS	NPS	**14**	**4, 7, 10, 16, 21, 25, 26, 29, 30, 31**	NPS	NPS	82	2, 4, 6, 7, 10, 11, 18, 21, 23, 24, 25, 26, 27, 29, 34, 35, 36, 38, 39, 40, 41, 42, 43, 47, 48, 49	**82**	**2, 4, 6, 7, 10, 11, 18, 21, 23, 24, 25, 26, 27, 29, 34, 35, 36, 38, 39, 40, 41, 42, 43, 47, 48, 49**	**96**
Swainson's thrush***	-	-	-	S3S4B	B, B-I	NPS	NPS	20	1, 3, 10, 17, 24, 25, 26, 27, 28, 29, 30, 31, 32	.	.	**20**	**1, 3, 10, 17, 24, 25, 26, 27, 28, 29, 30, 31, 32**	NPS	NPS	34	1, 2, 4, 6, 8, 9, 18, 22, 24, 26, 29, 39, 40, 42, 45	**34**	**1, 2, 4, 6, 8, 9, 18, 22, 24, 26, 29, 39, 40, 42, 45**	**54**
Tennessee warbler	-	-	-	S3S4B	B	.	.	1	25	.	.	**1**	**25**	.	.		.	**0**	**.**	**1**
Wilson's snipe***	-	-	-	S3B	B, I-B	NPS	NPS	3	2, 16, 30	.	.	**3**	**2, 16, 30**	NPS	NPS	.	.	**0**	**.**	**3**
Yellow-bellied flycatcher***	-	-	-	S3S4B	B, B-I	NPS	NPS	8	16, 17, 23, 28, 29, 30	.	.	**8**	**16, 17, 23, 28, 29, 30**	NPS	NPS	39	18, 20, 22, 23, 27, 28, 29, 32, 33, 35, 36, 40, 42, 44, 45, 46, 47, 49, 50	**39**	**18, 20, 22, 23, 2, 28, 29, 32, 33, 35, 36, 40, 42, 44, 45, 46, 47, 49, 50**	**47**
Totals						**37**		**67**		**181**		**285**		**54**		**216**		**270**		**555**

Notes: SC=Special Concern, T=Threatened, E= Endangered and V=Vulnerable. SM=Spring Migration, B=Breeding, FM=Fall Migration, I-B= Observed incidentally during breeding, I-FM= Observed incidentally during fall migration and I-SM=Observed incidentally during spring migration. The ACCDC works with provincial and federal experts to develop rarity ranks (i.e. S-ranks) for species in Nova Scotia, as well as the other maritime provinces, see http://www.accdc.com/en/rank-definitions.html for more information. Crusher Point Counts (**CPC**) waypoints were part of the mine footprint PA in Fall 2014, but that area of the mine footprint PA was removed following that season due to changes in the design of the Project footprint. Therefore data from these point counts were not included in analyses of results for the dedicated surveys, but priority species are included here as incidental observations. **NPS** Indicates that the species was observed in that season but based on breeding status; it is not a priority species during that season. **Inc**. indicates that the species was observed incidentally, i.e. outside of a designated point count location.

All priority species observed in the ~~PA~~ Beaver Dam Mine Site and Haul Road (SAR and SOCI) have been described individually in sub-sections for other taxa in this chapter (fish, flora, and terrestrial fauna). Given the abundance of priority bird species observed, SOCI are only described in tabular form above, which identifies the location, abundance, and seasonality of observations. The eight bird SAR observed in the ~~PA~~ Beaver Dam Mine Site and Haul Road are described in further detail below.

6.13.3.7.2 **Common Nighthawk**

The common nighthawk is a medium-sized bird, with large eyes, a small bill, and a large mouth on its large flattened head. They have long slender pointed wings and a long slightly notched tail. Preferred breeding habitats include areas devoid of vegetation, such as sand dunes, beaches, logged areas, burned-over areas, forest clearings, peat bogs, and pastures. Common nighthawks were not detected during the dedicated species surveys completed within the ~~mine footprint PA~~ Beaver Dam Mine Site in 2015; however, preferred breeding habitat, specifically logged areas, peat bogs and forest clearings, were observed within the ~~mine footprint PA~~ Beaver Dam Mine Site.

Suitable breeding habitats were observed within the ~~haul road PA~~ Haul Road and four common nighthawks were observed during both breeding bird (n=1) and dedicated species surveys (n=3) in 2016. Common nighthawks were observed within the ~~haul road PA~~ Haul Road, in habitats with expansive gravelly areas adjacent to clear cuts or disturbed areas (Haul Road PC26, CONI1, and CONI9). There were no signs of breeding evidence (e.g., booming display) observed, but breeding is still possible as these birds were observed near suitable nesting habitat, specifically clear cuts and gravel on expanded roadsides. Common nighthawk populations have been on the decline; however, the reasons for the decline have not been determined. Large-scale pesticide use, which has reduced the numbers of insect prey, is a likely factor for the decline in common nighthawk populations (COSEWIC, 2007a). Habitat loss and alteration, including fire suppression and intensive agriculture, may also have contributed to these declines (COSEWIC, 2007a). The common nighthawk is federally listed as threatened by COSEWIC and SARA, provincially listed as threatened by NSESA, and the breeding population in Nova Scotia is ranked as Imperiled (i.e., S-rank S2B) by ACCDC.

6.13.3.7.3 **Peregrine Falcon**

The peregrine falcon is a medium to large falcon with long, pointed wings. Peregrine falcons use a wide variety of habitats, including Arctic tundra, sea coasts, prairies, and urban centers. They nest on cliff ledges, in crevices, and near bridges. Suitable breeding habitat was not present within the ~~mine footprint or haul road PA~~ Beaver Dam Mine Site and Haul Road. Two peregrine falcons were observed incidentally (n=1) and during the dedicated fall migration surveys (n=1) adjacent to the ~~mine footprint PA~~ Beaver Dam Mine Site, in 2014. Both observations were documented immediately north of the ~~Mine Footprint PA~~ Beaver Dam Mine Site, between Mud Lake and Cameron Flowage. The peregrine falcon populations have seen a decline due to exposure to organochlorine pesticides, particularly DDT, causing reproductive failure (these compounds continue to be used in parts of the wintering range of Anatum and Tundrius peregrine falcons; COSEWIC, 2007b). Human disturbance at nest sites, including illegal harvest of eggs and nestlings also contribute to a decline in the populations (COSEWIC, 2007b). The peregrine falcon is federally listed as special concern under COSEWIC and SARA, provincially listed as vulnerable under NSESA, and the breeding population in Nova Scotia is ranked as critically imperiled (i.e., S-rank S1B) by the ACCDC.

6.13.3.7.4 **Chimney Swift**

The chimney swift is often mistaken for a swallow; however, it is easily distinguished by its cigar-shaped body, short tail, and long narrow pointed wings. Chimney swifts mainly use chimneys for nesting and roosting, since hollow trees in old growth forests have become rare, however, they will also nest in other artificial sites with vertical surfaces and low light (including air vents, old wells, abandoned cisterns, outhouses, boathouses, garages, silos, barns, lighthouses, and firewood sheds; Cornell Lab of Ornithology, n.d.). They are aerial foragers and are often found near water where insects are abundant. No suitable chimneys for roosting and nesting were observed within the PA; however, waterbodies used for foraging are present within the ~~mine footprint and the haul road PA~~ Beaver Dam Mine Site and Haul Road. Two chimney swifts were observed incidentally during the breeding season in 2015, within the ~~mine footprint PA~~ Beaver Dam Mine Site (Figure 6-12-2). They were observed from wetland 53, which is in the center of the ~~mine footprint PA~~ Beaver Dam Mine Site, south of Crusher Lake. There were no signs observed of chimney swifts breeding.

The main cause for the decline of the chimney swift is unknown; however, factors such as a decrease in insect prey due to pesticides and habitat loss are likely involved in the decline (COSEWIC, 2007c). The chimney swift is federally listed as threatened under COSEWIC and SARA, provincially listed as endangered under NSESA, and the breeding population in Nova Scotia is ranked as imperiled (i.e., S2B), whereas the aggregating transient population is ranked as critically imperiled by the ACCDC (i.e., S-rank SM1).

6.13.3.7.5 **Olive-sided Flycatcher**

The olive-sided flycatcher is a medium-sized songbird, with deep brown olive-gray on the sides and flanks. Suitable habitat for the olive-sided flycatcher includes open areas with tall trees or snags, forest openings, forest edges near natural openings, or human-made openings. Suitable habitat also includes coniferous or mixed coniferous forests, likely near wetland areas. Suitable habitat, including logged areas and forest edges near natural and human-made openings, are present within the ~~mine footprint and haul road PA~~ Beaver Dam Mine Site and Haul Road. No evidence of breeding was observed, however, 10 males were heard singing within the ~~PA~~ Beaver Dam Mine Site during the 2015 breeding bird surveys ~~within the mine footprint PA~~, and incidentally within the ~~haul road PA~~ Haul Road in 2016, suggesting possible breeding within the associated habitats (Figure 6.13-2A). Olive-sided flycatcher observations were sparse, yet scattered across the ~~mine footprint and haul road PA~~ Beaver Dam Mine Site and Haul Road. This species was documented near wetland boundaries, typically with disturbed habitats nearby.

The decrease in the population of olive-sided flycatchers is puzzling due to its preference for sparse canopy cover; it may respond positively to forest management practices, such as timber harvesting. A contributing factor to the population declines may be due to habitat alteration and loss in migration stop-over and wintering grounds (Cornell Lab of Ornithology, n.d.b). The olive-sided flycatcher is federally listed as threatened under COSEWIC and SARA, provincially listed as threatened under NSESA, and the breeding population in Nova Scotia is ranked as imperiled (i.e., S-rank S2B) by ACCDC.

6.13.3.7.6 **Canada Warbler**

The Canada warbler is a small brightly coloured songbird; the males have blue-gray upperparts and tail with a contrasting yellow throat and breast. The Canada warbler has a wide range of suitable habitats, including deciduous, coniferous, and mixed forests, with a well-developed shrub layer. Their preferred habitat is moist mixed forests (COSEWIC, 2008). They also use regenerating stands after natural and human-caused disturbances (COSEWIC, 2008). The Canada warbler's preferred habitat, moist mixed forests, was observed within the ~~mine footprint PA as well as within the haul road PA~~ Beaver Dam Mine Site and Haul Road. Regenerating forest stands and mixed, coniferous, and deciduous forests are predominant on the landscape within the PA. Sixteen Canada warblers were observed during the 2015 and 2016 breeding bird surveys within the ~~PA~~ Beaver Dam Mine Site and Haul Road. Within the ~~mine footprint PA~~ Beaver Dam Mine Site, probable breeding behavior (i.e., agitated behavior and anxiety calls of an adult) was observed by one Canada warbler and possible breeding was exhibited by singing males during breeding season. Observation of this species in the same location in two subsequent breeding bird surveys within the ~~haul road PA~~ Haul Road indicates that it may have established a territory, which is evidence of probable breeding.

The factors for population decline of the Canada Warbler are unknown. One likely reason is habitat degradation and loss of wintering ranges. Habitat loss includes agricultural activities and road development and conversion of swamp forests (COSEWIC, 2008). The Canada warbler is federally listed as threatened under COSEWIC and SARA, provincially listed as endangered under NSESA, and the breeding population in Nova Scotia is ranked as vulnerable (i.e., S-rank S3B) by ACCDC.

6.13.3.7.7 **Rusty Blackbird**

The rusty blackbird is a medium-sized songbird with pale yellow eyes, a black slightly curved bill, and a slightly rounded tail. Rusty blackbird breeding habitat is forested wetlands, including peat bogs, sedge meadows, marshes, swamp, beaver ponds, slow moving streams, and pasture edges. One rusty blackbird was observed incidentally within the ~~mine footprint PA~~ Beaver Dam Mine Site during the 2014 fall migration survey in a large wetland complex to the northwest of the ~~mine footprint PA~~ Beaver Dam Mine Site (PC15). Breeding habitat, including forested wetlands, swamps, and peat bogs are present within the ~~mine footprint and haul road PA~~ Beaver Dam Mine Site and Haul Road, however, no evidence of breeding was observed (no birds were observed in ~~haul road PA~~ Haul Road).

The biggest threat to the rusty blackbird is degradation of the primary wintering range in the Mississippi Valley (i.e., conversion of flood plain forests to agricultural land and urban zones; COSEWIC, 2006). The rusty blackbird is federally listed as special concern under COSEWIC and SARA, provincially listed as endangered under NSESA, and the breeding population in Nova Scotia is ranked as imperiled (i.e., S2B) by ACCDC.

6.13.3.7.8 **Barn Swallow**

The barn swallow is a medium-sized songbird, which is easily distinguishable by the steely-blue upperparts and cinnamon underparts, chestnut throat and forehead, and the deeply forked tail. Caves, holes, crevices, and ledges in cliff faces were the most common nesting habitats of barn swallows prior to European colonization; however, they have since shifted to nesting in and on artificial structures (e.g., barns and other outbuildings, garages, houses, bridges and road culverts; COSEWIC, 2011). Nesting habitat is available within the ~~mine footprint PA and the haul road PA~~ Beaver Dam Mine Site and Haul Road, particularly artificial structures including a cabin, bridges, and road culverts. One barn swallow was observed within the ~~haul road PA~~ Haul Road during the 2016 spring migration surveys, near wetland 159, between Highway 224 and the ~~mine footprint PA~~ Beaver Dam Mine Site, shown on Figures 6.13-2A to 6.13-2L. None were observed during the breeding bird surveys completed in the ~~PA~~ Beaver Dam Mine Site.

The main contributing factors in the decline of barn swallow populations are the loss of nesting and foraging habitats, the decline of insect prey populations, and direct and indirect mortality due to climate perturbation on breeding grounds. The barn swallow is federally listed as threatened under COSEWIC, provincially listed as endangered under NSESA, and the breeding population in Nova Scotia is range ranked as imperiled to vulnerable (i.e., S-rank S2S3B) by ACCDC.

6.13.3.7.9 **Eastern Wood-Pewee**

The eastern wood-pewee is a small forest bird with grayish-olive upperparts and pale underparts. Mature and intermediate-age deciduous and mixed forests with an open understory are the preferred breeding habitats of the eastern wood-pewee in Canada (COSEWIC, 2012). This species is also typically associated with forest clearings and edges within the vicinity of its nest (COSEWIC, 2012). Suitable breeding habitat (as previously described) is available for the eastern wood-pewee within the ~~mine footprint and haul road PA~~ Beaver Dam Mine Site and Haul Road. Two eastern wood-pewees were incidentally observed within the PA during the breeding season in 2016. One was identified at the outlet of Cameron Flowage, to the east of the ~~mine footprint PA~~ Beaver Dam Mine Site, while the second was observed incidentally within the ~~haul road PA~~ Haul Road, east of wetland 114. No breeding evidence was observed, although suitable habitat is present within the PA. As such, it is identified as a possible breeder.

The factors related to the decline of the eastern wood-pewee are largely unknown. Loss and degradation of habitat on the breeding and wintering grounds due to changes of forest management and urban development are possible contributing factors (COSEWIC, 2012). Other possible factors are the decrease of insect prey populations and high mortality on wintering grounds and while migrating and high rates of nest predation form avian predators (COSEWIC, 2012). The eastern wood-pewee is federally listed as special concern under COSEWIC, provincially listed as vulnerable under NSESA, and the breeding population in Nova Scotia is range ranked as vulnerable to apparently secure (i.e., S3S4B) by ACCDC.

6.13.3.7.10 **Bird SAR & SOCI Summary**

Twenty-five priority species were identified within the PA, of which 17 are SOCI and eight are SAR. A total of 555 individual priority birds were observed throughout the field programs. All bird SAR anticipated to be within the PA were observed. Five SOCI were observed that were not anticipated within the PA. Nineteen priority species that were anticipated to be observed within the PA were not observed throughout the various surveys or incidentally inside the season in which they are determined to be priority species (e.g., spotted sandpiper was observed during spring migration; however its rarity rank of S3 applies to the breeding population). Given the mobility of bird species, the absence of observation does not confirm absence of the species within the PA. The northern harrier (S3S4B) was observed, but was not anticipated to be observed within the PA. Their preferred habitat consists of open habitats ranging from the Arctic tundra to the prairie grasslands and fields. The northern harrier was not anticipated due to their preferred habitat, prairie grasslands and fields, not being present within the PA. The chimney swift (threatened under SARA & COSEWIC, endangered under NSESA, S2B, S1M) was observed within the PA, but was not anticipated to be within the PA. Their preferred breeding habitat, chimneys or old cabins, was not expected to be present within the PA, however, one outbuilding is present. One of the anticipated species that was absent is the killdeer (*Charadrius vociferous*; S3B). Their preferred habitat includes forested clear-cut areas. These forested clear cut areas were observed within the ~~mine footprint and haul road PA~~ Beaver Dam Mine Site and Haul Road, however, no killdeer were observed within the PA. Another anticipated species to be present within the PA is the rose-breasted grosbeak (*Pheucticus ludovicianus*; S2S3B). They use a wide variety of habitats including deciduous and mixed wood uplands and lowlands. The rose-breasted grosbeak's habitat, deciduous and mixed wood uplands, is present within the PA, however, no rose-breasted grosbeaks were observed.

During all breeding bird surveys, evidence of breeding behavior was recorded for all species, with particular attention towards SAR and SOCI. Breeding evidence was recorded in accordance with guidance provided by Bird Studies Canada (2016), which defines behavior in terms of possible, probable, and confirmed breeders. Any species observed during breeding season singing in suitable habitat is identified as a possible breeder. Signs of probable breeding observed are agitation and established territories. Evidence of confirmed breeders observed includes distraction displays, feeding young or carrying food, nests with young, or recently fledged young. The highest evidence of breeding status recorded for all priority bird species observed during breeding season is presented in Table 6.13-13. Three SAR are identified as possible breeders, while one (Canada warbler) was documented as a probable breeder. Eight SOCI are identified as possible breeders, while four show evidence of probable breeding. One species (Swainson's thrush) was confirmed to be breeding in the ~~mine footprint PA~~ Beaver Dam Mine Site. It was observed carrying food near PC 32 (along the western shore of Cameron Flowage).

Table 6.13-13 Highest breeding evidence recorded for avian SAR and SOCI within each portion of the PA

Species Code	Common Name	SARA, COSEWIC, NSESA Ranking	Srank	Mine Footprint	Haul Road
CONI	Common nighthawk	SARA, COSEWIC, NSESA Threatened	S2B	.	Possible
OSFL	Olive-sided flycatcher	SARA, COSEWIC, NSESA Threatened	S2B	Possible	Possible
CAWA	Canada warbler	SARA, COSEWIC Threatened, NSESA Endangered	S3B	Probable	Probable
EAWP	Eastern wood-pewee	COSEWIC Special Concern, NSESA Vulnerable	S3S4B	Possible	Possible
BBWA	Bay-breasted warbler		S3S4B	.	Possible
BBWO	Black-backed woodpecker		S3S4	.	Possible
BPWA	Blackpoll warbler		S3S4B	.	Possible
GRCA	Gray catbird		S3B	.	Possible
GRJA	Gray jay		S3	Possible	.
GRYE	Greater yellowlegs		S3B, S3S4M	Probable	Probable
NOHA	Northern harrier		S3S4B	Possible	Possible
RBNU	Red-breasted nuthatch		S3	.	Probable

Species Code	Common Name	SARA, COSEWIC, NSESA Ranking	Srank	Mine Footprint	Haul Road
RCKI	Ruby-crowned kinglet		S3S4B	Probable	Probable
SWTH	Swainson's thrush		S3S4B	Confirmed	Probable
TEWA	Tennessee warbler		S3S4B	Possible	.
WISN	Wilson’s snipe		S3B	Possible	.
YBFL	Yellow-bellied flycatcher		S3S4B	Probable	Probable

The location of all priority birds observed is provided on Figures 6.13-2 and 6.13-2A to 6.13-2L..

Greater yellowlegs were observed during breeding bird surveys in the Beaver Dam Mine Site in 2015 and in the Haul Road in 2016. The survey data showed that the area of highest evidence of possible nesting was at PC1, where the Haul Road meets the Beaver Dam Mine Site as shown in Table 6.13-14 and on Figure 6.13.2. PC1 is located on the road that currently exists through the central portions of Wetland 64. The evidence of probable nesting displayed by greater yellowlegs was within the wetland on the east side of the existing road. Other observations were of single individuals within the Beaver Dam Mine Site and along the Haul Road (Figures 6.13-2 and 6.13-2A to 6.13-2L). All observations were within breeding season, but no confirmed breeding activity was observed (using Second Atlas of Breeding Birds of the Maritime Provinces (2012) breeding evidence standards). Refer to Table6.13-14 for infrastructure associated with the specific point count locations.

Table 6.13-14 Greater Yellowlegs Observations During Breeding Bird Surveys

Area	Point Count	Infrastructure Association	Date	Easting	Northing	# Observed	Breeding Evidence*	Breedin g Status*
BDMS	PC1	Within proposed pit	June 8, 2015	522512	4990307	1	S	Possible
BDMS	PC3	Located on road between western and eastern waste rock stockpile.	June 25, 2015	521966	4990184	1	S	Possible
BDMS	PC10	Outside of proposed infrastructure	June 8, 2015	521672	4990823	1	S	Possible
HR	PC1	Northern extent of Haul Road study area	June 13, 2016	522642	4988939	2	S, A, P	Probabl e

Area	Point Count	Infrastructure Association	Date	Easting	Northing	# Observed	Breeding Evidence*	Breeding Status*
HR	PC1	Northern extent of Haul Road study area	June 25, 2016	522642	4988939	2**	S, T, A, P	Probable
HR	PC3	Haul road study area west WL121	June 13, 2016	522805	4987794	1	S	Possible

*Breeding evidence and status codes are reported using guidance provided by the Maritime Breeding Bird Atlas: http://www.mba-aom.ca/jsp/codes.jsp?lang=en&pg=breeding.
S: Singing male(s) present, or breeding calls heard, in suitable nesting habitat in breeding season (Possible breeding);
A: Agitated behaviour or anxiety calls of an adult (Probable breeding);
P: Pair observed in suitable nesting habitat in nesting season (Probable breeding); and
T: Permanent territory presumed through registration of territorial song, or the occurrence of an adult bird, at the same place, in breeding habitat, on at least two days a week or more apart, during its breeding season.
**Likely the same two individuals observed in the previous survey at this location

Touquoy Mine Site

The 2005 breeding bird surveys of the Touquoy Mine Site found ten priority species. They are as follows; pine grosbeak (*Pinicola enucleator*), willow flycatcher (*Empidonax traillii*), yellow-bellied flycatcher, barn swallow, boreal chickadee, ruby-crowned kinglet, rusty blackbird, bay-breasted warbler, Swainson’s thrush, and pine siskin.

6.13.4 Consideration of Consultation and Engagement Results

Key issues raised during public consultation and Mi’kmaq engagement relating to SAR and SOCI include potential direct effects on rare flora and fauna associated with construction of the Beaver Dam Mine Site and Haul Road and potential indirect effects associated with changes to other VCs, such as wetlands, surface water and groundwater. Potential effects on traditional uses of land and resources by the Mi’kmaq were noted, including SAR/SOCI species of significance to the Mi’kmaq such as moose and American Eel.

The results of the public consultation and Mi’kmaq engagement have been considered in the environmental effects assessment, including the Proponent’s commitments on mitigation and monitoring measures and proposed compliance and effects monitoring programs, as well as the Proponent’s broader commitment to ongoing public consultation and Mi’kmaq engagement. Specific to evaluating the effect on SAR and SOCI, these are found within the following environmental effects assessment.

6.13.5 Effects Assessment Methodology

6.13.5.1 Boundaries

Spatial Boundaries

The spatial boundaries used for the assessment of effects for all SAR and SOCI ~~include~~ are defined below: ~~the mine footprint and the haul road PA.~~

The PA encompasses three primary components from Marinette to Moose River Gold Mines, Halifax County, NS. The Beaver Dam Mine Site will be located at the end of the Beaver Dam Mines Road and has been extended to the east and west in order to encompass the micro siting of the till stockpile and the waste rock stockpile, respectively. The Haul Road will span from the Beaver Dam Mine Site to Moose River Gold Mines, where the Touquoy Mine [processing and exhausted pit (to be used to dispose Beaver Dam tailings)] is located.

The LAA and RAA are ~~consists of any habitat contiguous and consistent with habitat available within the PA upon which SAR or SOCI rely (i.e., critical habitat, if critical habitat is identified). Further guidance on inclusion of LAA within the effects assessment process is~~ specific to each taxa and ~~is~~ are provided herein:

- Fish: ~~LAA is the watercourse and any contiguous upstream watercourses, waterbodies, and wetlands connected by obvious surface flow;~~ The LAA (Figure 6.7-12) consists of portions of downstream aquatic habitats and headwaters where appropriate, depending on project activities, up to the maximum size of the tertiary watershed(s). The LAA boundaries were defined considering the maximum expected extent of direct and indirect impacts to the aquatic environment as well as the location of project activities across all three project components.

  The RAA (Figure 6.7-13) encompasses the three secondary watersheds that the PA is located within. These watersheds are the West River Sheet Harbour secondary watershed, the Tangier River secondary watershed, and the Fish River secondary watershed. The RAA is broader than expected project impacts and considers other project boundaries as per the cumulative effects methodology.

- Vascular Flora and Lichens: ~~LAA is the habitat which is contiguous and consistent with the habitat in which the species is located, up to and including the entire forest stand;~~ The LAA (Figure 6.10-6) includes a 500m buffer from the Beaver Dam Mine Site and new portion of the Haul Road plus a focused lichen survey area surrounding the Beaver Dam Mine Site. This area encompasses the maximum expected extent of project direct and indirect impacts to habitat and flora. The Touquoy Mine Site and the existing portion of the Haul Road were not included in the LAA because there is not expected to be a significant increase in impacts to habitat and flora from current conditions.

  The RAA (Figure 6.10-7) encompasses NSL&F's Ecological Land Classification Ecodistricts: 420 (Eastern Drumlins) and 440 (Eastern Interior). These Ecodistricts span an area broader than the expected project impacts and considers other project boundaries as per cumulative effects methodology.

- Terrestrial Fauna: ~~LAA is habitat consistent with and contiguous with habitat available within the PA, plus a 1bkm buffer (based on the recommended buffer for determining risks to bat SAR, identified above); and,~~ The LAA (Figure 6.10-6) consists of a 2 km buffer surrounding the Beaver Dam Mine Site and a 500 m buffer surrounding the Haul Road and Touquoy Mine Site components of the PA. The LAA boundaries were defined considering the maximum expected extent of direct and indirect impacts to terrestrial fauna.

The RAA (Figure 6.10-7) encompasses NSL&F's Ecological Land Classification Ecodistricts: 420 (Eastern Drumlins) and 440 (Eastern Interior). These Ecodistricts span an area broader than the expected Project impacts and considers other Project boundaries as per cumulative effects methodology.

- Birds: ~~LAA is habitat consistent with and contiguous within habitat within the PA, plus a 1bkm buffer. In this case, the 1 km buffer is based on breeding territory and home range for most priority bird species identified within the PA.~~ The LAA (Figure 6.10-6) consists of a 2 km buffer surrounding the Beaver Dam Mine Site and a 500 m buffer surrounding the Haul Road and Touquoy Mine Site components of the PA. The LAA boundaries were defined considering the maximum expected extent of direct and indirect impacts to birds.

  The RAA (Figure 6.10-7) encompasses NSL&F's Ecological Land Classification Ecodistricts: 420 (Eastern Drumlins) and 440 (Eastern Interior). These Ecodistricts span an area broader than the expected Project impacts to birds and considers other Project boundaries as per cumulative effects methodology.

~~These spatial boundaries (PA plus LAA) will help to identify the direct or indirect impacts to SAR and SOCI and the effects of the Project on distribution and abundance of these species.~~

As the Project has the potential to cause direct and indirect effects to SAR/SOCI outside of the PA, the LAA is the appropriate boundary for evaluation of this VC.

Temporal Boundaries

The temporal boundaries used for the assessment of effects to SAR and SOCI are the construction phase, operational phase, and decommissioning and reclamation phases.

Technical Boundaries

No technical boundaries were identified for the effects assessment of SAR and SOCI.

Administrative Boundaries

The primary administrative boundaries for SAR and SOCI are outlined in the federal SARA and provincial NSESA. Terrestrial fauna are provided protection under the provincial Wildlife Act and the federal Canada Wildlife Act. Fish species are further regulated under the federal Fisheries Act, while migratory bird species are regulated under the Migratory birds Convention Act.

6.13.5.2 Thresholds for Determination of Significance

A significant adverse effect from the Project on SAR and SOCI is defined as an effect that is likely to cause a permanent alteration to a species' distribution or abundance, or alteration of critical habitat. An adverse effect that does not cause a permanent alteration in distribution or abundance of terrestrial fauna species is considered to be not significant. Sedentary species such as vascular and non-vascular flora do not have the opportunity to move to avoid direct or indirect impact. For these species, the loss of a population of species that is important in the context of the province, or that species' overall abundance or distribution, is considered significant. Mortality of a single SAR could, under some circumstances, be considered a significant effect.

6.13.6 Project Activities and Species of Conservation Interest and Species at Risk Interactions and Effects

Priority species identified within the PA represent a diversity of taxa, habitat preferences, and, therefore, represent a diversity of potential and confirmed Project interactions, effects, mitigation, and monitoring. As such, Project effects, mitigation, and monitoring are discussed in terms of each taxa, rather than individual species, with a focus on SAR, recognizing that mitigation measures for SAR will generally provide appropriate mitigation for identified SOCI in the same taxonomic group. Where this is not the case, it will be stated. Project interactions, mitigation, and monitoring for each broad taxonomic group are outlined in previous chapters as well, and these mitigation measures are appropriate and should be applied for all SAR and SOCI within the same taxonomic group.

6.13.6.1 Priority Fish Species

Three priority fish species have been identified or are expected to reside within watercourses in the PA (American eel, Atlantic salmon, and ~~Blacknose dace~~ brook trout). American eel and Atlantic salmon have been included in the effects assessment section of this EIS. Although these species are not listed under provincial or federal endangered species legislation, DFO has indicated that they are currently being reviewed for protection under SARA, and it would be prudent for the Project Team to plan for these species as if they were protected under this legislation. Fish habitat is described in Section 6.9.3.1 using Atlantic salmon habitat as the reference species. Atlantic salmon and brook trout are sensitive to changes in their aquatic ecosystem, and they have specific habitat requirements, while American eel ~~and black-nose dace~~ are considered to be habitat generalists. As such, standard mitigation and monitoring for fish and fish habitat (Section 6.8) will address direct and indirect effects to Atlantic salmon, ~~Blacknose dace,~~ brook trout and American eel.

Atlantic salmon is documented by the Nova Scotia Salmon Association to be present within the Killag River (near the ~~mine footprint PA~~ Beaver Dam Mine Site) and the West River Sheet Harbour (~~haul road PA~~ Haul Road), and it is presumed that they also use tributaries to these watercourses, at least periodically. None of the watercourses within the ~~mine footprint~~ Beaver Dam Mine Site have been identified as Type 1 salmon habitat (good salmonid spawning and rearing habitat; often with some feeding pools for larger age classes). All watercourses within the ~~mine footprint PA~~ Beaver Dam Mine Site are first order streams and provide limited quality fish habitat, with the exception of watercourse 5 downstream of Crusher Lake, which has been determined to provide Type II habitat for Atlantic salmon, and migration, juvenile, and overwintering habitat for American eel. ~~Direct impacts to this watercourse, are not anticipated to support mine development.~~ The development of the waste rock stockpiles and low grade ore stockpiles within the contributing area to Crusher Lake and Mud Lake will directly reduce the overall size of the drainage area and will directly impact several watercourses that empty into Crusher Lake, and eventually drain to Mud Lake. Additionally, the waste rock stockpiles will require stockpile and storm water ditching. This ditching directs water through the north settling pond and eventually into Cameron Flowage, bypassing Crusher and Mud Lake. The result of this is a reduction of water in Crusher Lake, a reduction of flow in watercourse 5 (WC-5, between Crusher and Mud Lake), and a reduction of water in Mud Lake. As such, the direct loss of quality habitat for Atlantic salmon is anticipated to be ~~low~~ moderate within the ~~mine footprint PA~~ Beaver Dam Mine Site. Additional information pertaining to the loss of flow within the Beaver Dam Mine Site and its potential impact on fish are presented in Section 6.9.6.

Within the ~~haul road PA~~ Haul Road, there are twenty-four watercourses defined as Type 1 or 2 salmon habitat. American eel were confirmed in three watercourses (watercourses N, V and AH). Thirty-one watercourses within the ~~haul road PA~~ Haul Road are determined to provide potential migration, juvenile rearing, and/or overwintering habitat for American eel. Proposed Project development at these watercourse locations includes the upgrade of the existing Haul Road, including widening and straightening activities, and installation of new culverts and ditch systems to support upgrading and new construction where necessary. These Project interactions can be minimized with the implementation of standard mitigation practices for installation of culverts in fish bearing streams (Nova Scotia Environment, 2015b) and in many cases will result in improved fish passage based on condition of current culvert installation along the existing logging road. Construction of a 4 km section of new road is expected to involve one watercourse crossing (WC-O). Watercourse O provides juvenile rearing habitat for American eel and WC-O provides eel migration habitat. Other crossings may be required, once detailed design of this section of new road is completed. Standard approvals and mitigation will be required for all watercourse crossings, including those in involving new road construction.

American eel were identified only within watercourses in the ~~haul road PA~~ Haul Road, but absence of American eel within the ~~mine footprint PA~~ Beaver Dam Mine Site cannot be confirmed. Within the ~~mine footprint~~ Beaver Dam Mine Site, a single watercourse has been identified as providing habitat for American eel migration, juvenile rearing, and overwintering. Watercourse 5 is a direct tributary to the Killag River through Mud Lake and is present inside the ~~mine footprint PA~~ Beaver Dam Mine Site; ~~however, direct impacts to this watercourse are not anticipated.~~ Direct impacts to WC-5 are expected because the southern (upstream) extent of this watercourse (connection between Wetlands 8 and 2) is located within the proposed location of the eastern waste rock stockpile. Additionally, and as discussed above, Crusher Lake, Mud Lake, and WC-5 are expected to experience a loss of flow which will result in the loss of potential American eel habitat within WC-5.

Expected and potential direct and indirect fish and fish habitat impacts to surface water features (wetlands and watercourses) in the immediate vicinity of the PA as a result of the Project construction and development within the ~~mine footprint~~ Beaver Dam Mine Site are described in Table 6.6-27, and Table 6.6-28 in Section 6.9.6.2. These direct and indirect effects of Project activities are expected to be similar in nature between priority fish species and all other fish species. Broader potential indirect impacts to down-gradient ~~watershed~~ water quality and quantity within the LAA are described in Section 6.9.6.2.2 and effects are evaluated within that section. Maintaining water quality and quantity downstream in the LAA is paramount for limiting broader fish and fish habitat impacts within each affected watershed associated with the Beaver Dam Mine, particularly those known to support priority fish species.

Development of the mine will cause direct impacts to fish and fish habitat mostly within the construction phase of the Project during clearing, grubbing, blasting, and development of the mine and its associated infrastructure. On-going impacts to fish and fish habitat are possible during operations of the mine from on-going dewatering efforts within the open pit and potential siltation and release of substances to receiving surface water systems adjacent to the mine infrastructure.

Construction of the Haul Road may cause impacts to fish and fish habitat mostly within the construction phase of the Project during clearing, grubbing, and construction of new road components where necessary. During construction, positive direct impacts to fish and fish habitat are also expected where current culverts that are hung or crushed can be either replaced or removed and fish passage and habitat re-established.

The ~~Touquoy facility~~ Touquoy Mine Site is currently ~~under construction~~ operational. There are no direct or indirect effects to priority fish or fish habitat anticipated to be caused by the processing of ore and the management of tailings (exhausted pit) from the Beaver Dam Mine Project. ~~Effects to fish and fish habitat related to the Project are described in Section 6.6~~ . Broader potential indirect impacts to down-gradient water quality and quantity within Moose River are described in Section 6.9.6.2.2.

6.13.6.2 Priority Vascular Flora and Lichens

Development of the ~~mine footprint~~ Beaver Dam Mine Site and upgrading and construction of new sections of the Haul Road (Section 3B; Figure 2.2-2) will result in direct impacts to vascular and non-vascular individuals and to flora communities at the full or partial forest stand level. The effects of the Project on flora encompass vascular and non-vascular priority flora species in aquatic, wetland, and upland habitats. As such, many of the effects described in Section ~~6.5~~ 6.8 specific to wetland habitat and Section ~~6.7~~ 6.10 (Habitat and Flora) will directly relate to effects on priority flora species. The majority of direct mortality to flora will occur during site preparation.

~~Within the mine footprint PA, three of the seven documented locations of frosted glass whiskers (*Sclerophora peronella*) are expected to be directly impacted, along with two of the three locations of Wiegand's Sedge (*Carex wiegandii*), and the single location of lesser rattlesnake plantain (*Goodyera repens*) by construction of the Waste Rock Storage Area. Three of the twenty-six observed locations of blue felt lichen (*Degelia plumbea*) may be directly impacted by construction of a water diversion ditch (north of the open pit), the pit perimeter berm around the open pit, and the till stockpile. Impact to these individuals may be avoidable during the detailed design phase. The following species have been documented within close proximity to proposed infrastructure and may be indirectly impacted by development: frosted glass whiskers, *Sclerophora peronella* (4), blistered jellyskin lichen, *Leptogium corticola* (3), peppered moon lichen, *Sticta fuliginosa* (2), and Wiegands' sedge, *Carex wiegandii* (1).~~

Micrositing of infrastructure has been completed to avoid priority flora and lichen species and has reduced the direct impact of the Project on flora and lichens.

The division and micrositing of the waste rock stockpiles (eastern and western) has relocated infrastructure out of the confirmed critical function zone for three historical locations of BFL, south of the Beaver Dam Mine Site. The critical function zone is used to protect critical habitat for BFL (ECCC, 2018) and has been identified as (Figure 6.13-3):

- Phorophyte critical function zone
    - 500 m buffer around the historical BFL locations
- Wetland critical function zone
    - 50 m buffer surrounding the entire Wetland 29, which was determined to be associated wetland habitat for BFL

Micrositing has allowed for avoidance of the eight known locations of frosted glass whiskers, reduced the individuals of blue felt lichen directly impacted from three to one, and will not directly impact any priority vascular plants, with the exception of two clusters of Wiegand's sedge (eastern waste rock stockpile).

Within the Beaver Dam Mine Site two individuals of salted shell lichen and two individuals of slender monk's hood lichen are expected to be directly impacted by the construction of the western waste rock stockpile. As previously mentioned, two clusters of Wiegand's sedge are located within and expected to be directly impacted by the eastern waste rock stockpile. Potential indirect impacts to vascular plants and lichens surrounding Project infrastructure will be reduced through best management strategies and mitigation measures.

Blue felt lichen, highbush blueberry, Appalachian polypody and southern twayblade are species of non-vascular and vascular flora which have been documented in the ~~haul road PA~~ Haul Road. ~~None~~ Only one of these individuals, the southern twayblade, ~~of these individuals are~~ is found along the proposed alignment for the upgraded Haul Road or along the centerline of the section of new construction and an approximate 20 m buffer. While detailed design of the Haul Road layout is not yet complete, it is not anticipated that other vascular or non-vascular flora priority species will be directly impacted by upgrading the existing road or by the construction of the new 4 km section of the Haul Road. As is possible, the Proponent will work to avoid priority flora species during detailed Project design of the Haul Road upgrades. ~~Within the mine footprint, micro-siting of infrastructure has been completed to avoid priority flora species wherever possible.~~

Indirect effects to habitat and flora described in Section ~~6.7~~ 6.10 are relevant to priority flora species as well. Lichens are sensitive to changing environmental conditions, particularly air quality. As such, Project activities may indirectly affect priority lichen species which have been avoided, but exist in close proximity to Project infrastructure.

The ~~Touquoy facility~~ Touquoy Mine Site is currently ~~under construction~~ in operation. There are no direct or indirect effects to vascular flora and lichen species of conservation interest anticipated to be caused by the processing of ore and the management of tailings (exhausted pit) from the Beaver Dam Mine Project. Effects to flora and habitat related to the Project are described in Section ~~6.7~~ 6.10.

6.13.6.3 Priority Terrestrial Fauna

Terrestrial fauna priority SAR/SOCI observed during field surveys within the PA includes the mainland moose and the snapping turtle. Each of these species has variable habitat preferences, depending on the time of year. Mainland moose are found in habitat mosaics of uneven age stands with abundant twigs and foliage for foraging. These uneven-aged mosaic forests that moose prefer can be formed from natural disturbance such as fire or wind throw, or anthropogenic disturbance such as timber harvesting. During the summer months, they are reliant upon aquatic systems (lakes, rivers, and wetlands) for submergent and emergent vegetation, and cover from thermal stress (NSDNR, 2007). Mainland moose are not particularly affected by habitat fragmentation based on habitat preference; however, increased access into a site (construction of new roads) may increase poaching levels. As such, low-level habitat fragmentation can indirectly affect mainland moose.

The snapping turtle can be found in a variety of freshwater ecosystems, such as slow-moving rivers, wetlands, lakes, streams, and ponds. Hibernation occurs in freshwater systems deep enough to prevent freezing through during the winter, with a mucky or muddy substrate. They are the most aquatic of freshwater turtles in Nova Scotia, but they do travel through upland habitat and use gravelly areas to nest. The preference for gravelly substrate during nesting is a threat to turtles, as gravid females are attracted to the gravelly shoulders of roads for nesting. The potential for direct mortality of reproductive females is highest where roads intersect or are adjacent to aquatic ecosystems. This risk is highest in June when females are nesting, particularly given the proposed increase in traffic along the Haul Road.

Development of the ~~mine~~ Beaver Dam Mine Site and associated upgrades to the Haul Road will cause direct impacts to habitat used by terrestrial fauna, including wetlands with suitable hibernacula for snapping turtles, and those with abundant submergent and emergent vegetation for mainland moose. Wetlands 8, 10, 11, 29, 59, 61, 66, 66, 68, 69, 159, 168, ~~and~~ 171, and 207 are identified as potentially providing hibernacula for snapping turtles where open water is present. ~~The open water portions of Wetlands 8, 10, 11, 29, and 61 within the mine footprint PA not proposed for direct impact. Wetland 59 has been identified as potentially providing hibernacula habitat for snapping turtles. This anthropogenic wetland will be directly impacted by construction of the open pit~~. Wetland 10 is expected to be directly impacted by the western waste rock stockpile and Wetlands 59 and 61 are expected to be impacted by construction of the open pit. All other wetlands with hibernacula potential within the Beaver Dam Mine Site will be avoided. All other wetlands with potential to support snapping turtles within the ~~haul road PA~~ Haul Road (wetlands 66, 68, 69, 159, 168, and 171) will have minimal impact proposed, associated with upgrade or construction of the Haul Road. Either these wetlands will be avoided, or where interactions may occur with proposed alignment, impacts to snapping turtle habitat are expected to be minimal, with proper mitigation. Impacts to wetland habitats will occur mostly within the construction phase of the Project during clearing, grubbing, and development of the ~~mine~~ Beaver Dam Mine Site and its associated infrastructure, and upgrading of the Haul Road (widening). Habitat within the PA currently exhibits fragmented conditions based on historic mine operations and current and historic timber harvesting activity within and adjacent to the PA. Refer to the wetland cumulative effects modelling (Section 6.8.5.2) which determined the extent of predicted habitat loss for mainland moose and snapping turtle within the Beaver Dam Mine Site.

Sensory disturbance to terrestrial fauna would result from rock blasting (1-2 times per week during operation), clearing and grubbing, infrastructure construction during the construction phase and, overall increased traffic, blasting, mining activities and trucking during operations within the PA. This would likely result in localized wildlife avoidance of the PA, including moose and snapping turtle. Increased human activity could result in increased usage of the PA by opportunistic species such as coyotes, raccoons, skunks, or black bears. Overall, Project activities could cause a change in usage of the PA by wildlife, with some species tending to avoid the area, while others may be attracted to the increased activity.

How wildlife species such as mainland moose and snapping turtle are affected by habitat availability, use, or fragmentation is determined by species habitat requirements (e.g., thermal, cover, security) and rates of movement through various habitats (With & Crist, 1995). Fragmentation of a particular species' habitat implies a loss of habitat, reduced patch size, and/or increasing distance between patches. However, fragmentation may also suggest an increase of new habitat (Andren, 1994). Therefore, the effect of habitat fragmentation on a species (population) would be primarily through not only habitat loss, but also habitat changes. Habitat patches are parts of the landscape mosaic and the presence of a species in a patch may be a function not only of patch size and isolation, but also of the neighboring habitat. In landscapes with more than 30% of suitable habitat, fragmentation is primarily habitat loss (With & Crist, 1995). Habitat generalists may survive in very small patches because they can also use resources in the surroundings. Furthermore, the total species diversity across habitats in a given landscape may increase when new patches of habitat are created within the continuous habitat, since new species may be found in these new habitats, even if they are human-made (Andren, 1994).

Habitat selection by wildlife is primarily a response to security, thermal comfort, and forage needs. Wildlife must balance these conflicting requirements. Habitat selection is species-specific and choices will depend on physiological constraints and social needs of the species. Literature in conservation biology indicates that maintenance of movement corridors of suitable habitat between population centers is fundamental to wildlife health (Bentz, Saxena, & O'Leary, 1994).

Although security and thermal cover are important, habitat selection is strongly influenced by relative foraging opportunities (Renecker and Hudson 1999). Requirements for security vary seasonally and are greatest when animals feel threatened. Wildlife is vulnerable at parturition and when accompanied by neonates, a condition that is exacerbated when the mother is in poor condition. To off-set this disadvantage, wildlife select habitats consistent with their physical attributes and cryptic coloration. For example, white-tailed deer escape cover in forests (Renecker & Hudson, 1999).

Studies completed by Buckmaster et al. (1999) indicate that wildlife populations may be expected to disperse from the area during periods of construction. However, this displacement is generally of short temporal disturbance as most cases reveal that wildlife have returned rapidly after human activity has ceased (Shank, 1979).

Changes to ambient noise levels and the presence of periodic vibrations have the potential to adversely affect fauna and birds by influencing migration and behavioral patterns (refer to Section 6.9.6 for a discussion of the impact of predicted noise levels around the PA on terrestrial fauna). Noise and vibration is provincially regulated via the Workplace Health and Safety Regulations and the Pit and Quarry Guidelines, which protects the health of site workers and the general public at PA boundaries, respectively. If blasting is required near fish-bearing watercourses or waterbodies, guidelines identified by Wright and Hopky (1998) will be adhered to. Mainland moose are not likely significantly affected by noise and vibration, due to their ability to easily travel to avoid this disturbance. Hibernating snapping turtles, on the other hand, are unable to easily escape sensory disturbance easily during hibernation. As such, practices should be implemented to reduce blasting near wetlands with suitable snapping turtle hibernacula during hibernation. Hibernation generally occurs from October through March, depending on seasonal temperatures (i.e., hibernation can start later in a warm fall and end sooner in an early spring, and vice versa).

Direct mortality of priority fauna species could result from Project activities, particularly due to the increase in traffic during construction and operation of the facility. Increased traffic poses a risk to wildlife such as the mainland moose and snapping turtle along the entire length of the Haul Road between the ~~Beaver Dam mine~~ Beaver Dam Mine Site and the ~~Touquoy processing facility~~ Touquoy Mine Site. Indirect mortality to these species could also occur from exposure to contaminants or spills from unplanned incidents.

The ~~Touquoy facility~~ Touquoy Mine Site is currently ~~under construction~~ operational. There are no direct or indirect effects to priority fauna species anticipated to be caused by the processing of ore and the management of tailings (exhausted pit) from the Beaver Dam Mine Project. Effects to terrestrial fauna species related to the Project are described in Section ~~6.8~~ 6.11.

6.13.6.4 Priority Birds

The assessment of potential adverse interactions and effects of the Project on this VC takes into account the potential for the Project to result in changes to:

- Permanent and temporary habitat alteration and fragmentation
- Disturbance and/or displacement
- Potential for direct and indirect mortality to individuals
- Attraction and disorientation resulting from night-lighting

With appropriate mitigation and monitoring, no direct mortality of priority bird species is anticipated, with the exception of the low potential for a bird strike with a haul truck. Avian usage of the PA during construction and operation of the Beaver Dam Mine will largely be driven by changes to habitat, resulting in localized avoidance of the PA by some species. Noise generated during all Project phases also has the potential to affect birds and cause avoidance behaviour. Refer to Section 6.10.7 for a discussion of the impact of predicted noise levels around the PA on birds.

Some priority species may avoid the PA in favor of undisturbed habitat in the surrounding landscape. Other priority species are anticipated to be attracted to the mine infrastructure and newly created habitat. The common nighthawk, for instance, is a crepuscular insectivore which nests on exposed gravel and disturbed areas. Lighting of buildings at dawn and dusk can create a foraging opportunity where insects are attracted to the lights. Barn swallows commonly nest in the eaves of built structures and bank swallows can nest in vertical slopes in sandy or silty soil, even in areas with high activity levels. These species of swallows have similar feeding habits as the common nighthawk. As such, Project activities may increase habitat suitability for both these species. If mitigated properly, the direct impact to these species is anticipated to be low.

Refer to the wetland cumulative effects modelling (Section 6.8.5.2) which determined the extent of predicted habitat loss for Canada warbler, olive-sided flycatcher, and rusty blackbird within the Beaver Dam Mine Site.

The placement of the open pit cannot be microsighted as its location is dependent on the ore location. A single greater yellowlegs was observed during breeding bird surveys within Wetland 59 (Beaver Dam Mine Site PC1). Single observations of greater yellowlegs were also made during breeding bird surveys within the Beaver Dam Mine Site at PC3 and PC10, located along a road that connects the eastern and the western stockpiles and north of the PA, respectively. The road where PC3 is located was micrlandsited to minimize impact to wetlands.

Detailed designs of the Haul Road will minimize impact to wetlands which may offer suitable nesting habitat for greater yellowlegs (such as that observed at Haul Road PC3). The area of highest evidence of possible nesting (Haul Road PC1) will be impacted by upgrades to Beaver Dam Mines Road, increased traffic, and a waterline. This will occur during the construction and operation phases. At EOM and PC, water will be discharged into Wetland 64 via the eastern collection pond. The result of this is a predicted average vertical change of water depth in Wetland 64 of 5 cm. An increase in flow is not anticipated to adversely affect the wetland and may result in increased habitat for greater yellowlegs. Detailed design planning for these upgrades will take into consideration the location of Wetland 64, and others along the Haul Road to reduce the impact to these locations if possible (such as Haul Road PC 3, near Wetland 121) while maintaining safe road conditions for haul activities.

The current habitat in the Beaver Dam Mine Site displays a high level of disturbance and has been fragmented by historical mine operations, forestry operations, and roads. As a result, the Beaver Dam Mine Site does not offer high quality breeding habitat for the greater yellow legs. Suitable nesting habitat for greater yellowlegs is present within the LAA surrounding the Beaver Dam Mine Site and Haul Road, which will remain unaltered. Specific mitigation and monitoring commitments related to the greater yellowlegs are provided in Section 6.13.8.4.

The ~~Touquoy facility~~ Touquoy Mine Site is currently ~~under construction~~ in operation. There are no direct or indirect effects to priority avifauna species anticipated to be caused by the processing of ore and the management of tailings (exhausted pit) from the Beaver Dam Mine Project. Effects to avifauna species related to the Project are described in Section ~~6.9~~ 6.12.

6.13.7 Preferred Alternative Haul Road

6.13.7.1 Rationale for Valued Component Selection

Same rationale for valued component selection as indicated in Section 6.13.1.

6.13.7.1.1 Baseline Program Methodology

Specific field program methodologies for each taxonomic group are outlined in previous sections of this EIS (Fish and Fish Habitat, Flora and Habitat, Terrestrial Fauna, and Birds). Additionally, Section 6.13.2 describes certain methods specific to priority species (e.g. lichens).

No targeted surveys were conducted for mainland moose, bats, invertebrates and priority herpertofauna within the Preferred Alternative Haul Road.

6.13.7.1.2 **Baseline Conditions**

6.13.7.1.2.1 Priority Fish Species

Aside from fish habitat assessments, no targeted fish surveys (capture and electrofishing) were conducted within the Preferred Alternative Haul Road PA, nor were any fish incidentally observed.

Electrofishing surveys were conducted on the Haul Road, in tributaries of the watercourses that are present within the Preferred Alternative Haul Road. Watercourse AH within the Haul Road (which is contiguous with WC-AN and AO of the Preferred Alternative Haul Road) had two SOCI observed, brook trout (S3) and American eel (COSEWIC T). Refer to Sections 6.13.3.1.2 and 6.13.3.1.3 for additional information on brook trout and American eel, respectively.

Only one watercourse (WC-AI) within the Preferred Alternative Haul Road PA was assessed to have potential Atlantic salmon habitat (Type I, II, or III). None of the watercourses within the Preferred Alternative Haul Road PA have a topographically mapped connection to a documented salmon river.

No fish SAR were documented in tributaries of watercourses present within the Preferred Alternative Haul Road.

6.13.7.1.2.2 Priority Vascular Flora Species

No SAR/SOCI vascular plants were observed within the Preferred Alternative Haul Road PA during dedicated vascular plant surveys or incidentally.

6.13.7.1.2.3 Priority Lichen Species

Within the Preferred Alternative Haul Road PA, two SAR and seven SOCI lichens were identified (Table 6.13-15). The Preferred Alternative Haul Road PA consists primarily of clear cuts with scattered conifer and mixed wood stands. In the eastern extent of the Preferred Alternative Haul Road PA, Wetland 199 contains a mixed wood stand with an open canopy with pit and mound topography and two priority lichen species (frosted glass-whiskers lichen and corrugated shingles lichen). Within the Preferred Alternative Haul Road PA, salted shell lichen (a BFL indicator) was observed in Wetlands 194 and 198 in mature balsam fir swamps. Although salted shell lichen was present and BFL habitat was suitable, no BFL was observed. Hardwood stands were also present in Wetland 187 and dominated by yellow birch and red maple. Powdered fringe lichen was observed within this wetland.

Table 6.13-15 Priority Lichen Species Identified within the Preferred Alternative Haul Road PA.

Common name	Scientific name	SARA, COSEWIC, NSESA	S-Rank	
Frosted glass-whiskers lichen	*Sclerophora peronella*	SARA and COSEWIC SC	S1?	Three individuals in and immediately adjacent to Wetland 199.

Common name	Scientific name	SARA, COSEWIC, NSESA	S-Rank	
Blue felt lichen	*Degelia plumbea*	SARA and COSEWIC SC and NSESA V	S2S3	Two individuals were identified within the Preferred Alternative Haul Road PA. One is found within Wetland 186 and one was found east of WC-AI.
Corrugated shingles lichen	*Fuscopannaria ahlneri*	-	S3	Two individuals were observed within Wetland 199.
Powdered fringe lichen	*Heterodermia speciosa*	-	S3	One individual is found east of WC-AI and a second is located north of Wetland 187.
Blistered jellyskin lichen	*Leptogium corticola*	-	S3	Two individuals were identified. One is located within Wetland 186 and one is located north of Wetland 187.
Salted shell lichen	*Coccocarpia palmicola*	-	S3S4	Five of the six individuals are found within Wetland 198. The other individual was observed in Wetland 194.
Slender monk's hood lichen	*Hypogymnia vittata*	-	S3S4	A total of six individuals were observed within the Preferred Alternative Haul Road PA. Single individuals were found within Wetlands 182, 187, 194, 198. The remaining two individuals were found within Wetland 186.
Shaggy fringed lichen	*Anaptychia palmulata*	-	S3S4	Four individuals are located in close proximity to WC-AI at the western extent of the Preferred Alternative Haul Road PA. One other thallus is located south of the Preferred Alternative Haul Road PA, along WC-AK.
Fringe lichen	*Heterodermia neglecta*	-	S3S4	Six individuals were observed within the Preferred Alternative Haul Road PA. Single individuals are found in

Common name	Scientific name	SARA, COSEWIC, NSESA	S-Rank	
				Wetlands 182, 194, and 199. Three other individuals are located in close proximity to WC-AI.

Refer to Section 6.13.3.3.1 to 6.13.3.3.11 for descriptions of frosted glass whiskers lichen, blue felt lichen, blistered jellyskin lichen, salted shell lichen, slender monk's hood lichen, powdered fringe lichen, and fringe lichen. The following four lichens which were also found within the Preferred Alternative Haul Road were not identified within the broader PA or LSA; Corrugated Shingles Lichen and Shaggy Fringed Lichen. Descriptions of these lichens can be found in the following Sections.

6.13.7.1.2.3.1 Corrugated Shingles Lichen

Corrugated shingles lichen (*Fuscopannaria ahlneri*) is a foliose lichen. Two individuals were found in wetland habitat (Wetland 199) within the Preferred Alternative Haul Road both on mature red maples. Typical substrate of corrugated shingles lichen ranges from bark, cork, or plant surfaces, to rock. Corrugated shingles lichen is ranked by the ACCDC as S3.

6.13.7.1.2.3.2 Shaggy Fringed Lichen

Shaggy fringed lichen (*Anaptychia palmulata*) is cited as being commonly found on the bark of hardwood trees but can also be found over moss on rocks (Esslinger, 2007). Within the Preferred Alternative Haul Road, shaggy fringed lichen was discovered on yellow birch and red maple in close proximity to WC-AI and WC-AK. The ACCDC has ranked shaggy fringed lichen as S3S4.

6.13.7.1.2.4 Priority Fauna

No priority terrestrial fauna were observed within the Preferred Alternative Haul Road PA. Suitable habitat, however, is present for mainland moose throughout the PA. Additionally, the Preferred Alternative Haul Road is located within a Mainland Moose Concentration Area.

Potential habitat is also available for snapping turtle. Snapping turtle suitable habitat is present along the northern boundary of the Preferred Alternative Haul Road PA within WC-AL and Wetland 193. This habitat is characterized by slow-flowing water and soft mud substrate, habitat preferred by the species according to the *Management Plan for the Snapping Turtle (Chelydra serpentine) in Canada* (ECCC, 2016d).

Refer to Sections 6.13.3.4 and 6.13.3.5 for descriptions of mainland moose and snapping turtle, respectively.

No suitable hibernacula was observed for bats within the Preferred Alternative Haul Road PA.

6.13.7.1.2.5 Priority Birds

Of the 44 avifauna species observed during breeding bird surveys within the Preferred Alternative Haul Road PA, seven were identified as priority species. Two of the seven priority avifauna species are SAR and five are SOCI (Table 6.13-16).

Table 6.13-16 Priority Birds Identified within the Preferred Alternative Haul Road PA

Common Name	SARA	COSEWIC	NSESA	S-Rank	Point Count Location	Total #
Olive-sided flycatcher	T	T	T	S2B	3, 10	2
Eastern wood-pewee	-	SC	V	S3S4B	5	1
Blackpoll warbler	-	-	-	S3S4B	15, 20	2
Red-breasted nuthatch	-	-	-	S3	2, 3, 7, 9, 11, 20	6
Ruby-crowned kinglet	-	-	-	S3S4B	2, 3, 4, 5, 6, 16	13
Swainson's thrush	-	-	-	S3S4B	3, 5, 19	4
Yellow-bellied flycatcher	-	-	-	S3S4B	6, 17, 20	4
Total						**32**

All the seven priority avifauna species exhibited possible breeding evidence which was observed during breeding bird surveys in 2018. SAR/SOCI birds are discussed in detail in Section 6.13.3.7.

6.13.7.1.3 **Considerations of Consultation and Engagement Results**

The Preferred Alternative Haul Road is the result of consultation and engagement on the Primary Haul Road. Refer to Section 6.13.4 for key issues raised during public consultation and Mi'kmaq engagement relating to species of conservation interest and species of concern.

6.13.7.1.4 **Effects Assessment Methodology**

6.13.7.1.4.1 Boundaries

Spatial Boundaries

The spatial boundaries used for the assessment of effects to SAR and SOCI along the Preferred Alternative Haul Road are the PA, LAA, and RAA. The Preferred Alternative Haul Road PA (Figure 5.4-1) encompasses 50 m on either side of a 5.7 km long center line. The eastern and western extent of the Preferred Alternative Haul Road PA connects to the Haul Road at a pre-existing forestry road and to Mooseland Road, respectively. The Preferred Alternative Haul Road PA runs north of Sandy Pond and Miller Lake.

The LAA and RAA are specific to each taxa and are provided herein:

- Fish: The LAA (Figure 6.8-2) consists of portions of downstream aquatic habitats and headwaters where appropriate, depending on project activities, up to the maximum size of the tertiary watershed(s). The LAA boundaries were defined considering the maximum expected extent of direct and indirect impacts to the aquatic environment as well as the location of project activities across all three project components.

  The RAA (Figure 6.8-3) encompasses the two secondary watersheds that the PA is located within. These watersheds are the Tangier River secondary watershed, and the Fish River secondary watershed (Figure 6-7A). The RAA is broader than expected project impacts and considers other project boundaries as per the cumulative effects methodology.

- Vascular Flora and Lichens: The LAA (Figure 6.10-8) includes a 500m buffer from the Preferred Alternative Haul Road. This area encompasses the maximum expected extent of project direct and indirect impacts to habitat and flora.

  The RAA (Figure 6.10-9) encompasses NSL&F's Ecological Land Classification Ecodistricts: 420 (Eastern Drumlins). This Ecodistrict spans an area broader than the expected project impacts and considers other project boundaries as per cumulative effects methodology. These spatial boundaries will help to identify the direct or indirect impacts to flora species and critical habitats, and the effects of the Project on distribution and abundance of these species.

- Terrestrial Fauna: The LAA (Figure 6.10-8) includes a 500m buffer from the Preferred Alternative Haul Road. This area encompasses the maximum expected extent of project direct and indirect impacts to terrestrial fauna.

  The RAA (Figure 6.10-9) encompasses NSL&F's Ecological Land Classification Ecodistricts: 420 (Eastern Drumlins). This Ecodistrict spans an area broader than the expected Project impacts to terrestrial fauna and considers other Project boundaries as per cumulative effects methodology. These spatial boundaries will help to identify the direct or indirect impacts to terrestrial fauna and the effects of the Project on distribution and abundance of these species.

- Birds: The LAA (Figure 6.10-8) includes a 500m buffer from the Preferred Alternative Haul Road. This area encompasses the maximum expected extent of project direct and indirect impacts to birds.

  The RAA (Figure 6.10-9) encompasses NSL&F s Ecological Land Classification Ecodistricts: 420 (Eastern Drumlins). This Ecodistrict spans an area broader than the expected Project impacts to birds and considers other Project boundaries as per cumulative effects methodology. These spatial boundaries will help to identify the direct or indirect impacts to bird species and the effects of the Project on distribution and abundance of these species.

These spatial boundaries will help to identify the direct or indirect impacts to SAR and SOCI and the effects of the Project on distribution and abundance of these species.

Temporal Boundaries

The temporal boundaries used for the assessment of effects to SAR and SOCI are the construction phase, operational phase, and decommissioning and reclamation phases.

Technical Boundaries

No technical boundaries were identified for the effects assessment of SAR and SOCI.

Administrative Boundaries

The primary administrative boundaries for SAR and SOCI are outlined in the federal SARA and provincial NSESA. Terrestrial fauna are provided protection under the provincial Wildlife Act and the federal Canada Wildlife Act. Fish species are further regulated under the federal Fisheries Act, while migratory bird species are regulated under the Migratory birds Convention Act.

6.13.7.1.4.2 Thresholds for Determination of Significance

The thresholds for determination of significance regarding SAR/SOCI within the Preferred Alternative Haul Road are identical to the thresholds for determination of significance for this VC throughout the entire PA, as presented within Section 6.13.5.2.

6.13.7.1.5 Project Activities and Species at Risk and Species of Conservation Interest Interactions and Effects

Priority species identified within the Preferred Alternative Haul Road PA represent a diversity of taxa, habitat preferences, and, therefore, represent a diversity of potential and confirmed Project interactions, effects, mitigation, and monitoring. As such, Project effects, mitigation, and monitoring are discussed in terms of each taxa, rather than individual species, with a focus on SAR, recognizing that mitigation measures for SAR will generally provide appropriate mitigation for identified SOCI in the same taxonomic group. Where this is not the case, it will be stated. Project interactions, mitigation, and monitoring for each broad taxonomic group are outlined in previous chapters as well, and these mitigation measures are appropriate and should be applied for all SAR and SOCI within the same taxonomic group.

6.13.7.1.5.1 Priority Fish Species

Two priority fish species, American eel and brook trout, were identified within tributaries to WC-AN and WC-AO within the Preferred Alternative Haul Road PA during electrofishing surveys within the Haul Road.

Atlantic salmon are not expected to inhabit the watercourses of the Preferred Alternative Haul Road PA because these watercourses do not have a topographically mapped connection to a documented salmon river.

Project development of these watercourses locations include the construction of the Preferred Alternative Haul Road and installation of new culverts, bridges, and ditch systems.

These Project interactions can be minimized with the implementation of standard mitigation practices for installation of culverts in fish bearing streams (Nova Scotia Environment, 2015b) Construction of the Preferred Alternative Haul Road is expected to involve three watercourse crossings (WC-AI, AM, and AO) as well as upgrades to the bridges currently located at WC-AK and AL. The remaining two watercourses within the Preferred Alternative Haul Road PA, WC-AJ and AN are avoidable and are not expected to be crossed, however, crossings may be required once the detailed design of this road is completed. Standard approvals and mitigation will be required for all watercourse crossings, including those in involving new road construction.

Potential direct and indirect impacts to SAR and SOCI fish and fish habitat are described in Section 6.13.6.1.

6.13.7.1.5.2 Priority Vascular Flora and Lichens

No priority vascular flora were identified during dedicated surveys. Construction of the Preferred Alternative Haul Road may result in direct impacts to priority lichen species within both wetland and upland habitat.

Detailed design of the Preferred Alternative Haul Road has not yet been completed. It is expected that the majority of the priority lichen species observed will be avoided after micro siting and design has taken place. As a worst-case scenario, if the Preferred Alternative Haul Road (30 m wide) were to be constructed along the centerline of the Preferred Alternative Haul Road PA, the following lichen species would be directly impacted: blue felt lichen, fringe lichen, shaggy fringed lichen, blistered jellyskin lichen, powdered fringe lichen, and slender monk's hood lichen.

With the exception of fringe lichen (n=2), all of the lichen species expected to be impacted according to the Preferred Alternative Haul Road centerline alignment occur to a single individual. The locations of frosted glass-whiskers lichen, corrugated shingles lichen, and salted shell lichen do not fall within this alignment.

Further indirect effects to flora and lichens are discussed within Section 6.10 and are relevant to priority species.

6.13.7.1.5.3 Priority Terrestrial Fauna

No priority terrestrial fauna were observed within the Preferred Alternative Haul Road PA. Potential habitat, however, exists for mainland moose and snapping turtle. Section 6.13.6.3 describes direct and indirect project interactions with priority terrestrial fauna that can be correlated to the Preferred Alternative Haul Road.

Development of the Preferred Alternative Haul Road could directly affect habitat utilized by mainland moose as well as suitable habitat for snapping turtle (WC-AL and Wetland 193). Detailed design of the road alignment will take suitable habitat for priority species into account and minimize disturbance to the areas identified.

6.13.7.1.5.4 Priority Birds

Seven priority bird species were identified during breeding bird surveys within the Preferred Alternative Haul Road PA. The assessment of potential adverse interactions and effects of the Project on priority birds considers the potential for the Project to result in changes to:

- Permanent and temporary habitat alteration and fragmentation
- Disturbance and/or displacement
- Potential for direct and indirect mortality to individuals
- Attraction and disorientation resulting from night-lighting

Habitat loss for priority bird species associated with the development of the Preferred Alternative Haul Road is expected during the construction phase. With the appropriate mitigation and monitoring, no direct mortalities to birds are expected, except for the low potential for a bird strike by a haul truck. Refer to Section 6.12.6 and 6.13.6.4 for descriptions of bird activities in response to Project interactions.

6.13.8 Mitigation ~~and Monitoring~~

The potential effects related to species and that are associated with the different phases of the Beaver Dam Mine Project are outlined in Tables 6.9-36, 6.10-11, 6.11-9, and 6.12-16, for each taxonomic group of species. Specific mitigation ~~and monitoring~~ measures related to priority species are outlined in the following sections.

6.13.8.1 Priority Fish Species

Standard mitigation ~~and monitoring~~ for fish and fish habitat is expected to appropriately mitigate effects on priority fish species. Watercourse alteration permitting will also be required, at which time detailed fish habitat quantification and potential effects on priority fish species will be addressed. The following mitigation efforts are considered in addition to those general fish and fish habitat mitigation measures outlined in Table 6.9-36 in Section 6.9.8.

- Site specific terms and conditions for alteration of watercourses which support priority fish species will be communicated to all site personnel and strictly adhered to; fish rescue will be completed within ~~mine footprint PA~~ the Beaver Dam Mine Site prior to commencement of mine development;
- All culverts to be installed will be done in accordance with the NSE Watercourse Standard (2015) or as updated at time of construction to ensure fish passage through new culverts, and improving access by upgrading or removing improperly installed culverts, where possible; and,
- The location of all watercourses known to support priority species will be communicated to site personnel along with recommended mitigation measures

Table 6.13-17 Mitigation for SOCI Fish

Species	Rank	Observations	Direct Impact from Original Layout	Potential Adverse Effects	Monitoring Plan, Action Plan, or Recovery Strategy	Mitigation	Mitigation Connection to Plan	Direct Impact after Micro siting Infrastructure	Effectiveness of Mitigation
Atlantic salmon	Nova Scotia Southern Upland Population SARA – No Status COSEWIC - E	None observed during fish collection studies Atlantic salmon have been documented within the West River Sheet Harbour watershed and are expected to be present within contiguous surface water with the West River Sheet Harbour where suitable habitat is present along the Haul Road. Watercourse N and Cameron Flowage observations documented by NSSA High potential suitable habitat in watercourses: 4, 5, 7, 9, 14, B, C, F, G, H, I, J, L, M, P, Q, T, U, V, X, Y, Z Potential habitat, but no connection to a known Salmon river in watercourses: 10, 12, E, S, AA, AC, AD, AE, AF, AH	No direct impact to the West River Sheet Harbour or the Killag River, however, direct impacts are expected to watercourses that flow into the Killag River: WC-4 and 5 are located within the waste rock stockpile. WC-14 is located within a stockpile.	Habitat alteration, fragmentation, or loss Unintentional destruction of eggs, larvae, juveniles, or adults	No current monitoring plan, action plan or recovery strategy for this species in this area	Complete further detailed surveys for wetland and watercourse alteration permitting Complete further design phase micro siting of infrastructure and Haul Road to avoid or minimize impacts to fish and fish habitat Complete fish rescue and relocation as anticipated for Wetland 59 prior to pit development Adhere to approved timing windows for construction to minimize impact to eggs, larvae, and juvenile fish, wherever practicable Limit direct alteration within the Beaver Dam Mine Site to first order streams that have limited potential to support spawning, wherever practicable Limit access to the PA and prohibit staff fishing within the PA to avoid increased fishing pressures Blasting activities will adhere to setback recommendations and other mitigation strategies advised by DFO for measures to avoid causing harm to fish and fish habitat Implement accidental spill and contingency plans – e.g. use of spill kits and booms Implement wetland and surface water quality monitoring programs	N/A	No direct impact to the West River Sheet Harbour or the Killag River, however, direct impacts are expected to watercourses that flow into the Killag River: Loss of WC-4 and 5 (upstream of crusher) due to the placement of the eastern waste rock stockpile. Reduction of surface water within Crusher Lake, Mud Lake, and WC-5 (Which connects the two lakes). WC-14 is located within a till stockpile and WC-13 is expected to be lost due to the location of the open pit.	Avoidance, mitigation, and offsetting results in *no serious harm to fish* for the majority of the PA. Potential *Fisheries Authorization* may be required for system between Crusher and Mud Lake (WC-5) due to loss of flow within this system.

Species	Rank	Observations	Direct Impact from Original Layout	Potential Adverse Effects	Monitoring Plan, Action Plan, or Recovery Strategy	Mitigation	Mitigation Connection to Plan	Direct Impact after Micro siting Infrastructure	Effectiveness of Mitigation
						Implement downstream water quality and quantity monitoring program Replace crushed, hung, or improperly installed culverts along the Haul Road that are impeding fish passage			
Brook trout	S3	Brook Trout were confirmed within Watercourse 5, 12, 13 within the Beaver Dam Mine Site Expected to be using wetland habitat in Wetlands 8, 44, and 17 - connection to Watercourse 5 Likely also present in Wetlands 56, 59 and 61, where open water is present Within the Haul Road, brook trout was confirmed within Watercourse N, V, and AH Expected to be utilizing wetland habitat in Wetlands 171, 173 and 174 - connection with Watercourse AH	The open pit is expected to impact brook trout habitat at Wetlands 56, 59, 61, and WC-12 and WC-13. Waste rock storage will impact Wetland 44 and stockpiles will impact Wetland 8. Impacts from the Haul Road are to wetlands which were identified as potential fish habitat only.	Habitat alteration, fragmentation, or loss Unintentional destruction of eggs, larvae, juveniles, or adults	No current monitoring plan, action plan or recovery strategy for this species in this area	Complete further detailed surveys for wetland and watercourse alteration permitting Complete further design phase micro siting of infrastructure and Haul Road to avoid or minimize impacts to fish and fish habitat Complete fish rescue and relocation as anticipated for Wetland 59 prior to pit development Adhere to approved timing windows for construction to minimize impact to eggs, larvae, and juvenile fish Limit direct alteration within the mine footprint to first order streams that have limited potential to support spawning, wherever practicable Limit access to the PA and prohibit staff fishing within the PA to avoid increased fishing pressures Blasting activities will adhere to setback recommendations and other mitigation strategies advised by DFO for measures to avoid causing harm to fish and fish habitat including aquatic species at risk. Implement accidental spill and contingency plans – e.g.: use of spill kits and booms	N/A	The location of the open pit has not changed, therefore, it is expected to impact brook trout habitat at Wetlands 56, 59, 61 and WC-12 and WC-13. WC-5 (upstream of crusher) and Wetland 44 are located within the eastern waste rock stockpile. Reduction of surface water within Crusher Lake, Mud Lake, and WC-5 (Which connects the two lakes). Wetland 8 is no longer directly impacted by infrastructure. Impacts from the Haul Road are to wetlands which were identified as	Avoidance, mitigation, and offsetting results in *no serious harm to fish* for the majority of the PA. Potential *Fisheries Authorization* may be required for system between Crusher and Mud Lake (WC-5) due to loss of flow within this system.

Species	Rank	Observations	Direct Impact from Original Layout	Potential Adverse Effects	Monitoring Plan, Action Plan, or Recovery Strategy	Mitigation	Mitigation Connection to Plan	Direct Impact after Micro siting Infrastructure	Effectiveness of Mitigation
						Implement wetland and surface water quality monitoring programs Implement downstream water monitoring program Replacement of crushed, hung, or improperly installed culverts along the Haul Road that are impeding fish passage		potential fish habitat only.	
American eel	SARA – No Status COSEWIC - TH	American eel were confirmed in Watercourse N, V and AH Thirty-one watercourses within the Haul Road are determined to provide potential migration, juvenile rearing, and/or overwintering habitat for American eel. No American eel were confirmed in the Beaver Dam Mine Site Watercourse 5 has been identified as providing habitat for American eel migration, juvenile rearing, and overwintering. American eel have the potential to inhabit other watercourses within	WC-5 south of Crusher Lake will be directly impacted by the waste rock stockpile. No direct impact to watercourses along the Haul Road.	Habitat alteration, fragmentation, or loss Unintentional destruction of eels	No current monitoring plan, action plan or recovery strategy for this species in this area	Further detailed surveys for wetland and watercourse alteration permitting Further design phase micro siting of infrastructure and Haul Road to avoid or minimize impacts to fish and fish habitat Fish rescue and relocation is anticipated for Wetland 59 prior to pit development Adherence to approved timing windows for construction to minimize impact to juvenile and adult eels. Limit access to the PA and prohibit staff fishing within the PA to avoid increased fishing pressures Blasting activities will adhere to setback recommendations and other mitigation strategies advised by DFO for measures to avoid causing harm to fish and fish habitat including aquatic species at risk. Implementation of accidental spill and contingency plans – e.g. use of spill kits and booms Implementation of wetland and surface water quality monitoring programs	N/A	No change in impact along the Haul Road. Within the Beaver Dam Mine Site, WC-5 (upstream of crusher) and Wetland 44 are located within the eastern waste rock stockpile. Reduction of surface water within Crusher Lake, Mud Lake, and WC-5 (Which connects the two lakes). Further detailed surveys will be completed for alteration permitting.	Avoidance, mitigation, and offsetting results in *no serious harm to fish* for the majority of the PA. Potential *Fisheries Authorization* may be required for system between Crusher and Mud Lake (WC-5) due to loss of flow within this system.

Species	Rank	Observations	Direct Impact from Original Layout	Potential Adverse Effects	Monitoring Plan, Action Plan, or Recovery Strategy	Mitigation	Mitigation Connection to Plan	Direct Impact after Micro siting Infrastructure	Effectiveness of Mitigation
		the Beaver Dam Mine Site as well.				Implementation of downstream water quality and quantity monitoring program Replacement of crushed, hung, or improperly installed culverts along the Haul Road that are impeding fish passage			

6.13.8.2 Priority Vascular Flora and Lichens

No vascular flora SAR has been observed within the PA. Five priority species of vascular flora were identified across the ~~PA both within the mine footprint~~ Beaver Dam Mine Site and within the Haul Road ~~PA~~. ~~Three~~ Two SAR lichens and ~~3~~ seven SOCI lichens were identified within the PA. Standard mitigation measures outlined previously in Sections 6.10.8 will provide appropriate guidance and in addition:

- Avoid SOCI wherever possible, particularly during micro-siting and detailed engineering of the Haul Road upgrades and new construction. Clearly identifying locations of SOCI where they will be avoided, and instruct personnel of their whereabouts;
- A map of all priority vascular and non-vascular flora will be provided to site personnel during site orientation, and the locations of all priority flora species that will be avoided during Project construction will be clearly flagged in the field;
- The Proponent will transplant priority species, where deemed reasonable and appropriate in consultation with regulators, that are located within the direct footprint of the ~~mine~~ Beaver Dam Mine Site infrastructure or Haul Road to nearby areas where suitable habitat is present. Where avoidance or transplanting is not possible, the Project Team will collect vascular flora SOCI form areas proposed for direct impact for herbarium records or for preservation of seeds in a seed bank through Acadia University;
- Wherever avoidance of priority lichen species is not possible, the Project Team will consult with a lichen specialist to determine the likelihood of successful transplantation of SAR lichens to adjacent areas with suitable habitat. Where avoidance and transplantation is not possible, the Project Team will collect specimens for submission to Frances Anderson or equivalent contact at time of construction (Lichen Specialist, Research Associate, and Nova Scotia Museum); and,
- Lichens are particularly sensitive to changing environmental conditions, particularly air quality. the Proponent will consult with a lichen specialist to develop a lichen monitoring program for those lichen SAR identified outside of, but in close proximity to, the Project Area to determine extent of indirect effects on those species.

Table 6.13-18 Mitigation for SAR lichen

Species	Rank	Observations	Direct Impact from Original Layout	Potential Adverse Effects	Monitoring Plan, Action Plan, or Recovery Strategy	Mitigation	Mitigation Connection to Plan	Direct Impact after Micrositing Infrastructure	Effectiveness of Mitigation
Blue felt lichen	SARA - SC COSEWIC - SC NSESA – V	28 observed locations in the Beaver Dam Mine Site, Haul Road, and in the broader LSA Observations within the Beaver Dam Mine Site (14 individuals): • Seven individuals within Wetland 14 • Three individuals within Wetland 17 • One individual within Wetland 4 • Single individuals adjacent to Wetlands 2, 29, and 61. Observations within the Haul Road (one individual): • An individual adjacent to Wetland 112	One observed locations may be directly impacted by construction of the water line ditch (north of the open pit). No direct impact along Haul Road within 20 m buffer of centerline	Sensitive to changing environmental conditions, particularly air quality in close proximity Accidental cutting of host tree or too close to host tree Edge effects – e.g.: increased light, wind, temp; decrease in moisture due to nearby disturbance	An At-Risk-Lichens Special Management Practices (SMP) was released by NSL&F on May 23, 2018.	Complete further detailed design of Haul Road and micro siting of mine infrastructure to avoid priority lichen species Reduce disturbance through buffering of habitat - maintain 100m buffer, wherever practicable Implement air quality monitoring and dust suppression plans Flag host trees Provide map of all priority vascular and non-vascular flora to site personnel during site orientation Develop a lichen monitoring program in consultation with lichen specialist for Lichen SAR within and in close proximity to the PA Wherever avoidance of priority lichen species is not possible, the Project Team will consult with a lichen specialist to determine the likelihood of successful transplantation of SAR lichens to adjacent areas with suitable habitat. Where avoidance and transplantation are not possible, the Project Team will collect specimens for submission to Frances Anderson or equivalent contact at time of construction (Lichen Specialist, Research Associate, and Nova Scotia Museum)	N/A	Water line has been microsited to not impact locations north of the open pit. One individual is located within the eastern waste rock stockpile and is expected to be directly impacted. No direct impact along Haul Road within 20 m buffer of centerline	Observation during post construction monitoring Observed populations are of similar extent or exhibit similar abundance/distribution over the study area to baseline data (considering loss from external environmental factors) Include mitigation effectiveness in development of SAR lichen monitoring plan
Boreal felt lichen	SARA - E COSEWIC - E NSESA - E	Habitat identified as potential Boreal Felt Lichen habitat by NSL&F was surveyed – BFL was identified in the LSA. Three thalli were found south of the PA.	No direct interaction Original setback from project infrastructure was: 219m 216m 179m	Sensitive to changing environmental conditions, particularly air quality in close proximity Accidental cutting of host tree or too close to host tree Edge effects – e.g.: increased light, wind, temp; decrease in	Amended Recovery Strategy 2018	Micro siting of mine infrastructure has been completed to avoid BFL Reduce disturbance through buffering of habitat: - buffer increased to 500 m from 3 historically observed thalli - The entire WL 29 has additionally been buffered by 50 m Implement air quality monitoring and dust suppression plans	500 m critical function zone	The waste Rock Stockpile has been divided into two and microsited outside of the 500 m phorophyte critical function zone and the 50 m Wetland 29 critical function zone	Observation during post construction monitoring Observed populations are of similar extent or exhibit similar abundance/distribution over the study area to baseline data (considering loss from external environmental factors)

Species	Rank	Observations	Direct Impact from Original Layout	Potential Adverse Effects	Monitoring Plan, Action Plan, or Recovery Strategy	Mitigation	Mitigation Connection to Plan	Direct Impact after Micrositing Infrastructure	Effectiveness of Mitigation
		Follow up surveys conducted in the fall of 2016 determined that all three thalli were no longer present. Their absence was reconfirmed on December 4, 2017		moisture due to nearby disturbance		Provide map of all priority vascular and non-vascular flora to site personnel during site orientation Develop a lichen monitoring program in consultation with lichen specialist for Lichen SAR within and in close proximity to the PA		Proposed microsited setback from project infrastructure is: 502 m 505 m 517 m	Include mitigation effectiveness in development of SAR lichen monitoring plan
Frosted glass whiskers	SARA - SC COSEWIC - SC NSESA - Not listed	Identified within the mine footprint: • Central upland island of Wetland 29 • Edge of a cut block, east of Wetland 29 • Edge of a cut block, west of Wetland 2 • 4 Locations west of waste rock pile	3 of 7 documented locations are expected to be directly impacted by the waste rock pile The 4 locations west of waste rock pile are within close proximity to infrastructure	Sensitive to changing environmental conditions, particularly air quality in close proximity Accidental cutting of host tree or too close to host tree Edge effects – e.g.: increased light, wind, temp; decrease in moisture due to nearby disturbance	Management Plan 2011	Complete further detailed design of Haul Road and micro siting of mine infrastructure to avoid priority lichen species Reduce disturbance through buffering of habitat - maintain 100m buffer, wherever practicable Implement air quality monitoring and dust suppression plans Flag host trees Develop lichen monitoring program in consultation with lichen specialist for Lichen SAR within and in close proximity to the PA Provide map of all priority vascular and non-vascular flora to site personnel during site orientation Wherever avoidance of priority lichen species is not possible, the Project Team will consult with a lichen specialist to determine the likelihood of successful transplantation of SAR lichens to adjacent areas with suitable habitat. Where avoidance and transplantation is not possible, the Project Team will collect specimens for submission to Frances Anderson or equivalent contact at time of construction (Lichen Specialist, Research Associate, and Nova Scotia Museum)	100 m buffer from host trees	None of the 7 documented locations are expected to be directly impacted by Project infrastructure 100 m buffers have been established around all 7 locations	Observation during post construction monitoring Observed populations are of similar extent or exhibit similar abundance/distribution over the study area to baseline data (considering loss from external environmental factors) Include mitigation effectiveness in development of SAR lichen monitoring plan

6.13.8.3 Priority Terrestrial Fauna Species

- Standard mitigation for terrestrial fauna (Section 6.11.8) applies to SAR and SOCI;
- Wildlife observation reporting to appropriate site personnel during construction, operation and decommissioning of Project;
- Impacts to snapping turtles will be reduced by implementing a 30 m buffer on aquatic habitat deemed suitable for snapping turtles, wherever possible;
- Where avoidance of potential turtle hibernation habitat is not possible, construction in these habitats should be limited to the growing season when hibernating turtles are not likely to be impacted (October through April);
- Culverts will be installed in wetlands and watercourses under provincial permits as required. Culverts can encourage reptiles and amphibians to cross through those, rather than crossing roads, particularly if approach to the road prevents access. This can be especially important for turtles during nesting season (June) when they are more attracted to gravelly roadsides;
- Wetland and watercourse alterations will be completed under approval from NSE, with associated mitigation, monitoring and compensation measures employed;
- Implement signage on the Haul Road during operations adjacent to major stream crossings or waterbodies, preferably signage that is installed only seasonally during turtles' active period as drivers are more likely to pay attention to new signs when they are erected prior to nesting season, for example, than if signs remain all year; and,
- Increase dust suppression on roads to improve visibility during nesting season and hatchling emergence.

Table 6.13-19 Mitigation for Terrestrial Wildlife SAR

Species	Rank	Observations	Direct Impact from Original Layout	Potential Adverse Effects	Monitoring Plan, Action Plan, or Recovery Strategy	Mitigation	Mitigation Connection to Plan	Direct Impact after Micro siting Infrastructure	Effectiveness of Mitigation
Snapping turtle	SARA - SC COSEWIC - SC NSESA - V	One snapping turtle was observed within the Haul Road. Snapping turtles were also opportunistically observed adjacent the Touquoy Mine Site, within the LAA. Suitable habitat for Snapping Turtles has been observed in Wetlands 8, 10, 17, 29, 59, 61, 66, 68, 69, 159, 168, 171, and 207	Wetland 59 directly impacted by open pit The southern portion of Wetland 17 and western fingers of Wetland 61 fall within the open pit Portions of Wetland 29 are located within the waste rock stockpile The eastern extent of Wetland 8 is located within the till stockpile The open water portions of Wetlands 8, 10, 11, and 29 within the Beaver Dam Mine Site are not proposed for direct impact Wetland 207 was not located within the original PA Entire length of Haul Road potentially used by snapping turtles	Habitat alteration, fragmentation, or loss Unintentional destruction of nests, eggs, hatchlings or adults Accidental mortality from vehicle strike Potential chemical contamination	Management Plan 2016	Complete further detailed design of Haul Road and micro siting of Beaver Dam Mine Site infrastructure to avoid aquatic habitat Upgrade existing roads, wherever practicable, instead of building new roads Replace crushed, hung, or improperly installed culverts, wherever practicable, to improve habitat connectivity Reduce disturbance through buffering of habitat - a 30m buffer on aquatic habitat deemed suitable for snapping turtles, wherever practicable Where avoidance of potential turtle hibernation habitat is not possible, construction in these habitats will be limited to the growing season when hibernating turtles are not likely to be impacted (Overwintering period - October through April), wherever practicable Implement surface water quality monitoring program Implement Wildlife Management Plan If snapping turtle activity is occurring within and/or adjacent to the Beaver Dam Mine Site or Haul Road, a turtle awareness and management program will be implemented to ensure all staff are well informed regarding the increased turtle activity, especially during breeding season Install turtle crossing signs near major watercourse crossings, or in areas where snapping turtles have been observed, in an effort to increase awareness and reduce vehicular collisions - preferably only seasonally when turtles are active	Ensure that the needs of the snapping turtle are taken into consideration in road design and improvement projects Identify sites with high road mortality rates and develop and implement approaches for reducing mortality (e.g., discourage the construction of new roads in snapping turtle habitat, develop ecopassages, reduce speed limits near sensitive habitat).	Wetlands effected by the pit placement remain the same (Wetland 59 and portions of Wetlands 17 and 61) Small portions of Wetlands 10, 17, and 61 are directly impacted (in areas away from water features) The division and micro siting of the waste rock stockpile areas has removed infrastructure from in and around Wetland 29 Wetland 8 is no longer directly impacted by till stockpiles Wetland 207 is not impacted by Project infrastructure Potential use of Haul Road	No increase in mortalities due to mine related activities. If mortalities are occurring, the Proponent will consult with regulatory agencies to determine the necessary action to be taken Include mitigation effectiveness in development of Wildlife Management Plan Inclusion in development of EEM

Species	Rank	Observations	Direct Impact from Original Layout	Potential Adverse Effects	Monitoring Plan, Action Plan, or Recovery Strategy	Mitigation	Mitigation Connection to Plan	Direct Impact after Micro siting Infrastructure	Effectiveness of Mitigation
						Vehicles will yield to wildlife on roads Dust suppression to improve visibility during nesting and hatchling emergence Vehicles will adhere to safe speed limits, particularly around blind corners An un-vegetated buffer along roadsides will be maintained, where possible, to improve visibility along roadsides and reduce the potential for collisions with wildlife If a turtle is found, report immediately to site Environmental Technician; if found on road, move away provided not actively nesting using proper moving technique Use predator excluders on identified nests Install fencing, where practicable, to prevent wildlife from accessing areas with increased risk of injuries to wild species - appropriate dimensions to address and eliminate accidental falls of species of varying size including turtles into the open pit			
Mainland moose	SARA – Not Listed COSEWIC – Not Listed NSESA - E	PA is within a Mainland Moose Concentration Area Mainland moose tracks were observed within the Beaver Dam Mine Site north of Wetland 56, within Wetland 210, and observed incidentally outside of the PA to the	Potential habitat within the Beaver Dam Mine Site – use of disturbed roadside habitat	Increased access into a site (construction of new roads) may increase poaching levels Lowered viability of individual populations of moose by direct mortality and reduction in range	Recovery Plan for Mainland Moose in Nova Scotia (NSDNR, 2007)	Implement Moose Management and Monitoring Program - including activities such as repeated winter track surveys and pellet group inventories, and collaboration with the Mi'kmaq of Nova Scotia to study Mainland Moose in a broader context Implement wildlife observation reporting to appropriate site personnel during construction, operation, and decommissioning of Project Vehicles will yield to wildlife on roads Vehicles will adhere to safe speed limits, particularly around blind corners.	Decrease occurrence of preventable mainland moose mortality	Potential habitat within the Beaver Dam Mine Site – use of disturbed roadside habitat	No increase in mortalities due to mine related activities. If mortalities are occurring, the Proponent will consult with regulatory agencies to determine the necessary action to be taken If monitoring of Mainland Moose to verify the efficacy of mitigation strategies show signs of disturbance due to mine related activities, the Proponent will consult with

Species	Rank	Observations	Direct Impact from Original Layout	Potential Adverse Effects	Monitoring Plan, Action Plan, or Recovery Strategy	Mitigation	Mitigation Connection to Plan	Direct Impact after Micro siting Infrastructure	Effectiveness of Mitigation
		northwest of the Beaver Dam Mine Site No signs of mainland moose were observed during any survey within the Haul Road		Habitat alteration, fragmentation, or loss		An un-vegetated buffer along roadsides will be maintained, where possible, to improve visibility along roadsides and reduce the potential for collisions with wildlife Install fencing, where practicable, to prevent wildlife from accessing areas with increased risk of injuries to wild species - appropriate dimensions to address and eliminate accidental falls of species of varying size including deer and moose into the open pit			regulatory agencies to develop an adaptive management plan or other appropriate mitigation as deemed necessary by regulators Inclusion in development of EEM Plan to monitor effectiveness

6.13.8.4 Priority Birds

The potential effects related to migratory birds and the different phases of the Beaver Dam Mine Project are outlined in Section 6.12.7. Most direct and indirect impacts on birds, including SAR, are accounted for in general mitigation/monitoring for all birds, since many have legislated protection under the Migratory Birds Convention Act (primarily through avoiding clearing/grubbing during nesting season if possible, and conducting detailed pre-construction nest searches if clearing or grubbing must occur during nesting season). These pre-construction nest searches are particularly important in wetlands which provide suitable breeding habitat for the Olive-sided Flycatcher, Canada Warbler and Rusty Blackbird.

In order to verify the accuracy of the environmental assessment and the effectiveness of mitigation measures, a follow-up program is recommended. It is recommended that monitoring be conducted from the start of construction till the end of the decommissioning phase.

- Verify the effectiveness of mitigation measures related to light for a minimum of two years and, based on advice from appropriate jurisdictions, implement adaptive measures, if appropriate;
- Conduct routine inspections of the open pit to remove any trapped or injured wildlife;
- Notify Environment and Climate Change Canada within 24 hours in the event of the mortality or injury of ten or more migratory birds in a single event or in the event of the mortality or injury of a bird species at risk;
- Communicate regulations related to nesting birds to all site personnel, particularly focused on those priority bird species which may be attracted to Project activities. If nesting behavior of any bird is observed, site personnel are to report this activity to the Proponent's personnel as defined in the EPP so appropriate mitigation measures can be implemented as necessary; and,
- Clearing and construction can increase habitat quality for common nighthawk (CONI), increasing potential interactions with this species. To limit attraction of CONI to the Project Area, the Project Team should limit the amount of exposed soil during nesting season, favoring to cover or revegetate soil wherever possible.

Additional mitigation measures specific to greater yellowlegs include:

- Wherever possible, construction of infrastructure within wetland habitat will be limited during the nesting season;
- If construction is required within Wetland 64 during the active nesting season, an avian specialist will monitor for nesting activity within the wetland and adjacent undisturbed habitat. The proponent will consult with appropriate regulatory agencies to determine an appropriate spatial and temporal buffer, based on site and seasonal specific parameters at the time of the observation.
- A contractor awareness program will be implemented to inform contractors of greater yellowlegs identification and signs of nesting behavior. Contractors will be informed of their responsibility to remain inside approved work areas, and to report signs of nesting behavior of the greater yellowlegs to the Proponent's staff. If nests are found, they will be monitored from a distance using binoculars or a spotting scope to avoid further human disturbance from monitoring. If new breeding evidence is observed during construction monitoring activities, an acceptable setback (to be established in consultation with regulatory authorities) will be established and monitoring will take place.

Table 6.13-20 Mitigations for SAR Birds and Greater Yellowlegs (SOCI)

Species	Rank	Observations	Direct Impact from Original Layout	Potential Adverse Effects	Monitoring Plan, Action Plan, or Recovery Strategy	Mitigation	Mitigation Connection to Plan	Direct Impact after Micro siting Infrastructure	Effectiveness of Mitigation
Common nighthawk	SARA - Th COSEWIC - Th NSESA - Th	Observed along the Haul Road Four Common Nighthawks were observed during both breeding bird (n=1) and dedicated species surveys (n=3) in 2016	Possible breeding habitat within the PA - commonly associated with expansive gravelly areas adjacent to clear cuts or disturbed areas such as roadsides	Collisions with anthropogenic structures and vehicles Habitat alteration, fragmentation, or loss Unintentional destruction of nests, eggs, nestlings or adults Breeding disruption or functional habitat loss due to sensory disturbance (noise or light)	Recovery Strategy 2016	Avoid clearing/grubbing activities during nesting season If construction is required during the active nesting season, an avian specialist will monitor for nesting activity. If evidence of nesting is observed, the Proponent will consult with appropriate regulatory agencies to determine an appropriate spatial and temporal buffer, based on site and seasonal specific parameters at the time of the observation Limit light use to direct and focused light when needed for worker safety Implement noise management including use of mufflers on equipment and regular maintenance All site workers shall comply with regulations outlined in the Migratory Bird Convention Act, which prohibits the disturbance of migratory birds, their nests and eggs. If any nest is identified, the Proponent Environmental Technician must be notified immediately, so steps can be taken to identify the species and determine appropriate mitigation or avoidance if required. Species identified of particular risk and several species of birds known to nest around active construction sites will be included in the Wildlife Sighting Report Card similar to those required at the Touquoy Mine Site	No direct mitigation connections, but addressing potential impacts identified in report	Possible breeding habitat within the PA - commonly associated with expansive gravelly areas adjacent to clear cuts or disturbed areas such as roadsides	Verify the effectiveness of mitigation measures related to light for a minimum of two years and, based on advice from appropriate jurisdictions, implement adaptive measures, if appropriate If monitoring to verify the efficacy of mitigation strategies and any executed setbacks show signs of disturbance despite the setback, consultation with Environment and Climate Change Canada's Canadian Wildlife Service and other appropriate regulatory authorities will take place to develop a proposed adaptive management plan Monitor known nests around stockpiles and exposed areas from a distance with a spotting scope or binoculars to verify the effectiveness of the buffer until the nests are inactive Notify Environment and Climate Change Canada within 24 hours in the event of the mortality or injury of ten or more migratory birds in a single event or in the event of the mortality or injury of a migratory bird SAR

Species	Rank	Observations	Direct Impact from Original Layout	Potential Adverse Effects	Monitoring Plan, Action Plan, or Recovery Strategy	Mitigation	Mitigation Connection to Plan	Direct Impact after Micro siting Infrastructure	Effectiveness of Mitigation
Canada warbler	SARA - Th COSEWIC - Th NSESA - E	Preferred habitat (moist mixed forests) was observed within the Beaver Dam Mine Site and Haul Road Sixteen were observed during the 2015 and 2016 Breeding Bird surveys within the Beaver Dam Mine Site and Haul Road	Possible breeding habitat within the PA - moist mixed forests	Collisions with anthropogenic structures and vehicles Habitat alteration, fragmentation, or loss Unintentional destruction of nests, eggs, nestlings or adults Breeding disruption or functional habitat loss due to sensory disturbance (noise or light)	Recovery Strategy 2016	Avoid clearing/grubbing activities during nesting season If construction is required during the active nesting season, an avian specialist will monitor for nesting activity. If evidence of nesting is observed, the Proponent will consult with appropriate regulatory agencies to determine an appropriate spatial and temporal buffer, based on site and seasonal specific parameters at the time of the observation Limit light use to direct and focused light when needed for worker safety Implement noise management including use of mufflers on equipment and regular maintenance Implement air quality monitoring and dust suppression plans Implement surface water quality monitoring program All site workers shall comply with regulations outlined in the Migratory Bird Convention Act, which prohibits the disturbance of migratory birds, their nests and eggs. If any nest is identified, the Proponent Environmental Technician must be notified immediately, so steps can be taken to identify the species and determine appropriate mitigation or avoidance if required. Species identified of particular risk and several species of birds known to nest around active construction sites will be included in the Wildlife Sighting Report Card similar to those required at the Touquoy Mine Site	No direct mitigation connections, but addressing potential impacts identified in report	Possible breeding habitat within the PA - moist mixed forests Decreased impact to interior forest patch near Wetland 29 (interior patch 2)	Verify the effectiveness of mitigation measures related to light for a minimum of two years and, based on advice from appropriate jurisdictions, implement adaptive measures, if appropriate If monitoring to verify the efficacy of mitigation strategies and any executed setbacks show signs of disturbance despite the setback, consultation with Environment and Climate Change Canada’s Canadian Wildlife Service and other appropriate regulatory authorities will take place to develop a proposed adaptive management plan Notify Environment and Climate Change Canada within 24 hours in the event of the mortality or injury of ten or more migratory birds in a single event or in the event of the mortality or injury of a migratory bird SAR

Species	Rank	Observations	Direct Impact from Original Layout	Potential Adverse Effects	Monitoring Plan, Action Plan, or Recovery Strategy	Mitigation	Mitigation Connection to Plan	Direct Impact after Micro siting Infrastructure	Effectiveness of Mitigation
Olive-sided flycatcher	SARA - Th COSEWIC - Th NSESA - Th	Observations were sparse, yet scattered across the Beaver Dam Mine Site (n=5) and Haul Road (n=5)	Possible breeding habitat within PA - commonly associated with edge habitat	Collisions with anthropogenic structures and vehicles Habitat alteration, fragmentation, or loss Unintentional destruction of nests, eggs, nestlings or adults Breeding disruption or functional habitat loss due to sensory disturbance (noise or light)	Recovery Strategy 2016	Avoid clearing/grubbing activities during nesting season If construction is required during the active nesting season, an avian specialist will monitor for nesting activity. If evidence of nesting is observed, the Proponent will consult with appropriate regulatory agencies to determine an appropriate spatial and temporal buffer, based on site and seasonal specific parameters at the time of the observation Limit light use to direct and focused light when needed for worker safety Implement noise management including use of mufflers on equipment and regular maintenance Implement air quality monitoring and dust suppression plans Implement surface water quality monitoring program All site workers shall comply with regulations outlined in the Migratory Bird Convention Act, which prohibits the disturbance of migratory birds, their nests and eggs. If any nest is identified, the Proponent Environmental Technician must be notified immediately, so steps can be taken to identify the species and determine appropriate mitigation or avoidance if required. Species identified of particular risk and several species of birds known to nest around active construction sites will be included in the Wildlife Sighting Report Card similar to those required at the Touquoy Mine Site	No direct mitigation connects, but addressing potential impacts identified in report	Possible breeding habitat within PA - commonly associated with edge habitat	Verify the effectiveness of mitigation measures related to light for a minimum of two years and, based on advice from appropriate jurisdictions, implement adaptive measures, if appropriate If monitoring to verify the efficacy of mitigation strategies and any executed setbacks show signs of disturbance despite the setback, consultation with Environment and Climate Change Canada's Canadian Wildlife Service and other appropriate regulatory authorities will take place to develop a proposed adaptive management plan Notify Environment and Climate Change Canada within 24 hours in the event of the mortality or injury of ten or more migratory birds in a single event or in the event of the mortality or injury of a migratory bird SAR

Species	Rank	Observations	Direct Impact from Original Layout	Potential Adverse Effects	Monitoring Plan, Action Plan, or Recovery Strategy	Mitigation	Mitigation Connection to Plan	Direct Impact after Micro siting Infrastructure	Effectiveness of Mitigation
Eastern wood-pewee	SARA - SC COSEWIC - SC NSESA - V	Two observed: one identified at the outlet of Cameron Flowage, to the east of the Beaver Dam Mine Site, while the second was observed incidentally along the Haul Road, east of Wetland 114	Possible breeding habitat within PA – mature and intermediate mixed wood forest with open understory	Collisions with anthropogenic structures and vehicles Habitat alteration, fragmentation, or loss Unintentional destruction of nests, eggs, nestlings, or adults Breeding disruption or functional habitat loss due to sensory disturbance (noise or light) Impacts from dust along Haul Road	No current monitoring plan, action plan or recovery strategy for this species in this area	Avoid clearing/grubbing activities during nesting season If construction is required during the active nesting season, an avian specialist will monitor for nesting activity. If evidence of nesting is observed, the Proponent will consult with appropriate regulatory agencies to determine an appropriate spatial and temporal buffer, based on site and seasonal specific parameters at the time of the observation Limit light use to direct and focused light when needed for worker safety Implement noise management including use of mufflers on equipment and regular maintenance Implement air quality monitoring and dust suppression plans All site workers shall comply with regulations outlined in the Migratory Bird Convention Act, which prohibits the disturbance of migratory birds, their nests and eggs. If any nest is identified, the Proponent Environmental Technician must be notified immediately, so steps can be taken to identify the species and determine appropriate mitigation or avoidance if required. Species identified of particular risk and several species of birds known to nest around active construction sites will be included in the Wildlife Sighting Report Card similar to those required at the Touquoy Mine Site	N/A	Decreased impact from waste rock stockpile to interior forest patch near Wetland 29 (interior patch 2) No expected direct impact to two observation locations	Verify the effectiveness of mitigation measures related to light for a minimum of two years and, based on advice from appropriate jurisdictions, implement adaptive measures, if appropriate If monitoring to verify the efficacy of mitigation strategies and any executed setbacks show signs of disturbance despite the setback, consultation with Environment and Climate Change Canada's Canadian Wildlife Service and other appropriate regulatory authorities will take place to develop a proposed adaptive management plan Notify Environment and Climate Change Canada within 24 hours in the event of the mortality or injury of ten or more migratory birds in a single event or in the event of the mortality or injury of a migratory bird SAR

Species	Rank	Observations	Direct Impact from Original Layout	Potential Adverse Effects	Monitoring Plan, Action Plan, or Recovery Strategy	Mitigation	Mitigation Connection to Plan	Direct Impact after Micro siting Infrastructure	Effectiveness of Mitigation
Greater yellowlegs	S3B,S3S4M	A total of 25 observations within the Beaver Dam Mine Site and eight observations along the Haul Road	Possible breeding habitat within the Beaver Dam Mine Site in close proximity or directly impacted by infrastructure Probable breeding habitat within Wetland 64 in close proximity to Haul Road upgrades.	Collisions with anthropogenic structures and vehicles Habitat alteration, fragmentation, or loss Unintentional destruction of nests, eggs, nestlings or adults Breeding disruption or functional habitat loss due to sensory disturbance (noise or light) Impacts from dust along Haul Road	No current monitoring plan, action plan or recovery strategy for this species in this area	Avoid clearing/grubbing activities during nesting season Implement air quality monitoring and dust suppression plans Complete construction of the waterline and Haul Road within Wetland 64 outside of the active nesting season for Greater Yellowlegs, if practicable If construction is required during the active nesting season, an avian specialist will monitor for nesting activity within Wetland 64 and adjacent undisturbed habitat. If evidence of nesting is observed, the Proponent will consult with appropriate regulatory agencies to determine an appropriate spatial and temporal buffer, based on site and seasonal specific parameters at the time of the observation. Limit light use to direct and focused light when needed for worker safety All site workers shall comply with regulations outlined in the Migratory Bird Convention Act, which prohibits the disturbance of migratory birds, their nests and eggs. If any nest is identified, the Proponent Environmental Technician must be notified immediately, so steps can be taken to identify the species and determine appropriate mitigation or avoidance if required. Species identified of particular risk and several species of birds known to nest around active construction sites will be included in the Wildlife Sighting Report Card similar to those required at the Touquoy Mine Site	N/A	No changes to current road layout through Wetland 64. Southern waterline bisects Wetland 64 and discharges into it.	Verify the effectiveness of mitigation measures related to light for a minimum of two years and, based on advice from appropriate jurisdictions, implement adaptive measures, if appropriate If monitoring of Greater Yellowlegs to verify the efficacy of mitigation strategies and any executed setbacks show signs of disturbance despite the setback, consultation with Environment and Climate Change Canada's Canadian Wildlife Service and other appropriate regulatory authorities will take place to develop a proposed adaptive management plan Notify Environment and Climate Change Canada within 24 hours in the event of the mortality or injury of ten or more migratory birds in a single event or in the event of the mortality or injury of a migratory bird SAR

Species	Rank	Observations	Direct Impact from Original Layout	Potential Adverse Effects	Monitoring Plan, Action Plan, or Recovery Strategy	Mitigation	Mitigation Connection to Plan	Direct Impact after Micro siting Infrastructure	Effectiveness of Mitigation
Peregrine falcon	SARA - SC COSEWIC - SC NSESA - V	Two peregrine falcons were observed incidentally (n=1) and during the dedicated fall migration surveys (n=1) adjacent to the Beaver Dam Mine Site, in 2014. Both observations were documented immediately north of the Beaver Dam Mine Site, between Mud Lake and Cameron Flowage.	Suitable breeding habitat was not present within the Beaver Dam Mine Site or Haul Road	Habitat alteration, fragmentation, or loss Unintentional destruction of nests, eggs, nestlings, or adults Breeding disruption or functional habitat loss due to sensory disturbance (noise or light)	Management Plan 2017	Avoid clearing/grubbing activities during nesting season If construction is required during the active nesting season, an avian specialist will monitor for nesting activity. If evidence of nesting is observed, the Proponent will consult with appropriate regulatory agencies to determine an appropriate spatial and temporal buffer, based on site and seasonal specific parameters at the time of the observation Limit light use to direct and focused light when needed for worker safety Implement air quality monitoring and dust suppression plans Implement noise management including use of mufflers on equipment and regular maintenance All site workers shall comply with regulations outlined in the Migratory Bird Convention Act, which prohibits the disturbance of migratory birds, their nests and eggs. If any nest is identified, the Proponent Environmental Technician must be notified immediately, so steps can be taken to identify the species and determine appropriate mitigation or avoidance if required. Species identified of particular risk and several species of birds known to nest around active construction sites will be included in the Wildlife Sighting Report Card similar to those required at the Touquoy Mine Site	Consideration of the Peregrine Falcon as a VEC in Environmental Assessment procedures	No direct impact to two observation locations	Verify the effectiveness of mitigation measures related to light for a minimum of two years and, based on advice from appropriate jurisdictions, implement adaptive measures, if appropriate If monitoring to verify the efficacy of mitigation strategies and any executed setbacks show signs of disturbance despite the setback, consultation with Environment and Climate Change Canada's Canadian Wildlife Service and other appropriate regulatory authorities will take place to develop a proposed adaptive management plan Notify Environment and Climate Change Canada within 24 hours in the event of the mortality or injury of ten or more migratory birds in a single event or in the event of the mortality or injury of a migratory bird SAR

Species	Rank	Observations	Direct Impact from Original Layout	Potential Adverse Effects	Monitoring Plan, Action Plan, or Recovery Strategy	Mitigation	Mitigation Connection to Plan	Direct Impact after Micro siting Infrastructure	Effectiveness of Mitigation
Chimney swift	SARA - Th COSEWIC - Th NSESA - E	Two chimney swifts were observed incidentally during the breeding season in 2015, within the Beaver Dam Mine Site. They were observed from Wetland 53, which is in the center of the Beaver Dam Mine Site, south of Crusher Lake There were no signs observed of chimney swift breeding	No suitable chimneys for roosting and nesting were observed within the PA; however, waterbodies used for foraging are present within the Beaver Dam Mine Site and Haul Road. Wetland 53 is located at the waste rock stockpile.	Collisions with anthropogenic structures and vehicles Habitat alteration, fragmentation, or loss Unintentional destruction of nests, eggs, nestlings, or adults Breeding disruption or functional habitat loss due to sensory disturbance (noise or light)	No current monitoring plan, action plan or recovery strategy for this species in this area	Avoid clearing/grubbing activities during nesting season If construction is required during the active nesting season, an avian specialist will monitor for nesting activity. If evidence of nesting is observed, the Proponent will consult with appropriate regulatory agencies to determine an appropriate spatial and temporal buffer, based on site and seasonal specific parameters at the time of the observation Limit light use to direct and focused light when needed for worker safety Implement air quality monitoring and dust suppression plans Implement noise management including use of mufflers on equipment and regular maintenance All site workers shall comply with regulations outlined in the Migratory Bird Convention Act, which prohibits the disturbance of migratory birds, their nests and eggs. If any nest is identified, the Proponent Environmental Technician must be notified immediately, so steps can be taken to identify the species and determine appropriate mitigation or avoidance if required. Species identified of particular risk and several species of birds known to nest around active construction sites will be included in the Wildlife Sighting Report Card similar to those required at the Touquoy Mine Site	N/A	No impact to breeding habitat Impact to observation location from the eastern waste rock stockpile.	Verify the effectiveness of mitigation measures related to light for a minimum of two years and, based on advice from appropriate jurisdictions, implement adaptive measures, if appropriate If monitoring to verify the efficacy of mitigation strategies and any executed setbacks show signs of disturbance despite the setback, consultation with Environment and Climate Change Canada's Canadian Wildlife Service and other appropriate regulatory authorities will take place to develop a proposed adaptive management plan Notify Environment and Climate Change Canada within 24 hours in the event of the mortality or injury of ten or more migratory birds in a single event or in the event of the mortality or injury of a migratory bird SAR

Species	Rank	Observations	Direct Impact from Original Layout	Potential Adverse Effects	Monitoring Plan, Action Plan, or Recovery Strategy	Mitigation	Mitigation Connection to Plan	Direct Impact after Micro siting Infrastructure	Effectiveness of Mitigation
Rusty blackbird	SARA - SC COSEWIC - SC NSESA - E	One rusty blackbird was observed incidentally during the 2014 fall migration survey in a large wetland complex to the north of the Beaver Dam Mine Site (PC15).	Breeding habitat, including forested wetlands, swamps, and peat bogs are present within the Beaver Dam Mine Site and Haul Road, however, no evidence of breeding was observed (no birds were observed within PA).	Collisions with anthropogenic structures and vehicles Habitat alteration, fragmentation, or loss - particularly wetland loss Unintentional destruction of nests, eggs, nestlings, or adults Breeding disruption or functional habitat loss due to sensory disturbance (noise or light)	Management Plan 2015	Avoid clearing/grubbing activities during nesting season Complete further detailed design of Haul Road and micro siting of mine infrastructure to avoid major wetlands. Where wetlands cannot be avoided, total Project footprint within the wetland will be minimized to the extent practicable. Implement wetland monitoring programs If construction is required during the active nesting season, an avian specialist will monitor for nesting activity. If evidence of nesting is observed, the Proponent will consult with appropriate regulatory agencies to determine an appropriate spatial and temporal buffer, based on site and seasonal specific parameters at the time of the observation Limit light use to direct and focused light when needed for worker safety Implement air quality monitoring and dust suppression plans Implement noise management including use of mufflers on equipment and regular maintenance All site workers shall comply with regulations outlined in the Migratory Bird Convention Act, which prohibits the disturbance of migratory birds, their nests and eggs. If any nest is identified, the Proponent Environmental Technician must be notified immediately, so steps can be taken to identify the species and determine appropriate mitigation or avoidance if	Conservation of wetland habitat	No direct impact to observation location	Verify the effectiveness of mitigation measures related to light for a minimum of two years and, based on advice from appropriate jurisdictions, implement adaptive measures, if appropriate If monitoring to verify the efficacy of mitigation strategies and any executed setbacks show signs of disturbance despite the setback, consultation with Environment and Climate Change Canada’s Canadian Wildlife Service and other appropriate regulatory authorities will take place to develop a proposed adaptive management plan Notify Environment and Climate Change Canada within 24 hours in the event of the mortality or injury of ten or more migratory birds in a single event or in the event of the mortality or injury of a migratory bird SAR

Species	Rank	Observations	Direct Impact from Original Layout	Potential Adverse Effects	Monitoring Plan, Action Plan, or Recovery Strategy	Mitigation	Mitigation Connection to Plan	Direct Impact after Micro siting Infrastructure	Effectiveness of Mitigation
						required. Species identified of particular risk and several species of birds known to nest around active construction sites will be included in the Wildlife Sighting Report Card similar to those required at the Touquoy Mine Site			
Barn swallow	SARA - Th COSEWIC - Th NSESA - E	One barn swallow was observed along the Haul Road during the 2016 spring migration surveys, near Wetland 159. None were observed during the breeding bird surveys completed in the Beaver Dam Mine Site. Potential nesting habitat is available within the Beaver Dam Mine Site and Haul Road, particularly artificial structures including a cabin, bridges, and road culverts.	Possible breeding habitat within PA – artificial structures No direct impact to observation location	Habitat alteration, fragmentation, or loss Collisions with anthropogenic structures and vehicles Attraction to manmade structures for nesting Unintentional destruction of nests, eggs, nestlings or adults Breeding disruption or functional habitat loss due to sensory disturbance (noise or light)	No current monitoring plan, action plan or recovery strategy for this species in this area	Avoid clearing/grubbing activities during nesting season If construction is required during the active nesting season, an avian specialist will monitor for nesting activity. If evidence of nesting is observed, the Proponent will consult with appropriate regulatory agencies to determine an appropriate spatial and temporal buffer, based on site and seasonal specific parameters at the time of the observation Check abandoned structures on site for nests prior to any demolition Limit light use to direct and focused light when needed for worker safety Implement air quality monitoring and dust suppression plans Implement noise management including use of mufflers on equipment and regular maintenance All site workers shall comply with regulations outlined in the Migratory Bird Convention Act, which prohibits the disturbance of migratory birds, their nests and eggs. If any nest is identified, the Proponent Environmental Technician must be notified immediately, so steps can be taken to identify the species and determine appropriate mitigation or avoidance if	N/A	No expected direct impact to observation location along the Haul Road.	Verify the effectiveness of mitigation measures related to light for a minimum of two years and, based on advice from appropriate jurisdictions, implement adaptive measures, if appropriate If monitoring to verify the efficacy of mitigation strategies and any executed setbacks show signs of disturbance despite the setback, consultation with Environment and Climate Change Canada's Canadian Wildlife Service and other appropriate regulatory authorities will take place to develop a proposed adaptive management plan Notify Environment and Climate Change Canada within 24 hours in the event of the mortality or injury of ten or more migratory birds in a single event or in the event of the mortality or injury of a migratory bird SAR

Species	Rank	Observations	Direct Impact from Original Layout	Potential Adverse Effects	Monitoring Plan, Action Plan, or Recovery Strategy	Mitigation	Mitigation Connection to Plan	Direct Impact after Micro siting Infrastructure	Effectiveness of Mitigation
						required. Species identified of particular risk and several species of birds known to nest around active construction sites will be included in the Wildlife Sighting Report Card similar to those required at the Touquoy Mine Site			

6.13.9 Residual Effects and Significance

Based on avoidance, mitigation and monitoring proposed for all priority species listed above, the following residual effects are anticipated. Project VC interactions of a priority taxa (e.g. priority fish species) that have the same residual environmental effects characteristic rankings of their related non-priority specific VC (e.g. fish and fish habitat) are not carried forward in the tables below. Rationales for differences in residual environmental effect characteristic rankings are described following the tables.

The ecological and social context of each priority species taxa was included throughout the evaluation as was done for all VC's. In general, the ecological and social context specific to priority species are more significant, as reflected in the changes to the magnitude of impact. Ecological (species abundance, habitat, food source etc.) and social factors (commercial, aboriginal, and recreational) for priority species are typically more specific and sensitive than for non-priority species. For example, rusty blackbirds have very specific ecological requirements for foraging and nesting and brook trout is of great social importance recreationally as one of Nova Scotia's most important sports fish and is also an important fish for the indigenous peoples. SAR/SOCI species are less abundant than common species (mainland moose vs. snowshoe hare), therefore, the SAR/SOCI that are directly affected from Project VC interactions typically have a higher magnitude of impact.

6.13.9.1 Priority Fish Species

Table 6.13-21 Residual Environmental Effects for Priority Fish and Priority Fish Habitat

Project VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Significance Criteria for Residual Environmental Effects						Residual Effect	Significance
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Beaver Dam Mine Site and Haul Road (direct watercourse alteration)	Sediment and erosion control, best management practices, spill preparedness, and engagement in the watercourse permitting process.	A	M VC interaction causes direct loss of fish habitat, no serious harm to fish	LAA Potential adverse effect to fish habitat outside of the PA	A Watercourse alteration will occur outside of sensitive periods for fish, however, other interactions may seasonally affect VC	P VC unlikely to recover to baseline conditions	O Effects occur once during the construction phase	IR VC will not recover to baseline conditions	Habitat loss and disturbance	Not Significant
Operational – Beaver Dam Mine Site (indirect impacts to WC-5 from adjusted surface water flow)	Predicted reduction in flow based on modelling. Monitoring will be required to confirm predictions.	A	H Large change from baseline conditions	PA Effect to fish and fish habitat is confined to the PA	A Seasonal habitat provisions may affect VC	P VC unlikely to recover to baseline conditions	O Effects occur once at the beginning of the operational phase of the Project	IR VC will not recover to baseline conditions	Loss of habitat and disturbance	Not significant

Legend (refer to Table 5.10-1 for definitions)

Nature of Effect	Geographic Extent	Duration	Frequency
A Adverse	PA Project Area	ST Short-Term	O Once
P Positive	LAA Local Assessment Area	MT Medium-Term	S Sporadic
	RAA Regional Assessment Area	LT Long-Term	R Regular
Magnitude		P Permanent	C Continuous
N Negligible	**Timing**		
L Low	N/A Not Applicable		**Reversibility**
M Moderate	A Applicable		R Reversible
H High			IR Irreversible
			PR Partially Reversible

Two VC interactions presented in Table 6.9-37 have been carried forward to the above table for priority fish species. The geographic extent, timing, duration, frequency, and reversibility of direct impacts to priority fish species remains the same as is with non-priority specific fish and fish habitat for these VC interactions, however, the magnitude of impact increases. The increase in magnitude from direct impacts to priority fish and fish habitat is because these alterations will occur to several watercourses (WC-12 and 13) known to support brook trout. Although not observed, there is potential for these watercourses to support Atlantic salmon and American eel. Along the Haul Road, it is expected that fish habitat direct impact can be minimized through proper planning, micro-sighting of the upgraded road footprint, and installation of culverts in accordance with the Nova Scotia Watercourse Alteration Standard (2015). Small areas of fish habitat within wetland habitat may be directly impacted by the Project, but overall, this impact will be low.

The VC interaction specific to the reduction in flows within WC-5 during operations of the Beaver Dam Mine Site has a high magnitude of impact for priority fish species because brook trout have been captured within this watercourse. Appropriate permitting will be followed, and compensation will be provided should a serious harm to fish threshold be confirmed.

6.13.9.2 Priority Vascular Flora and Lichens

There are no differences between the residual environmental effects for non-priority specific flora and lichens compared to priority flora and lichens. Refer to Table 6.10-12 for residual environmental effects of habitat and flora.

6.13.9.3 Priority Terrestrial Fauna Species

Table 6.13-22 Residual Environmental Effects for Priority Fauna

Project VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Significance Criteria for Residual Environmental Effects						Residual Effect	Significance
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Beaver Dam Mine Site and Haul Road (loss of habitat from clearing and grubbing and disturbance (noise, light, and wildlife vehicle collisions) from construction activities)	Implement speed limits, install fences where necessary, and minimize lighting.	A	H VC interaction causes direct loss of habitat for fauna.	LAA Potential adverse effect to fauna outside of the PA	A VC interaction may affect seasonal aspects of fauna.	LT Effects can occur beyond 3 years	O Effects occur once during the construction phase	PR Mitigation cannot guarantee a return to baseline conditions	Disturbance and loss of habitat	Not significant
Operational – Beaver Dam Mine Site, Haul Road and Touquoy Mine Site (disturbance (light and wildlife vehicle collisions) from haul trucks and heavy machinery)	Implement speed limits, install fences where necessary, and minimize lighting.	A	M Moderate change from baseline conditions	LAA Potential adverse effect to fauna outside of the PA	A VC interaction may affect seasonal aspects of fauna.	LT Effects may extend beyond 3 years	R VC interaction will occur at regular intervals	R VC will recover to baseline conditions	Disturbance	Not significant

Legend (refer to Table 5.10-1 for definitions)

Nature of Effect A Adverse P Positive **Magnitude** N Negligible L Low M Moderate H High	**Geographic Extent** PA Project Area LAA Local Assessment Area RAA Regional Assessment Area **Timing** N/A Not Applicable A Applicable	**Duration** ST Short-Term MT Medium-Term LT Long-Term P Permanent	**Frequency** O Once S Sporadic R Regular C Continuous **Reversibility** R Reversible IR Irreversible PR Partially Reversible

Two VC interactions presented in Table 6.11-10 have been carried forward to the above table for priority terrestrial fauna species. The geographic extent, timing, duration, frequency, and reversibility of direct impacts to priority terrestrial fauna species remains the same as is with non-priority specific terrestrial fauna for these VC interactions, however, the magnitude of impact increases. The magnitude of impact from the construction of the Beaver Dam Mine Site and Haul Road as well as from operational disturbances has increased because priority terrestrial fauna (e.g. mainland moose and snapping turtle) are not as abundant and populations are less viable than non-priority terrestrial fauna species.

Clearing and grubbing during construction will reduce cover for priority turtle species (e.g. snapping turtle), indirectly affect water quality, and can isolate populations (ECCC, 2016), Regarding mainland moose, habitat loss and fragmentation caused by clearing and grubbing interferes with the long-term population viability and is a serious threat to the species (NSDNR, 2007). Baseline conditions within the Beaver Dam Mine Site and the majority of the Haul Road (between logging roads and forestry activity) already demonstrate fragmentation as a result of a high level of forestry activity, especially within the Beaver Dam Mine Site where habitat loss will be greatest.

Vehicle and haul truck activity will occur throughout the PA during the construction, operation, and decommissioning phases. Vehicle and haul truck activity can cause impacts to priority fauna from wildlife vehicle collisions, dust, noise, and accidents (e.g. spills). Wildlife vehicle collisions can directly affect priority fauna and noise can indirectly affect priority fauna by encouraging avoidance behaviour.

Blasting and drilling of in-situ rock is expected to occur weekly at the Beaver Dam Mine Site during the operational phase of the Project. Blasting could negatively affect priority fauna from the noise associated with the activity. Although blasting is restricted to the PA the sound disturbance to terrestrial fauna has the potential to extend into the LAA. For example, a noise disturbance can cause flight behaviour in all terrestrial fauna but the impact to the energy balance of a mainland moose may have more severe consequences compared to a non-priority fauna species because stress on an already endangered (NSESA) population may impede its biological success in turn having a greater impact on the species.

6.13.9.4 Priority Bird Species

Table 6.13-23Residual Environmental Effects for Priority Birds

Project VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Significance Criteria for Residual Environmental Effects						Residual Effect	Significance
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Beaver Dam Mine Site and Haul Road (loss of habitat from clearing and grubbing and disturbance (noise, light and wildlife vehicle collisions) from construction activities)	Implement speed limits and minimize lighting.	A	H VC interaction causes direct loss of habitat and birds.	LAA Potential adverse effect to birds outside of the PA	A Although clearing and grubbing will occur outside of the sensitive period for birds, other activities will not.	MT Effects can occur beyond 12 months and up to 3 years	O VC interaction will occur once within the construction phase	PR Mitigation cannot guarantee a return to baseline conditions	Disturbance and loss of habitat	Not significant
Operational – Beaver Dam Mine Site and Haul Road (disturbance from light and wildlife vehicle collisions) from haul trucks and heavy machinery)	Implement speed limits minimize and lighting.	A	M Moderate change from baseline conditions	LAA Potential adverse effect to birds outside of the PA	A VC interaction may affect seasonal aspects of birds.	LT Effects may extend beyond 3 years	R VC interaction will occur at regular intervals	R VC will recover to baseline conditions	Disturbance	Not significant

Legend (refer to Table 5.10-1 for definitions)

Nature of Effect	Geographic Extent	Duration	Frequency
A Adverse	PA Project Area	ST Short-Term	O Once
P Positive	LAA Local Assessment Area	MT Medium-Term	S Sporadic
	RAA Regional Assessment Area	LT Long-Term	R Regular
Magnitude		P Permanent	C Continuous
N Negligible	**Timing**		
L Low	N/A Not Applicable		**Reversibility**
M Moderate	A Applicable		R Reversible
H High			IR Irreversible
			PR Partially Reversible

Two VC interactions presented in Table 6.12-17 have been carried forward to the above table for priority bird species. The geographic extent, timing, duration, frequency, and reversibility of direct impacts to priority bird species remains the same as is with non-priority specific birds for these VC interactions, however, the magnitude of impact increases. The magnitude of impact from the construction of the Beaver Dam Mine Site and Haul Road (i.e. loss of habitat) as well as from operations (i.e. disturbance) has increased because priority birds are not as abundant and populations are less viable than non-priority specific birds.

Clearing and grubbing will result in habitat loss for avifauna. Mitigation measures such as bird awareness and best management practices will be used. Best management practices include the avoidance of clearing and grubbing during the breeding season for migratory birds where practical (beginning of April to end of August for migratory birds; ECCC 2015). Construction is expected to have a high magnitude of impact because it is associated with a direct loss of habitat. Although similar habitat is available adjacent to the PA the effect of habitat loss has the potential to have a greater impact on priority bird species. For instance, the habitat requirements for rusty blackbird are very specific and include forested wetlands with standing water and riparian areas and clearing and grubbing in these habitats is a major threat to the species (Environment Canada, 2014).

Disturbances (wildlife vehicle collisions, light etc.) have the potential to pose a greater impact on priority bird species in comparison to non-priority specific bird species. This can be attributed to the rarity of priority bird species.

6.13.9.5 Residual Effects and Significance of Priority Species within the Preferred Alternative Haul Road

6.13.9.5.1 Residual Effects and Significance of Priority Fish within the Preferred Alternative Haul Road PA

Table 6.9-38 was reviewed and it was determined that the construction (direct loss of fish habitat) of the Haul Road was the only VC interactions applicable to priority fish and fish habitat within the Preferred Alternative Haul Road. This VC interaction was not carried forward because no direct loss of watercourses are anticipated during the construction of the Preferred Alternative Haul Road.

6.13.9.5.2 Residual Effects and Significance of Priority Vascular Flora and Lichens within the Preferred Alternative Haul Road PA

The residual environmental effects on priority vascular flora and lichens within the Preferred Alternative Haul Road parallels those specific to the PA. Refer to Section 6.10.9.1 for rationales for residual environmental effects characteristics rankings.

6.13.9.5.3 Residual Effects and Significance of Priority Fauna within the Preferred Alternative Haul Road PA

The residual environmental effects on priority fauna within the Preferred Alternative Haul Road parallels those specific to the PA. Refer to Section 6.11.9.1 for rationales for residual environmental effects characteristics rankings.

6.13.9.5.4 Residual Effects and Significance of Priority Birds within the Preferred Alternative Haul Road PA

The residual environmental effects on priority birds within the Preferred Alternative Haul Road parallels those specific to the PA. Refer to Section 6.12.10.1 for rationale for residual environmental effects characteristics rankings.

6.13.10 Proposed Compliance and Effects Monitoring Program

Monitoring for specific priority species will be completed to verify the accuracy of the predicted environmental effects and the effectiveness of the mitigation measures outlined in the tables within Section 6.13.8. A Surface Water Monitoring Plan, Wetland Monitoring Plan, Mainland Moose Monitoring Plan, and Wildlife Management Program will be established as part of the Preliminary Environmental Effects Monitoring Plan (EEM; Appendix O.1). The EEM will be established through the life cycle of the permitting process and will commit to monitoring during baseline/pre-construction to establish baseline conditions, and through the operational phase, reclamation and post closure (as determined to be required). This document will evolve through regulatory permitting, as well as public and Mi'kmaw engagement.

The monitoring of priority fish species will be captured under general fish and fish monitoring within the Surface Water Monitoring Plan (Appendix O.1). Similarly, the monitoring of vascular plants encompassed within the Wetland Monitoring Plan may include priority vascular plants (Appendix O.1).

As part of the Wildlife Management Program, a Mainland Moose Management Plan (MMMP) will be developed. Monitoring associated with the MMMP will be completed for the Project on selected transects within suitable mainland moose habitat. Additionally, the Wildlife Management Plan (WMP) will be developed in order to outline protocols to minimize interactions between wildlife (e.g. snapping turtles) and Project activities.

The Wildlife Management Program, established as part of the Preliminary Environmental Effects Monitoring Plan (EEM), will be developed through the life cycle of the permitting process. The Wildlife Management Program will outline procedures to be followed should evidence of breeding bird activity be identified during construction activities. The Wildlife Management Program will be developed in order to comply with the Migratory Birds Convention Act, 1994. If construction is required during the active nesting season an avian specialist will monitor for nesting activity.

6.14 Indigenous Peoples

6.14.1 Rationale for Valued Component Selection

Assessment of the potential for the Project to interact with and affect Indigenous Peoples is included in consideration of its socio-economic, socio-cultural, and/or traditional importance; in recognition of potential or established Aboriginal and Treaty rights; and due to the nature of potential Project-VC interactions. Additionally, subparagraph 5(1)(c) of CEAA 2012 and the EIS Guidelines require assessment of potential effects to Indigenous Peoples including consideration of:

- Health and socio-economic conditions;
- Physical and cultural heritage, including any structure, site or thing that is of historical, archaeological, paleontological or architectural significance; and
- Current use of lands and resources for traditional purposes.

Per Nova Scotia's Environmental Assessment Regulations, proponents are required to identify concerns of Indigenous Peoples regarding potential adverse effects and clarify the steps taken or proposed to be taken by the proponent to address concerns.

The Mi'kmaq in Nova Scotia:

The provinces of Nova Scotia, New Brunswick, PEI, and the Gaspé Peninsula in Quebec are founded on land historically occupied by the ancestors of the Mi'kmaq. The earliest evidence of Indigenous peoples in the Maritimes Region indicates that the ancestors of the Mi'kmaq have existed on the land for more than 11,000 years (Nova Scotia Office of Aboriginal Affairs (OAA) website 2017). The Mi'kmaq generally lived in semi-permanent and permanent settlements at resource-rich locations (Mi'kma'ki All Points Services 2013). The lives of Indigenous peoples in what are today referred to as the Maritime Provinces considered the seasonal cycles of the local vegetation, animals, and fish, living a traditional life as fishers, hunters, and gatherers throughout their territory (MGS 2016). In the summer, areas around the coastal camps provided fish, shellfish, fowl, and eggs, while during the colder months, the Mi'kmaq did most of their game hunting moving inland from their summer camps (Speck 1922 in MGS 2016; Denys 1993 in MGS 2016). When resources such as fish, game and plants became scarce near an encampment, the Mi'kmaq moved it to a new location (Robertson 1969 in MGS 2016; Speck 1922 in MGS 2016).

The Mi'kmaq of Nova Scotia have established Aboriginal and Treaty rights, including the right to fish for a "moderate livelihood" which flows from the Peace and Friendship Treaties, and Aboriginal rights to hunt, fish and gather for food, social and ceremonial (FSC) purposes – more broadly referred to as "traditional" purposes. Per the CEA Agency Guidelines, the EIS is required to identify potential adverse impacts of the Project on potential or established Aboriginal or Treaty rights, and related interests.

The Crown has a duty to consult with Indigenous Peoples, which is achieved in accordance with the Mi'kmaq-Canada-Nova Scotia Consultation Terms of Reference. As per Supreme Court of Canada instruction and subsequent guidance from governments, such as the Updated Guidelines for Federal Officials to Fulfill the Duty to Consult (Government of Canada, 2011) and the Proponents' Guide: Engagement with the Mi'kmaq of Nova Scotia (Province of Nova Scotia, 2012), the Crown may delegate procedural aspects of consultation to proponents. However, the duty to consult, and ultimate decision-making authority remains with the Crown. The results of the Proponent's Indigenous engagement program and EIS development is expected to be considered by the federal and provincial governments in the decision-making process.

For the purposes of consultation, 11 of the 13 Mi'kmaq communities are represented in consultation by the Kwilmu'k Maw-klusuaqn Negotiation Office (KMKNO), which reports to the Assembly of Nova Scotia Mi'kmaq Chiefs. Millbrook and Sipekne'katik First Nations represent their own communities in consultation through their elected Chiefs and Councils.

In summary, the historical presence of the Mi'kmaq in Nova Scotia, their proven Aboriginal and treaty rights and title claim, the duty of the Crown to consult with Indigenous Peoples when contemplating decisions that could potentially adversely affect their rights, the potential for the Project to have an impact on Indigenous rights and interests, and the requirements of the Canadian Environmental Assessment Act, 2012 all form the rationale for the selection of Indigenous Peoples as a VC. The Mi'kmaq of Nova Scotia continue to rely on their traditional lands for cultural and economic survival. The Project has the potential to impact the Mi'kmaq's ability to access some lands; and, to alter the presence or availability of animals or plants that the Mi'kmaq rely on.

6.14.2 Baseline Program Methodology

Four main components were used to define the baseline information for Indigenous Peoples:

- Information obtained during ongoing engagement with the Mi'kmaq of Nova Scotia;
- Compilation of publicly-available data on Mi'kmaq groups in Nova Scotia;
- Completion of a Mi'kmaq Ecological Knowledge Study (MEKS);
- Information shared with the Proponent by Millbrook First Nation from a recently completed (January 2019) Indigenous Traditional Land and Resource Use Study (ITLRUS);
- Publicly-available Indigenous Knowledge related to the Mi'kmaq of Nova Scotia and Millbrook First Nation.
- Completion of archaeological screening and reconnaissance.

The ongoing engagement activities and issues raised during the engagement are described in Section 4 of this EIS. The archaeological screening is described in Section 6.15 of this EIS, with findings relevant to the Mi'kmaq noted in this section. Issues raised during the Mi'kmaq engagement activities were considered in the overall development of this EIS, as described in Section 6.14.4.

6.14.2.1 Mi'kmaq Ecological Knowledge Study

The Confederacy of Mainland Mi'kmaq (CMM) was retained in 2009 by GHD Limited (formerly Conestoga-Rovers & Associates) on behalf of the Proponent to complete a MEKS for the proposed mine at the Beaver Dam site. In 2015, CMM was retained on behalf of the Proponent to update the MEKS. Due to the change in the ~~haul route~~ Haul Road to include approximately 4 km of new construction, CMM was retained again in 2016 to finalize the MEKS to include the revised Project Area and any additional information. A final draft was prepared in November 2016, with final edits completed in January 2017. The MEKS is provided in Appendix M.1. The Proponent has shared the MEKS documents with staff of the two nearest Mi'kmaq communities – Millbrook and Sipekne'katik First Nations.

The MEKS supports the consideration and integration of Mi'kmaw knowledge of use and occupation of the area into development decisions via the EA process. The MEKS includes:

- a study of historic and current Mi'kmaq land and resource use;
- an evaluation of the potential impacts of the Project on Mi'kmaq use and occupation and constitutionally-protected rights;
- an evaluation of the significance of the potential impacts of the Project on Mi'kmaq use and occupation; and
- recommendations to proponents and regulators that may include recommendations for mitigation measures, further study, or consultation with the Mi'kmaq of Nova Scotia.

The MEKS was completed in accordance with the Mi'kmaq Ecological Knowledge Study Protocol (Second Edition) developed by the ANSMC. CMM is on the list of organizations that conduct MEKS in Nova Scotia.[2]

[2] http://mikmaqrights.com/wp-content/uploads/2014/01/MEK-Consultant-List.pdf

The MEKS baseline information includes both historic and current Mi'kmaq land and resource use. As defined in the MEKS, the study area for current use is the Project Area with a 5-km radius while the historic use also includes a broader context within Halifax County, including the lands adjacent to the road expansion projects, Moose River Cross road and the Beaver Dam Mine road. The current Mi'kmaq land and resource use in the vicinity of the mine site is shown on Figure 6.14-1 below, completed as part of the MEKS.

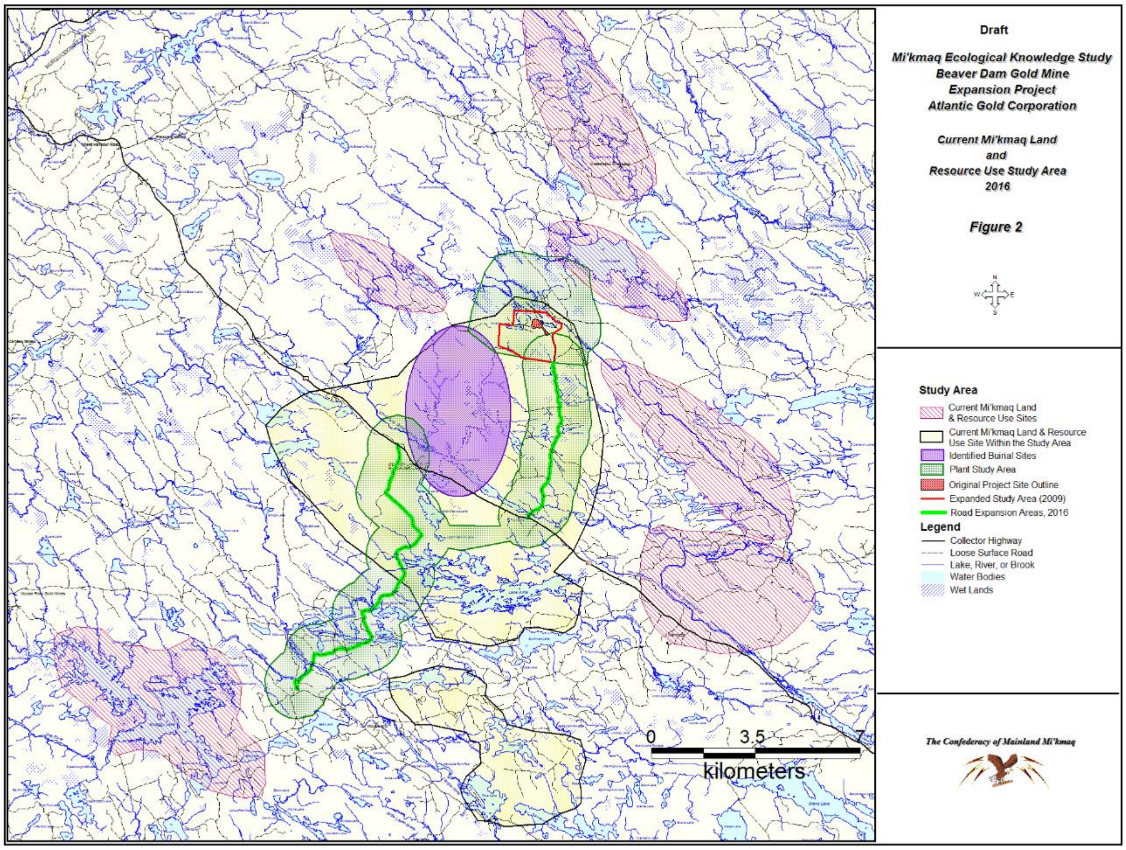

Figure 6.14-1 Current Mi'kmaq Land and Resource Use Study Area (MEKS, 2017)

It should be noted as well that a MEKS was completed for the Touquoy site in December 2005 (prior to the development of the Mi'kmaq of Nova Scotia's MEKS Protocol). Mi'kmaq involvement and the results of the MEKS for Touquoy were documented in the EA for this project that can be found on the NSE Environmental Assessment website (http://novascotia.ca/nse/ea/MooseRiver.asp).

In addition, a Mi'kmaq Ecological Knowledge Study was undertaken by Mi'kma'ki All Points Services for the Fifteen Mile Stream Gold Development Project at Fifteen Mile Stream, Nova Scotia – some of the more general information within this Study is useful for the purposes of the Beaver Dam assessment.

6.14.2.2 Indigenous Traditional Land and Resource Use Study (ITLRUS)

In addition to the various MEKS cited above, in 2018 an Indigenous Traditional Land and Resource Use Study (ITLRUS) was undertaken separately by Millbrook First Nation regarding historical and current use of the Project Area by the Millbrook First Nation. This document was recently shared with the Proponent under a confidentiality agreement. However, the Proponent has integrated information obtained from the ITLRUS, with permission from Millbrook First Nation, in appropriate sections of the EIS.

For the purposes of this study, a Local Study Area (LSA) and a Regional Study Area (RSA) were used. The RSA is based on the territorial boundaries of the Eskikewa'kik and captures some of the areas of greatest intensity of land and resource use by the Eskikewa'kik currently and within recent memory. The LSA includes the project footprint of the Beaver Dam Mine and associated Haul Road plus a 5 km buffer.

6.14.3 Baseline Conditions

There are 13 Mi'kmaq communities in Nova Scotia, with two First Nation (Mi'kmaq) reserves in the vicinity of the Project: Beaver Lake IR 17 (49.4 ha) is located approximately 5.5 km from the mine site and 3 km from the proposed Haul Road, and Sheet Harbour IR 36 (32.7 ha) is located 20 km south of the Project. Both these reserves belong to the Millbrook First Nation in Truro, Nova Scotia, part of the broader Mi'kmaw Nation. The 2017 Census reports 21 and 25 Mi'kmaw residents at Beaver Lake and Sheet Harbour, respectively (Statistics Canada 2017, 2017a).

The Sipekne'katik First Nation, located in Indian Brook, Nova Scotia, is the next closest First Nation to the Project, approximately 85 km northwest of the Beaver Dam mine site. The 2016 Census reports a total of 1,268 people living on reserve at Indian Brook IR 14, New Ross IR 20, Pennal IR 19, Shubenacadie IR 13, and Wallace Hill IR 14A.

Mi'kmaq rights are communal rights and therefore shared amongst all members of the Mi'kmaq Nation in Nova Scotia. Community profiles of the 13 Mi'kmaw First Nations in Nova Scotia have been included in Table 6.14-1 (Husky 2018).

The locations of First Nations reserve lands in Nova Scotia are also depicted below on Figure 6.14-2.

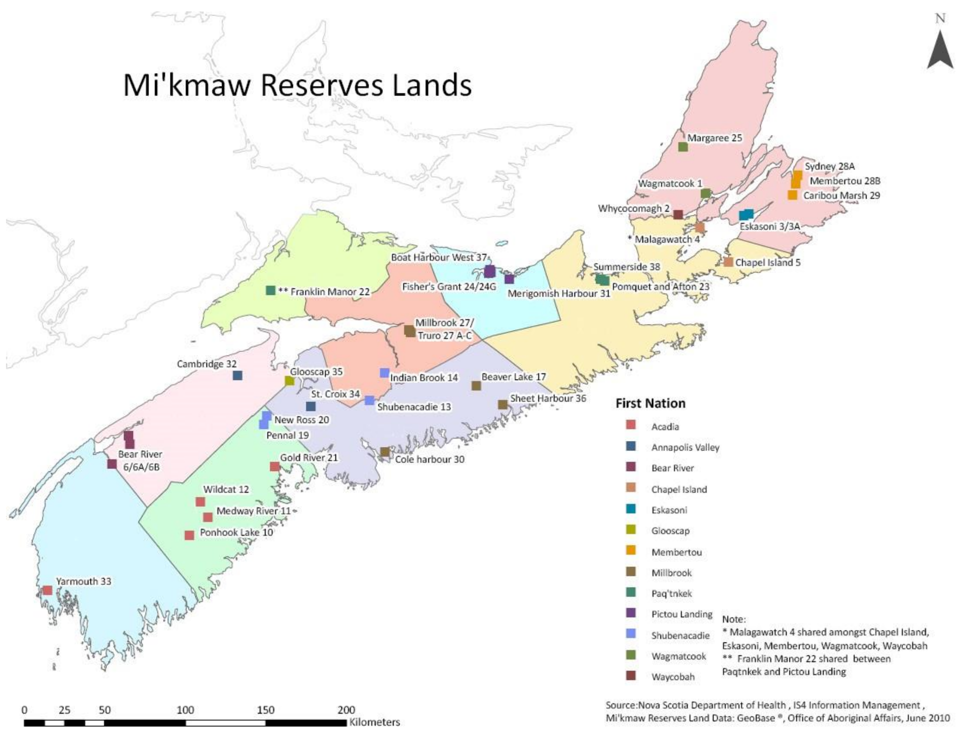

Figure 6.14-2 Mi'kmaw Reserve Lands in Nova Scotia

Table 6.14-1 Mi'kmaq Community Profiles (as referenced in Husky 2018[3])

Community Indicator	Description
Acadia First Nation	
Location	Acadia First Nation in southwestern Nova Scotia is comprised of five reserves, in five counties from Yarmouth to Halifax.
Reserves	Gold River IR 21; Medway River IR 11; Ponhook Lake IR 10; Wildcat IR 12; Yarmouth IR 33
General Overview	Acadia First Nation encompasses five reserves: Yarmouth 33 (3.2 km east of Yarmouth with an area of 27.7 ha), Ponhook Lake 10 (115.2 km southwest of Halifax with an area of 101.8 ha), Medway River 11 (l108.8 km southwest of Halifax with an area of 4.7 ha), Wildcat 12 (11 km southwest of Halifax with an area of 465.4 ha) and Gold River 21 (60.8 km west of Halifax with an area of 270.2 ha) (INAC undated). Acadia First Nation also has separate land holdings in Gardner's Mill and Hammonds Plains. Acadia First Nation is represented by the ANSMC. According to 2017 census data, the registered population was 1,524 (approx. 230 on and 1,289 off reserve).
Health and Socio-economic Conditions	The availability of infrastructure within each community varies, however Acadia First Nation has experienced infrastructure growth over the past decade, including the development of housing and roads (Acadia First Nation undated). An after-school program exists within Yarmouth for children ages 5-12 attending elementary school. Health centers are in Yarmouth and Gold River. The Yarmouth Health Centre includes a dentist, Victorian Order of Nurses (VON), clinic nursing, foot care clinics and wellness and health promotion clinics (Acadia First Nation undated). The Gold River Health Centre provides a VON, clinic nursing, wellness and health-promotion clinics, afterschool program and parent and tot groups (Acadia First Nation undated). In Wildcat, a VON is available once a month (Acadia First Nation undated). Recent economic developments for the Nation include administrative buildings, gaming facilities, and offices in Halifax and Milton to serve the off-reserve population.

[3] Relevant community baseline information was most recently published on September 25, 2018 in Newfoundland Orphan Basin Exploration Drilling Program – Environmental Impact Statement by: BP Canada Energy Group ULC. This information has been edited for relevance to the context of the currently proposed Project.

Community Indicator	Description
Physical and Cultural Heritage (including archaeological, paleontological, historical or architectural sites)	The Acadia First Nation were once based in what is today's Queen's County with artifacts found along the Mersey River (KMKNO undated).
Historical and Current Use of Lands and Waters	All Mi'kmaq in Nova Scotia would have a right to trap, hunt and harvest fish, animals and plants in the Project Area (PA), as part of their Aboriginal and Treaty rights to hunt, fish, and gather. In particular, Millbrook and other Mi'kmaq community members use the area within and surrounding the PA to hunt deer, bear, porcupine and foul; trap rabbits, fox and other small fur-bearing animals; fish for trout and other freshwater species; gather berries and plants for food and medicinal purposes; harvest plants, birchbark and fallen wood for handicrafts and cultural items. Mi'kmaq families also enjoy camps in the area for recreational purposes. All Nova Scotia Mi'kmaq communities hold Food, Social and Ceremonial (FSC) and commercial communal fishing licenses to harvest a variety of marine and freshwater species in tidal and non-tidal waters of Nova Scotia.
Asserted or Established Aboriginal and / or Treaty Rights	The Mi'kmaq of Nova Scotia have established Aboriginal and Treaty rights. This includes traditional rights to hunt, gather and fish, as well as treaty-protected rights to hunt and gather, and to fish for a "moderate livelihood". Those activities are related to sustenance, cultural and socio-economic practice.
Annapolis Valley First Nation	
Location	Annapolis Valley First Nation is comprised of two reserves within Kings County in southwestern Nova Scotia.
General Overview	Annapolis Valley First Nation encompasses two reserve lands: Annapolis Valley (Cambridge) (88 km northwest of Halifax with an area of 59 ha) and St. Croix 34 (46.6 km northwest of Halifax with an area of 126.2 ha) (INAC undated). Annapolis Valley First Nation is represented by the ANSMC. According to 2017 census data, the registered population was 290 (approx. 117 on and 173 off reserve).
Health and Socio-economic Conditions	Established in 1998, the Three Wishes Learning Centre provides a nursery school program, after school program, and culture programs (Annapolis Valley First Nation undated). The Annapolis Valley First Nation Health Centre has a registered community health nurse, access to prevention and weight control programs, foot care clinics, prenatal programs, massage therapy, physical activity programs, drug and alcohol abuse prevention, suicide prevention, injury / illness prevention and health and wellness promotion (Annapolis Valley First Nation undated). A dental hygienist is

Community Indicator	Description
	available twice a month at the health center. Annapolis Valley First Nation's economic initiatives include Annapolis Valley First Nation Gaming, Annapolis Valley First Nation Smoke Shop, and Annapolis Valley First Nation Gas Bar (Annapolis Valley First Nation undated).
Physical and Cultural Heritage (including archaeological, paleontological, historical or architectural sites)	There is a long history of Mi'kmaq presence in Annapolis Royal and the surrounding areas; archeologists have identified several settlement patterns (Statoil 2017). The Mi'kmaq lived in Annapolis Valley when the Europeans arrived in the area, with lifestyles heavily influenced by the land and ecosystems and a strong tradition of innovation connected to the homelands.
Historical and Current Use of Lands and Waters	All Mi'kmaq in Nova Scotia would have a right to trap, hunt and harvest fish, animals and plants in the Project Area (PA), as part of their Aboriginal and Treaty rights to hunt, fish, and gather. In particular, Millbrook and other Mi'kmaq community members use the area within and surrounding the PA to hunt deer, bear, porcupine and foul; trap rabbits, fox and other small fur-bearing animals; fish for trout and other freshwater species; gather berries and plants for food and medicinal purposes; harvest plants, birchbark and fallen wood for handicrafts and cultural items. Mi'kmaq families also enjoy camps in the area for recreational purposes. All Nova Scotia Mi'kmaq communities hold Food, Social and Ceremonial (FSC) and commercial communal fishing licenses to harvest a variety of marine and freshwater species in tidal and non-tidal waters of Nova Scotia.
Asserted or Established Aboriginal and / or Treaty Rights	The Mi'kmaq of Nova Scotia have established Aboriginal and Treaty rights. This includes traditional rights to hunt, gather and fish, as well as treaty-protected rights to hunt and gather, and to fish for a "moderate livelihood". Those activities are related to sustenance, cultural and socio-economic practice.
Bear River First Nation	
Location	Bear River First Nation is comprised of three reserves, within the Annapolis Valley between the towns of Annapolis Royal and Digby (KMKNO undated).
General Overview	Bear River First Nation encompasses three reserve lands: Bear River 6 (17.7 km southeast of Digby with an area of 633.8 ha), Bear River 6A (9.6 km southeast of Annapolis Valley with an area of 31.2 ha), and Bear River 6B (6.4 km southeast of Annapolis Valley with an area of 24.3 ha) (INAC undated). Bear River First Nation is represented by the ANSMC. According to 2017 census data, the registered population was 338 (approx. 110 on and 228 off reserve).

Community Indicator	Description
Health and Socio-economic Conditions	The majority of community members live on the Bear River 6, also known as L'sitkuk Mainland (Mainland Mi'kmaq Development Inc. 2016). In Bear River, a learning center provides space for educational activities. There is a health center in Bear River, offering healing services and workshops (Bear River First Nation 2016). A doctor visits the health center monthly (Bear River First Nation 2016). Recently, an RCMP satellite office opened in the community. Bear River First Nation enterprises include a Treaty Gas bar, L'sitkuk Gas Bar Limited, and a seasonal Heritage and Cultural Centre.
Physical and Cultural Heritage (including archaeological, paleontological, historical or architectural sites)	There is a long history of Bear River Mi'kmaq presence in Digby and Annapolis Counties (Mainland Mi'kmaq Development Inc. 2016). As early as 1612, the Mi'kmaq have been recorded as harvesting resources in the Annapolis River and French Bay (Bay of Fundy) (Mainland Mi'kmaq Development Inc. 2016). Traditionally, during the fall and winter, families would travel to hunt big game such as moose, deer, caribou and bear, and smaller game such as beaver, bird species, and rabbit. In the spring, families typically settled along the coast and in the summer, they harvested shellfish such as clam, mussels, and scallops as well as several fish species including cod, salmon, trout, eel, herring, and bass (Mainland Mi'kmaq Development Inc. 2016). Seals, walrus, porpoises and berries and plants were also harvested. Bear River First Nation was traditionally, and continues to be, well known for their artwork, specializing in embroidering porcupine quills on birchbark, leatherwork, and basketry (Mainland Mi'kmaq Development Inc. 2016).
Historical and Current Use of Lands and Waters	All Mi'kmaq in Nova Scotia would have a right to trap, hunt and harvest fish, animals and plants in the Project Area (PA), as part of their Aboriginal and Treaty rights to hunt, fish, and gather. In particular, Millbrook and other Mi'kmaq community members use the area within and surrounding the PA to hunt deer, bear, porcupine and foul; trap rabbits, fox and other small fur-bearing animals; fish for trout and other freshwater species; gather berries and plants for food and medicinal purposes; harvest plants, birchbark and fallen wood for handicrafts and cultural items. Mi'kmaq families also enjoy camps in the area for recreational purposes. All Nova Scotia Mi'kmaq communities hold Food, Social and Ceremonial (FSC) and commercial communal fishing licenses to harvest a variety of marine and freshwater species in tidal and non-tidal waters of Nova Scotia.
Asserted or Established Aboriginal and / or Treaty Rights	The Mi'kmaq of Nova Scotia have established Aboriginal and Treaty rights. This includes traditional rights to hunt, gather and fish, as well as treaty-protected rights to hunt and gather, and to fish for a

Community Indicator	Description
	"moderate livelihood". Those activities are related to sustenance, cultural and socio-economic practice.
Eskasoni First Nation	
Location	Eskasoni First Nation is comprised of three reserves, along the shore of the Bras d'Or Lakes.
General Overview	Eskasoni First Nation encompasses three reserves: Eskasoni 3 (40 km southwest of Sydney with an area of 3,504.6 ha), Eskasoni 3A (40 km southwest of Sydney with an area of 28.5 ha), and Malagawatch 4 (62 km southwest of Sydney with an area of 661.3 ha) (INAC undated). Eskasoni First Nation is the largest Indigenous community in Atlantic Canada (KMKNO undated). According to 2017 census data, the registered population was 4,443 (approx. 3,780 on and 631 off reserve).
Health and Socio-economic Conditions	Eskasoni First Nation has community-owned infrastructure such as a community-operated school, accommodating students from kindergarten to grade 12, a supermarket, a community rink and a cultural center. The Eskasoni Community Health Centre provides a wide range of primary care services as well as several health programs and services such as blood collection, community health nursing, maternal child health, medical transportation, and diabetic services (Eskasoni Community Health Centre 2004). The Eskasoni Pharmacy is in the Health Centre. The pharmacy provides information to the community on drug use, Native Alcohol and Drug Addiction Counseling Association, and Mi'kmaq Family and Children's Services. The Health Centre is staffed with a nurse, medical transcriptionist, and several physicians (Eskasoni Community Health Centre 2004). Community Health Representatives are also on-site and act as a liaison between health care providers and community members, assisting with translation and administration of health care services and programs (Eskasoni Community Health Centre 2004). Within the community there is also a fire department, with four career firefighters and 20 volunteer firefighters (Eskasoni First Nation undated). As described in more detail below, Eskasoni First Nation hold several commercial communal licenses for a variety of fish and marine species. The community operates Crane Cove Seafoods. Crane Cove Seafoods owns 13 vessels ranging from 30 – 65 feet and employs over 100 community members, with an additional 35 community members employed at the associated processing plant (Eskasoni First Nation undated). Fish harvesting takes place throughout Nova Scotia from Ingonish to Yarmouth.

Community Indicator	Description
Physical and Cultural Heritage (including archaeological, paleontological, historical or architectural sites)	Chartered in 1832, Eskasoni First Nation became an official reserve in 1834. From 1845 to 1851, much of Cape Breton suffered from famine (MGS 2012). During this time, the Mi'kmaq transitioned into a more stationary lifestyle and found opportunities to provide labour, typically traveling to Sydney to work and sell wares (MGS 2012). The population of Eskasoni grew in the 1940s as the Department of Indian Affairs implemented a new policy to centralize Indigenous peoples (Eskasoni First Nation undated). In the 1950s, Eskasoni First Nation began controlling their own affairs and a Band Council was established in 1958 (Eskasoni First Nation undated).
Historical and Current Use of Lands and Waters	All Mi'kmaq in Nova Scotia would have a right to trap, hunt and harvest fish, animals and plants in the Project Area (PA), as part of their Aboriginal and Treaty rights to hunt, fish, and gather. In particular, Millbrook and other Mi'kmaq community members use the area within and surrounding the PA to hunt deer, bear, porcupine and foul; trap rabbits, fox and other small fur-bearing animals; fish for trout and other freshwater species; gather berries and plants for food and medicinal purposes; harvest plants, birchbark and fallen wood for handicrafts and cultural items. Mi'kmaq families also enjoy camps in the area for recreational purposes. All Nova Scotia Mi'kmaq communities hold Food, Social and Ceremonial (FSC) and commercial communal fishing licenses to harvest a variety of marine and freshwater species in tidal and non-tidal waters of Nova Scotia.
Asserted or Established Aboriginal and / or Treaty Rights	The Mi'kmaq of Nova Scotia have established Aboriginal and Treaty rights. This includes traditional rights to hunt, gather and fish, as well as treaty-protected rights to hunt and gather, and to fish for a "moderate livelihood". Those activities are related to sustenance, cultural and socio-economic practice.
Glooscap First Nation	
Location	Glooscap First Nation is comprised of one reserve (Glooscap 35), northwest of Halifax.
General Overview	Glooscap 35 is 68.8 km northwest of Halifax with an area of 171.1 ha (INAC undated). Glooscap First Nation is represented by the ANSMC. According to 2017 census data, the registered population was 375 (approx. 94 on and 280 off reserve).
Health and Socio-economic Conditions	Glooscap First Nation does not have any schools within the community; however, the Nation has an appointed education director who oversees primary and secondary education for on-reserve members (Glooscap First Nation 2018). There is a Health Centre in the community, offering health and healing services that focus on six components: education, health promotion, culture and language, nutrition, social support, and parent / family involvement (Glooscap First Nation 2018).

Community Indicator	Description
	Established in 2014, Glooscap Ventures was created as the economic department for the community and is owned and operated by Glooscap First Nation. Glooscap Ventures manages on-reserve businesses including the variety store / gas bar, gaming facility, and commercial fisheries. Currently, Glooscap Ventures is developing a 27-acre parcel of land, Glooscap Landing, along Highway 101 for retail purposes (Glooscap First Nation 2018). Other initiatives include the expansion of the commercial fisheries and pursuing opportunities in renewable energy (Glooscap First Nation 2018).
Physical and Cultural Heritage (including archaeological, paleontological, historical or architectural sites)	Established in 1984, Glooscap First Nation became the thirteenth Mi'kmaq band in NS (KMKNO undated). Originally, Glooscap First Nation was created following the separation of two communities, Annapolis Valley and Glooscap, that were 30 km apart (KMKNO undated). Glooscap First Nation was originally known as Horton but was renamed in 2001 (KMKNO undated).
Historical and Current Use of Lands and Waters	All Mi'kmaq in Nova Scotia would have a right to trap, hunt and harvest fish, animals and plants in the Project Area (PA), as part of their Aboriginal and Treaty rights to hunt, fish, and gather. In particular, Millbrook and other Mi'kmaq community members use the area within and surrounding the PA to hunt deer, bear, porcupine and foul; trap rabbits, fox and other small fur-bearing animals; fish for trout and other freshwater species; gather berries and plants for food and medicinal purposes; harvest plants, birchbark and fallen wood for handicrafts and cultural items. Mi'kmaq families also enjoy camps in the area for recreational purposes. All Nova Scotia Mi'kmaq communities hold Food, Social and Ceremonial (FSC) and commercial communal fishing licenses to harvest a variety of marine and freshwater species in tidal and non-tidal waters of Nova Scotia.
Asserted or Established Aboriginal and / or Treaty Rights	The Mi'kmaq of Nova Scotia have established Aboriginal and Treaty rights. This includes traditional rights to hunt, gather and fish, as well as treaty-protected rights to hunt and gather, and to fish for a "moderate livelihood". Those activities are related to sustenance, cultural and socio-economic practice.
Membertou First Nation	
Location	Membertou First Nation is comprised of four reserves, in northeastern and southwestern Sydney.
General Overview	Membertou First Nation encompasses four reserves: Membertou 28B (1.6 km south of Sydney with an area of 100.1 ha), Sydney 28A (1.6 km northeast of Sydney with an area of 5.1 ha), Caribou Marsh 29 (8 km southwest of Sydney with an area of 219 ha) and Malagawatch 4 (62 km southwest of Sydney with an area of 661.3 ha) (INAC undated). Membertou First Nation is

Community Indicator	Description
	represented by the ANSMC. According to 2017 census data, the registered population was 1,500 (approx. 904 on and 552 off reserve).
Health and Socio-economic Conditions	Membertou First Nation has one school, Maupeltuewey Kina'matno'kuom, accommodating students from kindergarten to grade 6 (Membertou First Nation undated). A local Cape Breton Regional Police detachment is in Membertou. The Membertou Wellness Centre delivers programs to the community that address prominent health issues such as smoking cessation, crisis prevention / intervention, addictions services, and home and community care (Membertou First Nation undated). The Membertou Wellness Centre also provides a family practice medical clinic with a doctor available Monday through Friday (Membertou First Nation undated). Membertou First Nation has made considerable investments in infrastructure and providing services to community members over the last decade such as a gas station, church, community center, band office and boxing gym. Membertou First Nation also recently built the Membertou Sports and Wellness Centre, with two ice surfaces, an indoor walking track, a YMCA gym and multi-purpose meeting and event rooms (Membertou Sports and Wellness Centre undated). Within Membertou, there is a business park including the Membertou Trade and Convention Centre, Membertou Heritage Park and Petroglyphs Gift Shop, a hotel, Kiju's Restaurant, Membertou Entertainment Centre, and private businesses. In 2002, Membertou First Nation became the first Indigenous government in the world to be ISO-certified (CANDO 2018). The Nation owns and operates a seafood company, First Fishermen Seafoods. The company has six fleet vessels and harvests a variety of groundfish, shellfish, tuna, and swordfish (Membertou First Nation undated).
Physical and Cultural Heritage (including archaeological, paleontological, historical or architectural sites)	Once known as Kings Road, Membertou was situated along the banks of Sydney Harbour. In 1926, Membertou was officially moved to its present location (Membertou First Nation undated). As an urban Indigenous community, few members relied solely on traditional hunting, fishing, and gathering to earn their living; instead, both men and women worked in various industries (Membertou First Nation undated).
Historical and Current Use of Lands and Waters	All Mi'kmaq in Nova Scotia would have a right to trap, hunt and harvest fish, animals and plants in the Project Area (PA), as part of their Aboriginal and Treaty rights to hunt, fish, and gather. In particular, Millbrook and other Mi'kmaq community members use the area within and surrounding the PA to hunt deer, bear, porcupine and foul; trap rabbits, fox and other small fur-bearing animals; fish for trout and other freshwater species; gather berries and plants for food and medicinal purposes; harvest plants, birchbark and fallen wood for handicrafts and cultural items. Mi'kmaq

Community Indicator	Description
	families also enjoy camps in the area for recreational purposes. All Nova Scotia Mi’kmaq communities hold Food, Social and Ceremonial (FSC) and commercial communal fishing licenses to harvest a variety of marine and freshwater species in tidal and non-tidal waters of Nova Scotia.
Asserted or Established Aboriginal and / or Treaty Rights	The Mi’kmaq of Nova Scotia have established Aboriginal and Treaty rights. This includes traditional rights to hunt, gather and fish, as well as treaty-protected rights to hunt and gather, and to fish for a “moderate livelihood”. Those activities are related to sustenance, cultural and socio-economic practice.
Paq’tnkek Mi’kmaw Nation	
Location	Paq’tnkek Mi’kmaw Nation is comprised of three reserves, southeast of Amherst and east of Antigonish.
General Overview	Paq’tnkek Mi’kmaw Nation encompasses three reserves: Franklin Manor 22 (32 km southeast of Amherst with an area of 212.5 ha), Paq’tnkek-Niktuek 23 (24 km east of Antigonish with an area of 218.1 ha), and Welnek 38 (18 km east of Antigonish with an area of 43.4 ha) (INAC undated). Paq’tnkek is represented by the ANSMC. According to 2017 census data, the registered population was 573 (approx. 404 on and 141 off reserve).
Health and Socio-economic Conditions	Since 1980, the Paq’tnkek Pre-School has been in operation in Afton, NS. The nearest RCMP detachment is in Antigonish. The Paq’tnkek Health Centre provides a variety of programs and services to community members, including community health promotion, education, and prevention programming (Paq’tnkek Mi’kmaw Nation 2018). Paq’tnkek Mi’kmaw Nation has an Economic Development Department which manages all development projects within the community, including recent infrastructure development projects related to highway development and commercial opportunities. The First Nation also operates the Paq’tnkek Entertainment Centre, Gas Bar, and Smoke Shop (Paq’tnkek Mi’kmaw Nation 2018). The First Nation owns and operates the Paq’tnkek Fisheries Enterprise, employing 20 community members. The enterprise has a fleet of five communal vessels and harvests lobster, snow crab, and herring (Paq’tnkek Mi’kmaw Nation 2018).
Physical and Cultural Heritage (including archaeological, paleontological, historical or architectural sites)	Established in 1820, Paq’tnkek, meaning “by the bay”, has been a traditional stopping point for Mi’kmaq travelling to and from Unama’ki, and a central meeting point for Chiefs across the province. Cultural and traditional practices such as spearing eels and salmon and snaring rabbits are still practiced within the community (Paq’tnkek Mi’kmaw Nation 2018).

Community Indicator	Description
Historical and Current Use of Lands and Waters	All Mi'kmaq in Nova Scotia would have a right to trap, hunt and harvest fish, animals and plants in the Project Area (PA), as part of their Aboriginal and Treaty rights to hunt, fish, and gather. In particular, Millbrook and other Mi'kmaq community members use the area within and surrounding the PA to hunt deer, bear, porcupine and foul; trap rabbits, fox and other small fur-bearing animals; fish for trout and other freshwater species; gather berries and plants for food and medicinal purposes; harvest plants, birchbark and fallen wood for handicrafts and cultural items. Mi'kmaq families also enjoy camps in the area for recreational purposes. All Nova Scotia Mi'kmaq communities hold Food, Social and Ceremonial (FSC) and commercial communal fishing licenses to harvest a variety of marine and freshwater species in tidal and non-tidal waters of Nova Scotia.
Asserted or Established Aboriginal and / or Treaty Rights	The Mi'kmaq of Nova Scotia have established Aboriginal and Treaty rights. This includes traditional rights to hunt, gather and fish, as well as treaty-protected rights to hunt and gather, and to fish for a "moderate livelihood". Those activities are related to sustenance, cultural and socio-economic practice.
Pictou Landing First Nation	
Location	Pictou Landing First Nation is comprised of five reserves on the south shore of the Northumberland Strait in Pictou County.
General Overview	Pictou Landing First Nation encompasses five reserves: Franklin Manor 22 (32 km southeast of Amherst with an area of 212.5 ha), Fisher's Grant (10 km north of New Glasgow with an area of 142.7 ha), Boat Harbour West 37 (8 km north of New Glasgow with an area of 98.2 ha), Fisher's Grant 24G (3.2 km southeast of Pictou Landing with an area of 60.0 ha) and Merigomish Harbour 31 (12.8 km east of New Glasgow with an area of 14.2 ha) (INAC undated). Pictou Landing First Nation is represented by the ANSMC. According to 2017 census data, the registered population was 663 (approx. 483 on and 157 off reserve).
Health and Socio-economic Conditions	Pictou Landing First Nation School accommodates students from primary to grade 6. There are no police detachments or fire halls within the community. The Nation has a church, gas bar, and health center (KMKNO undated). As described in more detail below Pictou Landing First Nation holds several commercial communal licenses for a variety of fish and marine species. The Pictou Landing First Nation fishery is the Nation's main industry, with a fleet of 12 vessels and employing approximately 100 people (full and part time) a year (KMKNO undated).

Community Indicator	Description
Physical and Cultural Heritage (including archaeological, paleontological, historical or architectural sites)	Pictou Landing First Nation have lived on a seasonal basis in and around a small tidal estuary connected by a narrow channel to the Northumberland Strait (Statoil 2017). The area provided an abundance of resources such as fish, eels, crustaceans, and shellfish as well as hunting and trapping near shore (Statoil 2017).
Historical and Current Use of Lands and Waters	All Mi'kmaq in Nova Scotia would have a right to trap, hunt and harvest fish, animals and plants in the Project Area (PA), as part of their Aboriginal and Treaty rights to hunt, fish, and gather. In particular, Millbrook and other Mi'kmaq community members use the area within and surrounding the PA to hunt deer, bear, porcupine and foul; trap rabbits, fox and other small fur-bearing animals; fish for trout and other freshwater species; gather berries and plants for food and medicinal purposes; harvest plants, birchbark and fallen wood for handicrafts and cultural items. Mi'kmaq families also enjoy camps in the area for recreational purposes. All Nova Scotia Mi'kmaq communities hold Food, Social and Ceremonial (FSC) and commercial communal fishing licenses to harvest a variety of marine and freshwater species in tidal and non-tidal waters of Nova Scotia.
Asserted or Established Aboriginal and / or Treaty Rights	The Mi'kmaq of Nova Scotia have established Aboriginal and Treaty rights. This includes traditional rights to hunt, gather and fish, as well as treaty-protected rights to hunt and gather, and to fish for a "moderate livelihood". Those activities are related to sustenance, cultural and socio-economic practice.
Potlotek First Nation	
Location	Potlotek First Nation is comprised of two reserves, southwest of Sydney.
General Overview	Potlotek First Nation encompasses two reserves: Chapel Island 5 (69 km southwest of Sydney with an area of 595.5 ha) and Malagawatch 4 (62 km southwest of Sydney with an area of 661.3 ha (INAC undated). Potlotek First Nation is represented by the ANSMC. According to 2017 census data, the registered population was 727 (approx. 552 on and 140 off reserve).
Health and Socio-economic Conditions	Within the community, there is a day care and elementary school, the Mi'kmawey School. Established in 1998, it accommodates students from primary to grade 6 (Potlotek First Nation 2016). An RCMP building and fire hall exist within the community. The Potlotek Volunteer Fire Department has 14 active members (KMKNO undated). A Health Centre is in the community, providing a variety of services and programs such as addiction services, maternal care, home care, advanced and diabetic foot care, healing programs and wellness programs (Potlotek First Nation 2016). A doctor visits the Health Centre on a weekly basis (Potlotek First Nation 2016). Additional

Community Indicator	Description
	infrastructure within the community includes the Chapel Island Community Hall / Kateri Chapel and a Youth Centre. Recently, economic developments such as the construction of a store-gas bar which includes Robins Donuts, a Rite Stop, Esso and video lottery terminals have provided employment opportunities for community members (KMKNO undated). The fisheries industry plays a dominant role in the First Nation's economy, particularly in oyster cultivation. Formed in 1995, the Apaqtukewaq Fisheries Co-op includes four members and employs seven people during peak season (May to September) (Potlotek First Nation 2016). An oyster plant operates within the community and the Co-op operates two fishing vessels used for harvesting of lobster and snow crab (Potlotek First Nation 2016).
Physical and Cultural Heritage (including archaeological, paleontological, historical or architectural sites)	Established in 1834, Potlotek First Nation, also known as Chapel Island, is the home of the Saint Anne's Mission where each year Mi'kmaw people gather to celebrate the Feast of Saint Anne (Potlotek First Nation 2016). Chapel Island is considered a sacred ground to the Mi'kmaq (Potlotek First Nation 2016).
Historical and Current Use of Lands and Waters	All Mi'kmaq in Nova Scotia would have a right to trap, hunt and harvest fish, animals and plants in the Project Area (PA), as part of their Aboriginal and Treaty rights to hunt, fish, and gather. In particular, Millbrook and other Mi'kmaq community members use the area within and surrounding the PA to hunt deer, bear, porcupine and foul; trap rabbits, fox and other small fur-bearing animals; fish for trout and other freshwater species; gather berries and plants for food and medicinal purposes; harvest plants, birchbark and fallen wood for handicrafts and cultural items. Mi'kmaq families also enjoy camps in the area for recreational purposes. All Nova Scotia Mi'kmaq communities hold Food, Social and Ceremonial (FSC) and commercial communal fishing licenses to harvest a variety of marine and freshwater species in tidal and non-tidal waters of Nova Scotia.
Asserted or Established Aboriginal and / or Treaty Rights	The Mi'kmaq of Nova Scotia have established Aboriginal and Treaty rights. This includes traditional rights to hunt, gather and fish, as well as treaty-protected rights to hunt and gather, and to fish for a "moderate livelihood". Those activities are related to sustenance, cultural and socio-economic practice.
Wagmatcook First Nation	
Location	Wagmatcook First Nation is comprised of three reserves, within the Bras d'Or Lakes region of Cape Breton.

Community Indicator	Description
General Overview	Wagmatcook encompasses three reserves: Malagawatch 4 (62 km southwest of Sydney with an area of 661.3 ha), Margaree 25 (68.8 km northwest of Sydney with an area of 0.8 ha), and Wagmatcook 1 (51 km west of Sydney with an area of 385.0 ha) (INAC undated). Wagmatcook First Nation is represented by the ANSMC. According to 2017 census data, the registered population was 852 (approx. 626 on and 184 off reserve).
Health and Socio-economic Conditions	In 1986, Wagmatcook First Nation initiated the first Indigenous secondary school in the Atlantic Region and established the first Nova Scotia Mi'kmaq Day Care Centre (Statoil 2017). A new elementary-secondary education school, Wamgatcookewey School, is the first kindergarten to grade 12 Mi'kmaq First Nation school in Nova Scotia (Wagmatcook First Nation 2016). There is no police detachment within the community, but there is a fire hall. The cultural center, the Wagmatcook Enterprise and Cultural Centre, provides a variety of services to community members including an Alternate School for Youth, cultural demonstration projects, and a Fitness Centre (Wagmatcook First Nation 2016). The cultural center also houses the TD Canada Trust Agency bank, a Canada Post office, and the Clean Wave Restaurant (Wagmatcook First Nation 2016). The band also operates a gas bar, grocery store, wharf, and warehouse. The Wagmatcook commercial fishery has been in operation since 1990 and is communally owned by registered members of Wagmatcook First Nation (Wagmatcook First Nation 2016). The Wagmatcook Commercial Fishery employs 35 fishers and one shore-based manager (Wagmatcook First Nation 2016). It utilizes a total of eleven fishing vessels and primarily harvests groundfish, palegics, shellfish and is a producer / wholesaler of shell ice products (Wagmatcook First Nation 2016). The fishery has six Cape Islander-style lobster vessels, one groundfish vessel, two storage facilities and an ice processing facility (Wagmatcook First Nation 2016). The fishery generates the highest projected returns to the community (Wagmatcook First Nation 2016).
Physical and Cultural Heritage (including archaeological, paleontological, historical or architectural sites)	Proposed PA does not overlap with any known physical and cultural heritage sites related specifically to Wagmatcook First Nation.
Historical and Current Use of Lands and Waters	All Mi'kmaq in Nova Scotia would have a right to trap, hunt and harvest fish, animals and plants in the Project Area (PA), as part of their Aboriginal and Treaty rights to hunt, fish, and gather. In particular, Millbrook and other Mi'kmaq community members use the area within and surrounding the PA to hunt deer, bear, porcupine and foul; trap rabbits, fox and other small fur-bearing animals; fish for trout and other freshwater species; gather berries and plants for food and medicinal

Community Indicator	Description
	purposes; harvest plants, birchbark and fallen wood for handicrafts and cultural items. Mi'kmaq families also enjoy camps in the area for recreational purposes. All Nova Scotia Mi'kmaq communities hold Food, Social and Ceremonial (FSC) and commercial communal fishing licenses to harvest a variety of marine and freshwater species in tidal and non-tidal waters of Nova Scotia.
Asserted or Established Aboriginal and / or Treaty Rights	The Mi'kmaq of Nova Scotia have established Aboriginal and Treaty rights. This includes traditional rights to hunt, gather and fish, as well as treaty-protected rights to hunt and gather, and to fish for a "moderate livelihood". Those activities are related to sustenance, cultural and socio-economic practice.
We'koqma'q First Nation	
Location	We'ko'kmaq (Waycobah) First Nation is comprised of two reserves within the village of Whycocomagh in Cape Breton.
General Overview	Waycobah First Nation encompasses two reserves: Malagawatch 4 (62 km southwest of Sydney with an area of 661.3 ha) and Whycocomagh 2 (70 km west of Sydney with an area of 908 ha) (INAC undated). Waycobah First Nation is represented by the ANSMC. According to 2017 census data, the registered population was 999 (approx. 883 on and 81 off reserve).
Health and Socio-economic Conditions	In 2008, a new elementary-secondary school was opened within the community (Waycobah First Nation undated). A daycare facility also exists within the community as well as a RCMP station and volunteer fire department. In 2010, the Theresa Cremo Memorial Health Centre was opened, offering a variety of programs and services such as a full time Nurse Practitioner, full time clinical therapist, prenatal classes, lab collection, Reiki treatments, an Alcohol and Drug counselor, midwifery clinics, well women and men clinics, a dietician, teen health clinic and a variety of activities for members of the community of all ages (Waycobah First Nation undated). A doctor is available at the Health Centre twice a week. The Nation also owns and operates a convenience store and gas bar and a gaming center (Waycobah First Nation undated). The First Nation has two lobster licenses, shrimp trap and trawl licenses, groundfish quotas and an active elver fishery (Waycobah First Nation undated). The Waycobah Fisheries employs approximately 35 community members (Waycobah First Nation undated). In 2011, a trout fish farm was re-established within the community. Although owned by Cold Water Fisheries, employees are largely Waycobah community members (Waycobah First Nation undated).

Community Indicator	Description
Physical and Cultural Heritage (including archaeological, paleontological, historical or architectural sites)	Established in the early 1800s, Waycobah First Nation was originally known as We'ko'kmaq. In the 1940s, the community experienced a decline in population because of the federal government's centralization policy, where many individuals were relocated to the community of Eskasoni (Waycobah First Nation undated). Proposed PA does not overlap with any known physical and cultural heritage sites related specifically to We'ko'kmaq First Nation.
Historical and Current Use of Lands and Waters	All Mi'kmaq in Nova Scotia would have a right to trap, hunt and harvest fish, animals and plants in the Project Area (PA), as part of their Aboriginal and Treaty rights to hunt, fish, and gather. In particular, Millbrook and other Mi'kmaq community members use the area within and surrounding the PA to hunt deer, bear, porcupine and foul; trap rabbits, fox and other small fur-bearing animals; fish for trout and other freshwater species; gather berries and plants for food and medicinal purposes; harvest plants, birchbark and fallen wood for handicrafts and cultural items. Mi'kmaq families also enjoy camps in the area for recreational purposes. All Nova Scotia Mi'kmaq communities hold Food, Social and Ceremonial (FSC) and commercial communal fishing licenses to harvest a variety of marine and freshwater species in tidal and non-tidal waters of Nova Scotia.
Asserted or Established Aboriginal and / or Treaty Rights	The Mi'kmaq of Nova Scotia have established Aboriginal and Treaty rights. This includes traditional rights to hunt, gather and fish, as well as treaty-protected rights to hunt and gather, and to fish for a "moderate livelihood". Those activities are related to sustenance, cultural and socio-economic practice.
Millbrook First Nation	
Location	Millbrook First Nation is comprised of seven reserves, near the communities of Truro and Halifax. It is the Mi'kmaq First Nation that is located in closest geographic proximity to the proposed Project.
General Overview	Millbrook First Nation encompasses seven reserves. Four reserve lands: Truro 27A, Truro 27B, Truro 27C and Millbrook 27, are near the town of Truro with a total area of 344.9 ha (INAC undated). The remaining three are: Beaver Lake 17 (78.4 km southeast of Halifax with an area of 49.4 ha), Sheet Harbour 36 (91.2 km northeast of Halifax with an area of 32.7 ha), and Cole Harbour 30 (9.6 km east of Halifax with an area of 18.6 ha (INAC undated). The Beaver Lake and Sheet Harbour reserves are the two Millbrook communities in closest geographic proximity to the proposed Project.

Community Indicator	Description
	Millbrook First Nation is currently not represented in consultation by the ANSMC. According to 2017 census data, the registered population was 1,831 (approx. 872 on and 916 off reserve).
Health and Socio-economic Conditions	Infrastructure and services available in the community of Millbrook are the Millbrook Band Office, Millbrook Community Hall, Millbrook Ballfield, Millbrook Gym, Millbrook Early Education Centre, Millbrook Senior's Centre, and Sacred Heart Mission Church (Millbrook First Nation 2018). The Millbrook Health Centre is also in the community, providing a variety of programs and services such as home and community care and assisted living programs, youth support, addiction services, wellness programs and community support and family enrichment programs. Millbrook First Nation owns, develops, and manages the retail park, Millbrook Power Centre, in Truro, NS. This park encompasses 68 acres of commercial land on the most traveled stretch of highway in Nova Scotia, outside of Halifax (Millbrook First Nation 2018). Since opening in 2001, the Millbrook Power Centre has approximately a dozen tenants including a multiplex theatre, several restaurants, two hotels, a recreational vehicle retailer, a service station, an aquaculture facility, a furniture store, and the Glooscap Heritage Centre (Millbrook First Nation 2018). There have also been recent developments in the Cole Harbour community, including apartment buildings, General Dynamics Building, and a gaming center. Millbrook Fisheries is an important part of the local economy, controlling eight vessels and employing over 40 staff members throughout the year.
Physical and Cultural Heritage (including archaeological, paleontological, historical or architectural sites)	From the late 1700s to the early 1800s, the Mi'kmaq near Truro were settled along the banks of the Salmon River. The Mi'kmaq then relocated to their current community at Millbrook (Millbrook First Nation 2018). Both the MEKS and the Archaeological studies completed for the Touquoy Gold Project and the Beaver Dam Gold Project were considered in this EIS, and the pertinent MEKS and archaeological studies appended to this EIS. The proposed PA does not overlap with any known physical and cultural heritage sites related specifically to Millbrook First Nation.
Historical and Current Use of Lands and Waters	All Mi'kmaq in Nova Scotia would have a right to trap, hunt and harvest fish, animals and plants in the Project Area (PA), as part of their Aboriginal and Treaty rights to hunt, fish, and gather. In particular, Millbrook and other Mi'kmaq community members use the area within and surrounding the PA to hunt deer, bear, porcupine and foul; trap rabbits, fox and other small fur-bearing animals; fish for trout and other freshwater species; gather berries and plants for food and medicinal

Community Indicator	Description
	purposes; harvest plants, birchbark and fallen wood for handicrafts and cultural items. Mi'kmaq families also enjoy camps in the area for recreational purposes. All Nova Scotia Mi'kmaq communities hold Food, Social and Ceremonial (FSC) and commercial communal fishing licenses to harvest a variety of marine and freshwater species in tidal and non-tidal waters of Nova Scotia.
Asserted or Established Aboriginal and / or Treaty Rights	The Mi'kmaq of Nova Scotia have established Aboriginal and Treaty rights. This includes traditional rights to hunt, gather and fish, as well as treaty-protected rights to hunt and gather, and to fish for a "moderate livelihood". Those activities are related to sustenance, cultural and socio-economic practice.
Sipekne'katik First Nation	
Location	Sipekne'katik First Nation (also known as Indian Brook or Shubenacadie) is comprised of five reserves in Hants County, near the town of Shubenacadie. It is the second most proximate Mi'kmaw community to the proposed Project.
General Overview	Sipekne'katik First Nation encompasses five reserves: Indian Brook 14 (29 km southwest of Truro with an area of 1,234.2 ha), Wallace Hills 14A (with an area of 54.8 ha), Shubenacadie 13 (32 km north of Halifax with an area of 412.0 ha), Pennal 19 (67.2 km northwest of Halifax with an area of 43.5 ha) and New Ross 20 (64 km northwest of Halifax with an area of 408.3 ha) (INAC undated).The Indian Brook and Shubenacadie reserves would be the two most proximate Sipekne'katik communities to the proposed Project. Sipekne'katik First Nation is currently not represented by the ANSMC. According to 2017 census data, the registered population was 2,645 (approx. 1,268 on and 1,298 off reserve).
Health and Socio-economic Conditions	In 2008, the L'nu Sipuk Kina'muokum (LSK) school opened in the community, accommodating students from primary to grade 12. The school specializes in Mi'kmaq studies and Mi'kmaq language courses (Sipekne'katik First Nation 2016). Little Eagles Daycare Centre provides care to children ages 1-4 years old (Sipekne'katik First Nation 2016). The community also has the Sipekne'katik Multipurpose Centre, used for community meetings, events, and social gatherings. Local businesses within the community include a community gas-bar, tobacco shop, gaming room and convenience store. The Sipekne'katik First Nation Fisheries Department is an economic enterprise, managing 33 fishing licenses for various species including lobster, crab, and groundfish (BP 2017).

Community Indicator	Description
Physical and Cultural Heritage (including archaeological, paleontological, historical or architectural sites)	Established in 1820, Sipekne'katik was originally named "Indian Brook". The area was traditionally used as a sacred site to prepare for ceremonies and hunting and fishing trips (Sipekn'katik First Nation undated). In 1752, one of the most significant Peace and Friendship Treaties was signed at Shubenacadie District (Sipekn'katik First Nation 2016). This treaty dealt with lands, hunting, fishing, trapping, gathering, and trading. In 2002, a memorial was erected in honor of Chief Jean Baptiste Cope and the Treaty of 1752 (Sipekn'katik First Nation 2016).
Historical and Current Use of Lands and Waters	All Mi'kmaq in Nova Scotia would have a right to trap, hunt and harvest fish, animals and plants in the Project Area (PA), as part of their Aboriginal and Treaty rights to hunt, fish, and gather. In particular, Millbrook and other Mi'kmaq community members use the area within and surrounding the PA to hunt deer, bear, porcupine and foul; trap rabbits, fox and other small fur-bearing animals; fish for trout and other freshwater species; gather berries and plants for food and medicinal purposes; harvest plants, birchbark and fallen wood for handicrafts and cultural items. Mi'kmaq families also enjoy camps in the area for recreational purposes. All Nova Scotia Mi'kmaq communities hold Food, Social and Ceremonial (FSC) and commercial communal fishing licenses to harvest a variety of marine and freshwater species in tidal and non-tidal waters of Nova Scotia.
Asserted or Established Aboriginal and / or Treaty Rights	The Mi'kmaq of Nova Scotia have established Aboriginal and Treaty rights. This includes traditional rights to hunt, gather and fish, as well as treaty-protected rights to hunt and gather, and to fish for a "moderate livelihood". Those activities are related to sustenance, cultural and socio-economic practice.

6.14.3.1 Historic Mi’kmaq Land and Resource Use

Based on the proximity to watercourses and fish habitat, the existence of a number of species the Mi’kmaq would have, and continue to harvest, and the proximity of Mi’kmaq settlements, it is likely that the Mi’kmaq settled in and used the PA and the broader LSA. Traditional use of the land in Nova Scotia included permanent and semi-permanent settlements, as well as harvesting areas with high biodiversity that were used for subsistence and cultural purposes (for example, hunting, gathering, trapping for food, social and ceremonial purposes). Connectedness to the land, and the communal use and peaceful enjoyment of that land, is central to Indigenous identity. Semi-permanent settlements include summer villages which were often chosen near navigable watercourses and headwaters of rivers with spawning habitat potential, as well as smaller rivers flowing into a system of lakes. Settlements were also located near major waterways and harbours, providing accessibility to trade with the Europeans. The Mi’kmaq traveled inland through minor streams and rivers, either by canoe or on foot.

Beaver Dam lies within *Eskikewa’kik* or the “skin dressing territory” which spans from Halifax County to Guysborough County. While the MEKS notes that various authors and historians have differed in their description of this territory, all agree that Beaver Dam lies within this district. Seven main Mi’kmaq sites were located within *Eskikewa’kik*, including sites at Ship Harbour, Spry Bay Harbour and Liscomb Harbour near the MEKS study area.

The MEKS also notes that the site falls within the Meguma Terrane in the Atlantic Uplands of Nova Scotia; this geology has been used by the Mi’kmaq for grinding tools on other types of stone, bone, antlers and wood, while hard stones such as quartz would have been used as hammers, choppers, knives and arrowheads.

The area contains a variety of spruce, fir, birch, ash, maple pine and shrubs inland, which would have been used in making baskets and building shelters. Fauna such as lynx, moose, beaver, deer, marten and hare were known to be drawn to the area; these animals were harvested for food and pelts by the Mi’kmaq.

While there is currently no pre-contact archaeological activity recorded within the MEKS study area, it is noted that due to harsh winters, strong winds, and erosion, little evidence remains of early Mi’kmaq use and occupation.

The MEKS provides a description of Mi’kmaq use of land post-contact which is summarized as follows:

- In 1762, a proclamation was issued protecting the traditional hunting and fishing territories of Indigenous Peoples including a portion of Canso as far west as Musquodoboit. In 1783, a license of occupation was issued for 11,520 acres to protect fishing and hunting rights. Encroachment of European settlers occurred until the purchase of land to establish a formal reserve in 1915 at Sheet Harbour.
- In 1852, 100 acres at Beaver Dam was set aside on the Sheet Harbour Road at the head of Beaver Lake. The reserve was formally set aside to Millbrook Band in 1960. Based on a survey in 1973 at Beaver Lake, it was found that the reserve contained 122 acres instead of the initial 100 acres granted.
- In the first half of the 19^{th} century, there is documentation of land laid out in the Ship Harbour area for Mi’kmaw individuals. As noted in the MEKS, the Mi’kmaq continued to use the area at Ship Harbour;

however, the government centralized the Mi'kmaq on two main reserves at Shubenacadie and Indian Brook in 1919.

Three specific land claims are identified within the study area; however, results of these claims are still pending (CMM, personal communication). It is understood that Millbrook and Sipekne'katik First Nations have a joint claim on unlawful surrender and illegal sale of three IRs in 1919: Sambro, Ingramport, and Ship Harbour. As stated above, this process is ongoing and not yet resolved with the Crown. Of these, only Ship Harbour is near the Project area (adjacent to the Beaver Lake IR 17 footprint as per the MEKS).

The Maritime Archaeological Resource Inventory does not identify any registered archaeological sites within the study area. However, the lack of archaeological data may represent a lack of archaeological investigation and not an absence of archaeological sites. The adjoining areas have had some activity recorded in the Maritime Archaeological Resource Inventory, and the information collected from that research has shown that Mi'kmaq presence and use occurred all around the MEKS study area.

6.14.3.2 Current Mi'kmaq Land and Resource Use

Cultural continuity through practice is of great importance to the Mi'kmaq – and the connection of that continued practice for their cultural survival. According to the ITLRUS, the area is used significantly by the Mi'kmaq of Nova Scotia for the following purposes:

- Hunting deer, bear, rabbit and grouse for food;
- Trapping rabbits, fox and other small fur bearing animals for pelts and food;
- Gathering/harvesting various plants for medicinal and sustenance purposes;
- Gathering/harvesting fallen wood and birchbark for handicrafts and cultural items;
- Fishing for trout and other freshwater species; and,
- Modern-day camps for recreational purposes.

Additionally, the MEKS provided the following information related to current Mi'kmaq land and resource use sites, species of significance to Mi'kmaq, and Mi'kmaw communities, with the current Mi'kmaq land and resource uses categorized and identified as:

- Kill/hunting: trout, eel, bear, rabbit, deer, porcupine, partridge, coyote, mink, muskrat, weasels, raccoon, fox, otter and beaver;
- Burial/birth: potential burial sites recorded within the MEKS study area on the western side of the Beaver Dam Mine Road but not within the Project area;
- Ceremonial: none identified;
- Gathering: wild fruit, berries, water, food plant, specialty wood, logs, feathers, quills; and
- Habitation: anchored boat, travel route, overnight site.

Species of significance to the Mi'kmaq are associated with three categories; these are listed below with the number of occurrences in the study area based on field work completed by CMM in summer 2016:

- Medicinal: 49 species present
- Food/beverage: 27 species present
- Craft/art: 11 species present

The ITLRUS states that local residents of the Beaver Dam, Sheet Harbour and Millbrook IR's frequently use the area (range of use from weekly to yearly, depending on availability of species) for hunting and rely on the wild harvest as an important food and dietary source. Equally, community members harvest berries when in season, and a number of plants that are also used for sustenance, as well as traditional medicines. The seasonal and recreational use of animals and plants important to the Mi'kmaq supports the continuity of traditional practices, and is very important to the maintenance of their culture and the practice of their rights. Mi'kmaw harvesting activities and practices are culturally important within themselves as they ensure the sharing and maintenance of cultural values and their practice. The Mi'kmaq use plants and animals harvested in the area for traditional sustenance purposes, health-related medicinal purposes, and spiritual and cultural purposes.

There are two IRs near the MEKS study area that were set aside under the *Indian Act* under the administration of Millbrook First Nation:

- Beaver Lake: established in 1867 and approximately 49.4 ha in size is situated along Hwy 224. The estimated population (Census 2016) on reserve is 21 with a total of five homes and four small cottages/camps.
- Sheet Harbour: set aside under Millbrook administration in 1960 and approximately 32.7 ha along Hwy 7, the estimated population on reserve is 25 (Census 2016) with a total of nine homes, two trailers, a community hall and a convenience/gas bar.

The following section discusses the general known traditional and current use of the Project Area, based on discussions with Mi'kmaq community representatives, information provided in the ITLRUS, the MEKS completed for the Beaver Dam Mine and Haul Road sites, as well as the MEKS completed for the Touquoy Mine for the project design, and the MEKS completed for the Fifteen Mile Stream EIS. Community statistical baseline information has been cited from recent secondary sources (September 2018). The Proponent will consider any new information provided by Millbrook First Nation and any other Indigenous Group, wherever possible, throughout the lifecycle of the Environmental Assessment and the Mine.

The Mi'kmaq of Nova Scotia have established Aboriginal and Treaty rights. This includes traditional rights to hunt, gather and fish, as well as treaty-protected rights to hunt and gather, and to fish for a "moderate livelihood", which may take place throughout the year.

Considering the available information reviewed by the Proponent, there are a number of activities associated with the harvest and use of plants, animals and fish within the Project Area and in the area surrounding the Project Area that relate to historical traditions and customs of the Mi'kmaq that are still practiced today. For example, the ITLRUS, the MEKS and residents of the Beaver Lake IR identify trapping and hunting activities, plant and berry gathering, and fishing in, near and surrounding the Project Area for purposes of sustenance, spiritual and cultural practice. Frequency of use ranges from weekly to annually. This means the area was, and still is an important resource area for the Mi'kmaq, and any Project impacts may have potential impacts on the ability of the Mi'kmaq community to access certain areas to practice their rights where species with important cultural relevance may be found. Wild meat was traditionally a staple of the Mi'kmaq diet, and a few of the harvesters interviewed rely mainly on this food source, rather than purchase their meat at a local supermarket.

Based on the ITLRUS, Mi'kmaq community members are known to harvest heavily in the area alongside the Haul Road. Mi'kmaq hunters use the Haul Road to access their traditional hunting and harvesting sites for deer, bear, rabbit, fox, porcupine, grouse, berries and plants. The construction of the Haul Road would require a buffer for construction activity and road operations but would also mean that hunters would be restricted from discharging their firearms up to 30 metres from the road on both sides, according to provincial regulations. It is noted that the majority of the Haul Road isn't a regulated highway. It is recognized that there may be hesitancy on the part of hunters to discharge firearms surrounding the road due to potential safety issues. This may effectively establish a broader exclusion zone, where for safety purposes, the Mi'kmaq would lose access for the operational lifetime of the mine.

The Mi'kmaq of Nova Scotia also fish for trout and other freshwater species in the many brooks, streams and lakes in the area, which also provides sustenance to Mi'kmaq families.

Some Mi'kmaq community members have established modern-day camps on Crown land where they go to enjoy peaceful recreational and traditional activities with family and community members. For example, there are five camps located within 1 km of the Haul Road. The community is concerned that noise and activity from the mine and the Haul Road would negatively impact their ability to enjoy the remoteness and quiet of the area.

Recent consultation with Millbrook First Nation on January 31, 2019 provided information to the Proponent that there is a potential for a housing development (69 lots) on the existing lands of the Beaver Lake IR. Full analysis of this potential development was not completed for this revised EIS however a preliminary review of the modelling results and impact analysis to date for the revised EIS on this potential development was completed. As the geography of the potential development is contained within the existing Beaver Lake IR, many of the modelling efforts and impact assessment conclusions appear valid and consistent for the entire lands of the Beaver Lake IR. A review of the key VCs for the residents and lands at Beaver Lake IR such as light, air quality, noise, surface water, groundwater, socio-economic and cultural resources was completed. All of the predicted levels of impact (low to no) for those VCs remain valid for the potential development. The Proponent maintains a good working relationship with Millbrook First Nation and will continue to liaise on this potential development and the Beaver Dam Mine Project permitting, consultation and development processes.

The effects assessment will use the standard of moderate use of the area as defined by the ITLRUS and the Mi'kmaq of Nova Scotia; a spatial boundary of 5K from the extent of the Project Area; whether or not, and if so, to what extent, the specific activities related to the proposed Beaver Dam Project will adversely impact identified Mi'kmaq activity in the area; and, identify with the Mi'kmaq any potential avoidance, mitigation or compensation techniques, as appropriate.

The Proponent continues to work with the Mi'kmaq of Nova Scotia to ensure rights are protected and potential impacts identified so that they may be prevented or mitigated. For example, as a result of ongoing engagement with the Mi'kmaq, the Haul Road was altered in order to mitigate potential adverse effects to the Mi'kmaq community from noise, air and light emissions, as well as other potential effects related to safety, health and changes to socio-economic conditions. Proposed mitigations are outlined and discussed below in the Effects Assessment section.

6.14.4 Consideration of Consultation and Engagement Results

Key issues raised during public consultation and Mi'kmaq engagement relating to Indigenous Peoples include concerns related to pathways of adverse effects from Project activities during construction and operation, including potential habitat loss and effects on individual flora and fauna used in traditional hunting, fishing and trapping activities and medicinal food and plants. The Proponent acknowledges there will be a loss of access to the land, including the flora and fauna, of a specific area for up to eight years. However, the company believes there is sufficient immediate adjacent access to limit any impacts. The Proponent will engage in discussions with the Mi'kmaq regarding appropriate avoidance, mitigation and compensation as required.

Specific questions were noted on potential effects of accidents and malfunctions on current use of traditional lands and associated contingency planning for an unplanned release and the potential effects of climate change on the Project. The Proponent will continue to work with Mi'kmaq communities to ensure their interests are protected in the unlikely case of an accident or malfunction, and to ensure appropriate communication if an emergency were to occur. Other concerns included potential impacts to drinking water at the Mi'kmaq community of Beaver Lake and impacts to natural watercourses and receiving environs which may affect hunting, fishing and trapping activities. Specific questions have been raised relating to potential sensory disturbance from noise and light and their potential effect on traditional practices on the land surrounding the mine and Haul Road. Specific questions have also been asked about potential dust deposition into the forests surrounding the mine and Haul Road.

Concerns were expressed regarding the originally-proposed ~~haul route~~ Haul Road as it was planned to pass Beaver Lake IR 17 along Hwy 224. These were primarily concerns related to noise, air quality and health and safety. The Proponent addressed these concerns by revising the project design to include construction of 4 km of new Haul Road to avoid travel along Hwy 224. This change from the Project Description (October 2015) is documented in Section 2.3.5.

From a socio-economic perspective, interest has been expressed by the Mi'kmaq of Nova Scotia to work toward benefit agreement(s) with the ANSMC, as well as the two nearest Mi'kmaq communities of Millbrook and Sipekne'katik. These discussions and negotiations are ongoing and are privileged and confidential discussions between the Proponent and the Mi'kmaq of Nova Scotia. While not required by the Crown or legislation, such agreements are considered a best practice. The Proponent Corporation will continue to work with the interested Mi'kmaq communities in order to provide appropriate opportunities for economic benefits including training, contracting and employment.

The results of Mi'kmaq engagement have been considered and incorporated in the environmental effects assessment and are reflected in the Proponent's commitments to involve the Mi'kmaq in the development and implementation of mitigation and monitoring measures and proposed compliance and effects monitoring programs.

Section 6.17 provides additional information on Mi'kmaq engagement, including issues and concerns raised during Mi'kmaq engagement and Proponent responses. In response to requests by the Mi'kmaq of Nova Scotia, the Proponent has committed to continued engagement throughout all Project phases.

6.14.5 Effects Assessment Methodology

6.14.5.1 Boundaries

Spatial Boundaries

The spatial boundaries for the assessment of effects to Indigenous Peoples are defined below.

Project Area (PA): The PA is the most basic and immediate area of the Project and consists of the area of physical disturbance associated with the Construction and Operation of the Project, including the Beaver Dam mine site, the Haul Road corridor and the Touquoy Mine Site, as described in Section 2. The PA encompasses three primary components from Marinette to Moose River Gold Mines, Halifax County, NS. The Beaver Dam mine site will be located at the end of the Beaver Dam Mines Road and the Haul Road will span from the Beaver Dam mine site to Moose River Gold Mines, where the Touquoy Mine [processing and exhausted pit (to be used to dispose Beaver Dam tailings)] is located.

Local Assessment Area (LAA): The LAA encompasses a 5 km radius from the PA. The LAA includes the maximum extent of physical disturbance from project and interactions with expected Mi'kmaq current use of lands and resources, and physical and cultural heritage (Figure 6-14.3). The LAA is the maximum area within which Project-related effects can be predicted or measured with a reasonable degree of accuracy and confidence. Though development of the Project will be limited to the PA, some areas within and contiguous to the PA will no longer be accessible by the public or Indigenous peoples upon initiating Construction of the Project, even though these areas may not be physically disturbed. In recognition of this, the LAA for Indigenous Peoples consists of the PA and areas contiguous to the PA for which access will be restricted. The LAA represents the zone of influence of the Project on Indigenous Peoples due to exclusion zones that will exist in these areas due to Project development.

Regional Assessment Area (RAA): The RAA for the assessment of Indigenous Peoples is defined as the territorial boundaries of the *Eskikewa'kik* (meaning 'skin dressers territory'; Figure 6.14-4). The extent to which cumulative effects on Indigenous Peoples may occur depends on physical and biological conditions and the type and location of other past, present, or reasonably foreseeable future projects or activities that have been or will be carried out, as defined within the RAA.

Effects from the Project on Indigenous Peoples may potentially occur within and immediately adjacent to the Project Area, therefore, the LAA has been selected as the appropriate boundary for the evaluation of this VC.

Temporal Boundaries

The temporal boundary for the assessment of effects to Indigenous Peoples extends to the end of Project decommissioning and reclamation, including construction (1 year), Operation (3-4 years) and Reclamation (2-3 years) phases.

Technical Boundaries

The assessment of potential Project-related effects is limited by the availability of information, which has been obtained primarily through a balance of ongoing engagement, the various ITLRUS and MEKS conducted for this and related projects, and Mi'kmaq groups' reviews and submissions to the CEA Agency regarding the EIS Guidelines and draft EIS. The Proponent feels there has been a good balance between first-hand knowledge shared through engagement and the various Indigenous use studies completed to date, and secondary sources, although the limited amount of published information regarding historical use does present a technical limitation as to the comprehensiveness and verification of the information provided. The Proponent has assumed Mi'kmaq use of the area to be moderate, given information provided by Mi'kmaq community members, the history of the area, and the presence of a small Mi'kmaq community connected to a broader, and larger community at Millbrook, Sheet Harbour and Cole Harbour, and the broader Mi'kmaw Nation.

Administrative Boundaries

Provincially, the Nova Scotia *Environmental Assessment Regulations* include a requirement to identify concerns of Indigenous Peoples about potential adverse effects and steps taken or proposed to be taken by the proponent to address concerns, as well as the steps taken to identify these concerns.

Federally, subparagraph 5(1)(c) of *CEAA 2012* requires the assessment of effects of changes to the environment on Aboriginal peoples, including: health and socio-economic conditions; physical and cultural heritage, including any structure, site or thing that is of historical, archaeological, paleontological or architectural significance; and current use of lands and resources for traditional purposes.

The governments of Nova Scotia and Canada, and the Mi'kmaq follow a Terms of Reference that lays out a process for Crown consultation with the Mi'kmaq. Procedural aspects of the Crown's duty to consult are delegated to the Proponent.

6.14.5.2 Thresholds for Determination of Significance

A significant adverse residual effect on Indigenous Peoples is defined as a Project-related environmental effect that results in one or more of the following outcomes:

- Long-term loss of the availability of, or access to, land and resources currently relied on for traditional use practices or the permanent loss of traditional use areas within a large portion of the Project Area.
- Effects on health and/or socio-economic conditions of affected Indigenous communities to the extent that there are associated detectable and sustained decreases in the quality of life of a community.

Non-permanent and/or geographically limited (i.e., small scale) changes in harvest areas caused by displacement due to Project activities are not considered to be significant.

The significance of potential effects on potential or established Aboriginal or treaty rights is a matter of consideration by the Crown and Mi'kmaq representatives (Assembly of Nova Scotia Chiefs and the Governments of Canada and Nova Scotia).

6.14.6 Project Activities and Indigenous Peoples Interactions and Effects

Per subparagraph 5(1)(c) of CEAA 2012, the assessment of potential effects on Indigenous Peoples includes consideration of changes in health and socio-economic conditions; physical and cultural heritage, including any structure, site or thing that is historical, archaeological, paleontological or architectural significance; and current use of lands and resources for traditional purposes.

Potential interactions between Project activities and the Mi'kmaq of Nova Scotia are outlined in Tables 6.11-2 to 6.11-4 below.

Table 6.14-2 Potential Interactions with Project Activities and the Mi'kmaq of Nova Scotia at Beaver Dam Mine Site

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Drilling and rock blasting in preparation of construction • Topsoil, till and waste rock transport and storage from site preparation • Existing settling pond dewatering in preparation of construction • Watercourse and wetland alteration • Mine site road construction, infrastructure installation, and collection and settling pond construction • Environmental monitoring of surface water discharges and adjacent wetlands • Accidents and malfunctions to include fuel and other spills, forest fires, settling pond overflow, an unplanned explosive event, and mobile equipment accidents
Operation and Maintenance	3-4 years	• Rock blasting to access and extract ore • Surface mine dewatering to facilitate access to and extraction of ore • Management of ore at the mine site

Project Phase	Duration	Relevant Project Activity
		• Management of waste rock produced from crushing and preparing ore for transport • Treatment of site surface water runoff and surface mine pumped water • Petroleum products management • Environmental monitoring • Accidents and malfunctions to include fuel and other spills, forest fires, settling pond overflow, an unplanned explosive event, and mobile equipment accidents
Decommissioning and Reclamation	1-2 years	• Site reclamation activities and infrastructure demolition • Environmental monitoring of adjacent wetlands • Accidents and malfunctions to include fuel and other spills, forest fires, and mobile equipment accidents

Table 6.14-3 Potential Interactions with Project Activities and the Mi'kmaq of Nova Scotia along Haul Road

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Rock blasting in preparation of construction • Till and waste rock from site preparation transport and storage • Watercourse and wetland alteration in preparation of construction • Haul road construction and upgrades • Environmental monitoring of adjacent wetlands • Accidents and malfunctions to include fuel and other spills, forest fires, and a haul truck accident
Operation and Maintenance	3-4 years	• Ore transport along Haul Road • Road lighting • Haul road maintenance and repairs • Environmental monitoring • Accidents and malfunctions to include fuel and other spills, forest fires, and a haul truck accident
Decommissioning and Reclamation		N/A[1]

[1] *Decommissioning and Reclamation of the Haul Road is not expected. The Haul Road will be returned to owner for forestry industry*

Table 6.14-4 Potential Interactions with Project Activities and the Mi'kmaq of Nova Scotia at the Touquoy Mine Site

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Tailings pipeline, Make-up water pipeline alteration, and relocation of reclaim infrastructure

Project Phase	Duration	Relevant Project Activity
		• Accidents and malfunctions to include fuel and other spills, forest fires, and mobile equipment accidents
Operation and Maintenance	3-4 years	• Environmental monitoring • Accidents and malfunctions to include fuel and other spills, forest fires, and mobile equipment accidents
Decommissioning and Reclamation	1-2 years	• Environmental monitoring • Accidents and malfunctions to include fuel and other spills, forest fires, and mobile equipment accidents

Effects to Indigenous Peoples would begin with initiation of site preparation activities, as the land and resources in the PA and LAA will no longer be available for use and continue throughout all Project phases until completion of site reclamation and closure.

Many of the potential Project effects to Indigenous Peoples' health and socio-economic conditions and current use of lands and resources for traditional purposes are via effects to VCs assessed as part of this EIS (including potential adverse effects to surface water, groundwater, wetlands, fish and fish habitat, habitat and flora, birds, fauna, SOCI/SAR and human health).

Atmospheric

Project-related impacts to the atmospheric environment through air, noise and light emissions have the potential to result in adverse effects to the health of Indigenous Peoples and to current use of lands and resources for traditional purposes and may also contribute to climate change.

Dust is the primary atmospheric emission of concern at the Beaver Dam Mine Site, as suspended particulates will be generated during construction activities such as overburden removal, blasting, rock crushing and construction of the Haul Road. During operation, dust will be generated at the mine site from crushing processes and trucking operations and on the Haul Road from trucking operations. Exposure to Project-generated dust is not anticipated to result in significant adverse effects to human health, as described in Section 6.2 and 6.14. The Country Foods Evaluation (Appendix C.2), aimed at evaluating the potential effects of dust deposition from haul truck activity on soils, berries, and vegetation, concluded that metals will be released from dust deposition along the Haul Road, and have the potential to accumulate in soils, and thus vegetation. It is expected that there will be some accumulation of metals within vegetation and some exceedances of chemical contaminants in berries at the maximum point of impingement along the Haul Road, and in areas 30 to 70 metres from the Haul Road property boundary.

Project-related fugitive dust deposition effects on hunting and gathering (i.e., wild fruit, berries, food plant) is anticipated to be minimal as all metals considered in the Country Foods Evaluation assessment, with the exception of aluminum and boron, are predicted to be below provincial and federal soil quality guidelines, and most of the exceedances can be attributed to baseline metal conditions and are unrelated to dust deposition from the Haul Road. Airborne compounds of interest, such as combustion by-products (sulphur dioxide and nitrogen dioxide), were screened out as "negligible" during the preliminary air quality assessment. Dust emissions (total particulate, PM_{10} and $PM_{2.5}$) from the Beaver Dam Mine and Touquoy Mine Site were also modelled and found to be within criteria or below threshold values.

Emissions estimates and dispersion modelling for particulates of all size fractions demonstrated that concentrations exceeding provincial and federal guidelines were predicted in close proximity to the Haul Road. Predicted concentrations of particulates decrease rapidly with distance from the road, falling below air quality guidelines at a distance of approximately 200 m from the Haul Road. Road dust mitigation measures, including dust suppression along the Haul Road, will further minimize potential impacts on residences along the Haul Road as well as on adjacent traditional sites utilized for hunting and gathering. Additionally, design mitigation has occurred based on consultation with the Mi'kmaq of NS, with the Haul Road relocated to eliminate trucks passing the Mi'kmaq community of Beaver Lake. Airborne particulate monitoring will be undertaken during operations, to confirm modelled concentrations, and the Project team will modify or consider additional mitigation measures, if required.

With respect to noise, sources of Project-related noise on the Haul Road include heavy machinery and truck traffic during the construction and operational phases. Beaver Lake IR is located approximately 5 km south of the Project site and is separated by heavily-forested lands and two topographic ridges. These ridges block direct views from the nearest sensitive receptors at Beaver Lake IR to all work areas. The nearest point of the Haul Road to the Beaver Lake IR is approximately 3 km. The Haul Road is currently in use for forestry activities and the activities on the Haul Road related to the mine site will be similar in nature. The acoustical model did not identify any noise impacts directly to the Beaver Lake IR from the mine site or the Haul Road. Blasting events may result in a slight spike in the sound levels at distance for a brief period of time at the same time of day (daytime) once or twice a week.

The predicted noise levels at the property boundary of the Haul Road are variable based topography; however, 60 dBA (the evening limit) is the average noise levels from 20 to 40 m from the centerline of the road and the values attenuate to 55 dBa (the overnight limit) at less than 70 m from the centre of the Haul Road. Therefore, any type of camp or visiting spot greater than 70m from the centreline of the Haul road is below the lowest provincial regulatory limit (nighttime).

The MEKS identified (and the ITLRUS corroborated) hunting of trout, eel, bear, rabbit, deer, porcupine, coyote, mink, muskrat, weasels, raccoon, fox, otter and beaver. Terrestrial fauna within close proximity to the Haul Road and the two mine sites have the potential to be affected by noise during the day and evening (Haul Road) and also overnight (mine sites). Fauna may choose to avoid these areas during operations, resulting in a potential reduction in traditional Mi'kmaq hunting practices in these specific zones near the property boundaries.

Measures identified to mitigate noise impacts to human receptors (described in Section 6.1) will also minimize adverse effects to wildlife and fish species. Given the local nature of the noise impacts in close proximity to proposed property boundaries, the effects on local Mi'kmaq camps and hunting/fishing activities is expected to be low.

The company will share the noise and light impact studies with the Mi'kmaq of Nova Scotia and consider an independent review of the studies to consider any impacts on current use of the area (harvesting, occupancy).

A light impact assessment was completed for the Beaver Dam Mine Project and included 5 points of reception – Beaver Lake IR, River Lake Residence, Hwy 224 Intersection Residence, Ferry Lake Seasonal Cottage, and Second Rocky Lake Seasonal Cottage (See Appendix D.1). Based on the light impact assessment report, the calculated light levels at each sensitive receptor were significantly below the limits recommended by the ILE guidelines during both pre- and post-curfew conditions. With regards to the Haul Road, the Proponent has indicated that trucking operations will occur under daytime and evening conditions (6am to 11 pm). Light impacts will be minimized during darkness along the Haul Road through maintenance of the adjacent forest canopy as is practicable, limiting clearing widths along the Haul Road only to what is required for safe truck traffic. Based on the light impact assessment report, the calculated light levels at known camps or visiting spots are below the limits recommended by the ILE guidelines during both pre-curfew and post-curfew (curfew is typically considered to be 11:00 pm) conditions. Post-curfew illuminance values ranged from 8.18E-02 lux to 1.14E-02 lux, which are well below the Post-curfew value of 1 lux.

Ambient night-time light levels at the mine site as modelled will not affect the Beaver Lake IR community. The Beaver Lake IR is located approximately 5 km south of the mine site and is separated from the mine site by forest and two topographic ridges, which block direct views from the nearest sensitive receptors at Beaver Lake IR to all work areas. The mine is located in a topographic depression and the crusher is in a more elevated position; however, distance to any sensitive receptors would mitigate any effects. The lighting effects would have a lower impact although it could be more widely experienced, especially if moisture or particulate matter are present in the atmosphere. The resulting halo of light above the mine might be seen from numerous locations. Although evident and given the rural setting of the site, it is not considered that it would cause any significant visual impact, due to a combination of large viewing distance and the screening effects of topography and vegetative cover.

Light emissions may also adversely affect the immediate availability of local wildlife resources near the Project Area, which could result in indirect effects to Mi'kmaq hunting practices during construction, operation, and closure phases. Increased light may cause disturbance or displacement of species, while attracting other species, or general behavioral changes (DaSilva, Valcu and Kempenaers, 2015). For those species which may be attracted to lights, lighting may increase potential for direct mortality of these species or may increase habitat suitability by supplementing their source of prey. Light can also alter habitat quality and sleep/wake cycles for terrestrial fauna within the immediate vicinity of the PA and may decrease efficiency of nocturnal hunters. Some opportunistic wild species may be attracted to the site as a result of increased access and available food sources (natural prey or anthropogenic food sources). Mitigation measures described in Section 6.3.8 will be implemented to reduce light disturbance and minimize potential effects on wildlife and Mi'kmaq hunting activities.

Geology, Soil & Sediment

Based on the current Mi'kmaq land and resource use and the proposed project activities, the possible pathways of effects to the Mi'kmaq of Nova Scotia from a geological perspective include the potential for direct adverse effects to soil and sediment and the potential for ARD from Halifax Formation bedrock. During the public consultation and Mi'kmaq engagement the key issues raised related to geology, soil and sediment were the potential for ARD, suspended solids and leaching of metals from the rock at the Beaver Dam Mine site that may affect receiving waters and fish habitat. Particular concerns were raised regarding Cameron Flowage, the nearest watercourse to the Beaver Lake IR.

Potential ARD produced during exposure of Halifax Group or sulphide-bearing bedrock will increase the acidity of the surface water runoff and has the potential to create changes to fish habitat. These changes could lead to the potential for impacts to the availability, abundance, health, distribution and behavior of the species fished by the Mi'kmaq.

The results of the public consultation and Mi'kmaq engagement have been considered in the environmental effects assessment and include the Proponent's commitments to mitigation and monitoring measures and proposed compliance and effects monitoring programs, as well as the Proponent's broader commitment to ongoing public consultation and Mi'kmaq engagement. Mitigation measures include sediment and erosion control measures through all phases of project. As part of mitigation measures, the

Proponent has included a Mi'kmaq conservation organization in the development and implementation of appropriate monitoring programs.

No residual effects for geology, soils and sediment are anticipated after implementation of mitigation and monitoring programs, which have been designed to outline and avoid and monitor the potential long-term residual impacts. Therefore, no indirect significant effects are expected as a result of the link between biophysical effects and effects to Indigenous peoples.

Surface Water and Groundwater

Based on the current Mi'kmaq land and resource use and the proposed project activities, the possible pathways to affect the Mi'kmaq of Nova Scotia include the potential for direct and indirect adverse effects to surface water and groundwater quality and quantity.

Key issues raised during public consultation and Mi'kmaq engagement related to potential impacts to surface water quality due to ARD, suspended solids and leached metals from Beaver Dam Mine site activities, and to water quantity from mine pit dewatering. Mine pit dewatering could potentially alter flow regimes in nearby waterbodies. The importance of avoiding impacts to water quality was emphasized as clean water is an essential component of continued Mi'kmaq use of lands and resources such as fish, flora and fauna. Concerns were expressed regarding potential effects on the quantity of surface water near the Beaver Dam pit, specifically effects on the Killag River and connected waterbodies surrounding Beaver Dam Mine, particularly to Cameron Flowage. Concerns were also raised regarding effects on surface waters along the ~~haul route~~ Haul Road, specifically during road construction activities. Questions arose about potential effects on Moose River from placement of tailings in the mined-out pit at the Touquoy site.

Key issues raised during public consultation and Mi'kmaq engagement relating to groundwater include potential effects on groundwater levels from mining the pit at Beaver Dam and groundwater quality associated with Project activities at the both the Beaver Dam Mine site and the Touquoy Gold Mine site. Concerns were specifically expressed by Millbrook First Nation regarding effects on groundwater quality and quantity in terms of potable water wells and the health of its residents in Beaver Lake IR 17.

Mi'kmaq fishing opportunities and practices have the potential to be impacted through the change in the abundance and distribution of species fished and the change to fish health as a result of adverse water quality and quantity, and changes to water levels and flow.

There is also the potential for loss of drinking water sources around traditionally used trails, cabins and camps. As well, there is the potential for health impacts to Mi'kmaq peoples through contamination of potable water wells.

General mining construction, operations, and closure/post-closure conditions have the potential to adversely affect groundwater quality and quantity, and surface water discharged from the Beaver Dam mine site and the Touquoy exhausted pit. These mine activities include:

- the storage and handling of diesel;
- the use of explosives during blasting;
- the disturbance of soil and bedrock during site preparation;
- general construction including the direct loss of surface waterbodies and wetlands;
- operations at Beaver Dam including operational groundwater drawdown to facilitate pit access which could adversely affect surface water quantity in Cameron Flowage, adjacent wetlands and other watercourses, and nearby potable domestic drinking wells;

- operations at Beaver Dam including surface mine discharge into the Cameron Flowage;
- operations at Beaver Dam resulting in modifications to flow regimes/water balance of surrounding watercourses and wetlands;
- reclamation of the Beaver Dam mine including surface mine discharge from the flooded pit lake to Cameron Flowage; and,
- deposition of Beaver Dam tailings into the exhausted pit at the Touquoy site during operations, resulting in groundwater seepage into the Moose River.

Disturbance of soil and bedrock through site preparation and construction, general maintenance including regrading and de-icing, and dust suspension from operation of the Haul Road also has the potential to adversely affect surface water quality in streams and rivers crossing the Haul Road through culverts and under bridges. Blasting during road upgrades could affect potable wells. Haul Road upgrades will also positively affect fish habitat restoration and upstream passage of fish during culvert replacement (as most installed culverts are raised/hung/crushed and limit fish passage).

The results of the public consultation and Mi'kmaq engagement have been considered in the environmental effects assessment, including the Proponent's commitments on Mi'kmaq involvement in the development and implementation of mitigation and monitoring measures and proposed compliance and effects monitoring programs, as well as the Proponent's broader commitment to ongoing public consultation and Mi'kmaq engagement. The Millbrook First Nation has requested an independent study regarding impacts to human health, soil and water. Specific to evaluating the effect on surface water and groundwater quality and quantity, these are found within the following environmental effects assessment.

Mine construction will result in a direct loss of several linear surface watercourses to support mine development, and a reduction in flow to several other watercourses (potential indirect impact). Mine development has been designed to avoid Mud Lake, Crusher Lake, and Cameron Flowage. Mine operations will result in a drawdown effect on surface water bodies in close proximity to the Beaver Dam open pit (resulting from dewatering efforts within the pit to allow for ore removal). Impacts to potable wells at the Beaver Lake IR 17 are not anticipated based on groundwater modelling results since the maximum zone of groundwater influence (under conservative dry conditions) from the pit is localized and extends up to one kilometer (to the south of the pit in one localized location) and approximately 50-60 m north of the pit to the shores of Cameron Flowage. A reduction in baseflow contributions in Cameron Flowage is expected, based on predicted groundwater drawdown. However, all water collected from the pit during operations will be re-introduced into Cameron Flowage, at flow rates that generally mimic the natural seasonal variations of the river.

Mine operations will also result in surface discharge into Cameron Flowage through the designed northern settling pond and direct groundwater seepage into Cameron Flowage. Resulting potential effects to the Killag River have been modelled and found to be limited, with the provision/contingency of some on-site water treatment (as is required). Mine operations will also result in a decrease of surface flows to watercourse 5 (between Crusher and Mud Lake) and to Mud Lake itself. An increase of flows is predicted into Wetland 64, to the south of the Beaver Dam Mine Site. Resulting impact to these watercourses has been predicted to be adverse, but not significant, with the exception of watercourse 5 from Crusher Lake to Mud Lake. Mine operations are predicted to limit year-round flow through this watercourse system, resulting in a potential reduction of fish passage capability from Mud Lake to Crusher Lake. Monitoring will be undertaken to confirm these predictions and should reduction in flows be observed, watercourse permitting and a potential Fisheries Authorization will be required.

During post-closure, once the pit fills at Beaver Dam (predicted to occur in around 14 years), a surface discharge from the pit to Cameron Flowage will be designed to minimize the potential for erosion during higher flow periods. The results of the surface/groundwater modelling indicate that impact to the Killag River is limited, with the provision/contingency of some on-site water treatment (as is required). At Touquoy, once the pit has been filled with tailings and water (predicted to occur within approximately 10 years), there is also planned surface discharge and predicted groundwater seepage into the Moose River. The surface/groundwater modelling results indicate limited impact to the Moose River, with the provision/contingency of some on-site water treatment (as is required).

During the post-closure phase, groundwater seepage is predicted from remaining stockpiles at the Beaver Dam Mine Site potentially entering Crusher Lake, Mud Lake, and the outlet stream from Mud Lake as groundwater discharge. Groundwater monitoring wells will be established at the shores of these surface water bodies, with locations based on the modelling results, and periodic sampling completed to evaluate this prediction. Modelling will also be updated to reflect adjustments in source terms and water quality inputs throughout construction and operations to refine these predictions. Should predictions be validated/confirmed and elevated groundwater discharge be realized through monitoring at these locations during post-closure, groundwater will be intercepted upstream of these well locations and water treatment options will be considered to meet regulatory requirements, prior to discharge into the receiving environments.

Numerous mitigation measures will be applied to reduce the potential environmental impacts of the Project on surface water, listed in Section 6.7.8 and groundwater, listed Section 6.6.8. An annual review of the surface water, groundwater, and wetlands monitoring programs will be undertaken to confirm predicted interactions between these VCs. These will be shared with the Mi'kmaq environmental monitoring partners and revisions to the program can be implemented as required.

The predicted residual environmental effects of the Project construction, operation and closure/post closure phases (post mitigation) on surface water are considered to be adverse, but not significant. Therefore, no related indirect significant effects are expected to the Mi'kmaq's current known use of the land and resources for traditional purposes.

The predicted residual environmental effects of Project development and operations on groundwater are assessed to be adverse, but not significant. The overall residual effect of the Project on groundwater is assessed as not significant after mitigation measures have been implemented. Effects to groundwater resources used for domestic purposes are not predicted due to distance from site activities and predicted maximum groundwater drawdown based on modelling. The reclamation plan for the site includes a refilling of the pit to mimic the current conditions at the site so that post-mining conditions are not significantly different than baseline conditions.

Natural Environment

Based on the current Mi'kmaq land and resource use and the proposed project activities, possible pathways of effects to the Mi'kmaq of Nova Scotia from a Natural Environment perspective includes potential for direct loss and/or adverse effects to; wetlands, fish and fish habitat, terrestrial habitat, flora, birds, fauna and SOCI/SAR.

Key issues raised during public consultation and Mi'kmaq engagement relating to the natural environment include the following:

- Direct impacts to wetlands during construction activities at the Beaver Dam mine site and during Haul Road construction, as well as potential indirect effects from Project activities.

- Overall potential effects on habitat loss from direct and indirect wetland impacts including potential effects to use by Mi'kmaq peoples for hunting, fishing, fowling, trapping, and gathering.
- Adverse direct effects to fish and fish habitat or from potential indirect effects from wetland alteration or changes to surface water and groundwater quality and quantity on fish and fish habitat
- Potential effects on biodiversity and permanent loss of habitat associated with footprint of the Beaver Dam Mine site and Haul Road.
- Potential effects on traditional uses of land and resources by the Mi'kmaq were noted, including plants used for medicinal purposes, sustenance and cultural activities.
- Potential for direct bird mortality associated with the hauling operation and indirect effects on other VCs, such as dust, noise and light, as well as potential effects on birds associated with permanent loss of habitat from construction of the Beaver Dam Mine and the Haul Road.
- Potential effects on fauna from permanent loss of habitat associated with the footprint of the Beaver Dam Mine site and Haul Road, as well as direct mortality associated with the hauling operation.
- Effects on traditional uses of land and resources by the Mi'kmaq, including SAR/SOCI species of significance to the Mi'kmaq such as moose and American Eel.

Development of the mine and Haul Road will cause permanent loss of wildlife and plant resources within the immediate Project footprint, and permanent alteration to a species' distribution or abundance, or alteration of critical habitat. The Project will have direct and indirect impacts to wetlands, fish and fish habitat, vascular and non-vascular plants, habitat communities at the full or partial forest stand level, birds, and terrestrial fauna. The assessment of potential effects of the project on the natural environment is discussed at length in Section 6.

The possible effects of the project on the biophysical components of the natural environment have the potential to affect the current use of the lands and resources by the Mi'kmaq, including fishing, hunting and trapping, gathering, and cultural practices.

There is a potential for change of fishing opportunities and practices due to potential:

- Change in access or ability to access or use land and resource areas;
- Perception of change in quality of the food and health of the environment for areas located near mines limiting fishing practices;
- Change in quality of the natural experience for Mi'kmaq harvesters; and
- Effects to fish health, species abundance, distribution and diversity due to changes in water quality and ecosystem functions.

Hunting and trapping practices may be impacted through potential:

- Habitat loss;
- Change in access or ability to access or use land and resource areas;
- Increased harvest pressure as a result of increased access to the area;
- Habitat alteration and displacement of wildlife due to sensory disturbance from noise from the mine's construction and operation and increased traffic; and

- Change in quality of the natural experience for Mi'kmaq harvesters.

Gathering opportunities and practices may be impacted through potential:

- Effects to culturally and economically important plants due to changes in ecosystem functions;
- Changes to quality of plant resources and abundance and associated habitat;
- Change in access or ability to access or use land and resource areas; and
- Health impacts to Mi'kmaq communities due to changes to local access and subsequent availability of country foods.

The Proponent has proposed mitigation measures and monitoring plans for discussion and involvement of the Mi'kmaq of Nova Scotia to mitigate and reduce overall loss and function of the natural environment. Also, the Proponent will engage with the Mi'kmaq communities to implement wetland compensation activities for the wetland loss associated with the Project, as required by the provincial wetland alteration process.

The predicted residual environmental effects of project development and production on the natural environment is assessed to be adverse, but not significant; therefore, no indirect significant effects are expected on Indigenous peoples' use of land and resources resulting from adverse biophysical effects.

Physical and Cultural Heritage

Based on the current Mi'kmaq land and resource use and the proposed project activities, the possible pathways of effects to the Mi'kmaq of Nova Scotia from a Physical and Cultural Heritage perspective include the potential for direct adverse effects to Mi'kmaq archaeological sites. In addition, the MEKS noted that there are potential burial sites recorded within the MEKS study area on the western side of the Beaver Dam Mine Road but not within the Project area and no ceremonial areas/sites were identified.

There is low potential for the Project to interact with identified heritage resources that have been associated with historic mining at or near the Project site. The current plan is to avoid the areas identified above. The potential for heritage resources to be impacted exists primarily during the construction phase of the Project. Should heritage resources be discovered during mine construction, all work will stop in the immediate vicinity until an evaluation and assessment can be conducted. If areas of known heritage resources are to be impacted, further work will be undertaken to document these resources. While there has not been a confirmed Mi'kmaq archaeological significance of the Project site (based on the archaeological assessment undertaken for this undertaking), observations will be maintained during all construction activity. Should evidence be uncovered, all activity will cease in the area until Mi'kmaq archaeological experts have had an opportunity to examine the site and determine appropriate action.

Mi'kmaq groups expressed concern regarding potential adverse effects to the viewscape and visual aesthetics of the area. Figures 6.16-2 – 6.16-4 provides a visual representation of the Beaver Dam Mine Site at all Project phases (baseline, construction, operation and following closure and reclamation).

Three maps are presented showing the visual impact of the site from Beaver Lake IR 17. Three Observers (person 1.70 m tall) are positioned in a canoe in Lower Beaver Lake (0.8 m height), standing on the roof of home (5.0 m above ground), and at the stockpile location. The analysis is done on three conditions - existing condition (Figure 6.16-2), full mine operation (Figure 6.16-3), and 12 years post reclamation (Figure 6.16-4). The terrain model takes into account the regional topography, study area topography, and site topography (full mine operation and post reclamation). It is considered that in the decommissioning phase the beginning of the phase will be the same as full operation.

An observer in a canoe on the western side of Lower Beaver Lake has a view of the Lake and near shore areas in the direction of the Mine Site. A rise in topography, high forest canopy and distance are effect mitigation for screening the Mine from site to this observer. The analysis shows that an Observer standing on the roof of a residence in all three phases can only see in the direction of Beaver Lake a short distance, since the view towards the Mine site is obscured by trees – one can assume that this forest screening will be equally effective for an observer standing on the ground. During full operation, an observer on the stockpile has a commanding view but sees only of treetops over the landscape in the direction of Beaver Lake IR. The post-reclamation analysis, assumes forest growth of 3 m after 12 years and the view from the stockpile is obscured by vegetation. If the vegetation does not grow to this height the same effect as shown in full operation analysis is assumed and thus the stockpiles will not be visible by Observer 1 and 2.

A topographic profile showing bare ground and forest canopy elevations with fully developed mine are shown in Figure 6.16-5. The profile line extends form Lower Beaver Lake to Cameron Flowage. The Line is depicted graphically with a vertical exaggeration of 2x to show detail. A sight line analysis was conducted with an observer located on Lower Beaver Lake. It confirms that, with the current condition of the forest canopy between Beaver Lake and the Mine, the stockpiles are not visible from the Lake. In the unlikely event that all the trees are removed over the 5.5 km between Beaver Lake and the Mine, then an observer on the lake or at a residence at Beaver Lake IR could see the Stockpile; however, given that distance, the visual effect would be minimal.

The topographic map and profile, supported by results of the viewshed analysis provided above, show that Waste Rock Storage pile to be seen in a straight-line from Beaver Lake IR; however, the viewshed analysis shows that the view is obscured given the current forested screening between the IR and the Mine.

The Beaver Dam pit and Touquoy pit will re-fill with water after ore and mining equipment has been removed (mobile equipment, pumps, signage, etc.) from the excavated area. The Groundwater and Surface Water Sections (Section 6.6 and 6.7) discuss the pit re-filling timeframe estimates and the associated water quality predictions for both sites. The Proponent staff and consultants fielded questions and comments during both the public and Mi’kmaq consultation sessions as well as regulator discussions about what the final shorelines would look like at both facilities. The geology around the final pit perimeters are such that a variety of shoreline features will be present including exposed bedrock, till and organic soils with root mass before refilling begins. Shoreline development efforts will be completed as part of reclamation in order to create areas where aquatic plants (e.g. broad-leaved cattail) and typical shoreline plant assemblages (e.g. lambskill, Labrador tea, leatherleaf) will re-colonize. Visually the lake will, over time, look like any other natural lake in Nova Scotia with exposed rock, soils, and areas with low slope entry to the water with plant assemblages in and around the lake that flourish in these habitats.

The Proponent is committed by legislation to reclamation planning that is focused on safety and creating safe, stable and vegetated landscapes in keeping with the surrounding natural areas that the sites exist in. The Proponent also has publicly stated the desire to continue to engage the public and Mi’kmaq in reclamation planning through the CLC and input sessions/workshops nearer to the time of reclamation. These sessions are typically the time to discuss site-specific reclamation objectives such as plant types, the degree to which recreational use features such as trails, boat launches, docks, and interpretive panels will be incorporated into the final reclamation plan.

The reclamation planning phase presents opportunities for involvement for a number of groups including public, community, Mi’kmaq, academic institutions, environmental groups and others. Additional opportunities exist during actual reclamation activities for earthworks, shoreline development, revegetation programs, habitat development and restoration, reclamation involvement, employment, research and long-term monitoring programs.

Effects of project development on identified heritage resources are not expected.

Human Health and Socio-Economic Considerations:

Based on the current Mi'kmaq land and resource use and the proposed project activities, it is anticipated that there may be potential impacts to human health and socio-economic conditions from potential impacts outlined previously (dust accumulation, water and soil quality, in the case of an emergency, reduced access). However, given the limited area that will be restricted for access, the availability of species of interest to the Mi'kmaq in the immediate adjacent vicinity, and proposed mitigation and monitoring measures, impacts, including residual impacts on human health are expected to be low. With regard to socio-economic impacts, the Mine will provide added employment and economic opportunities to the area, and the Mi'kmaq are anticipated to benefit from this increased economic activity.

It is important to note that potential health impacts on Mi'kmaq communities are linked to the interconnected nature of the ability to access traditional territory to continue cultural practices, such as hunting, gathering and fishing – not only for their consumptive human health value, but also for mental and human health associated with cultural survival and continuity. While issues impacting Indigenous health are complex, the Mi'kmaq of Nova Scotia would view a loss of access to territory and the ability to exercise Aboriginal and Treaty rights in that area to extend to potential impacts to human health outcomes.

In particular, the Millbrook First Nation community members that utilize the PA may be concerned about potential loss of access to this specific area for community sharing and cultural purposes, access to plant and animal species for medicinal and consumptive purposes, trapping activities that are completed for economic benefit, or any loss of access due to perceived negative impacts on plants and animals, water or soil in the area.

The Health Canada document "Useful Information for Environment Assessments" (HC 2015) was reviewed to determine the appropriate baseline information that should be included relevant to human health and First Nations. Table 6.11-6 presents the relevant information related to effects on human health of Indigenous Peoples based on the review of the Health Canada document.

Based on the information provided in Table 6.11-6 below, there are no anticipated effects to human health related to Indigenous Peoples.

While there are no expected indirect effects on the Mi'kmaq of Nova Scotia based on the assessment of effects for related VCs, this evaluation is based on the implementation of the proposed mitigation and monitoring as a result of direct effects as outlined in the VC sections.

The MEKS and the ITLRUS both evaluated and assessed significance for potential impacts; these are summarized below in context of the effects assessment.

- While it is acknowledged that Mi'kmaq archaeological resources are extremely important to the Mi'kmaq as a method of determining use and occupation and as an enduring record of the Mi'kmaq First Nation and culture across the centuries, the potential Burial sites are not located within the proposed Project site and there is a low likelihood of pre-contact artifacts as per the archaeological study, therefore, direct effect of the Project is not expected to be significant as per the MEKS.

- Plant species of significance to the Mi'kmaq were identified within the MEKS study area. These same species also exist within the immediate adjacent surrounding area and remain easily accessible to the Mi'kmaq. The Proponent does acknowledge that there will be destruction of some specimens, therefore altering the area available to the Mi'kmaq for their use. However, the permanent loss of some species does not pose a threat to Mi'kmaq use of the species as a whole, given their abundance and availability within close proximity.
- As hunting, gathering and trapping activities were identified in the study areas and permanent loss of habitat is an impact of the Project, the MEKS evaluated the potential habitat loss located in and around the wetlands and lakes as potentially significant, resulting in loss of access to the area within the Project footprint. However, no Project effect is expected on the other identified areas of hunting, gathering and trapping activities in areas of interest to the Mi'kmaq such as Tent Lake and Cope Pond, Rocky, Otter, Como, Grassy and Beaver Lakes, the Killag River, the West River, and the West River Sheet Harbour.
- Increases in traffic related to the Project (haul trucks and mine staff) are presented in Section 6.16.3.7.
- The ITLRUS states that Mi'kmaq harvesters use the Haul Road and the Project Area (including the area where the operations will be located) and beyond for access to traditional harvesting areas. Due to the proximity of the Haul Road and the mine to traditional harvesting areas, there will be loss of access, including an exclusion zone for the use of firearms. This will reduce the overall area of access for current Mi'kmaq harvesters and hunters. Due to the reduction in harvesting area available to the Mi'kmaq, the direct effect on hunting, gathering and trapping activities is expected to be moderate.

Table 6.14-5 Pathway and Potential Effect of Valued Components with the Mi'kmaq of Nova Scotia

Valued Component	Health and socio-economic considerations	Physical and cultural heritage	Current use of lands and resources for traditional purposes	Possible pathway to affect the Mi'kmaq of Nova Scotia	Potential indirect effect based on effects assessment of other VCs
Atmospheric Environment	☑		☑	• Potential for direct effects to air quality, noise and light levels to affecting species harvested by the Mi'kmaq of NS • Potential for direct contributions to climate change which could alter the natural environment affecting the resources harvested by the Mi'kmaq of NS	• Indirect significant effects on the Mi'kmaq of NS are not expected based on predicted residual effects • No interaction in terms of noise, lighting, dust is expected given distance to Beaver Lake IR from Project Area (3 km). However, there may be indirect impacts on camps located closer to the mine than the IR.
Geology, Soil, and Sediment	☑		☑	• Potential for direct adverse effects to soil and sediment affecting resources harvested by the Mi'kmaq of NS • Potential for ARD from Halifax Formation bedrock affecting surface water quality and in turn aquatic resources, including fish and fish habitat used by the Mi'kmaq of NS	• Indirect significant effects on the Mi'kmaq of NS are not expected based on predicted residual effects
Surface Water Quality and Quantity	☑		☑	• Potential for direct adverse effects to surface water quality and quantity impacted the aquatic ecosystem creating a potential pathway to alter the Mi'kmaq's fishing practices (Killag River and Moose River)	• Indirect significant effects on the Mi'kmaq of NS are not expected based on predicted residual effects
Groundwater Quality and Quantity	☑		☑	• Potential for direct adverse effects to groundwater quality creating the possibility for unsafe drinking water	• Indirect significant effects on the Mi'kmaq of NS are not expected based on predicted residual effects • No interaction in terms of effect on potable water quality at Beaver Lake IR is expected given distance from Project Area
Wetlands			☑	• Potential for direct loss and/or adverse effects to wetlands impacting fish and fish habitat affecting fishing practices	• Indirect significant effects on the Mi'kmaq of NS are not expected based on predicted residual effects
Fish and Fish Habitat			☑	• Potential for direct adverse effects to fish and fish habitat affecting fishing practices	• Indirect significant effects on the Mi'kmaq of NS are not expected based on predicted residual effects
Habitat and Flora			☑	• Potential for direct loss of habitat affecting species distribution and abundance possibly affecting Mi'kmaq hunting and trapping practices • Potential for direct adverse effects to flora affecting gathering practices	• Indirect significant effects on the Mi'kmaq of NS are not expected based on predicted residual effects
Birds			☑	• Potential for direct adverse effects to birds affecting fowling practices	• Indirect significant effects on the Mi'kmaq of NS are not expected based on predicted residual effects
Fauna			☑	• Potential for direct adverse effects to fauna affecting hunting and trapping practices	• Indirect significant effects on the Mi'kmaq of NS are not expected based on predicted residual effects
Species of Conservation Interest / Species at Risk			☑	• Potential for direct adverse effects to SOCI/SAR potentially affecting cultural and harvesting practices of the Mi'kmaq of NS	• Indirect significant effects on the Mi'kmaq of NS are not expected based on predicted residual effects

Valued Component	Health and socio-economic considerations	Physical and cultural heritage	Current use of lands and resources for traditional purposes	Possible pathway to affect the Mi'kmaq of Nova Scotia	Potential indirect effect based on effects assessment of other VCs
Physical and Cultural Heritage		☑		• No interaction with identified archaeological features	• Indirect significant effects on the Mi'kmaq of NS are not expected based on predicted residual effects
Human Health and Socio-economic Considerations	☑			• Destruction of some species will potentially impact availability of some specimens in the PA. • Reduction of area available for hunting, gathering, fishing, trapping. • Change to migration patterns of some fauna due to project footprint. • Smothering of some plant and berry species along the Haul Road.	• Indirect significant effects on human health of the Mi'kmaq of NS are not anticipated, based on predicted residual effects (and associated mitigations). • Indirect significant adverse effects on socio-economic conditions are not expected due to the ongoing discussions between the Mi'kmaq of NS and the Proponent regarding opportunities for economic benefits.

Table 6.14-6 Potential Effects on Human Health related to Indigenous Peoples

Elements to Consider	Anticipated Effect
Location of First Nations in relation to the Project	The nearest First Nation (Mi'kmaq) reserve is the Beaver Lake IR 17, located 5 km from the mine site and 3 km from the proposed Haul Road. There are occasional use and modern day camps used by the Mi'kmaq in closer proximity to the proposed Haul Road.
Size of the Population Potentially Affected	Twenty-one people are living at Beaver Lake. However, extended familial and broader community relationships exist at the Sheet Harbour and Millbrook locations, and would indicate a larger potentially-affected population.
Presence of Drinking Water Intakes	The nearest domestic well is 5.5 kilometres southwest from, and up-gradient of, the mine site, at a residence along Hwy 224.
Timing/Duration of Project	The Project will take place in stages – first construction, followed by operations. It is anticipated that the period from construction to reclamation is eight years. The mine will limit access to specific areas for hunting, fishing and harvesting purposes for that period.
Recreational Use of Surface Water	The Project as planned does not restrict access to areas of documented use.
Country Food Harvesting	Based on the information compiled through the ITLRUS, MEKS, historical information and secondary sources, and findings during site visits, it is concluded that there is a moderate level of Mi'kmaq use of the Project site for subsistence harvesting of food and medical plants, fish and furbearing animals. It is known that areas to the west of the site have traditionally been used for these and ceremonial (burial) activities. Historical information indicates that the Mi'kmaq would have conducted these activities in the PA and surrounding areas.
Location of Traditional Resource Use	

6.14.7 Preferred Alternative Haul Road

6.14.7.1 Rationale for Valued Component Selection

The same rationale was used for the valued component selection as indicated in 6.14.1.

6.14.7.2 Baseline Program Methodology

The same methodology was used for the baseline program for the Preferred Alternative Haul Road option as indicated in Section 6.14.2. No additional baseline studies were completed for this Haul Road option

6.14.7.3 Baseline Conditions

The key sensitive receptor in the area is the Beaver Lake IR 17; a satellite community of the Millbrook First Nation located approximately 5 km south of the Beaver Dam mine site. At its nearest point, the Preferred Alternative Haul Road route is approximately 5.1 southwest of Beaver Lake IR 17. Other receptors in the area include permanent residences and seasonal camps/cottages along the Beaver Dam Mines Road and residences along Mooseland Road. Activities in these areas are ongoing and include recreational use (hunting, ATVs, etc).

Baseline conditions are presented in Section 6.14.3.

6.14.7.4 Consideration of Consultation and Engagement Results

The Preferred Alternative Haul Road is the result of public consultation and Indigenous engagement on the primary ~~haul route~~ Haul Road. The alternative Haul Road is further from human receptors located on the “Moose River Cross Road” so-called and from residents located on the Mooseland Road. Consultation and engagement results are presented in Section 6.14.4.

6.14.7.5 Effects Assessment Methodology

The effects assessment methodology of the Preferred Alternative Haul Road is as presented in Section 6.14.5. The spatial boundary of the PA for the Preferred Alternative Haul Road is confined only to this segment and assessed independently of the primary route. The LAA and RAA remain the same as indicated in Section 6.14.5.1. The PA for the Preferred Alternative Haul Road is within the LSA defined and evaluated by the ITRLUS.

6.14.7.6 Project Activities and Indigenous Peoples Interactions and Effects

The key sensitive receptor in the area is the Beaver Lake IR 17; a satellite community of the Millbrook First Nation located approximately 5 km south of the Beaver Dam mine site. At its nearest point, the Preferred Alternative Haul Road route is approximately 5.1 km southwest of Beaver Lake IR 17. Other receptors in the area include seasonal camps/cottages along the Beaver Dam Mines Road and residences along Mooseland Road and several camps as identified in the ITRLUS.

Potential interactions between Project activities and Indigenous Peoples are outlined in Tables 6.14-5 and 6.14-6, in Section 6.14.6. The Preferred Alternative Haul Road is located farther away from Beaver Lake IR 17 and would affect the Mi’kmaq in a similar fashion as the primary Haul Road orientation, so there are no further impacts on Indigenous Peoples to mitigate for this Haul Road option.

6.14.8 Mitigation and Monitoring

Mitigation measures and monitoring associated with related VCs are key to avoiding effects on the Mi’kmaq of Nova Scotia, as detailed in the VC sections and summarized in Sections 8 and 9. The Project has been planned to minimize footprint disturbance and hauling-related impacts to the Mi’kmaq of Nova Scotia. Notably, the originally-proposed ~~haul route~~ Haul Road was changed to avoid passing the community of Beaver Lake, which substantially minimizes the residual effects on residents, who are members of the Millbrook First Nation.

The Proponent’s mitigation and monitoring programs have been developed through ongoing discussions with the Mi’kmaq of Nova Scotia. Environmental monitoring and follow-up planning will be conducted with Mi’kmaq participation, including in planning and executing wetland compensation, wildlife monitoring, and fisheries productivity offsetting projects. A Haul Road Operational Management Plan will be prepared, with Mi'kmaq participation, to identify methods and plans to limit or reduce restrictions for Mi'kmaq who wish to access areas surrounding the Project for traditional purposes.

Follow-up programs will be developed in consultation with the Mi'kmaq of Nova Scotia to verify the nature and extent of the effects on current use of lands and resources for traditional purposes, to determine the effectiveness of mitigation measures, and to ensure ongoing and adaptive management of any unanticipated outcomes. A communications plan will also be developed and implemented with Indigenous groups to ensure the Mi'kmaq of Nova Scotia are kept informed and are able to provide feedback on key issues related to the Project.

Table 6.14-7 Mitigation and Monitoring Program for Potential Effects on the Mi'kmaq of Nova Scotia

Project Activity	Mitigation Measures	Monitoring Program
EIS Review		The Proponent to support joint funding initiatives with CEAA for Mi'kmaq third party review of the Proponent's proposed mitigation and monitoring programs during EIS review. Scope and scale of this commitment to be determined. This support provided may be a component of the broader discussion relating to impact benefits**
Pre-construction	Provide Millbrook land users the opportunity to walk the Haul Road with Proponent representatives to identify and document sensitive sites prior to construction	
Pre-Construction	Provide a tour of Beaver Dam Mine Site and information on Project operations to interested Mi'kmaq peoples.	
Pre-construction	The Proponent will develop a Complaints Management and Action Program for Millbrook input in advance of Project commencement.	
Pre-construction	Preparation of a Haul Road Operational Management Plan, with Mi'kmaq participation.	Regular review with the Mi'kmaq to ensure access to lands surrounding the Project is available for traditional purposes
Pre-construction		The Proponent will support Mi'kmaw participation in baseline studies of water and traditional foods (deer, trout, medicines, and

Project Activity	Mitigation Measures	Monitoring Program
		berries) in the LAA to establish baseline metal levels. Scope and methods of study to be developed in conjunction with the Proponent (data shared). This support provided may be a component of the broader discussion relating to impact benefits**
Pre-construction	Work collaboratively with Millbrook to create a Water Protection Plan for the West River (with a focus on River Lake)	
Construction	During the construction phase, as part of expected IA conditions, the Proponent will prepare an Emergency Response Plan for the Project and work with Millbrook to provide and fund appropriate training to interested participants.	
Construction	In the event that Mi'kmaw archaeological features are encountered during construction or operation of the Project, all work in the area will be halted and immediate notification made to the Special Places Coordinator, Nova Scotia Museum, the KMKNO and the communities of Sipekne'katik and Millbrook	As part of the EMS and associated procedures under the EPP, the Proponent will ensure mitigation measures are undertaken to prevent irreversible damage to Mi'kmaq archaeological resources and burial site, including ensuring activities are within defined Project area
Ongoing	Engagement with the Mi'kmaq of NS as per the engagement strategy, including specific participation in environmental monitoring and wetland compensation	Review of Mi'kmaq engagement strategy with the Mi'kmaq of Nova Scotia
~~Ongoing~~	~~Continuation of the CLC which is made of up local community representatives including persons from the two nearest Mi'kmaq communities, Sipekne'katik and Millbrook First Nations~~	~~Review of Mi'kmaq input on specific actions and implementation where agreed with the Mi'kmaq CLC members~~
Ongoing	Implement specific community engagement activities to address interests of the residents of Beaver	Develop and review approaches to specific engagement of nearby residents as mutually

Project Activity	Mitigation Measures	Monitoring Program
	Lake, including information sharing, site tour, etc.	agreed with the Chief and Council and the staff of Millbrook First Nation
Ongoing	The Proponent will support Millbrook First Nation in actively participating in the Reclamation Plan for the Project including a reclamation working group, the opportunity for Millbrook members to provide input on species used in revegetation, reclamation techniques, and the opportunity for Millbrook members to join the reclamation team to execute this Project phase.	
On-going	All vehicle operators will receive driver training as related to health, safety, and environment. The training will involve measures to minimize wildlife-vehicular interactions.	
On-going	The Proponent commits to conducting an employee and contractor Mi'kmaq Cross Cultural Awareness Training Program. Scope to be determined based on further discussions	
Ongoing	Engage in in-depth access management planning, including traffic management and enforcement strategies, with Millbrook to ensure continued access to preferred harvest and occupancy areas, where possible. This includes a meaningful, and documented discussions/seminar with Millbrook First Nation technicians on the range of access options available. This may include the use of an agreed-upon third party, funded by the Proponent.	
Closure		The Proponent commits to Mi'kmaq participation in community-based monitoring programs. Scope and methods of the study to be developed in conjunction with the

Project Activity	Mitigation Measures	Monitoring Program
		Proponent (data to be shared). This support provided may be a component of the broader discussion relating to impact benefits**

**Funding requests and participation in Project related activities such as monitoring and report review may be components of a broader impact benefits agreement.

6.14.9 Residual Effects and Significance

The predicted residual environmental effects of the Project on the Mi’kmaq of Nova Scotia are assessed to be adverse, but not significant following implementation of applicable mitigation measures. Potential residual effects to Indigenous peoples' physical health from Project-related changes to the environment (e.g., changes to country foods, water, and soils) are anticipated to be not significant. Potential pathways of effects on human health associated with consumption of or contact with country foods, water and soils will be minimized by implementing mitigation measures such as dust control and water management infrastructure and processes. Mitigation measures to reduce atmospheric emissions will be implemented to minimize potential related effects on human health, and the residual risk to human health from inhalation of Project-related dust and airborne contaminants is considered low. Access issues will be discussed during engagement with the Mi’kmaq of Nova Scotia, and appropriate mitigation and/or compensation measures developed.

Table 6.14-8 Residual Environmental Effects on the Mi'kmaq of Nova Scotia

Project - VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction - Beaver Dam Mine Site and Haul Road (Direct effect on archaeological resources and burial site)	Ensure no Project activities occur outside of PA, education and procedures in place as part of the EPP to halt work and notify the Mi'kmaq if archaeological deposits are encountered.	A	N No interactions with known archaeological resources and burial sites are expected. Identified resources will be avoided	PA VC confined to the mine site	N/A This project interaction is not expected to be affected by timing	ST VC interaction will occur during construction phase	O VC interaction will occur once	IR VC remains at the end of the activity	None	Not Significant
Construction - Beaver Dam Mine Site and Haul Road (Direct habitat loss, including wetlands, and loss of plants of significance to the Mi'kmaq)	Minimize footprint as per Project design, implementation of mitigation and monitoring as per other VCs to minimize indirect effects, engagement and involvement of the Mi'kmaq throughout Project (including monitoring and compensation)	A	M Mitigation strategies and best management practices reduce the magnitude of impact	PA VC confined to the mine site	A timing is applicable and clearing and grubbing will be completed outside of the growing season (planned for Winter)	ST VC interaction will occur during construction phase	O VC interaction will occur once	IR VC remains at the end of the activity	Loss of plant specimens, habitat loss	Not Significant
Construction and Operations - Beaver Dam Mine Site and Haul Road (direct and indirect impacts to fish and fish habitat)	Minimize footprint as per Project Design, erosion and sediment control to minimize impact, and water quality treatment	A	L Mitigation strategies and best management practices reduce the magnitude of impact	PA/LAA Direct effect within PA, indirect effect within LAA	A Seasonality (spawning) windows applicable	LT VC interaction will occur during construction, operations and active reclamation	O/S Effects will be once from direct impacts, effects will be sporadic from indirect impacts	IR VC interactions are permanent	Loss of fish habitat, change in water quality/quantity	Not Significant
Construction and Operations - Beaver Dam Mine Site and Haul Road (direct and indirect impacts to fauna- loss of habitat; noise and fragmentation)	Minimize footprint as per Project Design, utilize existing roads wherever possible.	A	M Mitigation and best management strategies reduce magnitude of impact	PA/LAA Direct effect within PA, indirect effect within LAA	A Seasonality (breeding windows) applicable	LT VC interaction will occur during construction, operations and active reclamation	O/R Effects will be once from direct impacts, effects will be regular from indirect impacts	PR Traffic will reduce on roads once operations cease	Loss of habitat, potential changes in species movement patterns	Not Significant
Construction and Operation - Beaver Dam Mine Site, Haul Road and Touquoy Mine Site	Utilize berms and other mitigation where required to reduce noise levels to minimize indirect impact to	A	H Exceeding guidelines and thresholds- co-developed	LAA Noise levels from the BD Mine Site and	N/A	LT VC interaction will occur during	S	R VC interaction will recover to baseline	Sensory Disturbance	Not Significant

Project - VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
(Predicted Noise levels and potential interaction with traditional practices surrounding the Project)	Mi'kmaq; share noise study results and involve Mi'kmaq in data collection		mitigation strategies and best management practices reduce the magnitude of impact	Haul Road are predicted to extend into the LAA	This project interaction is not expected to be affected by timing	construction, operations and active reclamation (2 yrs) phases of the Project	VC interaction will occur at sporadic intervals throughout the Project	after Project activities are completed		
Operations and Closure - Beaver Dam Mine Site (Predicted Visual Assessment for Beaver Lake IR)	Maintenance of forested canopy wherever possible within the Project property boundaries	A	L Limited visual impact from the BD Mine Site is predicted outside of the range of natural variation	LAA Visual impact extents into the LAA	A Timing is applicable as visual effect is adjusted based on foliage on trees	P VC will not return to baseline	C Visual effects are continuous	IR VC will not return to baseline	Visual Change	Not Significant
Construction and Operation - Beaver Dam Mine Site, Haul Road and Touquoy Mine Site (Predicted Light levels and potential interaction with traditional practices surrounding the project)	Maintenance of forested canopy wherever possible within the Project property boundaries. Limit unnecessary lighting at Mine Sites; utilization of potential green energy options	A	M Marginally exceeding guidelines	LAA light from the BD Mine Site and Haul Road is predicted to extend into the LAA	A Timing is applicable as visual effect is adjusted based on foliage on trees	LT VC interaction will occur during construction, operations and active reclamation (2 yrs) phases of the Project	S VC interaction will occur at sporadic intervals throughout the Project	R VC interaction will recover to baseline after Project activities are completed	Sensory Disturbance	Not Significant
Operation - Haul Road (Predicted Dust Deposition in lands surrounding the Project)	Maintenance of forested canopy wherever possible within the Project property boundaries; intermittent monitoring of dust deposition to verify predictions; adaptive management	A	H exceeding guidelines and thresholds at the property boundary	LAA dust from the Haul Road is predicted to extend into the LAA	A Timing is applicable as dust effect is adjusted based on foliage on trees	LT VC interaction will occur during construction and operations phases of the Project	S VC interaction will occur at sporadic intervals throughout the Project	PR Mitigation cannot guarantee return to baseline after Project activities are completed	Aesthetics effect	Not Significant
Operation - Haul Road (Predicted change in traffic volumes and vehicle types at Highway 224 junction with Haul Road)	Enforce speed limits, increased signage, lighting	A	L Existing traffic will have right of way; haul trucks will yield to traffic; and no changes to existing speed limits on 224 are anticipated.	PA Activities are confined to the PA	N/A Timing is not applicable	LT VC interaction will occur during construction and operations phases of the Project	R VC interaction will occur regularly	R VC returns to baseline conditions at the end of the activity	Increased Vehicle Traffic at Junction	Not Significant
Construction, Operation and Closure - Beaver Dam Mine Site, Haul	Continue discussions with the Mi'kmaq to determine appropriate mitigation and	A	L	LAA	N/A	MT	R	R	Loss of Access	Not Significant

Project - VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Road, and Touquoy Mine Site (Restriction and loss of access during construction and operations of the Mine (approx. 8 years))	compensation requirements, where appropriate		Mitigation strategies and best management practices reduce the magnitude of impact	Activities are confined to LAA	This project interaction is not expected to be affected by timing	VC interaction will occur during construction and operation phase	VC interaction will occur regularly	VC returns to baseline conditions at the end of the activity		
Construction, Operation and Closure - Beaver Dam Mine Site, Haul Road, and Touquoy Mine Site (Construction and operations of the Mine (approx. 8 years))	Continue confidential discussions with the Mi'kmaq of Nova Scotia (parallel to the federal environmental assessment) to identify employment, community and economic benefits.	P	H Considerable and tangible opportunities for Mi'kmaq communities	RAA Opportunities can be considered across the RAA	N/A This project interaction is not expected to be affected by timing	LT Opportunities will extend past operational period into reclamation and post closure.	C There are continuous opportunities throughout all project phases.	R VC returns to baseline conditions at the end of the activity	Benefits to the Mi'kmaq	Not Significant

Legend (refer to Table 5.10-1 for definitions)

Nature of Effect	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
A Adverse	N Negligible	PA Project Area	N/A Not Applicable	ST Short-Term	O Once	R Reversible
P Positive	L Low	LAA Local Assessment Area	A Applicable	MT Medium-Term	S Sporadic	IR Irreversible
	M Moderate	RAA Regional Assessment Area		LT Long-Term	R Regular	PR Partially Reversible
	H High			P Permanent	C Continuous	

A significant adverse environmental effect for Indigenous Peoples has not been predicted for the Project for the following reasons, with consideration of the ecological and social context of the LAA surrounding the Project:

- During Construction:
    - Direct impacts to terrestrial habitat, flora and fish habitat will be minimized through on-going Project design and micro-sighting of infrastructure footprints where practicable.
    - Construction work and methods will be considerate of fish spawning timing windows and the breeding bird season.
    - Construction noise and light will be limited and temporary in nature with an approximate 12 month duration.
    - Fish habitat improvements will be completed along the Haul Road during construction through appropriate and necessary upgrades to culverts to support re-establishment of fish connectivity.
    - Changes to access for Indigenous Peoples will be evaluated through on-going dialogue between individual Mi’kmaq communities and the Proponent as part of broader impact benefits and compensation discussions.
- During Operations:
    - Noise will be elevated above baseline during this period, however the likelihood of receptors being regularly in close proximity to noise generation sites is very low.
    - Dust will be elevated above baseline during this period along the Haul Road; however, the likelihood of receptors being regularly in close proximity to the Haul Road is very low.
    - Changes to access for Indigenous Peoples will be evaluated through on-going dialogue between individual Mi’kmaq communities and the Proponent as part of broader impact benefits and compensation discussions.
- During Closure:
    - Noise will be elevated above baseline during reclamation activities (2-3 years) involving mobile equipment and then drop to baseline for the post-closure period.
    - Changes to access for Indigenous Peoples will be evaluated through on-going dialogue between individual Mi’kmaq communities and the Proponent as part of broader impact benefits and compensation discussions.

6.14.9.1 Preferred Alternative Haul Road Residual Effects and Significance

The residual effects and significance for the Mi’kmaq of Nova Scotia within the Preferred Alternative Haul Road are presented below:

Table 6.14-9 Residual Environmental Effects on the Mi'kmaq of Nova Scotia for the Preferred Alternative Haul Road

Project - VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction - Preferred Alternative Haul Road (Direct effect on archaeological resources and burial site)	Ensure no Project activities occur outside of PA, education and procedures in place as part of the EPP to halt work and notify the Mi'kmaq if archaeological deposits are encountered.	A	N No interactions with known archaeological resources and burial sites are expected. Identified resources will be avoided	PA VC confined to the mine site	N/A This project interaction is not expected to be affected by timing	ST VC interaction will occur during construction phase	O VC interaction will occur once	IR VC remains at the end of the activity	None	Not Significant
Construction - Preferred Alternative Haul Road (Direct habitat loss, including wetlands, and loss of plants of significance to the Mi'kmaq)	Minimize footprint as per Project design, implementation of mitigation and monitoring as per other VCs to minimize indirect effects, engagement and involvement of the Mi'kmaq throughout Project (including monitoring and compensation)	A	M Mitigation strategies and best management practices reduce the magnitude of impact	PA VC confined to the mine site	A timing is applicable and clearing and grubbing will be completed outside of the growing season (planned for Winter)	ST VC interaction will occur during construction phase	O VC interaction will occur once	IR VC remains at the end of the activity	Loss of plant specimens, habitat loss	Not Significant
Construction and Operations - Preferred Alternative Haul Road (direct and indirect impacts to fish and fish habitat)	Minimize footprint as per Project Design, erosion and sediment control to minimize impact, and water quality treatment	A	L Mitigation strategies and best management practices reduce the magnitude of impact	PA/LAA Direct effect within PA, indirect effect within LAA	A Seasonality (spawning) windows applicable	LT VC interaction will occur during construction, operations and active reclamation	O/S Effects will be once from direct impacts, effects will be sporadic from indirect impacts	IR VC interactions are permanent	Loss of fish habitat, change in water quality/quantity	Not Significant
Construction and Operations - Preferred Alternative Haul Road (direct and indirect impacts to fauna- loss of habitat; noise and fragmentation)	Minimize footprint as per Project Design, utilize existing roads wherever possible.	A	M Mitigation and best management strategies reduce magnitude of impact	PA/LAA Direct effect within PA, indirect effect within LAA	A Seasonality (breeding windows) applicable	LT VC interaction will occur during construction, operations and active reclamation	O/R Effects will be once from direct impacts, effects will be regular from indirect impacts	PR Traffic will reduce on roads once operations cease	Loss of habitat, potential changes in species movement patterns	Not Significant
Construction and Operation - Preferred Alternative Haul Road	Utilize berms and other mitigation where required to reduce noise levels to minimize indirect impact to Mi'kmaq; share noise study	A	H Exceeding guidelines and thresholds- co-developed mitigation strategies and	LAA Noise levels from the BD Mine Site and Haul Road are	N/A This project interaction is not expected to be affected by timing	LT VC interaction will occur during construction,	S VC interaction will occur at sporadic intervals throughout the Project	R VC interaction will recover to baseline after Project	Sensory Disturbance	Not Significant

Project - VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
(Predicted Noise levels and potential interaction with traditional practices surrounding the Project)	results and involve Mi'kmaq in data collection		best management practices reduce the magnitude of impact	predicted to extend into the LAA		operations and active reclamation (2 yrs) phases of the Project		activities are completed		
Construction and Operation - Preferred Alternative Haul Road (Predicted Light levels and potential interaction with traditional practices surrounding the project)	Maintenance of forested canopy wherever possible within the Project property boundaries. Limit unnecessary lighting at Mine Sites; utilization of potential green energy options	A	M Marginally exceeding guidelines	LAA light from the BD Mine Site and Haul Road is predicted to extend into the LAA	A Timing is applicable as visual effect is adjusted based on foliage on trees	LT VC interaction will occur during construction, operations and active reclamation (2 yrs) phases of the Project	S VC interaction will occur at sporadic intervals throughout the Project	R VC interaction will recover to baseline after Project activities are completed	Sensory Disturbance	Not Significant
Operation - Preferred Alternative Haul Road (Predicted Dust Deposition in lands surrounding the Project)	Maintenance of forested canopy wherever possible within the Project property boundaries; intermittent monitoring of dust deposition to verify predictions; adaptive management	A	H exceeding guidelines and thresholds at the property boundary	LAA dust from the Haul Road is predicted to extend into the LAA	A Timing is applicable as dust effect is adjusted based on foliage on trees	LT VC interaction will occur during construction and operations phases of the Project	S VC interaction will occur at sporadic intervals throughout the Project	PR Mitigation cannot guarantee return to baseline after Project activities are completed	Aesthetics effect	Not Significant
Construction, Operation and Closure - Preferred Alternative Haul Road (Restriction and loss of access during construction and operations of the Mine (approx. 8 years))	Continue discussions with the Mi'kmaq to determine appropriate mitigation and compensation requirements, where appropriate	A	L Mitigation strategies and best management practices reduce the magnitude of impact	LAA Activities are confined to LAA	N/A This project interaction is not expected to be affected by timing	MT VC interaction will occur during construction and operation phase	R VC interaction will occur regularly	R VC returns to baseline conditions at the end of the activity	Loss of Access	Not Significant
Construction, Operation and Closure - Preferred Alternative Haul Road (Construction and operations of the Mine (approx. 8 years))	Continue confidential discussions with the Mi'kmaq of Nova Scotia (parallel to the federal environmental assessment) to identify employment, community and economic benefits.	P	H Considerable and tangible opportunities for Mi'kmaq communities	RAA Opportunities can be considered across the RAA	N/A This project interaction is not expected to be affected by timing	LT Opportunities will extend past operational period into reclamation and post closure.	C There are continuous opportunities throughout all project phases.	R VC returns to baseline conditions at the end of the activity	Benefits to the Mi'kmaq	Not Significant

Project - VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
	Legend (refer to Table 5.10-1 for definitions)									

Nature of Effect	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
A Adverse	N Negligible	PA Project Area	N/A Not Applicable	ST Short-Term	O Once	R Reversible
P Positive	L Low	LAA Local Assessment Area	A Applicable	MT Medium-Term	S Sporadic	IR Irreversible
	M Moderate	RAA Regional Assessment Area		LT Long-Term	R Regular	PR Partially Reversible
	H High			P Permanent	C Continuous	

Table 6.14-8 was reviewed and it was determined that nine VC interactions specific to the Haul Road are also applicable to Indigenous Peoples within or in close proximity to the Preferred Alternative Haul Road. There were no changes in the significance criteria or overall significance for any of these VC interactions.

Mitigations presented in Table 6.14-7 will be established to reduce the impact of Project activities on Indigenous peoples.

6.14.10 Proposed Compliance and Effects Monitoring Program

As the Project moves forward, discussions will continue with the Mi'kmaq of Nova Scotia regarding participation in the development, implementation and evaluation of proposed compliance and effects monitoring programs. These could include monitoring programs such as:

- Wetland Monitoring;
- Wildlife Monitoring, including Moose;
- Other monitoring programs such for air, surface water, groundwater, and noise.

In addition, the Proponent will hold periodic meetings with the Mi'kmaq of Nova Scotia, including Millbrook and Sipekne'katik First Nations, to review overall environmental compliance and effects monitoring programs associated with other VCs, provide data and results of monitoring programs, and report on Project benefits. Table 6.14-7 describes a list of potential monitoring opportunities for Mi'kmaq communities. On-going dialogue will continue with the Mi'kmaq of Nova Scotia regarding participation in, and implementation of, monitoring programs for the Project.

The effects monitoring program will verify the effectiveness of mitigation measures associated with minimizing any potential effects to human health from consumption of or contact with country foods, water and soils, and results will be shared with local Indigenous groups.

6.15 Physical and Cultural Heritage

6.15.1 Rationale for Valued Component Selection

Physical and cultural heritage are provincially regulated through the *Special Places Act*, which supports the preservation, regulation, and study of archaeological, historical, and paleontological sites and artifacts ~~remains~~ deemed to be important parts of Nova Scotia's natural or cultural heritage. The areas historical importance for post-Contact land use and recreational value are important considerations for the mine development.

~~Given the proximity of the haul road and Mine Site to the Beaver Lake IR 17, the areas were identified as having high potential for pre-European contact natural and cultural resources. In addition, the Beaver Dam Mine Site area has been subject to extensive exploration and mining activity since gold was first discovered in 1868. These activities have left behind 20 AMO's and several other areas with high potential for post-European contact natural and cultural resources.~~

6.15.2 Baseline Program Methodology

In 2008, ~~the archaeologist,~~ Cultural Resource Management Group (CRM Group), undertook an archaeological screening and reconnaissance program at the Beaver Dam Mine Site on behalf of Acadian Mining. At that time, a surface ~~open-pit~~ mine was in early stage planning ~~proposed~~ as well as associated mine features including a crusher, a settling pond, stockpiles of overburden and product, and service roads.

In 2014, CRM Group was retained on behalf of the Proponent to conduct archaeological screening and reconnaissance at the Beaver Dam Mine Site using the current site development plan. Building upon the research and reconnaissance undertaken on the property in 2008, CRM Group revisited several of the sites previously noted, as well as identified other features related to previous site activities (sawmill and possible cookhouse sites). The 2014 archaeological screening and reconnaissance consisted of a visual inspection of the ground surface and did not involve sub-surface testing. As part of the 2014 archaeological assessment, an archaeological screening was completed prior to Site reconnaissance. CRM Group reviewed documents available through the Nova Scotia Archives, the Department of Natural Resources and Crown Land Information Management Centre. The screening included a review of land grant records, legal survey, historical maps, local and regional histories, topographic maps, and aerial photos.

In 2015, CRM Group was retained on behalf of the Proponent to conduct additional archaeological reconnaissance. Changes to the layout of the proposed facility led to additional archaeological reconnaissance being undertaken in the summer of 2015. Previously investigated mine features that were proposed, such as the WRSP and the crusher site had been reconfigured. Two till piles, two ore piles, two settling ponds, and the ROM/crusher/service pad site were added to the Project. The reconnaissance was focused within the pit, the WRSP, the till piles, the ore piles, the settling ponds, and the ROM/crusher/service pad site.

CRM Group was also retained in 2015 to complete archaeological reconnaissance of the proposed Haul Road where upgrades to the existing road will be conducted. The focus of the reconnaissance was on Beaver Dam Mines Road and Moose River Cross Road (so-called), which are portions of the proposed Haul Road that require upgrades to allow for truck travel. The water crossings exhibited the highest potential in the background research and were the focus of the reconnaissance. In 2016, CRM Group completed archaeological reconnaissance of a proposed 4.0 km new section of the Haul Road, located west of Hwy 224 (Section 3B; Figure 2.2-2).

The 2015, 2016, and 2018 ~~and 2016~~ archaeological reconnaissance for the Beaver Dam Mine Site, Haul Road, and the Preferred Alternative Haul Road ~~and the haul road~~ consisted of a visual inspection of the ground surface and did not involve sub-surface testing.

In 2018, CRM Group was retained on behalf of the Proponent to conduct additional archaeological assessment on the Preferred Alternative Haul Road and the western waste rock stockpile (western extent of the Beaver Dam Mine Site). As part of the 2018 archaeological assessments, an archaeological screening was completed prior to Site reconnaissance. In addition to the archaeological assessment conducted on the Preferred Alternative Haul Road, an archaeological screening and reconnaissance of the proposed WRSP west, located on the west end of the proposed mine layout, on the west side of Crusher Lake, was completed.

The Touquoy Mine Site ~~site~~ was previously subjected to archaeological reconnaissance in November 2006. No additional disturbances are anticipated at the Touquoy site as a result of the Beaver Dam Mine Project and therefore no additional work was completed.

The archeological reports are included in Appendix N.1-N.5.

6.15.3 Baseline Conditions

Beaver Dam Mine Site

Site reconnaissance in 2008, completed as part of the archaeological assessment, noted 6 features, of which Sites 1 to 5 were within close proximity to Crusher Lake. Site 6 was located northwest of the lake. Two areas along the Cameron Flowage were identified as being high potential for pre-European contact resources. In addition to these features and high potential areas, numerous industrial features were identified along the northern shore of Crusher Lake. CRM Group recommended that the features and the high potential areas be subject to shovel testing and the industrial features subject to detailed documentation if any of them fell within areas of future development.

An archaeological screening was undertaken at the Beaver Dam Mine Site in 2014 that identified that the land within the study area was historically part of the greater Mi'kmaq territory known as *Eskikewa'kik,* meaning 'skin dressers territory'. The Maritime Archaeological Resource Inventory does not identify any registered archaeological sites within the study area. However, the lack of archaeological data may represent a lack of archaeological investigation and not an absence of archaeological sites. The Beaver Dam Mine Site property was historically developed for industrial use since the late-1800s. Aerial photographs from 1982 and 1992 indicate that the mine underwent a significant amount of development during this time period. This development likely destroyed any features that may have been present in the area.

Archaeological screening conducted in 2014 identified that, based on the environmental setting and Indigenous Peoples ~~Native~~ land use, as well as the Property's long history of industrial use, the Beaver Dam Mine Site exhibits high potential for encountering Pre-contact and historic Indigenous Peoples~~Native~~ archaeological resources and high potential for encountering historic Euro-Canadian archaeological resources.

Based on the field reconnaissance completed as part of the 2014 archaeological assessment, historic features that had been identified in the mine footprint ~~Pit study~~ area were determined to have been destroyed, likely by mining activities previously undertaken on the site during the 1980s. ~~No archaeological features were identified within the WRSP study area.~~

A site described as Site 6 in the 2008 archaeological assessment, a historic cabin site, was revisited and investigated further in 2018. This site has the potential to be impacted by construction of the road leading to the West waste rock stockpile. The site could be avoided by adjusting the location of the road. It is recommended that a program of archaeological shovel testing be conducted in advance of any disturbance at this Site. The remainder of the West Waste Rock Stockpile Study area is recommended to be cleared form any further archaeological investigation.

CRM Group recommended that any development around the features identified during the 2008 or 2014 reconnaissance would require shovel testing and intensified historical research. In addition, any development around Crusher Lake should be subjected to intensified reconnaissance. The pit and WRSP study areas, as they were oriented at the time of reconnaissance, were cleared of any requirement for further archaeological investigation.

The additional archaeological reconnaissance in 2015 determined that one historic feature (Feature 5 Cookhouse) was identified within the Till Pile 2 study area and Feature 4 (Mill) were in proximity to the mine activities. Subsequent adjustments of the mine layout put these features in the Haul Road to the western waste rock stockpile. No archaeological features or areas of archaeological potential were identified within any of the other study areas, either during the background or field reconnaissance. It was recommended that either a program of shovel testing be conducted around the possible cookhouse (Feature 5) prior to disturbance or a buffer of 20 m be put in place around the feature to protect it from any mining activities. No further archaeological work is required for the rest of the till pile 2 study area. CRM Group recommended that any development around the features identified in 2008 and/or 2014 would require shovel testing and intensified historical research in advance of disturbance. Other areas were cleared of any requirement for further archaeological investigation. ~~The pit and WRSP, till Pile 1, the ore piles, the settling ponds, and the ROM/crusher/service pad study areas, as they were oriented at the time of reconnaissance, were cleared of any requirement for further archaeological investigation.~~

Further archaeological reconnaissance and assessment in 2018 of the western waste rock stockpile concluded that there were two sites/areas that had elevated potential for encountering archaeological resources: Site 6, located on the eastern side of a logging road that runs through the western portion of the study area, exhibited elevated potential for encountering archaeological resources related to the historic Beaver Dam Gold District, and Area 1, located approximately 25 m north of Crusher Lake, ascribed elevated potential for encountering Mi'kmaw archaeological resources. CRM Group recommended that an intensified reconnaissance be conducted if any development is set to occur within 100 m of Crusher Lake. It was also recommended that shovel testing be conducted in advance of any disturbance in the proximity of Site 6 or Area 1, or if development is set to occur around any historic feature identified in the 2008 and 2014 reconnaissance. These areas will be avoided during site construction and no further work other than construction monitoring will be required.

Haul Road

An archaeological assessment conducted for the Haul Road in 2015 identified that water crossings along the Haul Road, in particular the West River Sheet Harbour, would have been important transportation corridors for the Mi'kmaq and their ancestors prior to the arrival of European settlers. Faribault (1898) depicts several features in the vicinity of the Haul Road. This includes a camp within three kilometres of the alignment of the Haul Road and several dams located in the vicinity of Moose River Cross Road. Although no other features were depicted, dams would suggest further activity not noted on the Faribault map. Several houses and a Mi'kmaq community (Beaver Lake IR) ~~First Nations reserve~~ are located adjacent to what is now Hwy 224. The section of the Haul Road along Mooseland Road passes two camps, several structures noted as "Icelanders huts", and a dam at the south end of Cope Lake. The review of Faribault indicates there was heavy activity in the area and that many of the modern road alignments follow closely to the historic alignments. The Maritime Archaeological Resource Inventory does not identify any registered archaeological sites within the study area. However, the lack of archaeological data may represent a lack of archaeological investigation and not an absence of archaeological sites.

During the 2015 and 2016 field reconnaissance, water crossings exhibited the highest potential in the background research and were the focus of the field investigations. The field reconnaissance did not identify any areas along the Haul Road that were ascribed high archaeological potential.

Based on the recommendations of the 2015 and 2016 archaeological reconnaissance, the alignment of the Haul Road, as specified at the time of 2015 site reconnaissance and including the proposed new section of road (Section 3B; Figure 2.2-2), was cleared of any requirement for further archaeological investigation.

Preferred Alternative Haul Road

An archaeological assessment completed for the Preferred Alternative Haul Road was conducted in 2018 by CRM Group, to evaluate the archaeological potential within the Preferred Alternative Haul Road PA. Based on the recommendations of the archaeological screening and reconnaissance, the alignment of the Preferred Alternative Haul Road, as specified at the time of the 2018 site reconnaissance was cleared of any requirements for further archaeological investigation.

Touquoy Mine Site

The entire Touquoy Mine Site was previously subjected to archaeological reconnaissance in November 2006. An archaeological screening was conducted by CRM Group to evaluate the archaeological potential within the proposed Touquoy development limits. The results of the study indicated that there is a low archaeological potential ascribed to the area. No additional disturbances are anticipated at the Touquoy site as a result of the Beaver Dam Mine Project.

6.15.4 Consideration of Consultation and Engagement Results

Issues raised during public consultation and Mi'kmaq engagement relating to physical and cultural heritage include potential disturbance of pre- and post-European contact archaeological resources.

The results of the public consultation and Mi'kmaq engagement have been considered in the environmental effects assessment, including the Proponent's commitments on mitigation and monitoring measures and proposed compliance and effects monitoring programs, as well as the Proponent's broader commitment to ongoing public consultation and Mi'kmaq engagement. Specific to evaluating the effect on physical and cultural heritage, these are found within the following environmental effects assessment.

6.15.5 Effects Assessment Methodology

6.15.5.1 Boundaries

Spatial Boundaries

~~The loss or destruction of heritage or archaeological resources material is a potential environmental effect of the Project. The spatial boundary used for the assessment of effects is the disturbed footprint of the project at the Mine Site and along the haul road.~~

The spatial boundaries used in the assessment of physical and cultural heritage is the PA.

The PA encompasses three primary components from Marinette to Moose River Gold Mines, Halifax County, NS. The Beaver Dam Mine Site will be located at the end of the Beaver Dam Mines Road and the Haul Road will span from the Beaver Dam Mine Site to Moose River Gold Mines, where the Touquoy Mine [processing and exhausted pit (to be used to dispose Beaver Dam tailings)] is located. There is no LAA or RA for physical and cultural heritage, as the loss of destruction of heritage or archaeological resources could occur only within the disturbed footprint of the Project (Figure 5.4-1).

Temporal Boundaries

The temporal boundaries used for the assessment of effects to physical and cultural heritage are limited to the construction phase of the Project. Construction is estimated to take approximately one year.

Technical Boundaries

No technical boundaries were identified for the effects assessment of physical and cultural heritage.

Administrative Boundaries

Physical and cultural heritage are provincially regulated through the *Special Places Act*. In order to conduct any archaeological work, a Heritage Research Permit must be issued by the Minister of the Department of Communities, Culture, and Heritage.

6.15.5.2 Thresholds for Determination of Significance

A significant adverse effect ~~is defined as a disturbance to or destruction of a cultural heritage resource where archaeological resources are identified~~ is an uncontrolled disturbance to, or destruction of, any unassessed historical or cultural resource of importance in the context of the Special Places Act.

6.15.6 Project Activities and Physical and Cultural Heritage Interactions and Effects

Potential interactions between Project activities and physical and cultural heritage resources are outlined in Tables 6.15-1 to 6.15-2 below.

Table 6.15-1 Potential Interactions with Project Activities and Physical and Cultural Heritage at Beaver Dam Mine Site

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Drilling and rock blasting in preparation of construction • Topsoil, till and waste rock transport and storage from site preparation • Watercourse and wetland alteration • Mine Site road construction and maintenance • Site infrastructure installation and construction • Settling pond construction • ~~Accidents and malfunctions, including slope failure and mobile equipment accidents~~
Operation and Maintenance	3-4 years	N/A
Decommissioning and Reclamation	1-2 years	N/A

Table 6.15-2 Potential Interactions with Project Activities and Physical and Cultural Heritage along Haul Road

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Rock blasting in preparation of construction • Till and waste rock from site preparation transport and storage • Watercourse and wetland alteration in preparation of construction • Haul road construction and upgrades • ~~Accidents and malfunctions, including slope failure and mobile equipment accidents~~
Operation and Maintenance	3-4 years	N/A
Decommissioning and Reclamation		N/A[1]
1 Decommissioning and Reclamation of the Haul Road is not expected. The Haul Road will be returned to owner for forestry industry		

There is low potential for the Project to interact with identified heritage resources that have been associated with historic mining at or near the Project site. The current plan is to avoid the areas identified above.

The current configuration of the western waste rock stockpile Haul Road impacts identified Features 4 (Stamp Mill) and 5 (Cook House). Micrositing of the road to the south would allow for avoidance; however, the road would encroach on other identified features close to Crusher Lake. The elevation of Crusher Lake is also several metres above the proposed Haul Road (slope approximate 1:4 H:V). Further investigation of these two features is required to determine the significance of the cultural resource. Based on the investigations to date significance of the resource is low since the features are similar to features found at other sites in the general region and are from the early 1900s. There is potential for Site 6 to be disturbed by the construction of a road required to access the western waste rock stockpile. Mitigations listed for Site 6 in Section 6.15.8 were recommended by CRM Group and accepted by Nova Scotia Communities, Culture and Heritage.

If areas of known heritage resources are to be impacted, further work will be undertaken to document these resources. If heritage resources are identified during construction of the mine then all work will stop in the immediate vicinity until said resources can be further studied. The potential for heritage resources to be impacted exists primarily during the construction phase of the Project.

There is no potential for the disturbance of cultural or physical heritage resources during the operational and reclamation phases of the Project based on studies to date.

There are no known federal decisions that could affect physical and cultural heritage in the PA, or that could affect structures, sites, or items of historical, archaeological, paleontological, or architectural significance of non-Indigenous ~~Aboriginal p~~eoples.

The Touquoy facility is currently operational ~~under construction~~. There are no effects to physical and cultural heritage anticipated to be caused by the processing of ore and the management of tailings (exhausted pit) from the Beaver Dam Mine Project. Effects to physical and cultural at the Touquoy facility were ~~are~~ only anticipated to potentially occur during the initial construction phase for the Touquoy facility which is complete. No additional cultural resources were encountered during development and all activities for the Beaver Dam ore processing will occur within the existing planned disturbed footprint at Touquoy.

6.15.7 Preferred Alternative Haul Road

6.15.7.1 Rationale for Valued Component Selection

The same rationale was used for the valued component selection as indicated in 6.15.1.

6.15.7.2 Baseline Program Methodology

The same methodology was used for the baseline program for the Preferred Alternative Haul Road operation as indicated in 6.15.2. CRM Group completed an additional Archaeological assessment, including archaeological screening and Site reconnaissance, for the Preferred Alternative Haul Road option in September of 2018.

6.15.7.3 Baseline Conditions

The baseline physical and cultural heritage considerations of the Preferred Alternative Haul Road is the same as presented in Section 6.15.3.

The assessment of the Preferred Alternative Haul Road concluded that there is low potential for encountering Pre-Contact and early Historic Native archaeological resources and low potential for encountering historic Euro-Canadian archaeological resources.

6.15.7.4 Consideration of Consultation and Engagement Results

The Preferred Alternative Haul Road is the result of consultation and engagement on the primary ~~haul route~~ Haul Road. The alternative ~~haul route~~ Haul Road is further from human receptors located on the "Moose River Cross Road" so-called and from residents located on the Mooseland Road.

6.15.7.5 Effects Assessment Methodology

The effects assessment methodology of the Preferred Alternative Haul Road is as presented in Section 6.15.5. The spatial boundary of the PA for the alternative route is confined only to this segment and assessed independently of the primary route

6.15.7.5.1 Thresholds for Determination of Significance

The thresholds for determination of significance regarding physical and cultural heritage within the Preferred Alternative Haul Road are identical to the thresholds for determination of significance for this VC throughout the entire PA, as presented within Section 6.15.5.2.

6.15.7.6 Project Activities and Bird Interactions and Effects

Potential interactions between Project activities and Physical and Cultural Heritage considerations are outlined in Tables 6.15-1 and 6.15-2 located in Section 6.15.6.

6.15.8 Mitigation ~~and Monitoring~~

Mitigation ~~and monitoring~~ for the Beaver Dam Mine Site and the Haul Road are described below. Mitigation measures and monitoring programs at the Touquoy facility are anticipated to be completed during the construction and preparation of the Touquoy facility and will not be applicable for the Beaver Dam Mine Project.

The areas included in the 2014 and 2015 archaeological assessments were cleared of any requirement for further archaeological investigation. Based on the 2014, ~~and~~ 2015, and 2018 archaeological assessments, the following mitigation activities were recommended by CRM Group and accepted by Nova Scotia Communities, Culture and Heritage:

- Either a program of shovel testing be conducted around the possible cookhouse (Feature 5) or a buffer of 20 metres be put in place around the feature to protect it from any mining activities.
- A program of shovel testing be conducted around Site 6, if development is to occur.
- If any development is to occur within 100 metres of Crusher Lake, intensified reconnaissance should be conducted to identify any additional features.
- If any development is to occur specifically around the historic features identified during the 2008, 2014, ~~and/or~~ 2015, and/or 2018 reconnaissance intensified historical research and archaeological shovel testing should be conducted in advance of disturbance.
- It is recommended that any further changes in the layout of the mine and associated facilities be evaluated as to potential impacts to archaeological resources.
- In the event that archaeological deposits or human remains are encountered during any ground disturbance associated with the Beaver Dam Mine Site or Haul Road, the Coordinator of Special Places, Nova Scotia Communities, Culture, & Heritage Department must be contacted.

Table 6.15-3 Mitigation for Physical and Cultural Heritage

Project Activity	Mitigation Measures
Construction	Either a program of shovel testing be conducted around the possible cookhouse (Feature 5) or a buffer of 20 metres should be put in place around the feature to protect it from any mining activities.
	A program of archaeological shovel testing will be conducted in advance of any disturbance to Site 6, if development is to occur.
	If any development is to occur within 100 metres of Crusher Lake, intensified reconnaissance should be conducted to identify any additional features.
	If any development is to occur specifically around the historic features (e.g. Feature 4) identified during the 2008, 2014, and/or 2015 and/or 2018 reconnaissance intensified historical research and archaeological shovel testing should be conducted in advance of disturbance.

Project Activity	Mitigation Measures
	Any further changes in the layout of the mine and associated facilities be evaluated as to potential impacts to archaeological resources
Operation	N/A
Decommissioning	N/A

6.15.9 Residual Effects and Significance

The predicted residual environmental effects of Project development and production on physical or cultural heritage resources are assessed to be adverse, but not significant. The overall residual effect of the Project on physical or cultural heritage resources is assessed as not significant after mitigation measures have been implemented.

Table 6.15-4 Residual Environmental Effects for Physical and Cultural Heritage

Project - VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Beaver Dam Mine Site and Haul Road (Identification and/or damage to physical and cultural heritage resources – Site 6)	Evaluate changes to layout for potential impacts to archaeological resources, contact Coordinator of Special Places, Nova Scotia Communities, Culture, & Heritage Department if human remains or archaeological deposits are identified.	A	M Identified features will be avoided with the exception of Site 6	PA Potential to encounter archaeological deposits confined to the PA	N/A	P Effects are permanent	O Effects occur once within the life of the Project	IR VC will not return to baseline conditions	Loss of Resource	Not significant

Legend (refer to Table 5.10-1 for definitions)

Nature of Effect	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
A Adverse	N Negligible	PA Project Area	N/A Not Applicable	ST Short-Term	O Once	R Reversible
P Positive	L Low	LAA Local Assessment Area	A Applicable	MT Medium-Term	S Sporadic	IR Irreversible
	M Moderate	RAA Regional Assessment Area		LT Long-Term	R Regular	
	H High			P Permanent	C Continuous	

A significant adverse environmental effect for Physical and Cultural Heritage has not been predicted for the Project for the following reasons, with consideration of the ecological and social context of the LAA surrounding the Project:

- During Construction: No impacts are predicted based on the studies completed to date, with the exception of the potential loss of Site 6. Appropriate mitigation and evaluation will be completed prior to construction at this location
- During Operations: No impacts are predicted based on the studies completed to date.
- During Closure: No impacts are predicted based on the studies completed to date.

6.15.9.1 Preferred Alternative Haul Road Residual Effects and Significance

Table 6.15-5 Residual Environmental Effects for Physical and Cultural Heritage within the Preferred Alternative Haul Road

Project - VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Preferred Alternative Haul Road (Identification and/or damage to physical and cultural heritage resources – Site 6)	Evaluate changes to layout for potential impacts to archaeological resources, contact Coordinator of Special Places, Nova Scotia Communities, Culture, & Heritage Department if human remains or archaeological deposits are identified.	A	N Identified features will be avoided. Project will not destroy any known archeological artifacts in context of the Special Places Act.	PA Potential to disturb any encountered archaeological deposits confined to the PA	A Seasonal impacts may affect VC	ST Effects are limited to occur from as little as 1 day to 12 months	S Effects occur at irregular intervals throughout the Project	IR VC will not return to baseline conditions	None	Not significant

Legend (refer to Table 5.10-1 for definitions)

Nature of Effect	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
A Adverse	N Negligible	PA Project Area	N/A Not Applicable	ST Short-Term	O Once	R Reversible
P Positive	L Low	LAA Local Assessment Area	A Applicable	MT Medium-Term	S Sporadic	IR Irreversible
	M Moderate	RAA Regional Assessment Area		LT Long-Term	R Regular	PR Partially Reversible
	H High			P Permanent	C Continuous	

Table 6.15-4 was reviewed and it was determined that the construction of the Haul Road was the only VC interactions applicable to physical and cultural heritage within the Preferred Alternative Haul Road. There were no changes in the significance criteria or overall significance for this VC interaction.

Mitigations presented in Table 6.15-3 will be established to reduce the impact of Project activities on physical and cultural heritage.

6.15.10 Proposed Compliance and Effects Monitoring Program

As noted above, there is no determined need for compliance or effects monitoring programs related to physical and cultural heritage.

6.16 Socioeconomic Conditions

6.16.1 Rationale for Valued Component Selection

All phases of the Project will provide employment opportunities for local residents and Indigenous Peoples, as well as provide tax revenue for the municipal, provincial, and federal levels of government. It is anticipated that additional labour force will be required during construction and a smaller, but still significant, labour force will be required during operation - the operational labour force will come directly from the Touquoy Mine with additional trucking contractors required to haul ore between the sites. Indirect employment will be generated by the Project through the use of external contractors and suppliers. Tax revenue in the millions of dollars per year will be generated through corporate income taxes paid by the Proponent, as well as its contractors and suppliers. Emphasis on the local economy may shift slightly from Middle Musquodoboit to Sheet Harbour depending on contract services for mine operation, however the overall regional economy will benefit equally from both sites operating simultaneously.

6.16.2 Baseline Program Methodology

Preliminary research on the socioeconomic conditions for Nova Scotia, and more locally in the Sheet Harbour area was completed. Population and demographics, recreation and tourism, housing, land use, and protected areas, nature reserves, and parks near the Project site were among the socioeconomic conditions considered. Sources including Statistics Canada and Nova Scotia Finance and Treasury Board were accessed to conduct the preliminary research.

6.16.3 Baseline Conditions

6.16.3.1 Nova Scotia Economic Outlook

Economic growth in Nova Scotia has been the slowest of the Canadian provinces for more than 20 years. It is expected that Nova Scotia will see better economic growth over the near term, due in part to gains in export-oriented manufacturing and construction.

Real Gross Domestic Product (GDP) grew by 0.8% in 2015 and forecast to be 0.9% in 2016 and 0.8% in 2017. The nominal GDP growth in 2015 was 2.1% - limited by lower consumer prices; accelerated nominal GDP growth is expected in 2016 (2.5%) and 2017 (2.7%) spurred by several large projects including the shipbuilding program, the Maritime Link, Nova Centre, and offshore exploration. This growth is expected to slow beyond 2017 as some of these projects are concluded. Nova Scotia's GDP can be broken down as follows: production of goods (20%); private sector service (~50%); and, health, education and public administration (~30%). (NSFTB 2016)

Restricted labour force growth and a slowdown in potential output growth will be a result of the wave of retiring baby-boomers and a decrease in the province's population as immigration gains are offset by the aging population. This in turn will translate to financial challenges for government as the aging population limits the provincial revenue base. Inflationary pressures are expected to remain at bay over the long term, given the softer domestic demand. (Conference Board of Canada 2016)

Nova Scotia's unemployment rate is expected to edge slightly lower, due to a shrinking labour force brought about by a declining working age population. Despite negative employment growth in 2016, the unemployment rate has declined slightly (0.2%) since 2015. Net job creation is expected to resume in 2017; however with in-migration, unemployment rates will be modest. The aging of the Nova Scotia's population is increasingly taking a toll on the pool of available labour, although it is expect that his phenomenon will be partly offset by evolving interprovincial migration flows with Alberta (which has been a long-standing drain on the Nova Scotia population) (RBC 2016).

Local Economy

The Project area is located in the Halifax Regional Municipality (HRM) approximately 15 km north of Sheet Harbour on Hwy 224. The area economy is resource based with some services related to that industry stemming mainly from forestry, fishing, and tourism with some mining/quarrying industries. The area has had previous benefit from mining at various locations within 50 km of the site. Sheet Harbour region has a population of about 5,000 people. The Village of Sheet Harbour is a commercial and services centre for the larger region with an accessible regional health care facility and shopping available.

This part of HRM and the adjoining County of Guysborough has the fourth largest proportion of outmigration patterns in Nova Scotia (ACOA 2009).

6.16.3.2 Socio-economic Conditions

Population and demographics

Industries – mainly in the resource sectors - have run through boom and bust cycles over the years. Each cycle attracts new or returning workers but also tends to push workers away when there is a downturn in the economy. This has meant a decline in young families with school age children to support the school system and provide a trained worker base in the community. Youth are leaving the Eastern Shore to seek different experiences and more lucrative and/or longer-term employment opportunities elsewhere in Nova Scotia and Canada.

Census Tract 2050154.04 (CT) includes Sheet Harbour and several surrounding communities including the Beaver Dam area, north and east to the Halifax County boundary. The total population base of this CT was 3,221 in the 2016 Census, a decline of 6.5 % from 2011. In comparison, the population of Nova Scotia increased by 0.2% and HRM increased by 3.3%. The population density in the CT is 1.8 people per square kilometer (73.4 in HRM and 17.4 in NS) (Statistics Canada 2016).

The age distribution in the Sheet Harbour CT indicates an older population with a median age of 54.9, (Nova Scotia – 45.5, HRM – 41.0). In 2016, 16.6% of the population were under the age of 20, and 29.6% of the population was 65 years or older. The male (49.3%) and female (50.7 %) population is nearly equal. The area is predominantly English (first language) speaking (98.3%) (Statistics Canada 2016).

The cultural origins of the area are mainly Canadian/European; 6% identify as First Nations and about 1% are of other origin (Statistics Canada 2016). The population identifies with a Christian religion (89%) with nearly 10% having no religious affiliation (Statistics Canada 2011). The population of this CT remained relatively constant from the 2016 Census with 8% noting having moved within the previous year as compared to 16.8% having moved in the area 5 years previously (Statistics Canada 2016).

Of the population between 25 and 64 years of age, at least 24% have attained a high school diploma only and 48.6% have received a post-secondary education (apprenticeship or trade certificate - 34%, college diploma/university certificate – 50%, university degree (bachelor's or higher) – 19%) (Statistics Canada 2016).

The average full time employment income in 2015 of people 15 years or older $48,177. The average family income is $65,958 (after tax average - $57,205).

Unemployment rates in Eastern Nova Scotia in 2016 averaged 15.2% (range 14.7-16.5%).

Health and Well-Being

The Project site extending from Beaver Dam to Moose River is covered under the Nova Scotia Health Authority, which provides services through community based facilities located at Middle Musquodoboit (Musquodoboit Valley Memorial Hospital (MVMH)) and Sheet Harbour (Eastern Shore Memorial Hospital (ESMH). Both facilities offer a community emergency department (MVMH 8 am – 8pm; ESMH 24 hour) and a variety of other inpatient and outpatient services.

Table 6.16-1 Hospitals offerings services to the PA

Hospital	Services	Beds
Musquodoboit Valley Memorial	Acute Home Nursing Care, Clinical nutrition, Diabetic Clinic and Meals-on-Wheels, Diagnostic services including laboratory, EKG and radiology, Emergency services, Family Practice, Mental Health, Occupational therapy, Outpatient services, Palliative services, Public health, Physiotherapy, Social work,	6
Eastern Shore Memorial	Palliative and Respite Care, Acute Care, Outpatient/Emergency, Ambulatory Care, Diagnostic Imaging, Laboratory Services, Physiotherapy, Occupational Therapy, Clinical Nutrition, Social Services, Adult Day Clinic, Diabetic Clinic, Meals-on-Wheels, Addiction Prevention and Treatment Services, Public Health Home Care Nova Scotia, Nova Scotia Hospital Outreach, IWK Health Centre - Metal Health and Family Services	Not specified

A new elder care facility, Harbourview Lodge Continuing Care Centre, is attached to ESMH. Braeside Nursing Home is located in Middle Musquodoboit. Social services are offered in both centres. Several denominations of churches are found between Sheet Harbour and Middle Musquodoboit.

Public Safety

This part of Halifax Regional Municipality is protected by the Royal Canadian Mounted Police (RCMP), based in Sheet Harbour, and is considered to have a very low crime rate (Greater Halifax Partnership).

The crime rate, including violent crime, property crime and other crime (expressed per 10,000 people), in Halifax County (outside the urban core) is generally half of the corresponding urban Halifax crime rate. The five-year average of total crime incidents is 485 /10,000 in the county. The provincial rate in 2015 was 1172 /10,000 (Statistics Canada 2016). Violent crime has risen but total crime has decreased. There was a double homicide in Sheet Harbour in December 2012 that remains unsolved, and a suspicious death in August 2016.

The Halifax Regional Fire & Emergency Service has fire stations located at Sheet Harbour, Upper Musquodoboit and Middle Musquodoboit that are in close proximity to the Site. They also have several other stations on the Eastern Shore that can be called out depending on the complexity and severity of an incident.

Recreation and Tourism

The project lies in a broad area of diverse landscapes with varying degrees of present day and historical human activities that have modified what we see currently. The land surrounding the project area has typically been used as forest resource management/harvesting and mineral exploration associated with the Beaver Dam deposit and its environs. This activity has opened the area up to the public to be able to access the area by interconnected resource and logging roads that extend between Mooseland Road east to Highway 224 and to Highway 374.

The presence of unauthorized cabins and hunting blinds on private land is a good indicator that the area is used for hunting and fishing activity. The area is open to several seasons of hunting that include deer, bear, snowshoe hare, ruffed grouse, and ring-necked pheasant to name a few. Recreational fishing occurs in areas near the Site. Camp Kidston, which operates only in the summer months, is located 3.5 km northeast (upstream) of the Touquoy Mine Site, and offers swimming, water activities, and canoeing as part of its program. In addition, the camp uses groundwater as a source for public drinking water.

The Snow Mobile Association of Nova Scotia trail system stretches 3,500 km connecting twenty local snowmobile clubs across Nova Scotia. Discussions are underway with local associations, including the Lake Charlotte ATV Association. The network of logging roads in this part of HRM could be used by local residents as trails to access recreational activities such as hunting, fishing, ATVing, motorcross and cross country skiing.

There is no documented, observed or anecdotal evidence that supports recreational swimming in the area of the Beaver Dam Mine Site. There is potential that cabin/householders located on the rivers crossed by the Haul Road could use the rivers for swimming. There are many structures that are built on lands that are not owned by private individuals that appear to be used by multiple parties throughout the region. Scraggy Lake has a number of private land holdings on its shore that have some type of cottage and outbuildings. A total of 12 cottages/camps were noted during a survey in July 2007 a survey of aerial photographs from 2016 did not reveal any additional camps. Scraggy Lake camp owners have seen very limited boating canoe use and mainly in the spring if any as low water levels in the summer present extra challenges for navigability (rocks). Swimming is not a typical activity in Scraggy Lake. The PA does not provide any unique opportunities for recreational activity that cannot be found elsewhere on the Eastern shore of Nova Scotia.

The nearest recreational facility is in Sheet Harbour is the Seaside Fitness Centre, which offers trained staff to assist with fitness goals. The Musquodoboit Valley Bicentennial Theatre & Cultural Centre is a non-profit volunteer-operated organization located in Middle Musquodoboit that operates both as a community centre and as a fully-equipped 230 seat performing arts theatre. Taylor Head, located southwest of Sheet Harbour, is a natural environment, day-use, provincial park that offers 16 km of unspoiled Atlantic coastline.

Receptors in other directions increases in distance up to 18 km over considerable changes in topography and are generally forested. Activities in these areas are ongoing and include recreational use (hunting, ATVs, etc).

First Nations Communities

There are two First Nations (Mi'kmaq) reserves in the area of the Project. Beaver Lake IR 17 and Sheet Harbour IR 36. Both of these communities are part of Millbrook First Nation and are discussed in more detail in Section 6.14.3. First Nations communities rely primarily on the fishing industry as a source of income, as is the case with the Millbrook First Nation, but Millbrook in particular has significant economic interests and successful businesses in and around the primary community of Millbrook. Mi'kmaq residents in the area would support and benefit from the availability of new job and economic opportunities.

6.16.3.3 Infrastructure

Housing

The total number of occupied dwellings in the Census Tract (2050154.04) in 2016 was 1,455. The majority (86%) of these are single detached homes that were owned by respondents (14% were rented or Community housing (<1%)). The homes (83%) were occupied by primary maintainers over the age of 45 and 79% of homeowners or tenants spend less than 30% of their income on shelter related expenses (average $592 / month). The average value of dwellings in 2016 is $151,521 (Statistics Canada 2016)

Temporary Housing

There are several Bed & Breakfast (2), motels (3) and campgrounds (2) in the Sheet Harbour area that cater to both tourist and business traffic. Most are seasonal operations (May to October) but some offer service outside of the tourist season.

Water, Wastewater and Solid Waste Management

Water supply in the region is by drilled or dug well. Wastewater is managed through individual septic fields. Solid waste management is handled by the municipality in the form of weekly garbage and recyclable collection. Waste transfer stations are located at Middle Musquodoboit and Sheet Harbour and solid waste is disposed of at the Otter Lake Waste Processing and Disposal Facility.

A water supply survey was conducted in Sheet Harbour in 2006 to determine if there was a need or desire for a central water supply. Those locations on drilled wells had little to no bacteria but reported high mineral content, while those on dug wells had higher bacteria and few complaints of mineral content. While nearly 97% surveyed felt a central supply would benefit the community, only 85% said they would support it at minimal cost per household. No water supply has been built to date.

The nearest known domestic well is 5.5 km southwest from and down-gradient of the Mine Site, at a residence along Hwy 224. Water sourced from wells will be treated as required for use at the washhouse and for potable water supply. Recreational water quality may be impacted by sediment loading, as discussed in Section 6.7. In addition, homes, seasonal cottages / camps, and campgrounds may be impacted by project development and operation, such as Camp Kidston, located approximately 20 km west of the Beaver Dam Mine Site (and 3.4 km north of Touquoy), which uses groundwater as a source for public drinking water, and offers recreational boating, swimming, and fishing on Long Lake.

6.16.3.4 Land and Resource Use

Existing Land Use

The Beaver Dam Mine Site is located in the Halifax Regional Municipality approximately 20 km northeast of Sheet Harbour and 7 km east of Highway 224 in Marinette. The surrounding area is undeveloped land that has had resource use (forestry, mining) for a century or more. The property is accessed by the Beaver Dam Mines Rd that is classed as a public right of way up to the Mine Site. Beyond that point, roads are private resource roads developed by forestry companies to access the interior areas of the region. The network of roads is extensive and provides access to the public for recreational activity, namely for hunting, fishing, and ATV use. There is one permanent resident on Beaver Dam Mines Rd., located close to the intersection of Beaver Dam Mines Rd. and Highway 224. The next nearest resident to the Mine Site, is more than 5 km to the west.

The Haul Road labeled as the Moose River Cross Rd is located through an area of managed forest by several forest companies and is part of a warren of logging roads. This road connects Highway 224 and Mooseland Road. There are no residences along this road; however, several seasonal properties are located in the vicinity of the road, near the western terminus with Mooseland Rd. This area also sees public use for access to hunting, fishing, and ATV activity.

Land Ownership and Tenure

The Mine Site is located on land predominantly owned by Northern Timber Nova Scotia Limited (8 parcels) and the Province of Nova Scotia (one parcel). Northern Timber also owns lands adjacent to the Beaver Dam Mines Rd, a Crown-owned public right-of-way. One parcel of Crown land is adjacent to this road.

The Haul Road is a private logging road owned by the various landowners that include Northern Timber and the Province, and for the last 1.5 km owned by Musquodoboit Lumber Co. and Prest Bros. Ltd.

The Beaver Dam Mine Site and Touquoy Mine Site are located in the Musquodoboit Valley and Dutch Settlement Plan Area. The Land Use By-law and Municipal Planning Strategy for this area were last amended in October 2014. The area is zoned mixed use and extractive facilities, of which mining related infrastructure is one, are permitted within this zoning designation. The by-law for mixed-use land use prescribes minimum separation distances from features such as lot lines, dwellings, watercourses, domestic wells, and residential zones. The physical activity of mining or extraction is not specified in the by-law as it is governed in the provincial and federal regulatory regime (pers. comm. L. Walsh 2016).

The majority of the Haul Road is located in the Eastern Shore (East) Plan Area, while a minor portion is located in the Musquodoboit Valley and Dutch Settlement Plan Area. The area is zoned mixed use under the Musquodoboit Valley and Dutch Settlement Land Use By-law, and rural resource under the Eastern Shore (East) Land Use By-law. Haul roads are not specified in either by-law as these are governed in the provincial regulatory regime (pers. comm. L. Walsh 2016).

First Nation Land and Resource Use

The Confederacy of Mainland Mi'kmaq completed a MEKS for the Project in 2015, which is provided in Appendix N.1 and discussed in detail in Section 6.14. Based on the information compiled through the MEKS and findings during site visits, discussions with M'kmaq communities, information from secondary sources and historical use of the area, it is concluded that there is likely a moderate Mi'kmaq use of the

Project site for subsistence harvesting of food, medical plants or furbearing animals. It is known that areas to the west of the site have traditionally been used for these and ceremonial (burial) activities.

The Mi'kmaq community continues to harvest plant species throughout Nova Scotia and the area around the Beaver Dam Mine Site is no exception. Harvesting of trees and plants such as maple, ash, and birch for tools and crafts continue wherever these resources are known to occur. This is also true for blueberries, cranberries, strawberries, and fox berries. The MEKS also noted that several species of medicinal plants continue to be collected in the region.

Protected Areas, Nature Reserves, and Parks

Several databases maintained by NSL&F and NSE, including the Restricted and Limited Land Use database and the more recent (December 2015) assignment of protected lands to Wilderness Areas, Provincial Parks and Nature Reserves indicated areas in proximity to the proposed Project:

- Tait Lake Nature Reserve (~~1.6 km~~ 1.0 km north of mine);
- Cowan Brook Nature Reserve (9.5 km south of Touquoy Mine Site);
- Twelve Mile Stream Wilderness Areas (4 parcels – closest is ~~5.2 km~~ 4.5 km northeast of Beaver Dam Mine Site);
- Liscomb Game Sanctuary (no restrictions to mining – 7.3 km east of ~~site~~ Beaver Dam Mine Site);
- Tangier Grand Lake Wilderness Area (2.2 km south of intersection of Moos River Cross Road and Mooseland Road);
- Ship Harbour Long Lake Wilderness Area (west and adjacent to Mooseland Rd, south of Touquoy Mine Site);
- Middle Musquodoboit Natural Water Supply Area (9 km north of Beaver Dam mine, 6.3 km north of Touquoy Mine Site); and
- Significant Habitats within the Provincial Landscape Viewer (NSDNR 2015) are identified as:
    - Mainland Moose Concentration Area (entire Project Area);
    - Deer wintering Areas (~~9 km~~ 6.8 km west of Beaver Dam Mine Site);
    - Areas with Species of Concern (~~5.2 east~~ 4.5 km northeast of Beaver Dam mine~~; 3.2 km and 8.9 km~~ 1.8 km and 7.5 km northeast of Touquoy; immediately south and adjacent to Touquoy Mine Site;

These protected areas and areas of significant habitat features are shown on Figure 6.16-1.

6.16.3.5 **Tourism and Recreation**

Other than those areas and activities described above there are no designated Tourist or recreational areas within 20 km of the Mine Site.

Hunting and fishing are popular activities in rural Nova Scotia. Hunting includes large game such as white tail deer and bear. Smaller species may also be hunted and or trapped in the region – hare, fox, bobcat, beaver, etc. Moose hunting is prohibited on the mainland. The Nova Scotia Salmon Association (NSSA) monitors the Killag River where most of the salmon spawning occurs in the West River Sheet Harbour system. Other species that may be fished are species of trout (NSSA 2015). The exact area of monitoring is not indicated by NSSA.

The closest recreational facility is located in Sheet Harbour, which provides programs in sport/fitness, wellness and general interest. The Halifax County Exhibition is an annual event that occurs at Middle Musquodoboit.

6.16.3.6 Natural Resource Use

Natural resources include forestry, mining, and water. As previously stated, the region of the Project has had considerable activity related to forest harvesting activities and locally from mineral exploration and mining activities extending more than 100 years. There is no water use for any purpose currently. Historically, a flume was known to have been used from Crusher Lake to power mills for forest and mining activity.

6.16.3.7 Traffic

Public sources of data for traffic are available and were used to the greatest extent possible. Observations made by the project team through the course of EBS work from 2015 to present indicate that there is great variability in numbers and frequency on the public (e.g. Highway #224) and the local roads (e.g. Beaver Dam Mines Road). Records of traffic over a nine-year period (2004-2014 -the current data set available) show annual average daily traffic on Hwy 224 between Beaver Dam Mines Road., and Pleasant Valley Road to range between 150 to 340 vehicles per day. Beaver Dam Mines Road is used as a resource road and no traffic counts are publicly available and no baseline studies were completed for this aspect; however, it is estimated at approximately 10 vehicles per day. Based on observations, the traffic and vehicle types on the Beaver Dam Mines Road is dependent on activities taking place/time of year. Increased local traffic was more evident during hunting season in the fall/winter and lower during spring thaw when road conditions were poor.

The Haul Road (sometimes locally referred to as the Cross Road) connects Hwy 224 and Mooseland Road. Currently, local traffic from a few seasonal properties and recreational use the Haul Road path. In the past (not observed during baseline studies) it is reported that the Haul Road will have intermittent high use periods (up to 100 truck trips per day) associated with haul trucks and forestry worker trucks from logging activities utilizing the Haul Road. The average daily traffic when forestry operations are not occurring is estimated to be approximately 10 vehicles per day. The road is unmaintained and may not be accessible by trucks or other road legal vehicles for much of the winter and parts of the spring. Snowmobile and 4-wheeler use was difficult to determine from public records, public consultation, and Mi'kmaq engagement.

The remaining portion of the ore haul route along the Mooseland Road to the Touquoy Mine Site is on a public road with little available public information on traffic. The Touquoy Mine Site is operational and thus traffic now consists of local residents, service vehicles and mine workers forming the new baseline. Data is not available from NSTIR on this route but based on observation is in the same range as traffic (types , count and frequency) as on Highway #224. The data for the #224 has therefore been used in the assessment of this portion of the haul route.

Table 6.16-2 Highway 224 Section 025 Beaver Dam Mines Road (Marinette) to Pleasant Valley Road Traffic Count

Start Date	Location Description for Count	Group	Type	% TRK	Average Daily Traffic	Average Annual Daily Traffic	Direction
June 27, 2007	1 km West of Fisher Lake Road (Westbound)	A	VC	:8	168	150	W
June 27, 2007	1 km West of Fisher Lake Road (Eastbound)	A	VC	:3	169	150	E
November 12, 2009	1 km West of Fisher Lake Road	A	TC		336	340	
October 17, 2011	1 km West of Fisher Lake Road	A	TC		295	290	
November 22, 2012	1 km West of Fisher Lake Road	A	TC		254	370	
September 3, 2013	1 km West of Fisher Lake Road	A	VC	:1	386	340	

Project Duration Changes

The anticipated 246 person workforce at the Beaver Dam Mine Site will include approximately 105 mine personnel (working two or three shifts per day of 12 or 8 hours respectively, or approximately 26 persons per shift (includes 26 on leave at any time). The workforce also includes 60 haul truck drivers, 12 general and administrative staff (for the Beaver Dam Mine Site only). An allowance of 10 days per year of no mine production has been assumed to allow for adverse weather conditions. No group transportation to the mine site or on-site lodging are anticipated at this time so long as the local labour pool can supply the necessary labour requirements.

The maximum anticipated daily volume on the Highway #224 and Beaver Dam Mines Road associated with the Beaver Dam Project would therefore be 175 (passenger and service vehicles). In reality, based on use of the Haul Road, intermittent service vehicle schedules and car-pooling, the number on #224 could be reduced by 50% to around 85-90 per day over a 24 hour period or roughly 4 per hour on the #224. For staff and service vehicles this increase may come from the north or south depending on the current or planned residences of workers and the direction from which deliveries are made. During construction, Highway #224 will likely be used to transport equipment from Touquoy Mine Site to/from Sheet Harbour to Beaver Dam but the frequency and volume is not determined. Highway #7 to the Mooseland Road is available as an east-west then north route option to the Touquoy Mine Site as well thereby reducing the number on the #224.

Traffic on Highway #224 will therefore remain within the traffic count ranges as provided by NSTIR. Highway #224 will be crossed at Beaver Dam Mines Road, south of Beaver Lake IR, by the project related trucks transporting ore to the processing facility but will not travel north or south on the #224 and therefore not add to the overall traffic count on that highway corridor. Project and service vehicles will also use the Haul Road and Highway #224.

The Haul Road portion from the Mooseland Road to Touquoy Mine Site will have an increase in traffic by project trucks transporting ore to the Touquoy Mine Site and addition of project related staff vehicles and possibly service vehicles. Traffic volumes on those existing roads are unknown and variable both seasonally and annually. Project activities will increase the traffic levels by an average 20 trucks per day for 12-16 hours a day during the operational phase of the project, (an annual average of approx. 185 return truck trips per day). As noted above the baseline for this portion of the ore Haul Road has been assumed to be in the range for Highway #224 and therefore the project related traffic increase should be within the existing range based on published data (150 to 340 per day).

Foreseeable Projects

Cochrane Hill Gold Project – No project related changes to traffic volumes or frequency on Highway #224 are anticipated due to the location of Cochrane Hill being of some distance from Beaver Dam. That project would be accessed by staff and service vehicles via Highway #7, #347 and #348.

Fifteen Mile Stream Gold Project – No project related changes to traffic volumes or frequency on Highway #224 are anticipated as that project would be accessed by staff and service vehicles via Highway #7 and #374.

Dexter Quarry – No project related changes to traffic volumes or frequency on Highway #224 are anticipated as the majority of the aggregate would be moved along Highway #7.

6.16.4 Viewshed Analysis

Three maps are presented showing the visual impact of the site from Beaver Lake IR 17. Three Observers (person 1.70 m tall) are positioned in a canoe in Lower Beaver Lake (0.8 m height), standing on the roof of home (5.0 m above ground), and at the stockpile location. The analysis is done on three conditions - existing condition (Figure 6.16-2), full mine operation (Figure 6.16-3), and 12 years post reclamation (Figure 6.16-4). The terrain model takes into account the regional topography, study area topography, and site topography (full mine operation and post reclamation). It is considered that in the decommissioning phase the beginning of the phase will be the same as full operation.

An observer in a canoe on the western side of Lower Beaver Lake has a view of the Lake and near shore areas in the direction of the Mine Site. A rise in topography, high forest canopy and distance are effect mitigation for screening the Mine form site to this observer. The analysis shows that an Observer standing on the roof of a residence in all three phases can only see in the direction of Beaver Lake a short distance, since the view towards the Mine Site is obscured by trees – one can assume that this forest screening will be equally effect from an observer standing on the ground. During full operation, an observer on the stockpile has a commanding view but sees only of treetops over the landscape in the direction of Beaver Lake IR. The post reclamation analysis, assumes forest growth of 3 m after 12 years and the view from the stockpile is obscured by vegetation. If the vegetation does not grow to this height the same effect as shown in full operation analysis is assumed and thus the stockpiles will not be visible by Observer 1 and 2.

A topographic profile showing bare ground and forest canopy elevations with fully developed mine are shown in Figure 6.16-5. The profile line extends form Lower Beaver Lake to Cameron Flowage. The Line is depicted graphically with a vertical exaggeration of 2x to show detail. A sight line analysis was conducted with an observer located on Lower Beaver Lake. It confirms that, with the current condition of the forest canopy between Beaver Lake and the Mine, the stockpiles are not visible from the Lake. In the unlikely event that all the trees are removed over the 5.5 km between Beaver Lake and the Mine, then an observer on the lake or at a residence at Beaver Lake IR could see the Stockpile; however, given that distance, the visual effect would be minimal.

The topographic map and profile, supported by results of the viewshed analysis provided above, show that Waste Rock Storage pile to be seen in a straight-line from Beaver Lake IR; however, the viewshed analysis shows that the view is obscured given the current forested screening between the IR and the Mine.

The Beaver Dam Mine and Touquoy Mines will re-fill with water after ore and mining equipment has been removed (mobile equipment, pumps, signage, etc.) from the excavated area. The Groundwater and Surface Water Sections (Section 6.6 and 6.7) discuss the pit re-filling timeframe estimates and the associated water quality predictions for both sites. The Proponent's staff and consultants fielded questions and comments during both the public and Mi'kmaq consultation sessions as well as regulator discussions about what the final shorelines would look like at both facilities. The geology around the final pit perimeters are such that a variety of shoreline features will be present including exposed bedrock, till and organic soils with root mass before refilling begins. Shoreline development efforts will be completed as part of reclamation in order to create areas where aquatic plants (e.g. broad-leaved cattail) and typical shoreline plant assemblages (e.g. lambskill, Labrador tea, leatherleaf) will re-colonize. Visually the lake will, over time, look like any other natural lake in Nova Scotia with exposed rock, soils, and areas with low slope entry to the water with plant assemblages in and around the lake that flourish in these habitats

The Proponent is committed by legislation to reclamation planning that is focused on safety and creating safe, stable and vegetated landscapes in keeping with the surrounding natural areas that the sites exist in. the Proponent also has publicly stated the desire to continue to engage the public and Mi'kmaq in reclamation planning through the CLC and input sessions/workshops nearer to the time of reclamation. These sessions are typically the time to discuss site-specific reclamation objectives such as plant types, the degree to which recreational use features such as trails, boat launches, docks, and interpretive panels will be incorporated into the final reclamation plan.

The reclamation planning phase presents opportunities for involvement for a number of groups including public, community, Mi'kmaq, academic institutions, environmental groups and others. Additional opportunities exist during actual reclamation activities for earthworks, shoreline development, revegetation programs, habitat development and restoration) reclamation involvement, employment, research and long term monitoring programs.

6.16.5 Consideration of Consultation and Engagement Results

Issues raised during public consultation and Mi'kmaq engagement relating to ~~human health and~~ socio-economic considerations include potential adverse effects associated with potential effects to natural environments (e.g., surface water, groundwater, air emissions, etc.) during planned Project activities and unplanned accidents and malfunctions, such as traffic accidents. Questions on access to land and changes to land use were noted by members of the public and landowners, as well as the Mi'kmaq of Nova Scotia in terms of access to traditional land and resources. Maintenance of existing access for recreation, such as ATV, fishing, etc., was also identified as an issue. Volume of trucks on existing public roads was expressed as a key concern in terms of safety and road condition. Members of the public and Mi'kmaq community members expressed interest in employment and economic development opportunities associated with the Beaver Dam Mine Project.

The results of the public consultation and Mi'kmaq engagement have been considered in the environmental effects assessment, including the Proponent's commitments to include the Mi'kmaq in the development and implementation of mitigation and monitoring measures and proposed compliance and effects monitoring programs, as well as the Proponent's broader commitment to ongoing public consultation and Mi'kmaq engagement. Specific to evaluating the effect on ~~human health and~~ socio-economic considerations, these are found within the following environmental effects assessment.

6.16.6 Effects Assessment Methodology

6.16.6.1 Boundaries

Spatial Boundaries

Since the Project site is remote, the spatial boundary for assessment of potential impacts to the local economy extends beyond the footprint of the Project, and are classified as PA, LAA, and RAA. Since there is no opportunity for the purchase or exchange of goods and services within that footprint. The LAA spatial boundary, extends to parts of Halifax County, Colchester County, and Guysborough County, Nova Scotia. This boundary captures all economic exchange and movement connected to project-related employment and trades in goods and services based on population density and proximity to the project (Figure 6.16-6).

The RAA encompasses all of Nova Scotia. This boundary captures all potential socioeconomic considerations from this project relating to the province of Nova Scotia (Figure 6.16-6).

As the Project has the potential to cause direct and indirect effects to socioeconomic considerations beyond the footprint of the Project, the LAA and RAA are the most appropriate spatial boundaries, respectively.

Temporal Boundaries

The Project has three distinct phases - Construction (I year), Operation (3-4 years) and Reclamation (2-3 years) - that define the temporal boundary for assessment of impacts on the socio-economic components of the Project. The maximum Project life is 8 years.

Technical Boundaries

Economic effects potential is a qualitative assessment based on a comparison of the relative scale of predicted Project-related employment levels (person-hours; wages) with existing employment opportunities within the HRM, especially the area between Middle Musquodoboit and Sheet Harbour. Statistical data is used where available for these VCs.

Administrative Boundaries

The Nova Scotia *Municipal Government Act* (1998 c.18 s.1) empowers the Halifax Regional Municipality to enact and enforce a Municipal Planning Strategy (HRM MPS 2014) that describes Halifax's approach to planning within its jurisdiction. The MPS outlines criteria for Council and planning staff to consider when evaluating development proposals and issuing development permits. Together with the Land Use Bylaw and Subdivision Bylaw, the MPS controls future land use and development in the Municipality. Recreational activities, such as hunting and fishing are regulated by the Province of Nova Scotia under the *Wildlife Act* and for hunting migratory birds by federal authority under the *Migratory Birds Convention Act*, 1994 and *Migratory Birds Regulations*

6.16.6.2 Thresholds for Determination of Significance

A significant positive effect of the Project is a long-term employment gain and/or sustained economic activity within the Study Area; whereas long term decreases in economic activity or employment opportunities within the Study Area could be a significant adverse Project effect on the Local Economy.

Enhanced cultural or economic value of land to the community that is consistent with the regulatory planning process is a positive effect of the Project. Within the Study Area, there is no pervasive change in land use patterns that would adversely affect a community's use of that land. Use of land that is inconsistent with a designated land use established through a municipal planning process is a significant adverse effect on Land and Resource Use.

6.16.7 Project Activities and Socioeconomic Interactions and Effects

Potential interactions between Project activities and Socio-economic Conditions are outlined in Tables 6.16-3 to 6.16-5 below

Table 6.16-3 Potential Interactions with Project Activities and Socio-Economic Conditions at Beaver Dam Mine Site

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Drilling and rock blasting in preparation of construction • Topsoil, till and waste rock transport and storage from site preparation • Wetland and watercourse alteration • Mine Site road construction • Surface infrastructure installation and construction • Collection and settling pond construction • ~~Accidents and malfunctions to include fuel and other spills, forest fires, slope failure, collection/settling pond failure, an unplanned explosive event, and mobile equipment accidents~~
Operation and Maintenance	3-4 years	• Rock blasting to access and extract ore • Surface water management • Petroleum products management • Site maintenance and repairs • ~~Environmental monitoring~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, slope failure, collection/settling pond failure, an unplanned explosive event, and mobile equipment accidents~~
Decommissioning and Reclamation	1-2 years	• Infrastructure demolition • Site reclamation • ~~Environmental monitoring~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and mobile equipment accidents~~

Table 6.16-4 Potential Interactions with Project Activities and Socio-Economic Conditions along Haul Road

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Rock blasting in preparation of construction • Till and waste rock from site preparation transport and storage • Watercourse and wetland alteration • Haul road construction and upgrades • ~~Environmental monitoring~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and a haul truck accident~~
Operation and Maintenance	3-4 years	• Ore transport along Haul Road • Haul road maintenance and repairs • ~~Environmental monitoring~~ • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and a haul truck accident~~
Decommissioning and Reclamation		N/A[1]

[1] *Decommissioning and Reclamation of the Haul Road is not expected. The Haul Road will be returned to owner for forestry industry*

Table 6.16-5 Potential Interactions with Project Activities ~~and Human Health~~ and Socio-Economic Conditions at the Touquoy Mine Site

Project Phase	Duration	Relevant Project Activity
Site Preparation and Construction	1 year	• Tailings pipeline, make-up water pipeline alteration, and relocation of reclaim infrastructure • ~~Accidents and malfunctions to include fuel and other spills, forest fires, and mobile equipment accidents~~
Operation and Maintenance	3-4 years	• ~~Environmental monitoring~~ • ~~Accidents and malfunctions to include fuel and other spills or unplanned releases, forest fires, and mobile equipment accidents~~
Decommissioning and Reclamation	1-2 years	• ~~Environmental monitoring~~ • ~~Accidents and malfunctions to include fuel and other spills or unplanned releases, forest fires, and mobile equipment accidents~~

Positive socio-economic impacts are associated with the Project, including long-term employment gain and/or sustained activity within the area. All phases of the Project will provide employment opportunities for local residents and Indigenous Peoples, as well as provide tax revenue for the municipal, provincial, and federal levels of government. It is anticipated that additional labour force will be required during construction and a smaller, but still significant, labour force will be required during operation.

Indirect employment will be generated by the Project through the use of external contractors and suppliers. Emphasis on the local economy may shift slightly from Middle Musquodoboit to Sheet Harbour depending on contract services for mine operation, however the overall regional economy will benefit equally from both sites operating simultaneously.

The construction of a new portion of road and upgrades to existing roads will provide local residents and recreational users improved access to the interior areas of the region.

There is low potential for the Project to cause adverse socio-economic conditions. The potential does exist for a mobile equipment accident along the Haul Road. Haul trucks will travel daily from the Beaver Dam Mine Site to the Touquoy Mine Site. The number of return truck trips per day will be an annual average of approximately 185 (370 one-way trips) for 12 or 16 hours per day, 350 days per year for the duration of the mine Project (3.3 years). During construction and pre-production (8 months), the number of trips will be less. The Haul Road will be dual lane and designed to facilitate the safe passage of two-way truck traffic at 70 km/h. Speed limit and right-of-way signage will be installed and all haul truck operators will receive operator training to minimize the risk of haul truck collisions. All intersections will be designed to NSTIR Standards. A haul truck accident may result in fuel and/or other spills, fires, and/or injury or death to site workers and the general public. Discussions with NSTIR will identify additional mitigation measures that may be required, in particular at the Hwy 224 crossing.

The Proponent is not aware of any federal decision that could affect the socio-economic conditions of non-Aboriginal peoples.

6.16.7.1 Touquoy Mine Site

The Touquoy facility is currently operational ~~under construction~~. There are no effects to socio-economic conditions anticipated to be caused by the processing of ore and the management of tailings (exhausted pit) from the Beaver Dam Mine Project. The primary effect of the continued use of the Touquoy facility on socio-economic conditions is the provision of employment for an additional four years in the processing facility.

6.16.8 Preferred Alternative Haul Road

6.16.8.1 Rationale for Valued Component Selection

The rationale for the selection of socioeconomic VC for the Preferred Alternative Haul Road is the same as presented in Section 6.16.1.

6.16.8.2 Baseline Program Methodology

The baseline methodology for socioeconomic analysis of the Preferred Alternative Haul Road is the same as presented in Section 6.16.2.

6.16.8.3 Baseline Conditions

The baseline socioeconomic conditions of the Preferred Alternative Haul Road is the same as presented in Sections 6.16.3 and 6.16.4.

6.16.8.4 Consideration of Consultation and Engagement Results

The Preferred Alternative Haul Road is the result of consultation and engagement on the primary Haul Road. The alternative Haul Road is further from human receptors located on the "Moose River Cross Road" so-called and form residents located on the Mooseland Road.

6.16.8.5 Effects Assessment Methodology

The effects assessment methodology of the Preferred Alternative Haul Road is as presented in Section 6.16.7. The spatial boundary of the PA for the alternative route is confined only to this segment and assessed independently of the primary route. The LAA and RAA remain the same as indicated in Section 6.16.6.1.

6.16.8.5.1 Thresholds for Determination of Significance

The thresholds for determination of significance regarding socioeconomic conditions within the Preferred Alternative Haul Road are identical to the thresholds for determination of significance for this VC throughout the entire PA, as presented within Section 6.16.6.2.

6.16.8.6 Project Activities and Socioeconomic Interactions and Effects

Potential interactions between Project activities and Socio-economic Conditions are outlined in Tables 6.16-1 to 6.16-3 located in Section 6.16.8.

6.16.9 Mitigation ~~and Monitoring~~

Recreational activities that currently occur within the spatial boundaries of the Project, such as hunting and fishing, will, for safety reasons, be restricted during construction and operation. Recreational users will be notified of restricted access by signage at the entrance to the Mine Site. Site restrictions will be within Project Area and within fly rock management area during blasting activities only. Liaison with local recreational groups, such as ATV associations, will be undertaken. Other recreational opportunities exist near the Project site, therefore, impacts caused by lack of use are considered to be an inconvenience but is not likely to be significant. Access to areas beyond the Mine Site will be developed in discussion with the property owner.

A potential adverse effect on socio-economic conditions is related to a risk for mobile vehicle accidents along the Haul Road, in particular at the Hwy 224 crossing. Speed limit and right-of-way signage will be installed, and all haul truck operators will receive operator training to minimize the risk of collisions. Intersection requirements and additional mitigation measures will be determined through discussions with NSTIR.

Table 6.16-6 Mitigation Program for Socio-economic Considerations

Project Activity	Mitigation Measures
Site Preparation and Construction	• Restriction of recreational activities within the spatial boundaries of the Project. Notification will be provided by signage. • Liaison with any local recreation groups, such as ATV associations
	• Equipment maintenance • Reduction of mobile equipment accident risk through discussions with NSTIR, appropriate signage, and operator training

Project Activity	Mitigation Measures
Operation	• Restriction of recreational activities within the spatial boundaries of the Project. Notification will be provided by signage. • Liaison with any local recreation groups, such as ATV associations
	• Equipment maintenance • Limiting haul truck operational hours to 12 to 16 hours per day • Reduction of mobile equipment accident risk through discussions with NSTIR, appropriate signage, and operator training
Decommissioning and Reclamation	N/A

6.16.10 Residual Effects and Significance

There are no significant adverse environmental effects anticipated on socio-economic conditions, once mitigation measures are applied. Positive impacts are anticipated in the form of direct and indirect employment, and tax revenues for municipal, provincial, and federal governments. Additionally, improvements to local roads will be completed as part of the Project, which will provide improved access to the region's interior.

Table 6.16-7 Residual Environmental Effects for Socioeconomic Conditions

Project - VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Beaver Dam Mine Site and Haul Road (Interior road network upgrades)	N/A	P	M Moderate change from baseline conditions	PA Road network upgrades confined to the Beaver Dam Mine Site	N/A VC is not expected to be affected by timing	P Permanent upgrade to road network	O Effects occur once during the construction phase	IR Upgrade to road network are permanent	Upgrade to interior road network	Not significant
Construction, Operational, and Reclamation – Beaver Dam Mine Site and Haul Road (Direct and indirect employment opportunities)	N/A	P	M Moderate change from baseline conditions	RAA Employment benefits may extend beyond the LAA	N/A VC is not expected to be affected by timing	LT Effects may extend beyond 3 years	C Effects occur continuously throughout the Project	R VC will return to baseline conditions	Employment opportunities	Not significant
Construction and Operational – Beaver Dam Mine Site and Haul Road (Restriction of recreational activities within the PA, haul truck activity, potential mobile equipment accidents)	Communicate with local recreational groups, regular equipment maintenance, operator training and proper signage at intersections to inform public and reduce accidents.	A	L Minor change from baseline conditions	PA Potential adverse effects confined to the PA	N/A VC is not expected to be affected by timing	LT Effects may extend beyond 3 years	C Effects occur continuously throughout the Project	R VC will return to baseline conditions	Disturbance to recreational usage of site	Not significant

Legend (refer to Table 5.10-1 for definitions)

Nature of Effect	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
A Adverse	N Negligible	PA Project Area	N/A Not Applicable	ST Short-Term	O Once	R Reversible
P Positive	L Low	LAA Local Assessment Area	A Applicable	MT Medium-Term	S Sporadic	IR Irreversible
	M Moderate	RAA Regional Assessment Area		LT Long-Term	R Regular	
	H High			P Permanent	C Continuous	

A significant adverse environmental effect for Socio-economic Conditions has not been predicted for the Project for the following reasons, with consideration of the ecological and social context of the LAA surrounding the Project:

- During Construction: Changes occur but are similar to those that have occurred or will occur in other areas of the LAA and in line with the ecological and social context of the LAA surrounding the Project.
- During Operations: Changes occur but are similar to those that have occurred or will occur that in other areas of the LAA and in line with the ecological and social context of the LAA surrounding the Project.
- During Closure: Changes occur but are similar to those that have occurred or will occur that in other areas of the LAA and in line with the ecological and social context of the LAA surrounding the Project.

6.16.10.1 Preferred Alternative Haul Road Residual Effects and Significance

Table 6.16-8 Residual Environmental Effects for Socioeconomic conditions within the Preferred Alternative Haul Road

Project - VC Interactions	Mitigation and Compensation Measures	Nature of Effect	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Preferred Alternative Haul Road (Interior road network upgrades)	N/A	P	M Moderate change from baseline conditions	PA Road network upgrades confined to the Beaver Dam Mine Site	N/A VC is not expected to be affected by timing	P Permanent upgrade to road network	O Effects occur once during the construction phase	IR Upgrade to road network are permanent	Upgrade to interior road network	Significant
Construction and Operational - Preferred Alternative Haul Road (Direct and indirect employment opportunities)	N/A	P	M Moderate change from baseline conditions	RAA Employment benefits may extend beyond the LAA	N/A VC is not expected to be affected by timing	LT Effects may extend beyond 3 years	C Effects occur continuously throughout the Project	R VC will return to baseline conditions	Employment opportunities	Significant
Construction and Operational – Preferred Alternative Haul Road (Restriction of recreational activities within the PA, haul truck activity, potential mobile equipment accidents)	Communicate with local recreational groups, regular equipment maintenance, operator training and proper signage at intersections to inform public and reduce accidents.	A	L Minor change from baseline conditions	PA Potential adverse effects confined to the PA	N/A VC is not expected to be affected by timing	LT Effects may extend beyond 3 years	C Effects occur continuously throughout the Project	R VC will return to baseline conditions	Disturbance to recreational usage of site	Not significant

Legend (refer to Table 5.10-1 for definitions)

Nature of Effect	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
A Adverse	N Negligible	PA Project Area	N/A Not Applicable	ST Short-Term	O Once	R Reversible
P Positive	L Low	LAA Local Assessment Area	A Applicable	MT Medium-Term	S Sporadic	IR Irreversible
	M Moderate	RAA Regional Assessment Area		LT Long-Term	R Regular	PR Partially Reversible
	H High			P Permanent	C Continuous	

Table 6.16-6 was reviewed and it was determined that the three VC interactions specific to the Haul Road are applicable to socioeconomic conditions for the Preferred Alternative Haul Road. There were no changes in the significance criteria or overall significance for these VC interactions.

Mitigations presented in Table 6.16-6 will be established to reduce the impact of Project activities on socioeconomic conditions.

6.16.11 Proposed Compliance and Effects Monitoring Program

As noted above there is no determined need for compliance or effects monitoring programs related to socio-economic impacts. No follow-up monitoring will be undertaken with respect to the effect of the Project on the local economy.

6.17 Assessment of Valued Components within Federal Jurisdiction

6.17.1 Environmental Effects within Federal Jurisdiction

This section summarizes those changes to the environment that may be caused by a Project on environmental components listed in paragraph 5(1)(a) of CEAA 2012. This includes fish and fish habitat as defined in the *Fisheries Act*, migratory birds as defined in the *Migratory Birds Convention Act, 1994,* and species designated by the *Species at Risk Act.* These VCs have been discussed in greater detail in the Sections above (in particular Sections 6.6, 6.9, and 6.10) and are summarized below. However, it is not anticipated that changes to the environment arising as a result of a federal decision will affect migratory birds or species at risk. It has been determined that fish and fish habitat as defined in the *Fisheries Act* is the only project component for which a federal authorization/decision may be required. This is discussed in greater detail in the following sections.

Fish and Fish Habitat

Development of the mine will cause direct impacts to fish and fish habitat mostly within the construction phase of the Project during clearing, grubbing, blasting and development of the mine and open pit and its associated infrastructure. Continuing impacts to fish and fish habitat are possible during operations of the mine from on-going dewatering efforts within the open pit, and potential siltation and release of substances to downstream receiving surface water systems adjacent to the mine infrastructure.

Construction of the Haul Road may cause impacts to fish and fish habitat mostly within the construction phase of the Project during clearing, grubbing and construction of new road components and road widening where necessary. During construction, positive direct impacts to fish and fish habitat are also expected where current culverts that are hung or crushed can be either replaced or removed and fish passage and habitat re-established.

Further work to understand potential fish habitat and fish presence at specific alteration locations will be required to support surface water permitting (wetlands and watercourse alteration). Mitigation will be implemented to reduce the potential for direct fish mortality where fish were observed through fish rescue efforts prior to commencement of construction and completion of relevant construction activities within confirmed fish habitat within approved timing windows for construction (June 1 to Sept 30) to reduce potential for mortality of eggs and juvenile fish.

Maintaining water quality and quantity downstream in the PA and LAA is paramount for limiting broader fish and fish habitat impacts within each affected watershed associated with the Beaver Dam Mine Haul

Road PA. However, indirect impacts to down-gradient watershed water quality and quantity within the PA and LAA that may affect fish and fish habitat are not expected from the road infrastructure (re-alignment and widening) once standard construction methods for culvert installation and mitigation strategies are implemented during road widening and re-alignment.

Migratory Birds

1. Mine Site preparation may cause temporary and medium-term loss of habitat for birds and may cause disturbance or displacement of species. The widening of existing roads may cause a permanent loss of habitat for birds, and construction of new roads may affect habitat use by birds. Habitat fragmentation may alter habitat suitability for those species which rely on interior forest conditions. Within the ~~haul road PA~~ Haul Road, this change in habitat is expected to be permanent.

2. Lights on the Mine Site may cause disturbance or displacement of species, while attracting other species, or may cause general behavioral changes (DaSilva, Valcu and Kempenaers, 2015). For those species which may be attracted to lights (i.e. insectivores), lights may increase potential for direct mortality of these species or may increase habitat suitability by supplementing their source of prey.

3. Increased truck and vehicular traffic will increase noise levels, which may displace and/or disturb birds. Heavy machinery operation during open pit development, road construction, and construction of mine infrastructure for crushing and hauling will increase dust emissions, which may affect surrounding vegetation and, consequently, birds (Farmer, 1993). Blasting and drilling of in-situ rock during open pit mining will increase dust emissions, which may affect surrounding vegetation and, consequently, birds (Farmer, 1993).

4. There is the potential for migratory bird mortality during clearing activities. Birds (particularly injured or fledgling) may get trapped in the open pit or collide with other Project infrastructure (crushers or trucks), which could lead to death or injury. Vehicle activity and heavy machinery operation may cause bird injury or mortality.

The overall effects of the Project on birds and bird habitat is assessed as not significant after mitigation measures have been implemented. Monitoring will be undertaken for the life of the Project.

Species at Risk

Three priority species have been identified or are expected to reside within watercourses in the PA (American eel, Atlantic salmon, and ~~Blacknose dace~~ brook trout). Although these species are not listed under provincial or federal endangered species legislation, DFO has indicated that American eel and Atlantic salmon ~~they~~ are currently being reviewed for protection under SARA. This is discussed further in the Fish and Fish Habitat section above. Standard mitigation and monitoring for fish and fish habitat (Section 6.9.8) will address direct and indirect effects to Atlantic salmon, ~~Blacknose dace~~ brook trout, and American eel.

Development of the ~~mine footprint~~ Beaver Dam Mine Site and upgrading and construction of new sections of the Haul Road (Section 3B; Figure 2.2-2) will result in direct impacts to vascular and non-vascular individuals and to flora communities at the full or partial forest stand level.

~~Within the mine footprint PA, three of the seven documented locations of frosted glass whiskers (*Sclerophora peronella)* are expected to be directly impacted, along with two of the three locations of Wiegand's Sedge (*Carex wiegandii)*, and the single location of lesser rattlesnake plantain (*Goodyera repens)* by construction of the Waste Rock Storage Area. Three of the twenty-six observed locations of blue felt lichen (*Degelia plumbea*) may be directly impacted by construction of a water diversion ditch~~

~~(north of the open pit), the pit perimeter berm around the open pit, and the till stockpile. Impact to these individuals may be avoidable during the detailed design phase. The following species have been documented within close proximity to proposed infrastructure and may be indirectly impacted by development: frosted glass whiskers, *Sclerophora peronella* (4), blistered jellyskin lichen, *Leptogium corticola* (3), peppered moon lichen, *Sticta fuliginosa* (2), and Wiegands' sedge, *Carex wiegandii* (1).~~

Micro siting of infrastructure has been completed to avoid priority flora and lichen species and has reduced the direct impact of the Project on flora and lichens.

The division and micrositing of the waste rock stockpiles (eastern and western) has relocated infrastructure out of the confirmed critical function zone for three historical locations of BFL, south of the Beaver Dam Mine Site. The critical function zone is used to protect critical habitat for BFL (ECCC, 2018) and has been identified as (Figure 6.13-3):

- Phorophyte critical function zone
  - 500 m buffer around the historical BFL locations
- Wetland critical function zone
  - 50 m buffer surrounding the entire Wetland 29, which was determined to be associated wetland habitat for BFL

Micrositing has allowed for avoidance of the eight known locations of frosted glass whiskers, reduced the individuals of blue felt lichen directly impacted from three to one, and will not directly impact any priority vascular plants, with the exception of two clusters of Wiegand's sedge (eastern waste rock stockpile).

Within the Beaver Dam Mine Site two individuals of salted shell lichen and two individuals of slender monk's hood lichen are expected to be directly impacted by the construction of the western waste rock stockpile. As previously mentioned, two clusters of Wiegand's sedge are located within and expected to be directly impacted by the eastern waste rock stockpile. Potential indirect impacts to vascular plants and lichens surrounding Project infrastructure will be reduced through best management strategies and mitigation measures.

Blue felt lichen, highbush blueberry, Appalachian polypody and southern twayblade are species of non-vascular and vascular flora which have been documented in the ~~haul road PA~~ Haul Road. ~~None~~ Only one of these individuals, the southern twayblade, ~~of these individuals are~~ is found along the proposed alignment for the upgraded Haul Road or along the centerline of the section of new construction and an approximate 20 m buffer. While detailed design of the Haul Road layout is not yet complete, it is not anticipated that other vascular or non-vascular flora priority species will be directly impacted by upgrading the existing road or by the construction of the new 4 km section of the Haul Road. As is possible, the Proponent will work to avoid priority flora species during detailed Project design of the Haul Road upgrades. ~~Within the mine footprint, micro-siting of infrastructure has been completed to avoid priority flora species wherever possible.~~

Indirect effects to habitat and flora described in Section 6.10 are relevant to priority flora species as well. Lichens are sensitive to changing environmental conditions, particularly air quality. As such, Project activities may indirectly affect priority lichen species which have been avoided, but exist in close proximity to Project infrastructure.

Terrestrial fauna priority SAR/SOCI observed during field surveys within the PA includes the mainland moose and the snapping turtle.

Development of the ~~mine~~ Beaver Dam Mine Site and associated upgrades to the Haul Road will cause direct impacts to habitat used by terrestrial fauna, including wetlands with suitable hibernacula for snapping turtles, and those with abundant submergent and emergent vegetation for mainland moose. Sensory disturbance to terrestrial fauna would result from rock blasting (1-2 times per week during operation), clearing and grubbing, infrastructure construction during the construction phase and, overall increased traffic, blasting, mining activities and trucking during operations within the PA. This would likely result in localized wildlife avoidance of the PA, including moose and snapping turtle. Direct mortality of priority fauna species could result from Project activities, particularly due to the increase in traffic during construction and operation of the facility. Increased traffic poses a risk to wildlife such as the mainland moose and snapping turtle along the entire length of the Haul Road between the Beaver Dam ~~mine~~ Mine Site and the Touquoy ~~processing facility~~ Mine Site. Indirect mortality to these species could also occur from exposure to contaminants or spills from unplanned incidents.

With appropriate mitigation and monitoring, no direct mortality of priority bird species is anticipated, with the exception of the low potential for a bird strike with a haul truck. Avian usage of the PA during construction and operation of the Beaver Dam Mine will largely be driven by changes to habitat, resulting in localized avoidance of the PA by some species. Some priority species may avoid the PA in favor of undisturbed habitat in the surrounding landscape. Other priority species are anticipated to be attracted to the mine infrastructure and newly created habitat.

Most direct and indirect impacts on birds, including SAR, are accounted for in general mitigation/monitoring for all birds, since many have legislated protection under the Migratory Birds Convention Act (primarily through avoiding clearing/grubbing during nesting season, and conducting detailed pre-construction nest searches if clearing or grubbing must occur during nesting season). These pre-construction nest searches are particularly important in wetlands which provide suitable breeding habitat for the Olive-sided Flycatcher, Canada Warbler and Rusty Blackbird.

6.17.2 Environmental Effects on Federal or Transboundary Lands

There are no federal or transboundary lands located within or adjacent to the PA. Given the distance from the Project site to federal lands and the analysis completed in Section 6, the Project has limited potential to result in a change to the environment on federal lands. The nearest federal lands to the PA are the Beaver Lake IR 17, located approximately 5 km from the Mine Site and 3 km from the nearest point of the Haul Road. This is discussed further in the following section.

6.17.3 Environmental Effects on Indigenous Peoples

Beaver Lake IR 17 is located approximately 5 km from the Mine Site and 3 km from the nearest point of the Haul Road. A MEKS was undertaken in 2015 to characterize past and present traditional use of the PA. Based on the findings presented in the MEKS report~~, the evaluation of potential pathways and interactions described in Section 6.11.6, and findings obtained during site visits, it is concluded that there is currently no direct Mi'kmaq use of the~~ and direct engagement through a focused meeting held in Sheet Harbour, Nova Scotia, with residents of the Beaver Lake IR community confirmed that there is direct us of the Project site for subsistence harvesting of food, medical plants or hunting or furbearing animal harvesting. It is known that areas to the west of the site have traditionally been used for these and ceremonial (burial) activities. The potential Burial sites are not located within the proposed Project site and there is a low likelihood of pre-contact artifacts as per the archaeological study, therefore, a direct effect of the Project is not expected to be significant as per the MEKS.

The Mi'kmaq community continues to harvest plant species throughout Nova Scotia and the area around the Project Mine Site is no exception. Harvesting of trees and plants such as maple, ash, and birch for tools and crafts continue wherever these resources are known to occur. This is also true for blueberries, cranberries, strawberries and fox berries. The MEKS also noted that several species of medicinal plants continue to be collected in the region. While plant species of significance to Mi'kmaq were identified within the MEKS study area, these same species also exist within the surrounding area. While the destruction of some specimens is a Project effect, it does not pose a threat to Mi'kmaq use of the species; therefore, permanent loss of some specimens of plant species of significance to Mi'kmaq is not expected to be significant as per the MEKS. Based on the relatively small footprint of the Project, existing disturbance in the Project Area, and proposed mitigation, monitoring, and follow up associated with other VCs, the direct effects of the Project on hunting, gathering and trapping activities is expected to be minimal.

Under the circumstances described above, changes to the environment caused by the Project are not likely to directly affect the current use of lands and resources for Mi'kmaq purposes. While there are no expected indirect effects on the Mi'kmaq of Nova Scotia based on the effects assessment of the other VCs, this is based on the implementation of the mitigation and monitoring proposed for these other VCs as outlined in this EIS.

6.17.4 Power or Duty by Federal Authority

Should the Project require a federal authority to exercise a power or perform a duty, Section 5(2)(b) of CEAA, 2012 requires the following environmental effects to be considered:

(a) a change, other than those referred to in paragraphs (1)(a) and (b) [of Section 5, CEAA 2012], that may be caused to the environment and that is directly linked or necessarily incidental to a federal authority's exercise of a power or performance of a duty or function that would permit the carrying out, in whole or in part, of the physical activity, the designated Project or the Project; and

(b) an effect, other than those already described related to aboriginal peoples, of any change referred to in paragraph (a) on
   - (i) health and socio-economic conditions,
   - (ii) physical and cultural heritage, or
   - (iii) any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

Any physical activities in wetlands, watercourses or waterbodies may require authorization in accordance with the Fisheries Act. A significant adverse effect from the Project on fish and fish habitat is defined as an effect that is likely to cause serious harm to fish. An adverse effect that does not cause a permanent loss to fish or fish habitat is considered to be not significant and therefore would not likely require a Fisheries Act Authorization. An adverse effect that does cause a permanent loss to fish habitat may be mitigated by replacement of lost habitat and removal/rescue of fish present prior to commencement of the activity. This completion of compensation and fish rescue may also allow for an adverse effect to be considered not significant. In this way, a Fisheries Act Authorization may not be required.

For the Beaver Dam Mine Project, within the mine footprint, the Project Team has conservatively calculated a maximum loss of 81,585.3 m^2 of fish habitat to support the mine development (direct impact to confirmed fish habitat based on watercourse and wetland characterization, electrofishing and manual fish collection results). An additional 107,612.66 m^2 of potential fish habitat is also expected to be lost to support the mine development (direct impact to potential fish habitat based on watercourse and wetland characterization, electrofishing and manual fish collection results). Minimal loss of confirmed or potential fish habitat is expected to support the Haul Road upgrade and new construction where necessary. Five watercourses along the Haul Road will be affected by upgrade activities that are not currently designed to be perpendicular to the proposed upgraded road. A total of 211.5 m^2 of watercourse habitat that is potential or confirmed fish habitat will be lost to support road upgrades. Additionally, nine wetlands that are confirmed to, or potentially support fish and fish habitat, will be impacted by Haul Road upgrade activities totaling 4029.2 m^2 of wetland habitat.

There is also potential for indirect impacts to additional fish habitat surrounding the mine development and upgraded Haul Road. However, with proper mitigation techniques employed, the likelihood of this occurring is low, and with proposed monitoring programs implemented, even if impacts occurred, they would be identified quickly, and thus, would not likely alone trigger serious harm to fish and a Fisheries Act Authorization.

The predicted residual environmental effects of Project development, operations and decommissioning on fish and fish habitat are determined to be present. The overall residual effect of the Project on fish and fish habitat is assessed as not significant after mitigation measures have been implemented. Whether these residual environmental effects will require a Fisheries Act Authorization will be determined during future permitting stages of this project. During permitting, detailed design will focus on reduction of impact to fisheries resources as much as is possible. A Fisheries Act Authorization has been determined possible, based on confirmed direct impacts to fish and fish habitat associated with the mine development infrastructure, and to a much lesser degree, the upgrade and new construction associated with the Haul Road.

6.17.5 Environmental Effects Incidental of Decisions Made by a Federal Authority

Section 5(2)(b) of CEAA, 2012 identifies that if the Project requires a federal authority to exercise a power or perform a duty or function required by an Act to allow the Project to proceed, environmental effects must be taken into account, including effects on the following:

(i) Health and socio-economic conditions
(ii) Physical and cultural heritage, or
(iii) Any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

As a result of the predicted residual environmental effects on fish and fish habitat, associated changes to the environment are described in accordance with 5(2) of CEAA 2012. The following table described the linkages to relevant VCs (if any), where the related effects assessment is present within the EIS, and additional effects assessment, if necessary.

Table 6.17-1 Linkages to Environmental Effects Assessment for Relevant VCs

Federal Permit/Decision Required	Beaver Dam Project Component(s)	Linkage to other Valued Component (VCs)	Effects Evaluation Location in EIS	Additional Evaluation Needed
Fisheries Act Authorization	Waste Rock Pile, Stockpiles and Open Pit within mine footprint. Limited potential from Haul Road upgrades and new construction	Wetlands	Section 6.8.6	none
		Surface Water	Section 6.7.6	none
		Groundwater	Section 6.6.6	none
		Habitat/Flora	Section 6.10.6	none
		Fauna	Section 6.11.6	none
		Birds	Section 6.12.6	none
		Species at Risk	Section 6.13.6	none

The mine footprint project area is currently accessible to humans with a network of existing forestry access roads, and small truck/ATV trails. A cabin is present on the northeastern shore of Crusher Lake. The land is privately owned by Northern Timber. Forestry activity surrounding the PA is significant and the Project Area is located in a remote location without any significant human settlement/town/village/city. Therefore, although access is reasonable into the PA, human traffic into the area for recreational opportunities like hunting, fishing and hiking is limited, and surrounding forestry activity and private ownership limit human recreational opportunities.

Loss of fish habitat within the mine footprint will result from the development of the open pit, waste rock pile and other associated stockpiles. First order stream habitat and associated headwater and through-flow wetland habitat will be lost to support the development of the mine. Stream habitat lost will be Type II or IV fish habitat that primarily support feeding, passage and refuge for fish. Some stream habitat was observed to be deep enough to potentially support overwintering for fish populations. However, these streams are not large river systems and are not quality commercial or aboriginal fishing locations. As a result, the potential effect of a Fisheries Act Authorization on non-Aboriginal health and socio-economic conditions (e.g. reduction of fishing activity) is expected to be very low due to the loss of fish habitat associated with the mine development.

Fish habitat loss via wetland alteration within the mine footprint Beaver Dam Mine Site will also result from the development of the open pit, waste rock pile and other associated stockpiles. Wetland habitat that will be altered has been determined to support passage for fish, refuge habitat for fish, and feeding habitat for fish. Several wetlands also have sufficient depth to potentially support overwintering populations of fish. These wetland habitats do provide some hiking, berry picking, bird watching, hunting and recreational opportunities, but provide limited to no fishing opportunities. As a result, the potential effect of a Fisheries Act Authorization on non-Aboriginal health and socio-economic conditions (e.g. reduction of hiking, hunting, and fishing activity) is expected to be very low due to the loss of fish habitat associated with the mine development.

6.18 Accidents and Malfunctions

In relation to accidents and malfunctions, Section 19(1) of the *Canadian Environmental Assessment Act, 2012* (CEAA 2012) states that:

“The environmental assessment of a designated project must take into account the following factors:

(a) the environmental effects of the designated project, including the environmental effects of malfunctions or accidents that may occur in connection with the designated project and any cumulative environmental effects that are likely to result from the designated project in combination with other physical activities that have been or will be carried out;

(b) the significance of the effects referred to in paragraph (a)".

Accidents and malfunctions refer to events that are not part of any planned activity or normal operation of the Project as has been ~~planned~~ proposed by the Proponent. Many accidents and malfunctions are preventable and their consequences can be severely limited by applying a precautionary approach during planning and design, developing thorough emergency response procedures, and ensuring mitigation measures are incorporated into standard operating procedures. However, even with the implementation of best management practices and preventative measures, accidents and malfunctions still have the potential to occur and create adverse effects to the environment and worker health and safety. ~~Many accidents and malfunctions are preventable and their consequences severely limited by applying the precautionary approach during planning and design, developing thorough emergency response procedures, and ensuring mitigation measures are incorporated into standard operating procedures.~~ By identifying likely worst-case accidents and malfunctions and assessing their effects should they occur, the Proponent can develop preventative and responsive procedures to ~~eliminate~~, reduce or control adverse effects caused by accidents and malfunctions. Preventative and responsive procedures will be developed via the following principles:

- best management practices and ~~innovative~~ proven technologies will be utilized to undertake the Project and all planned releases to the environment and their effects will be ~~controlled~~ properly managed;
- worker health and safety will be the central focus of process and mine safety management;
- develop and apply procedures and training that will aim to promote safe operation of mining equipment and facilities; and
- develop and implement emergency response procedures that will reduce and control the adverse effects of an accident or malfunction.

The Project will be designed to implement preventative and mitigation procedures throughout its entire life that will minimize the potential for accidents and malfunctions to occur. Should those accidents or malfunctions occur, emergency response procedures would be implemented to ~~eliminate,~~ reduce or control the resulting adverse effects.

6.18.1 Assessment Methodology

The assessment of effects from potential accidents and malfunctions were ~~assessed~~ based on a ~~reasonable~~ credible worst-case scenario, which employs a risk based approach that involves identifying hazards associated with Project infrastructure and activities, as well as the consequences should those hazards create an accident and malfunction. The identification of hazards was completed utilizing the operational expertise of the Proponent and experience of the EA Study Team and consulting other projects similar to the Project. The identification of worst-case scenarios/consequences were determined using a qualitative risk assessment to determine the likelihood that hazards would create an accident and malfunction, and determining the level of magnitude of those accidents and malfunctions should they occur.

Accidents and malfunctions that are considered either likely to occur, or have a significant effect should they occur, are included in this assessment. For each potential accident and malfunction, the following details will shape the effects assessment:

- a threshold for determination of significance is provided to set a benchmark for significance of an accident and malfunction;
- the interactions between the accident and malfunctions and specific VCs and the resulting effects are discussed in reference to their significance;
- mitigation measures are presented and designed to prevent the occurrence of accidents and malfunctions; and
- preliminary emergency response measures are discussed to lessen the magnitude of accidents and malfunctions should they occur.

Accidents and malfunctions have the potential to occur through every phase of the Project. In order to decrease the likelihood of occurrence and level of magnitude should these accidents and malfunctions occur, the Proponent will implement a preventative system approach to environmental protection and worker and health and safety. Contractors will be subject to the same health, safety, and environment policies and procedures, and all personnel will receive site specific training to prevent and mitigate accidents and malfunctions. The Proponent has developed an Environmental Management System and Health and Safety Plans~~ under development~~ at the fully approved and operating Touquoy Gold Project. These Plans will extend to the activities at the Touquoy Mine Site ~~in~~for all phases of the processing of ore from the Project. These ~~p~~Plans will be examined and refined where needed to reflect BMP prior to the time that the Beaver Dam ore is processed at the Touquoy Mine Site. Revised versions of these Plans will also be developed specific to the Beaver Dam Mine Site and operations.

6.18.2 Hazard Identification

Nearly all Project components and activities outlined in Sections 2.2 and 2.3 of this EIS, including the processing activities at the Touquoy mine of ore from Beaver Dam Mine Site, have the potential to create accidents and malfunctions ~~give ideal conditions~~; however, the likelihood is often extremely low. Those hazards considered to have the greatest likelihood to create an accident and malfunction, or have a significant effect should those accidents and malfunctions occur are outlined by phase in Table 6.18-1.

Table 6.18-1 Summary of Potential Accidents and Malfunctions

Hazard Categories	Potential Accidents and Malfunctions Scenarios	Site Preparation and Construction	Operation and Maintenance	Decommissioning and Reclamation
Structural Failures	Open Pit ~~Surface~~ Mine Slope Failure	○	●	○
	Stockpile Slope Failure	○	●	○
	Settling Pond Failure	○	●	○
	Infrastructure Failure	○	●	○

Hazard Categories	Potential Accidents and Malfunctions Scenarios	Site Preparation and Construction	Operation and Maintenance	Decommissioning and Reclamation
Accidents	Fuel and/or Other Spills	●	●	○
	Unplanned Explosive Event	○	●	-
	Mobile Equipment Accident	●	●	○
	Tailings and Reclaim Water Pipeline Spills at Touquoy	N/A	●	N/A
	Cyanide Spills at Touquoy	N/A	●	N/A
Other Accidents and Malfunctions	Forest and/or Site Fires	●	●	○
Legend **Potential for Adverse Effects** ● High potential for adverse effects ○ Low potential for adverse effects				

6.18.3 Structural Failures

6.18.3.1 ~~Surface~~Open Pit Mine Slope Failure

All phases of the Project have the potential for structural failures of slopes within the footprint of the ~~surface mine~~open pit. The potential slope failures are as follows:

- failure of overburden slopes caused by erosion from vegetation stripping and surface water runoff; and
- failure of bedrock faces caused by improperly designed benches and erosion/fracturing from groundwater inflow.

A worst-case scenario is the severe collapse of areas directly adjacent to the open pit and ground surface slump of the surrounding area possibly affecting the site's infrastructure, Haul Roads, and on-site access roads and worker safety. However, the site's components and infrastructure have been designed as far from the perimeter of the open pit as possible so it is not expected that slope failure would affect the site's components and infrastructure.

During the initial stages of site preparation and construction, potential slope failures caused by erosion from vegetation stripping and surface water runoff will be limited to overburden; however, as blasting, and ore and non-ore bearing waste rock extraction commences, bedrock faces have the potential to fail if not properly designed and groundwater inflow is not properly managed. Based on the current delineation of ore, the mine will be excavated through bedrock to an end depth of approximately 170 m below ground surface. Currently, ~~B~~bench heights of 10 m are designed with 8 m wide berms placed every two benches. Actual ~~B~~bench face angles ~~prescribed by a geotechnical study~~will be implemented for specific depths and zones of the ~~surface mine~~ open pit as prescribed by a qualified professional based upon a geotechnical study.

Geotechnical work has been completed at the Touquoy site and the expertise gained from working with these materials will be applied to the final design of the Beaver Dam disturbed areas using actual geotechnical data collected at Beaver Dam to supplement the abundant public information available. The soil and bedrock at the site are well understood from a geotechnical and construction standpoint including extreme conditions such as drought, freeze-thaw cycles, and weather (high rainfall events or storm events and wind). All of these “extreme” factors have been accounted for in the design of the Project and will be for all phases of the Project. ~~Features constructed from site materials such as waste rock stockpiles and overburden stockpiles will use the collected data for final design to produce features with appropriate safety factors to reduce the possibility of landslides, slope erosion and subsidence. With many stockpiles it is common to have subsidence in the short term creating a landscape that is varied in topography that is in line with NSDNR objectives for reclamation to have surfaces that are not uniform but offer safe long term landscapes with a variety of features. General reclamation goals to have heterogeneous landscapes that offer habitat features greater than simply a hydro seeded mat are important and can be assisted by some variation in the topography through subsidence.~~

~~Surficial geology in the area is described as stony till plains and drumlins with minor organic deposits. Till is typically 2-20 m thick and primarily comprised of a stony and sandy matrix material derived from local bedrock sources, while drumlin facies are typically 4-30 m thick and siltier due to erosion and incorporation of older till units by glaciers.~~

Threshold for Determination of Significance

The criteria that would determine a significant effect should an overburden or bedrock slope fail, is based primarily on worker health and safety, and secondarily on property damage. Should a slope failure result in injury or death to a worker, or loss of mobile equipment the event will be considered significant.

Potential Interactions and Effects

The potential interactions between a ~~surface mine~~ open pit mine slope failure and VCs is outlined in Tables 5.7-1 to 5.7-3. Additional detail by VC is outlined in Table 6.18-2. Only those interactions with a high potential to cause adverse effects should they occur are discussed in detail.

Table 6.18-2 Open Pit Mine Slope Failure Interactions with VCs

Valued Component (VC)	Potential ~~Surface~~ Open Pit Mine Slope Failure and VC Interaction	Potential for Adverse Effects
Atmospheric Environment	• Failure of overburden slopes could potentially cause temporary dust generation	Low

Valued Component (VC)	Potential ~~Surface~~ Open Pit Mine Slope Failure and VC Interaction	Potential for Adverse Effects
Geology, Soil, and Sediment Quality	• No potential interaction anticipated	-
Surface Water Quality and Quantity	• No potential interaction anticipated	-
Groundwater Quality and Quantity	• No potential interaction anticipated	-
Wetlands	• No potential interaction anticipated	-
Fish and Fish Habitat	• No potential interaction anticipated	-
Habitat and Flora	• No potential interaction anticipated	-
Birds	• No potential interaction anticipated	-
Fauna	• No potential interaction anticipated	-
Species of Conservation Interest and Species at Risk	• No potential interaction anticipated	-
Indigenous Peoples	• No potential interaction anticipated	-
Physical and Cultural Heritage	• Failure of overburden slopes could potentially cause destruction of archaeological, historical, and paleontological sites	Low
Human Health and Socio-economic Considerations	• Failure of overburden slopes and bed rock faces could potentially result in injury or death to mine workers	High

Dust generated from the failure of a ~~surface mine~~ open pit slope would be temporary and localized to the area directly around the slope failure. In addition, the physical and cultural heritage artifacts in the area of any ~~surface mine~~ open pit slope failure are likely to be identified during mine development. As a result, potentially adverse effects to the atmospheric environment and physical and cultural heritage are considered low.

Surface mines with improperly designed benches and slopes and poor surface water and groundwater management pose a health and safety risk to workers during the site preparation and construction, and operation and maintenance phases, as well as a financial liability risk related to mobile equipment damage or loss.

The maximum effect of an overburden or bedrock face slope failure as it relates to worker health and safety would be a death caused by falling objects. The maximum effect of an overburden or bedrock face slope failure as it relates to financial liability would be a total loss of one or more pieces of mobile equipment.

~~Given proper surface mine design, and surface water and groundwater management,~~ Overburden or bedrock face slope failure ~~is most likely to~~ may also occur during the decommissioning and reclamation/closure phase of the Project ~~when~~ as the ~~surface mine~~ open pit ~~is allowed to in~~ fills with water via surface water runoff and groundwater inflow. Surface water runoff may erode overburden to a point of failure, while groundwater inflow may weaken major bedrock joints or discontinuities and cause a failure. ~~Fortunately~~ However, as this ~~reclamation~~ decommissioning activity is passive, ~~and~~ it will not involve direct interaction between workers and slopes and ~~G~~given a lack of environmental receptors in the ~~surface mine~~ open pit and that all effects from a slope failure will be contained to the~~surface mine~~ open pit, potential adverse effects to other VCs from an overburden slope failure or bedrock face failure are anticipated to be non-existent.

Mitigation and Emergency Response

Regional and site specific drilling has encountered bedrock materials that consist mainly of metamorphosed sedimentary rocks of the Goldenville Group. These materials are very stable and widely used in Nova Scotia for road materials and situations where erosion resistant materials are needed. Abundant highway construction projects leave these strata at vertical or near vertical with limited issues of stability.

A daily inspection of pit slopes by qualified personnel will be undertaken for any work area within the pit prior to employees or machinery entering. It is proposed to have an independent ~~consultant~~ qualified professional review slopes on a quarterly basis. Pit slopes are based on recommendations of the qualified professional ~~independent expert~~ with appropriate design safety factors applied. Slopes will be monitored throughout the life of the operation.

A berm surrounding the ~~surface mine~~ open pit will direct surface water runoff into a water diversion channel that discharges to the settling pond to the west. The berm will be keyed into the bedrock to prevent shallow groundwater flow and/or surface water originating in Cameron Flowage from entering the ~~surface mine~~ open pit. An in-mine water diversion ditch will be established along the top bench of the mine to intercept any surface water that infiltrates the berm and flows into the mine. This ditch will direct water to in-mine sumps where it will be pumped out of the mine.

Based on the current delineation of ore, the ~~surface mine~~ open pit will be excavated through bedrock to an end depth of approximately 170 m below ground surface. Bench heights and bench face angles prescribed by a geotechnical study (O'Bryan et. al., 2015) will be implemented for specific depths and zones of the ~~surface mine~~ open pit.

If slope failure were to occur, emergency procedures would be implemented that will be outlined in the site emergency response plan. Generally slope failure emergency response includes evacuation of all equipment and personnel from the area and areas up-slope and down-slope from the slope failure area. An assessment is then made using on-site staff and possibly external resources (geotechnical specialists) to make a determination if the area can be accessed to make repairs, what repairs are needed and actions to prevent future incidents. This will be detailed in a recovery plan. Depending on the regulator involvement there may be a requirement to file incident reports with certain regulatory agencies prior to initiating the repairs and return to work in the area; these are very case specific and often dependent on whether personnel were injured or equipment damaged as a result of the slope failure.

6.18.3.2 Stockpile Slope Failure

All phases of the Project have the potential for structural failures of topsoil, till, and waste rock stockpile slopes. Failure of these slopes may be caused by improperly designed lifts, and erosion from surface water runoff.

Worst-case scenario resulting from stockpile slope failure would be disturbance to surrounding area, including the potential for mine rock and low-grade ore to enter nearby watercourses, damage to infrastructure and worker safety. As discussed below, stockpiles will be constructed in a way to reduce the consequences of the worst-case scenarios.

Topsoil stockpiles will be constructed to completion in single lifts of 10 m with 1.5:1 active slopes during the preparation and construction phase. They will be removed through use in progressive reclamation of the till and waste rock stockpiles during operation and maintenance and will have no significant presence prior to or shortly after decommissioning and reclamation commences.

Till stockpiles will be constructed to completion in single lifts of 15 m with 1.5:1 active slopes during the preparation and construction phase. They will be progressively capped with topsoil excavated from the ~~surface mine~~ open pit area and hydro seeded at the end of operations. This should allow for revegetation to being prior to or shortly after the decommissioning and reclamation commences.

The waste rock stockpile will be constructed in multiple lifts of 10 m with each lift having an active slope of 2:1. Construction of the waste rock stockpile will begin during the site preparation and construction phase and will be completed prior to or shortly after the decommissioning and reclamation phase commences. The waste rock stockpile will be progressively capped with topsoil excavated from the ~~surface mine~~ open pit area and hydro seeded during the decommissioning and reclamation phase.

Ore stockpiles will be constructed in 15 m lifts with 1.5:1 active slopes during the operation and maintenance phase. High-grade ore will be stockpiled near the crusher on the ROM and facilities pad. The high-grade ore stockpiles will be continually added to by mine trucks and subtracted from by front end loaders. Low-grade ore will be stockpiled east of this area and will remain until near the end of the operation and maintenance phase. All ore stockpiles will be removed prior to the decommissioning and reclamation phase.

Threshold for Determination of Significance

The criteria that would determine a significant effect should a stockpile slope fail, is based primarily on worker health and safety, and secondarily on property damage and environmental effects. Should a slope failure result in injury or death to a worker, a loss of mobile equipment, or a release of low pH surface water to the environment the event will be considered significant.

Potential Interactions and Effects

The potential interactions between a stockpile slope failure and the VCs are outlined in Tables 5.7-1 to 5.7-3. Additional detail by VC is outlined in Table 6.18-3. Only those interactions with a high potential to cause adverse effects should they occur are discussed in detail.

Table 6.18-3 Stockpile Slope Failure Interactions with VCs

Valued Component	Potential Stockpile Slope Failure and VC Interaction	Potential for Adverse Effects
Atmospheric Environment	• Failure of stockpile slopes could potentially cause temporary dust generation	Low
Geology, Soil, and Sediment Quality	• Failure of waste rock stockpile slopes could potentially ~~cause~~ alter acid rock drainage (ARD) ~~production~~ mitigation measures and discharge to settling ponds	Low
Surface Water Quality and Quantity	Failure of waste rock stockpile slopes could potentially alter ~~cause~~ ARD mitigation measures ~~production~~ and discharge to settling ponds	Low
Groundwater Quality and Quantity	• No potential interaction anticipated	-
Wetlands	Failure of waste rock stockpile slopes could potentially cause alter ~~ARD~~ mitigation measures ~~production~~ and discharge to settling ponds	Low
Fish and Fish Habitat	○ Failure of waste rock stockpile slopes could potentially cause alter ~~ARD~~ mitigation measures ~~production~~ and discharge to settling ponds	Low
Habitat and Flora	• No potential interaction anticipated	-
Birds	• No potential interaction anticipated	-
Fauna	• No potential interaction anticipated	-
Species of Conservation Interest and Species at Risk	• No potential interaction anticipated	-
Indigenous Peoples	• No potential interaction anticipated	-
Physical and Cultural Heritage	• No potential interaction anticipated	-
Human Health and Socio-economic Considerations	• Failure of stockpile slopes could potentially result in injury or death of mine workers	High

Dust suspended from the failure of a stockpile slope would be temporary and localized to the area directly around the slope failure. In addition, production and discharge of ARD to receiving watercourses in the area is unlikely due to all surface water runoff being directed to settling ponds for treatment and monitoring prior to discharge to the environment. As a result, potentially adverse effects to the atmospheric environment, geology, soil, and sediment, surface water quality and quantity, wetlands, and fish and fish habitat are considered low.

Improperly designed stockpiles with poor surface water management pose a health and safety risk to workers and a financial liability risk related to mobile equipment damage or loss through all phases of the Project.

The maximum effect of a stockpile slope failure as it relates to worker health and safety would be a death caused by falling objects. The maximum effect of a stockpile slope failure as it relates to financial liability would be damage to or a total loss of one or more pieces of mobile equipment.

Given proper stockpile design and surface water management, as well as progressive reclamation practices for the till and waste rock stockpiles, stockpile slope failure is most likely to occur during the operation and maintenance phase of the Project when stockpiles are being continually acted upon either through loading, unloading, or shaping of material. Surface water runoff may erode topsoil, till, and waste rock to a point of failure as well.

Given surface water runoff from all stockpiles will be directed to settling ponds for treatment and a slope failure would likely not result in disturbance to a greenfield environment, potential adverse effects to other VCs from a stockpile slope failure are anticipated to be non-existent.

Mitigation and Emergency Response

Stockpile slopes will be designed at an angle determined by geotechnical analysis and acceptable safety factors, thereby reducing the likelihood of a slope failure. Placement of materials in the stockpiles would follow a plan developed for the stockpile that would consider thickness of the lift, compaction – if needed, load size, start and stockpile physical limits. Slopes will be monitored throughout the life of the operation with routine inspections by qualified staff and repairs made if warranted.

Surface water run-off from the non-ore bearing waste rock stockpile, Mine Site roads, and till stockpiles will flow by gravity, with the aid of berms and channels, to a settling pond located west of the ~~surface mine~~ open pit. Water will be gradually decanted to Cameron Flowage by gravity via a water diversion structure that runs northeast from the settling pond.

If stockpile slope failure were to occur, emergency procedures would be implemented that will be outlined in the site emergency response plan. Generally, stockpile slope failure emergency response includes evacuation of all equipment and personnel from the area and areas up-slope and down-slope from the stockpile slope failure area. An assessment is then made using on-site staff and possibly external resources (geotechnical specialists) to make a determination if the area can be accessed to make repairs, what repairs are needed and actions to prevent future incidents. This will be detailed in a recovery plan. Depending on the regulator involvement there may be a requirement to file incident reports with certain regulatory agencies prior to initiating the repairs and return to work in the area, these are very case specific and often dependent on whether personnel were injured or equipment damaged as a result of the stockpile slope failure.

6.18.3.3 Settling Pond Failure

All phases of the Project have the potential for a settling pond failure. A failure of the settling pond is defined as a breach of the banks through overflow or bank structure failure resulting in the release of sediment laden water to the environment. A worst-case scenario would be complete failure of the settling pond, resulting in uncontrolled discharge of sediment laden water into the surrounding environment. The capacity demand of the settling pond will increase as ~~surface mine~~ open pit depth increases and more infiltrated groundwater is pumped out of the mine.

Surface water run-off from the non-ore bearing waste rock stockpile, Mine Site roads, topsoil stockpiles, and till stockpiles will flow by gravity, with the aid of berms and channels, to a settling pond located west of the ~~surface mine~~ open pit. This settling pond will also receive water from the ~~surface mine~~ open pit dewatering program. Treatment of surface water runoff and mine infiltration groundwater will be passive. Water will eventually decant to Cameron Flowage through a fringe wetland and by gravity via a water diversion structure that runs northeast from the settling pond.

Surface water runoff from the Beaver Dam Mine Site ROM and facilities pad will flow by gravity, with the aid of berms and channels, to a collection pond located between the crushing operation and water storage tanks. A culvert located beneath the mine entrance road will facilitate decant overflow from the pond to a water diversion structure that splits the two ore stockpiles. The water diversion structure will discharge to a channel that will run down gradient to the northeast and ultimately discharge to Cameron Flowage. The discharge point will be equipped with a concrete flow-control structure with the ability to be shutoff allowing no flow to leave if needed.

The final design of the settling pond, collection pond, and additional required water management measures will be submitted as part of the IA process.

In the event of a 1 in 100 year precipitation event, which in Nova Scotia is identified as approximately 115 mm in a 24 hour storm, a spillway into the water diversion structure will be used for overflow. In the case of a storm event or infrastructure failure, settling ponds will be monitored regularly.

Threshold for Determination of Significance

The criteria that would determine a significant effect should a settling pond fail, is based primarily on environmental protection. Should a settling pond failure result in an uncontrolled discharge of sediment laden water to Cameron Flowage the event will be considered significant.

Comparison of surface water samples to CCME FWAL TSS guidelines and MMER TSS guidelines will be utilized to determine if sediment laden water will have an impact on surface water quality in Cameron Flowage and subsequently on fish and fish habitat.

Potential Interactions and Effects

The potential interactions between settling pond failure and the VCs are outlined in Tables 5.7-1 to 5.7-3. Additional detail by VC is outlined in Table 6.18-4. Only those interactions with a high potential to cause adverse effects should they occur are discussed in detail.

Table 6.18-4 Settling Pond Failure Interactions with VCs

Valued Component (VC)	Potential Settling Pond Failure and VC Interaction	Potential for Adverse Effects
Atmospheric Environment	• No potential interaction anticipated	-
Geology, Soil, and Sediment Quality	• Failure of settling pond could potentially cause contaminated suspended solids to settle in Cameron Flowage and effect sediment quality	Low
Surface Water Quality and Quantity	• Failure of settling pond could potentially cause sediment laden water to discharge	High

Valued Component (VC)	Potential Settling Pond Failure and VC Interaction	Potential for Adverse Effects
	to Cameron Flowage via the fringe wetland around Mud Lake	
Groundwater Quality and Quantity	• No potential interaction anticipated	-
Wetlands	• Failure of settling pond could potentially cause sediment laden water to discharge to fringe wetlands around Mud Lake	High
Fish and Fish Habitat	• Failure of settling pond could potentially cause sediment laden water to discharge to Cameron Flowage via the fringe wetland around Mud Lake	High
Habitat and Flora	• No potential interaction anticipated	-
Birds	• No potential interaction anticipated	-
Fauna	• No potential interaction anticipated	-
Species of Conservation Interest and Species at Risk	• Failure of settling pond could potentially cause sediment laden water to discharge to Cameron Flowage via the fringe wetland around Mud Lake	High
Indigenous Peoples	• No potential interaction anticipated	-
Physical and Cultural Heritage	• No potential interaction anticipated	-
Human Health and Socio-economic Considerations	• No potential interaction anticipated	-

The degree to which suspended solids are expected to settle out of solution in a concentrated area should a settling pond failure occur is considered minimal. As a result, potentially adverse effects to the sediment quality portion of the geology, soil, and sediment quality VC are considered low.

Inadequate settling pond capacity and water level monitoring, combined with a significant precipitation event may cause a settling pond failure and thus, pose a risk to surface water quality, wetlands, fish and fish habitat, and SOCI/SAR through all phases of the Project.

The maximum effect of a settling pond failure as it relates to VCs above would be heavy siltation of wetlands and Cameron Flowage and subsequent stresses on fish and other aquatic species.

Given inputs for the settling pond would originate partially from the ~~surface mine~~ open pit dewatering program, settling pond failure is more likely to occur as development of the ~~surface mine~~ open pit progresses. Extracting waste rock and ore from the ~~surface mine~~ open pit will increase the potential for groundwater infiltration, thus increasing the amount of water that needs to be pumped from the ~~surface mine~~ open pit to the settling pond. As a result, the capacity requirements of the settling pond will increase the further the ~~surface mine~~ open pit is advanced and the potential for settling pond failure through bank overflow and structure failure increases as well.

Given the settling pond is a passive treatment process and it will not provide habitat for terrestrial species, adverse effects to other VCs from a settling pond failure are anticipated to be non-existent.

Mitigation and Emergency Response

The water diversion structure leading from the collection pond will discharge to a channel that will run down-gradient to the northeast and ultimately discharge to Cameron Flowage. The discharge point will be equipped with a concrete flow-control structure. Sediment laden water from the settling pond will be gradually decanted to Cameron Flowage via a water diversion structure that runs northeast from the settling pond.

The settling pond will be lined with suitable materials, such as clay or a plastic liner. In the event of a 1 in 100 year precipitation event that creates volumes in excess of the capacity available in ponds and ditching, or infrastructure failure, a spillway into the water diversion structure will be used for overflow. In the case of a storm event or infrastructure failure, settling ponds will be monitored regularly.

If settling pond failure were to occur, emergency procedures would be implemented that will be outlined in the site emergency response plan. Generally, settling pond failure emergency response includes raising the alarm and evacuation of all equipment and personnel from the area. If settling pond contents encroach on neighbouring properties or public roadways, appropriate authorities will be notified and construction of bunds and/or diversion drains may be required to contain settling pond contents on-site. An assessment is then made using on-site staff and possibly external resources (surface water specialists) as to what repairs are needed and actions to prevent future incidents. This will be detailed in a recovery plan. Depending on the regulator involvement there may be a requirement to file incident reports with certain regulatory agencies prior to initiating the repairs and return to work in the area, these are very case specific and often dependent on whether personnel were injured or equipment damaged as a result of the settling pond failure.

6.18.3.4 Infrastructure Failure

All phases of the Project have the potential for failures of infrastructure. Failure of these structures may be caused by improper design and construction, or natural causes such as hurricanes or earthquakes. A worst-case scenario would be failure of multiple operational components as a result of a natural cause impacting worker health and safety and the surrounding environment. The following operational facilities will be installed or constructed to support the Project:

- crusher and conveyors;
- underground septic tanks and leach drains;
- raw water and potable water tank;
- diesel fuel storage and distribution system;
- skid-mounted diesel generators and power distribution overhead transmission lines;
- pole mounted lighting;
- vehicle washdown facility;
- pre-fabricated office facility and workshop building; and
- fire protection systems.

All infrastructure will be located on a central operational and ROM facilities pad that will provide quick access to the Haul Road and ~~surface mine~~ open pit. These components are described in detail in Section 2.2.1 of this EIS.

Threshold for Determination of Significance

The criteria that would determine a significant effect should an infrastructure failure occur is based primarily on worker health and safety and environmental impact, and secondarily on property damage. Should an infrastructure failure result in injury or death to a worker or a loss of infrastructure the event will be considered significant.

Should an infrastructure failure event result in the loss of any quantity of fuel, oil, lubricant, or other Project related raw materials to the environment such that a measurable contamination of soil, surface water, or groundwater results, the event will be considered significant.

Contamination is defined as the following:

- Soil
  - when concentrations of any contaminant exceed the guidelines provided in the Nova Scotia Contaminated Sites Regulations – Tier 1 Environmental Quality Standards for Soil at a Non-potable Site, Section 1, Table 1B;
- Surface Water
  - when concentrations of any contaminant exceed the guidelines provided in the Nova Scotia Contaminated Sites Regulations – Tier 1 Environmental Quality Standards for the Protection of Freshwater Aquatic Life in Surface Water, Section 1, Table 3;
- Groundwater
  - when concentrations of any contaminant exceed the guidelines provided in the Nova Scotia Contaminated Sites Regulations – Tier 1 Environmental Quality Standards for Groundwater at a Non-potable Site, Section 1, Table 4.

Potential Interactions and Effects

The potential interactions between infrastructure failure and VCs are outlined in Tables 5.7-1 to 5.7-3. Additional detail by VC is outlined in Table 6.18-5. Only those interactions with a high potential to cause adverse effects should they occur are discussed in detail.

Table 6.18-5 Infrastructure Failure Interactions with VCs

Valued Component (VC)	Potential Infrastructure Failure and VC Interaction	Potential for Adverse Effects
Atmospheric Environment	• An infrastructure failure event could potentially cause a fuel oil spill or small fire and release particulate matter, carbon monoxide, sulphur dioxide, nitrous oxides, and volatile organic compounds to the atmosphere	Low

Valued Component (VC)	Potential Infrastructure Failure and VC Interaction	Potential for Adverse Effects
Geology, Soil, and Sediment Quality	• An infrastructure failure event could potentially cause a release of fuel oil to soil if released to the terrestrial environment	Low
Surface Water Quality and Quantity	• No potential interaction anticipated	-
Groundwater Quality and Quantity	• No potential interaction anticipated	-
Wetlands	• No potential interaction anticipated	-
Fish and Fish Habitat	• No potential interaction anticipated	-
Habitat and Flora	• No potential interaction anticipated	-
Birds	• No potential interaction anticipated	-
Fauna	• No potential interaction anticipated	-
Species of Conservation Interest and Species at Risk	• No potential interaction anticipated	-
Indigenous Peoples	• No potential interaction anticipated	-
Physical and Cultural Heritage	• No potential interaction anticipated	-
Human Health and Socio-economic Considerations	• Failure of infrastructure could potentially cause injury or death to mine workers	High

The emissions produced through volatilization of fuel oil or through a small fire from an infrastructure failure event would be temporary and localized to the area directly around the failure. In addition, a release of fuel oil, lubricants or other Project related raw materials would be minor in volume and likely contained and cleaned up prior to significantly effecting soil. As a result, potentially adverse effects to the atmospheric environment, and geology, soil, and sediment quality are considered low.

Infrastructure that is improperly designed and constructed poses a health and safety risk to workers during the site preparation and construction, and operation and maintenance phases, as well as a financial liability risk related to infrastructure damage or loss.

The maximum effect of an infrastructure failure as it relates to worker health and safety would be a death caused by falling objects or collapsing structures. The maximum effect of an infrastructure failure as it relates to financial liability would be damage to or a total loss of one or more pieces of infrastructure.

Given proper design and construction of infrastructure, failure will most likely to occur during the operation and maintenance phase of the Project when infrastructure is being worn and torn through operational processes. Infrastructure with moving components, such as the crusher and conveyor, are more likely to fail than static infrastructure, such as the office and workshop facilities.

Given infrastructure failure would likely not result in disturbance to a greenfield environment, potential adverse effects to other VCs from an infrastructure failure occurrence are anticipated to be non-existent.

Mitigation and Emergency Response

Infrastructure at the Beaver Dam Mine Site will be minimal and given the short life of the Project, failure should not occur without being acted upon by extreme natural causes, such as a hurricane or earthquake, or human error.

On-site infrastructure would be informally inspected by site personnel for signs of premature failure through the normal course of the working shift. More rigorous inspection would occur with routine maintenance. Existing legislation is well established and understood by the Proponent personnel through the development and future operation of the Touquoy Mine Site.

A Health and Safety Plan will be developed and implemented for the Beaver Dam Mine Site, which will include evacuation procedures, proper housekeeping procedures for the storage and use of small equipment, and materials.

6.18.4 Accidents

6.18.4.1 Beaver Dam Mine Site

6.18.4.2 Fuel and/or Other Spills

All phases of the Project have the potential for fuel and/or other spills to occur. The perceived risk of a spill is most logical during the operation and maintenance phase when the following is occurring at the Beaver Dam Mine Site:

- bulk storage of diesel fuel is present on-site;
- frequent transfer and handling of diesel fuel is occurring;
- mobile equipment is operating and being maintained; and
- waste fluids such as oils, lubricants, and antifreeze are produced.

The site preparation and construction, and decommissioning and reclamation phases of the Project will have reduced risk due to a number of these activities not yet occurring or ceasing once the operation and maintenance phase is over.

Spills associated with these activities may occur through failure of storage tanks, improper fuel transfer procedures, fuel/hydraulic line breaks or leaks, spillage or failure of storage containers, and/or mobile equipment and refueling truck accidents.

A worst-case scenario would be a transportation collision causing the entire amount of material being transported to be spilled into a water body. The effects of the spill would vary depending on the material spilled; diesel fuel and gasoline are toxic to aquatic life and would have the greatest impact to the environment.

Diesel fuel will be delivered to double-walled aboveground storage tanks via licensed tanker trucks and be used in all mobile equipment and to power on-site generators. Other petroleum based and non-petroleum based liquids will be used for equipment maintenance.

Diesel fuel and lubricant storage will be located near the primary crusher and a dedicated refueling truck will deliver these materials to the mine and maintenance mobile fleet, as well as diesel powered generators. The fleet of Haul Road trucks required to transport crushed ore from the Beaver Dam Mine Site to Touquoy Mine Site will be refueled at the Beaver Dam Mine Site as needed using the fuel and lube truck noted above.

Threshold for Determination of Significance

The criteria that would determine a significant effect should a fuel and/or other spill occurs is based primarily on environmental protection. Should a spill result in the loss of any quantity of fuel, oil, lubricant, or other Project related raw materials to the environment such that a measurable contamination of soil, surface water, or groundwater results, the event will be considered significant.

Contamination is defined as the following:

- Soil
  - when concentrations of any contaminant exceed the guidelines provided in the Nova Scotia Contaminated Sites Regulations – Tier 1 Environmental Quality Standards for Soil at a Non-potable Site, Section 1, Table 1B;
- Surface Water
  - when concentrations of any contaminant exceed the guidelines provided in the Nova Scotia Contaminated Sites Regulations – Tier 1 Environmental Quality Standards for the Protection of Freshwater Aquatic Life in Surface Water, Section 1, Table 3;
- Groundwater
  - when concentrations of any contaminant exceed the guidelines provided in the Nova Scotia Contaminated Sites Regulations – Tier 1 Environmental Quality Standards for Groundwater at a Non-potable Site, Section 1, Table 4.

Potential Interactions and Effects

The potential interactions between fuel and/or other spills and VCs are outlined in Tables 5.7-1 to 5.7-3. Additional detail by VC is outlined in Table 6.18-6. Only those interactions with a high potential to cause adverse effects should they occur are discussed in detail.

Table 6.18-6 Fuel and/or Other Spills Interactions with VCs

Valued Component	Potential Fuel and/or Other Spills and VC Interaction	Potential for Adverse Effects
Atmospheric Environment	• Fuel and/or other spills could potentially volatilize into the atmosphere	Low
Geology, Soil, and Sediment Quality	• Fuel and/or other spills could potentially contaminate bedrock and soil if released to the terrestrial environment • Fuel and/or other spills could potentially contaminate sediment if released to the aquatic environment along the Haul Road	High
Surface Water Quality and Quantity	• Fuel and/or other spills could potentially contaminate surface water if released to	High

Valued Component	Potential Fuel and/or Other Spills and VC Interaction	Potential for Adverse Effects
	the aquatic environment ~~along the haul road~~	
Groundwater Quality and Quantity	• Fuel and/or other spills could potentially contaminate groundwater if released to the terrestrial environment and soil/bedrock conditions allow vertical migration	High
Wetlands	• Fuel and/or other spills could potentially contaminate wetlands if released to the aquatic or terrestrial environment ~~along the haul road~~	High
Fish and Fish Habitat	• Fuel and/or other spills could potentially adversely affect fish and fish habitat if released to the aquatic environment ~~along the haul road~~	High
Habitat and Flora	• No potential interaction anticipated	-
Birds	• Fuel and/or other spills could potentially adversely affect birds	Low
Fauna	• Fuel and/or other spills could potentially adversely affect fauna	Low
Species of Conservation Interest and Species at Risk	• Fuel and/or other spills could potentially adversely affect species of conservation interest and species at risk if released to the terrestrial environment and/or aquatic environment ~~along the haul road~~	High
Indigenous Peoples	• Fuel and/or other spills could potentially adversely affect Indigenous Peoples.~~No potential interaction anticipated~~	High
Physical and Cultural Heritage	• No potential interaction anticipated	-
Human Health and Socio-economic Considerations	• No potential interaction anticipated	-

Volatilization of fuel oil and/or other substances should they be spilled would be localized to the area directly around the spill. In addition, only a minor portion of diesel fuel oil, the most widely used substance for the Project, is considered volatile. Adverse effects to birds and fauna are considered low due to the developed nature and lack of habitat in areas (Beaver Dam Mine Site) considered being at the greatest risk for fuel and/or other spills. As a result, potentially adverse effects to the atmospheric environment, birds, and fauna are considered low.

Accidents that cause a fuel and/or other spill pose an environmental risk to the following VCs:

- geology, soil, and sediment;
- surface water quality and quantity;
- groundwater quality and quantity;
- wetlands;

- fish and fish habitat; and
- SOCI/SAR; and
- Indigenous Peoples.

Indigenous Peoples' use of land and resources for traditional purposes has the potential to be adversely affected from the underlying changes to other VCs that a fuel and/or other spill would cause. Depending on the location and timing of a potential fuel and/or other spill both groundwater and surface water quality could be affected, which in turn could directly affect traditional practices and drinking water of Indigenous people. There also could be potential indirect effects as a result of a spill event to the current land and resource use due to potential adverse effects to fish, fish habitat, wetlands and terrestrial habitats and species.

The greatest potential for a fuel and/or other spills to occur is during the site preparation and construction, and operation and maintenance phases when the greatest amount of fuel is being stored, handled, and transferred on-site.

Small spills like those seen due to improper transfer procedures during refueling of equipment will likely have negligible environmental effects, while larger spills like those seen due to equipment/storage tank failures and mobile equipment accidents may have significant environmental effects.

The location of the spill will also determine the magnitude of effects. A spill occurring within the Beaver Dam Mine Site is unlikely to cause significant environmental effects as the area will be largely devoid of ecological receptors and the presence of hundreds of workers will likely lead to quick and efficient containment and cleanup efforts. The primary receiver for spills in this area is the soil portion of the geology, soil, and sediment quality VC. Spills are unlikely to reach surface water, sediment, groundwater, wetlands, and fish habitat due to anticipated spill response times, as well as containment and cleanup efforts. A spill occurring due to an accident along the Haul Road may have more significant environmental effects if the accident occurs in close proximity to a watercourse or wetland. If not, the primary receiver for spills along the Haul Road is the soil portion of the geology, soil, and sediment quality VC.

Mitigation and Emergency Response

The source of greatest risk for potential spills and releases of diesel fuel relates to the improper execution of procedures for transfer and handling to and from stationary and mobile tankage. Other sources of potential spills and releases of diesel fuel relate to equipment failures, damage to storage or piping systems, mobile equipment accidents, and mobile refueling truck accidents. Releases of maintenance fluids pose a lesser risk in terms of magnitude, but can still occur due to equipment failures, damage to storage containers, and mobile equipment accidents. A release of these fluids may result in soil, groundwater, and/or surface water contamination that may adversely ecological receptors through absorption, and/or ingestion of contaminated media.

Preventative procedures will be undertaken and fuel storage and transfer areas will be designed to accommodate these procedures, such as limiting areas of fuel transfer. Staff will be trained in spill response measures and spill response kits will be accessible in areas of fuel transfer. A petroleum management plan and a spill response plan will be developed. The contingency measures developed as part of the spill response plan will be focused on areas of high ecological importance and areas used by Indigenous Peoples and will provide a plan on how such areas could/would be protected in the event of a spill.

If a spill were to occur, emergency procedures would be implemented that will be outlined in the site emergency response plan. Generally, spill response includes raising the alarm, evacuation of all equipment and personnel from the area and possibly the area up wind, away from any vapour cloud, and establishment of a 500-1000 m radius exclusion zone from the spill location. An assessment is then made using on-site staff and possibly external resources (air quality specialists) to determine the type, quantity and source of the spill and whether Emergency Services are required. If required, Emergency Services will be contacted. The safety data sheet for the spilled material will be reviewed and will be made available to Emergency Services. A plan to contain and clean up the spill, as well as actions to prevent future incidents, will be detailed in a recovery plan. If it is safe to do so, the spill source will be shut down and any ignition sources will be isolated. Barriers and signs to prevent access to the affected area may be required until the spill is completely contained and cleaned up. Depending on the regulator involvement there may be a requirement to file incident reports with certain regulatory agencies prior to initiating the clean up and return to work in the area, these are very case specific and often dependent on whether personnel were injured or equipment damaged as a result of the spill.

6.18.4.3 Unplanned Explosive Event

An unplanned explosive event is limited to the site preparation and construction, and operation and maintenance phases of the Project. The worst-case scenario would be bodily harm as a result of improperly handling explosives.

Explosives will be supplied by an off-site contractor and there will be no requirement for an on-site magazine.

Threshold for Determination of Significance

The criteria that would determine a significant effect should an unplanned explosive event occur is based primarily on worker health and safety and secondarily on property damage and environmental protection.

Should an unplanned explosive event result in injury or death to a worker or a loss of infrastructure or mobile equipment the event will be considered significant.

Should an unplanned explosive event result in the loss of any quantity of fuel, oil, lubricant, or other Project related raw materials to the environment such that a measurable contamination of soil, surface water, or groundwater results, the event will be considered significant.

Contamination is defined as the following:

- Soil
  - concentrations of any contaminant exceed the guidelines provided in the Nova Scotia Contaminated Sites Regulations – Tier 1 Environmental Quality Standards for Soil at a Non-potable Site, Section 1, Table 1B;
- Surface Water
  - concentrations of any contaminant exceed the guidelines provided in the Nova Scotia Contaminated Sites Regulations – Tier 1 Environmental Quality Standards for the Protection of Freshwater Aquatic Life in Surface Water, Section 1, Table 3;

- Groundwater
  - concentrations of any contaminant exceed the guidelines provided in the Nova Scotia Contaminated Sites Regulations – Tier 1 Environmental Quality Standards for Groundwater at a Non-potable Site, Section 1, Table 4.

Potential Interactions and Effects

The potential interactions between an unplanned explosive event and VCs are outlined in Tables 5.7-1 to 5.7-3. Additional detail by VC is outlined in Table 6.18-7. Only those interactions with a high potential to cause adverse effects should they occur are discussed in detail.

Table 6.18-7 Unplanned Explosive Event Interactions with VCs

Valued Component	Potential Unplanned Explosive Event and VC Interaction	Potential for Adverse Effects
Atmospheric Environment	• An unplanned explosive event could potentially cause suspension of dust particles into the atmosphere	Low
Geology, Soil, and Sediment Quality	• An unplanned explosive event could potentially cause a release of fuel oil and/or ammonium nitrate to soil	Low
Surface Water Quality and Quantity	• No potential interaction anticipated	-
Groundwater Quality and Quantity	• No potential interaction anticipated	-
Wetlands	• No potential interaction anticipated	-
Fish and Fish Habitat	• No potential interaction anticipated	-
Habitat and Flora	• No potential interaction anticipated	-
Birds	• An unplanned explosive event could potentially cause behavioral effects to birds in the area	Low
Fauna	• An unplanned explosive event could potentially cause behavioral effects to fauna in the area	Low
Species of Conservation Interest and Species at Risk	• An unplanned explosive event could potentially cause behavioral effects to species of conservation interest and species at risk in the area	Low
Indigenous Peoples	• No potential interaction anticipated	-
Physical and Cultural Heritage	• An unplanned explosive event could potentially destroy undiscovered archaeological, historical, and/or paleontological artifacts	Low
Human Health and Socio-economic Considerations	• An unplanned explosive event could potentially cause injury or death to mine workers	High

Dust suspended from an unplanned explosive event would be temporary and localized to the area directly around the explosion. In addition, a release of ammonium nitrate or fuel oil to the environment is considered unlikely as the majority of these substances will be consumed should an explosion occur. Effects to birds, fauna, and SOCI/SAR will likely be minimal due to the Beaver Dam Mine Site being devoid of habitat once blasting commences. Effects to physical and cultural heritage will likely be minimal as well; it is anticipated that anywhere an unplanned explosive event as the potential to occur, the ground will already be disturbed by site preparation and construction activities. As a result, potentially adverse effects to the atmospheric environment, birds, fauna, SOCI/SAR, and physical and cultural heritage are considered low.

Explosives that are improperly handled pose a health and safety risk to workers during the site preparation and construction, and operation and maintenance phases of the Project, as well as a financial liability risk related to infrastructure and mobile equipment damage or loss.

The maximum effect of an unplanned explosive event as it relates to worker health and safety would be a death caused by direct interaction or from falling objects or collapsing structures damaged from the explosion. The maximum effect of an unplanned explosive event as it relates to financial liability would be damage to or a total loss of one or more pieces of infrastructure or mobile equipment.

Explosives will be supplied and managed by a licensed contractor. ~~Explosives will be supplied and managed by an off-site licensed contractor. There will be no requirement for an on-site magazine.~~

Mitigation and Emergency Response

Blasting will be undertaken by a qualified contractor and explosives who will be responsible for all licensing and approvals as required by Natural Resources Canada for this Project. Transportation, storage and handling of explosives will be carried out in compliance with the Explosives Act and any other relevant legislation. ~~Blasting will be undertaken by a qualified contractor and explosives will be stored off-site. As the magazine will be off-site there is no requirement for an on-site magazine or associated permitting through Natural Resources Canada for this Project.~~ If an unplanned explosive event were to occur, emergency procedures would be implemented that will be outlined in the site emergency response plan. Generally, unplanned explosive event response includes raising the alarm and evacuation of all equipment and personnel from the area. No attempt to approach or extinguish any fire should be made. An assessment is then made using on-site staff to determine whether Emergency Services are required. If required, Emergency Services will be contacted. A safe zone around the affected area will be established, the size of which will be determined by on-site staff and possibly external resources (explosive specialists). Barriers and signs to prevent access to the affected area may be required until clean up is complete. Depending on the regulator involvement there may be a requirement to file incident reports with certain regulatory agencies prior to initiating the clean up and return to work in the area, these are very case specific and often dependent on whether personnel were injured or equipment damaged as a result of the unplanned explosive event.

6.18.4.4 Mobile Equipment Accident

All phases of the Project will have the potential for vehicular accidents to occur. A worst-case scenario would be a severe accident causing injury or death.

The majority of mobile equipment traffic will be limited to the Beaver Dam Mine Site where guided traffic patterns, speed limits, right-of-way signage, and training will minimize the risk of vehicular accidents. The remaining mobile equipment will include haul trucks, which will ~~travel~~ transport crushed ore 30 km from the Beaver Dam Mine Site to the Touquoy Mine Site. The number of return truck trips per day will be an annual average of approximately 185 for 12 or 16 hours per day, 350 days per year for the anticipated duration of the mine Project (3.3 years). During construction and pre-production (8 months), the number of trips will be less and required for moving material from Touquoy to Beaver Dam and construction and upgrade of the Haul Roads.

The Haul Road will be dual lane and designed to facilitate the safe passage of two-way truck traffic at 70 km/h. Speed limit and Right-of-way signage will be installed and all haul truck operators will receive operator training to minimize the risk of haul truck collisions. All intersections will be designed to NSTIR Standards.

Threshold for Determination of Significance

The criteria that would determine a significant effect should a mobile equipment accident occur is based primarily on worker health and safety and secondarily on property damage and environmental protection.

Should a mobile equipment accident result in injury or death to a worker or a loss of infrastructure or mobile equipment the event will be considered significant.

Should a mobile equipment accident result in the loss of any quantity of fuel, oil, lubricant, or other Project related raw materials to the environment such that a measurable contamination of soil, surface water, or groundwater results, the event will be considered significant.

Contamination is defined as the following:

- Soil
  - concentrations of any contaminant exceeding the guidelines provided in the Nova Scotia Contaminated Sites Regulations – Tier 1 Environmental Quality Standards for Soil at a Non-potable Site, Section 1, Table 1B;
- Surface Water
  - concentrations of any contaminant exceeding the guidelines provided in the Nova Scotia Contaminated Sites Regulations – Tier 1 Environmental Quality Standards for the Protection of Freshwater Aquatic Life in Surface Water, Section 1, Table 3;
- Groundwater
  - concentrations of any contaminant exceeding the guidelines provided in the Nova Scotia Contaminated Sites Regulations – Tier 1 Environmental Quality Standards for Groundwater at a Non-potable Site, Section 1, Table 4.

Potential Interactions and Effects

The potential interactions between a mobile equipment accident and VCs are outlined in Tables 5.7-1 to 5.7-3. Additional detail by VC is outlined in Table 6.18-8. Only those interactions with a high potential to cause adverse effects should they occur are discussed in detail further.

Table 6.18-8 Mobile Equipment Accident Interactions with VCs

Valued Component (VC)	Potential Mobile Equipment Accident and VC Interaction	Potential for Adverse Effects
Atmospheric Environment	• A mobile equipment accident could potentially cause a fuel oil spill or small fire and release particulate matter, carbon monoxide, sulphur dioxide, nitrous oxides, and volatile organic compounds to the atmosphere	Low
Geology, Soil, and Sediment Quality	• A mobile equipment accident could potentially cause a release of fuel oil to soil if released to the terrestrial environment • A mobile equipment accident could potentially cause a release of fuel oil to sediment if released to the aquatic environment.	Low
Surface Water Quality and Quantity	• A mobile equipment accident could potentially cause a release of fuel oil to watercourses ~~along the haul road~~	High
Groundwater Quality and Quantity	• No potential interaction anticipated	-
Wetlands	• A mobile equipment accident could potentially cause a release of fuel oil to wetlands ~~along the haul road~~	High
Fish and Fish Habitat	• A mobile equipment accident could potentially cause a release of fuel oil to fish habitat ~~along the haul road~~	High
Habitat and Flora	• No potential interaction anticipated	-
Birds	• A mobile equipment accident could potentially cause bird mortality through direct strikes	Low
Fauna	• A mobile equipment accident could potentially cause fauna mortality through direct strikes	Low
Species of Conservation Interest and Species at Risk	• A mobile equipment accident could potentially cause a release of fuel oil to watercourses ~~along the haul road~~ • A mobile equipment accident could potentially cause aquatic based species of conservation interest and species at risk mortality through direct strikes	High / Low
Indigenous Peoples	• No potential interaction anticipated	-
Physical and Cultural Heritage	• No potential interaction anticipated	-
Human Health and Socio-economic Considerations	• A mobile equipment accident could potentially cause injury or death to mine workers	High

The emissions produced from a mobile equipment accident would be temporary and localized to the area directly around the accident. In addition, a release of fuel oil, lubricants or other Project related raw materials would be minor in volume and likely contained and cleaned up prior to significantly effecting soil or sediment quality. Effects to birds, fauna, and SOCI/SAR would be limited to death by direct strike, which would be limited to individuals rather than species populations. As a result, potentially adverse effects to the atmospheric environment, geology, soil, and sediment quality, birds, fauna, and SOCI/SAR are considered low.

Mobile equipment accidents pose an environmental risk to the following VCs:

- surface water quality and quantity;
- wetlands;
- fish and fish habitat; and
- SOCI/SAR.

The greatest potential for a mobile equipment accident to occur and cause adverse environmental effects is during the site preparation and construction, and operation and maintenance phases when the largest amount of mobile equipment is in use. The primary risk for the VCs listed above is associated with the release of fuel oil to the environment.

The magnitude of a release from mobile equipment is dependent on the severity and type of accident that occurs. A large spill can occur if an accident results in the complete destruction of a storage tank, or a small spill can occur if an accident results in a fuel line leak.

The location of the mobile equipment accident will also determine the magnitude of effects. An accident occurring within the Beaver Dam Mine Site boundaries is unlikely to cause significant environmental effects as the area will be largely devoid of ecological receptors and the presence of hundreds of workers will likely lead to quick and efficient containment and cleanup efforts. The primary receiver for spills as a result of accidents in this area is the soil portion of the geology, soil, and sediment quality VC. Spills are unlikely to reach surface water, sediment, groundwater, wetlands, and fish habitat due to anticipated spill response times, as well as containment and cleanup efforts. A spill occurring due to an accident along the Haul Road may have more significant environmental effects if the accident occurs in close proximity to a watercourse or wetland. Should this occur, the effects to surface water quality, wetland health, fish and fish habitat, and SOCI/SAR may be more pronounced.

A mobile equipment accident may pose a health and safety risk to workers during all phases of the Project, as well as a financial liability risk related to mobile equipment damage or loss. The risk of a mobile equipment accident may decrease once the operations and maintenance phase ceases, as decommissioning and reclamation will likely require fewer pieces of mobile equipment.

The maximum effect of a mobile equipment accident as it relates to worker health and safety would be a death caused by a collision of two pieces of mobile equipment, a single equipment crash, or a direct strike from mobile equipment. The maximum effect of a mobile equipment accident as it relates to financial liability would be damage to or a total loss of one or more pieces of mobile equipment.

Mitigation and Emergency Response

The majority of mobile equipment traffic will be limited to the Beaver Dam Mine Site where guided traffic patterns, speed limits, right-of-way signage, and training will minimize the risk of vehicular accidents. The remaining mobile equipment will include haul trucks, which will transport crushed ore 30 km from the

Beaver Dam Mine Site to the Touquoy Mine Site. The Haul Road will be dual lane and designed to facilitate the safe passage of two-way truck traffic at 70 km/h. Speed limits will be enforced on the Mine Site and Haul Road.

Speed limit and right-of-way signage will be installed and all haul truck operators will receive operator training to minimize the risk of haul truck collisions. All intersections will be designed to NSTIR Standards. Communications will be maintained between vehicles using radios so that adverse conditions or collisions may be reported immediately. The operator~~s~~ ~~will~~ training~~ undergo training which~~ will include proper procedures for daily travel to minimize the risk of vehicular accidents, as well as procedures related to emergency response should there be a vehicular accident.

Good maintenance practices for equipment and vehicle maintenance will be undertaken, including regular maintenance as specified by suppliers.

An emergency response plan will be developed for the Project and will include procedures to be followed in the event of a mobile equipment accident. The legislation is well established and understood by the Proponent’s staff and will be conveyed to any contractors at the site so that all know of actions to take and reporting requirements.

If a mobile equipment accident were to occur, emergency procedures would be implemented that will be outlined in the site emergency response plan. Generally, mobile equipment accident response includes raising the alarm, providing first aid to any injured persons, and securing all equipment in the area. An assessment is then made using on-site staff to determine whether Emergency Services are required and the cause of the accident. If required, Emergency Services will be contacted. A plan to determine what repairs are needed and actions to prevent future incidents will be detailed in a recovery plan. Depending on the regulator involvement there may be a requirement to file incident reports with certain regulatory agencies prior to initiating the clean up and return to work in the area, these are very case specific and often dependent on whether personnel were injured or equipment damaged as a result of the mobile equipment accident.

6.18.4.5 Touquoy Mine

The Project will utilize the existing processing facility at the Touquoy Mine Site to process Beaver Dam ore. The Touquoy Mine Site is a fully permitted and approved facility currently operating as part of the Touquoy Gold Mine Project in Moose River, Halifax County, Nova Scotia.

Only minor changes to the existing works will be necessary to modify the Touquoy Mine Site to process Beaver Dam ore. The minor modifications to the processing facility can be accommodated within the existing footprint and do not result in a change the processing flowsheet. Beaver Dam tailings will be stored in the exhausted Touquoy open pit as opposed to the Touquoy tailings management facility. The tailings and reclaim water lines will be re-routed in order to transport Beaver Dam tailings to the exhausted Touquoy pit and return process water to the mill. The Touquoy Mine Site footprint will, as a result, be maintained as originally permitted.

An amendment to the Touquoy IA will be sought as necessary to accommodate these changes. As well, the currently approved Reclamation Plan will be updated to reflect the above changes and re-submitted.

The continued operation of the Touquoy processing plant and the use of the open pit mine for tailings storage will create the potential for accidents and malfunctions to occur at the Touquoy Mine Site for an additional four years. The potential for accidents and malfunctions at the Touquoy Mine Site will continue to be mitigated through the application of existing environmental management plans, operating procedures and monitoring programs.

6.18.4.6 Tailings and Reclaim Water Pipelines Spills

Prior to the completion of mining operations at the Touquoy Mine Site, a tailings line will be routed to the exhausted Touquoy pit in preparation to receive Beaver Dam tailings. Tailings will flow by gravity from the mill to the open pit. Initially, reclaim water will continue to be withdrawn from the supernatant pond in the existing TMF via the existing reclaim works to supply processing water needs for Beaver Dam ore. A reclaim water pump and barge, with a new pipeline to the process water tank, will be installed when process water accumulation from the tailings slurry deposited in the open pit is adequate. The transition from the TMF to the open pit reclaim water system is expected to be smooth, requiring minimal downtime and no expected extra fresh water requirements beyond what is currently permitted from Scraggy Lake under Touquoy's water withdrawal approvals. The existing TMF will only be used for initial process water requirements and will not be used for tailings storage in the processing of Beaver Dam ore.

Supernatant water collected in the open pit will be pumped to the process water tank located next to the pre-leach thickener. The sections of the tailings and reclaim pipelines between the plant site and open pit will be double-walled and run in HDPE lined trenches to an adequately sized lined collection ponds capable of containing the volume of the pipeline. Monitoring systems will be installed on the pipelines for leak detection and triggering shutdown procedures.

The Touquoy Project currently employs an Operation, Maintenance and Surveillance (OMS) Manual for the existing TMF. This manual will be updated in advance of using the open pit for storage of Beaver Dam tailings in order to reflect changes in operating conditions and environmental factors. As well, Touquoy also currently employs an Emergency and Spill Response Plan which will also be updated, Environmental monitoring will continue as prescribed under the Touquoy IA which will be amended as necessary to reflect the changes in processing of Beaver Dam ore and storage of Beaver Dam tailings in the exhausted pit.

Threshold for Determination of Significance

The criteria that would determine a significant effect should a tailings or reclaim water pipeline fail, is based primarily on environmental protection. Should a pipeline failure result in an uncontrolled discharge of tailings and/or process water to the receiving surface water environment the event will be considered significant.

Comparison of receiving surface water samples to CCME FWAL TSS guidelines and MMER TSS guidelines will be utilized to determine if tailings/process water will have an impact on surface water quality and subsequently on fish and fish habitat.

Potential Interactions and Effects

The potential interactions between a tailings or reclaim water pipeline accident and VCs are outlined in Tables 5.7-1 to 5.7-3. Additional detail by VC is outlined in Table 6.18-9. Only those interactions with a high potential to cause adverse effects should they occur are discussed in detail further.

Table 6.18-9 Unplanned Tailings/Reclaim Water Line Event Interactions with VCs

Valued Component (VC)	Potential Unplanned Tailings/Reclaim Line Event and VC Interaction	Potential for Adverse Effects
Noise	• No potential interaction anticipated	-
Air	• No potential interaction anticipated	-
Light	• No potential interaction anticipated	-
Greenhouse Gases	• No potential interaction anticipated	-
Geology, Soil, and Sediment Quality	• No potential interaction anticipated	-
Surface Water Quality and Quantity	• Failure of a tailings or reclaim water pipeline could potentially cause tailings solids and/or contaminated process water to discharge to surface waters	Low
Groundwater Quality and Quantity	• No potential interaction anticipated	-
Wetlands	• No potential interaction anticipated	-
Fish and Fish Habitat	• Failure of a tailings or reclaim water pipeline could potentially cause tailings solids and/or contaminated process water to discharge to surface waters	Low
Habitat and Flora	• No potential interaction anticipated	-
Birds	• No potential interaction anticipated	-
Fauna	• No potential interaction anticipated	-
Species of Conservation Interest and Species at Risk	• No potential interaction anticipated	-
Indigenous Peoples	• No potential interaction anticipated	-
Physical and Cultural Heritage	• No potential interaction anticipated	-
Socioeconomic Considerations	• No potential interaction anticipated	-

Mitigation and Emergency Response

The sections of the tailings and reclaim pipelines between the plant site and open pit will be double-walled and run in HDPE lined trenches to an adequately sized lined collection pond capable of containing the volume of the pipeline. The catchment pond will be lined with suitable materials, such as clay or a plastic liner.

Process controls will be in place to detect a pipeline leak or spill and initiate shutdown procedures.

The potential for accidents and malfunctions at Touquoy mine will continue to be mitigated through the application of existing environmental management plans, operating procedures and monitoring programs, including the OMS Manual and Emergency and Spill Response Plan.

Given the location of the pipelines, trench and catchment pond within the mine production area and in close proximity to other facilities and personnel, detection and response to any spill would be expected to be rapid and confined to the mine footprint area and not result in significant release to the receiving environment.

If a tailings and/or reclaim water pipelines spill were to occur, emergency procedures would be implemented that will be outlined in the site emergency response plan. Generally, tailings and/or reclaim water pipelines emergency response includes evacuation of all equipment and personnel from the area. If tailings and/or reclaim water encroach on neighbouring properties or public roadways, appropriate authorities will be notified and construction of bunds and/or diversion drains may be required to contain tailings and/or reclaim water on-site. Other immediate responses may include lowering tailing pond levels, stopping the inflow into the tailings pond from the mill, stabilizing unstable slopes, and mitigating downstream consequences. An assessment is then made using on-site staff and possibly external resources (surface water specialists) as to what repairs are needed and actions to prevent future incidents. This will be detailed in a recovery plan. Depending on the regulator involvement there may be a requirement to file incident reports with certain regulatory agencies prior to initiating the repairs and return to work in the area, these are very case specific and often dependent on whether personnel were injured or equipment damaged as a result of tailings and/or reclaim water pipelines spill.

6.18.4.7 Cyanide Release

Cyanide Handling

Sodium cyanide (NaCN) is a key reagent used in the Carbon-In-Leach (CIL) process to leach gold from a sold matrix to form a gold cyanide complex that can be extracted from the slurry by adsorption onto activated carbon.

NaCN is delivered to Touquoy in the form of in dry briquettes from an approved supplier as per International Cyanide Management Code (ICMC) standards. NaCN deliveries are made by truck in one tonne secured (strapped) wooden crates. Within the crates the NaCN is double wrapped and sealed closed. Upon receipt at Touquoy, the sodium cyanide is stored in a locked, fenced area within the secure reagent building and kept under camera surveillance.

Prior to use, NaCN is mixed with water and sodium hydroxide (NaOH) for dilution and pH control within a mixing tank. Prior to mixing, operators suit up in full personnel protective equipment (PPE) including Tyvek suits and powdered air purifying respirators (PAPR). Water and NaOH are added to the cyanide mix tank. The wooden crates are opened, and a gantry crane lifts the bags out and transports them to the mix tank. The bags are lifted by crane into the bag cutter on top of the mix tank and the door is shut to enclose the bag. The bag is slowly lowered onto the bag cutter and the dry solids are emptied into the mix tank. The bag cutter has water sprays to clean the cyanide bags prior to removing from the enclosure. This process is repeated for 4 cyanide (NaCN) bags to achieve a mix concentration of ~22%. Once the NaCN storage tank level drops below 20% the contents of the mix tank are then transferred to the storage tank for distribution throughout the plant.

Cyanide is added into three areas; Leach tank #1, Intensive Leach Reactor (ILR) and Barren Eluate tank #12. Leach tank #1 is a continuous addition whenever the leach circuit is being fed with ore. It is controlled based on constant cyanide titrations throughout the leach/CIL circuit. The ILR and Barren Eluate tank are dosed based on a batch process. When a batch is ready, the dosage is controlled based on a flowmeter to a targeted concentration. All these addition points have pH control reagents (NaOH or Lime) with automated interlocks that will not permit NaCN addition until a suitable pH is achieved to avoid the formation of hydrogen cyanide (HCN) gas.

Cyanide target concentrations are as follows:

- Leach tank # 1 = 50ppm (0.005%). By the end of the CIL circuit (CIL tank #6), the remaining cyanide is about 30ppm (0.003%)
- ILR = 14, 000ppm (1.4%). Once the process is complete, this small volume (5.2m3) is transferred and diluted in the much larger Leach/CIL circuit (9,100m3) for consumption.
- Barren Eluate Tank #12 = 1000ppm (0.1%). Once the process is complete, the remaining cyanide stays in the tank to be re-used during the next batch. Each new batch, the cyanide is just topped up to the target concentration.

Cyanide Detoxification

Cyanide detoxification occurs within the cyanide destruction circuit. Slurry passing through the carbon safety screen gravitates to two 300 m3 cyanide detoxification tanks which are designed on the conventional air-SO2 process and can operate in series or parallel for operational flexibility. The average slurry residence time at 250 t/h is 1.5 hours.

The tanks utilize high shear agitators and air injection to enhance high oxygen dissolution in the slurry to meet the high oxygen demand of the cyanide destruction process. Sodium metabisulphite and copper sulphate solutions are dosed into either tank providing the oxidizing agent and catalyst respectively for the cyanide destruction. Acid generation is neutralized by the addition of lime slurry to the detox tanks via a ring main.

The detoxified slurry stream gravitates to the tailings hopper from where it is pumped through a single pipeline to the TMF by variable speed tailings pumps (1 duty/1 standby). The tailings slurry is then discharged at selected outlet points around the periphery of the facility. Pipe runs are designed to be self-draining to avoid dead legs.

Contingency measures for cyanide detoxification include primary linear and secondary rotary vezin tailings samplers taking representative tailings samples after the slurry has been detoxified and prior to entering the tailings hopper. The cyanide destruction and tailings hopper area has a dedicated bunded concrete area for collecting spillage. A local sump pump returns any spillage to the carbon safety screen. The area is enclosed for cold weather protection. A CNWAD analyzer automatically monitors slurry levels and a HCN detector provides monitoring for airborne gas.

Shutdown procedures are in place in the event of process upsets including cyanide detoxification.

Threshold for Determination of Significance

The criteria that would determine a significant effect should an unplanned cyanide release occur is based primarily on worker health and safety and environmental impact. Should an unplanned cyanide release result in injury or death to a worker or contamination of the receiving environment the event will be considered significant.

Potential Interactions and Effects

The potential interactions between an unplanned cyanide release and VCs are outlined in Tables 5.7-1 to 5.7-3. Additional detail by VC is outlined in Table 6.18-10. Only those interactions with a high potential to cause adverse effects should they occur are discussed in detail further.

Table 6.18-10 Unplanned Cyanide Event Interaction with VCs

Valued Component (VC)	Potential Unplanned Cyanide Event and VC Interaction	Potential for Adverse Effects
Noise	• No potential interaction anticipated	-
Air	• An unplanned cyanide release event could potentially cause short term toxic effects within the localized area	Low
Light	• No potential interaction anticipated	-
Greenhouse Gases	• No potential interaction anticipated	-
Geology, Soil, and Sediment Quality	• No potential interaction anticipated	Low
Surface Water Quality and Quantity	• An unplanned cyanide release event could potentially cause toxic effects within the localized area	Moderate
Groundwater Quality and Quantity	• An unplanned cyanide release event could potentially affect groundwater within the localized area	Low
Wetlands	• No potential interaction anticipated	-
Fish and Fish Habitat	• An unplanned cyanide release event could potentially cause toxic effects within the localized area	Moderate

Valued Component (VC)	Potential Unplanned Cyanide Event and VC Interaction	Potential for Adverse Effects
Habitat and Flora	• An unplanned cyanide release event could potentially cause toxic effects within the localized area	Low
Birds	• An unplanned cyanide release event could potentially cause toxic effects within the localized area	Low
Fauna	• An unplanned cyanide release event could potentially cause toxic effects within the localized area	Low
Species of Conservation Interest and Species at Risk	• An unplanned cyanide release event could potentially cause toxic effects within the localized area	Low
Indigenous Peoples	• An unplanned cyanide release event could potentially affect land use in short or long term	Low
Physical and Cultural Heritage	• No potential interaction anticipated	-
Socioeconomic Considerations	• An unplanned cyanide release event could potentially cause effects to safety and land use	Moderate

Mitigation and Emergency Response

Cyanide handling and use is highly regulated and subject to strict practices and procedures. Cyanide as delivered in dry briquette form is relatively safe from spills and easy to clean up in the event of a transportation or handling incident. Cyanide in solution is restricted to use within the processing facility with an abundance of design and process controls, as well as occupational health and safety practices, to prevent release of cyanide solution or gas within and without the building structure. Cyanide solution is detoxified by a proven and efficient process and tested by an automated in-line sampler prior leaving the processing facility, making the release of a high concentration (ie, non-detoxified) cyanide solution outside the confines of the process facility a highly unlikely event.

If cyanide exposure were to occur, emergency procedures would be implemented that will be outlined in the site emergency response plan. Generally, cyanide exposure response includes raising the alarm, contacting Emergency Services, evacuation of all personnel from the area to fresh air, removal of contaminated clothing, washing of cyanide residue from affecter personnel, administering oxygen, and securing the area. A plan to determine what repairs are needed and actions to prevent future incidents will be detailed in a recovery plan. Depending on the regulator involvement there may be a requirement to file incident reports with certain regulatory agencies prior to initiating the clean up and return to work in the area, these are very case specific and often dependent on whether personnel were injured as a result of the cyanide exposure.

6.18.5 Other Malfunctions

6.18.5.1 Forest and/or Site Fires

All phases of the Project will have the potential for forest and/or site fires to occur. A worst-case scenario is an extreme fire that results in worker injury or death ~~and~~ or that causes significant damage to the environment. A forest fire may occur through human or natural causes, while a site fire may occur due to an equipment failure and/or human error. Forest fires have the potential to affect the Project at the Beaver Dam Mine Site and at the Touquoy Mine Site; however, due to a lack of vegetation at the Beaver Dam Mine Site and Touquoy Mine Site, it is unlikely that a site fire could spread to and affect the surrounding forest. Forest fires along the Haul Road have the potential to affect Haul Road operations and likewise, site fires along the Haul Road could spread to and affect the surrounding forest.

Threshold for Determination of Significance

The criteria that would determine a significant effect should a forest and/or site fire occur is based primarily on worker health and safety and secondarily on property damage and environmental protection.

Should a forest and/or site fire result in injury or death to a worker or a loss of infrastructure or mobile equipment the event will be considered significant.

Should a forest and/or site fire result in the loss of any quantity of fuel, oil, lubricant, or other Project related raw materials to the environment such that a measurable contamination of soil, surface water, or groundwater results, the event will be considered significant.

Contamination is defined as the following:

- Soil
  - concentrations of any contaminant exceed the guidelines provided in the Nova Scotia Contaminated Sites Regulations – Tier 1 Environmental Quality Standards for Soil at a Non-potable Site, Section 1, Table 1B;
- Surface Water
  - concentrations of any contaminant exceed the guidelines provided in the Nova Scotia Contaminated Sites Regulations – Tier 1 Environmental Quality Standards for the Protection of Freshwater Aquatic Life in Surface Water, Section 1, Table 3;
- Groundwater
  - concentrations of any contaminant exceed the guidelines provided in the Nova Scotia Contaminated Sites Regulations – Tier 1 Environmental Quality Standards for Groundwater at a Non-potable Site, Section 1, Table 4.

Potential Interactions and Effects

The potential interactions between a forest and/or site fire and VCs are outlined in Table 5.7-1 to 5.7-3. Additional detail by VC is outlined in Table 6.18.11. Only those interactions with a high potential to cause adverse effects should they occur are discussed further.

Table 6.18-11 Forest and/or Site Fire Interactions with VCs

Valued Component	Potential Forest and/or Site Fire and VC Interaction	Potential for Adverse Effects
Atmospheric Environment	• A forest and/or site fire could potentially release particulate matter, carbon monoxide, Sulphur dioxide, nitrous oxides, and volatile organic compounds to the atmosphere.	Low
Geology, Soil, and Sediment Quality	• No potential interaction anticipated	-
Surface Water Quality and Quantity	• A forest and/or site fire could potentially cause surface water runoff to erode and entrain suspended solids for deposition into water courses • A forest and/or site fire could potentially reduce surface water quantity through extraction to extinguish the fire.	Low
Groundwater Quality and Quantity	• No potential interaction anticipated	-
Wetlands	• A forest and/or site fire could potentially cause wetland destruction through burning of vegetation	Low
Fish and Fish Habitat	• A forest and/or site fire could potentially cause surface water quality and quantity issues that may indirectly effect fish and fish habitat	Low
Habitat and Flora	• A forest and/or site fire could potentially cause destruction of habitat and flora	High
Birds	• A forest and/or site fire could potentially cause destruction of bird habitat and/or direct mortality	High
Fauna	• A forest and/or site fire could potentially cause destruction of fauna habitat and/or direct mortality	High
Species of Conservation Interest and Species at Risk	• A forest and/or site fire could potentially cause destruction of species of conservation interest and species at risk	High
Indigenous Peoples	• A forest and/or site fire could potentially cause effects to the current use or land and resources for traditional purposes by Indigenous Peoples	Low
Physical and Cultural Heritage	• No potential interaction anticipated	-

Valued Component	Potential Forest and/or Site Fire and VC Interaction	Potential for Adverse Effects
Human Health and Socio-economic Considerations	• A forest and/or site fire could potentially result in injury or death of mine workers	High

The topographic profile of the region allows for precipitation to be retained in soil and numerous watercourses and wetlands to form. As a result, large forest and/or site fires are unlikely to occur. In the unlikely event a forest and/or site fire occurs, the following adverse effects to VCs are considered low:

- emissions produced from a forest and/or site fire would be temporary; however, may adversely affect ambient air quality in the area;
- surface water run-off created from extinguishing the fire may transport sediment and potential contaminants towards watercourses along the Haul Road; thereby affecting surface water quality;
- surface water quantity in watercourses near the Beaver Dam Mine Site may be slightly affected through extraction and use of surface water for extinguishing the fire; however, these watercourses will only be utilized to aid in extinguishing small localized fires;
- effects to wetlands and fish and fish habitat are expected to be minimal due to the presence of water and saturated soils and flora; and
- unless a forest and/site fire extends to the Beaver Lake IR 17, it is unlikely that Indigenous Peoples will be adversely affected by forest and/or site fires.

As a result, potentially adverse effects to the atmospheric environment, surface water quality and quantity, wetlands, fish and fish habitat, and Indigenous Peoples are considered low.

The greatest potential for a forest and/or site fire to occur as a result of the Project is during the site preparation and construction, and operation and maintenance phases when the greatest amount of physical activity is occurring at the at the Beaver Dam Mine Site and along the Haul Road. The primary risk for the environment is associated with physical habitat destruction and death of terrestrial species.

A forest and/or site fire caused by the Project has the potential to modify terrestrial habitat and cause direct mortality to wildlife populations, especially during the breeding season when the mobility of immature individuals is limited. The destruction of habitat may result in the loss of breeding, nesting, rearing, and/or other habitat for birds, fauna, and SOCI/SAR. Habitat fragmentation created by a fire may cause potential adverse effects for species that migrate throughout a landscape based on resources that are seasonally available.

Although a forest and/or site fire caused by the Project is likely to be extinguished before it creates a significant effect to the local area, it is unlikely that terrestrial habitat loss or direct individual mortality would create population viability issues if an uncontrollable fire was allowed to burn. It is likely that mobile terrestrial species will move to adjacent areas and any habitat loss would lead to regrowth within a few generations. In addition, habitat types in the area of the Project are not unique and would be easily supplanted with minor migration efforts by terrestrial species.

A forest and/or site fire created by the Project would likely result from a structural failure or accident identified in Sections 6.18.3 and 6.18.4 of this EIS. Should the mitigation measures for these structural failures or accidents be implemented, it is extremely unlikely that a forest and/or site fire created by the Project would occur.

Mitigation and Emergency Response

Fire protection for the plant site will be via a “wet system” with hydrants located around the plant site area. The water contained within the lower portion of the raw water tank will be reserved for fire protection. Fire detection systems will be installed in all buildings and in key areas of the Mine Site.

In each area, a combination of heat and smoke detectors will be provided with break-glass units mounted externally to the buildings. The large primary mining fleet including excavators, front end loader, haul truck, dozers and drills will be fitted with fire suppression systems in case of fire.

The water truck will be fitted with a pump and 2.5 inch hydrant hose reel for firefighting. Supplementary hand held fire extinguishers, each suitable for its specific area, will be mounted in all buildings and vehicles. The site will have fire-fighting and fire-suppression capabilities that will be supplemented by support from the local community.

Fire response training and fire extinguisher training will be provided to all staff. An emergency response plan will be developed for the site, which will include fire response ~~Adequate fire protection for the Beaver Dam Mine Site will be provided, and will likely consist of a truck equipped with a water tank and pumps. All large equipment on the Mine Site will have fire suppression equipment. Supplementary hand held fire extinguishers, each suitable for its specific area, will be mounted in all buildings and vehicles. It is intended that firefighting activities will be handled by the local fire authority in Upper Musquodoboit and Sheet Harbour.~~

~~Fire detection systems will be installed in all buildings and in key areas of the Mine Site. Fire response training and fire extinguisher training will be provided to all staff. An emergency response plan will be developed for the site, which will include fire response.~~

The site will be staffed to varying levels 24 hours a day with personnel in all areas of the Beaver Dam Mine Site. Fires, if they occur, would be quickly detected and emergency procedures able to be acted on. The availability of water, equipment and nearby personnel from volunteer fire departments and NSL&F staff with expertise in forest fire control are all benefits to the Project and greatly reduce the possibility of fires that would not be able to be quickly controlled, and damage limited.

If a forest fire were to occur, emergency procedures would be implemented that will be outlined in the site emergency response plan. Generally, forest fire response includes raising the alarm and evacuation of all personnel from the area. If required, Emergency Services will be contacted.

6.18.6 Risk Assessment

Each potential accident and malfunction identified in the previous sections was assessed considering the likelihood of occurrence and the level magnitude should these accidents and malfunctions occur.

The likelihood of occurrence is given a score of 1 to 5 with an associated rating as defined below:

1. **Negligible**
   - accident or malfunction not likely to occur with a less than 1 in 10,000 probability of occurrence per year;
2. **Low**
   - accident or malfunction unlikely to occur with a less than 1 in 1,000 probability of occurrence per year;
3. **Moderate**

- accident or malfunction has potential to occur with a less than 1 in 100 probability of occurrence per year;

4. **<u>High</u>**

- accident or malfunction may occur with a less than 1 in 10 probability of occurrence per year; and

5. **<u>Extreme</u>**

- Accident or malfunction is likely to occur with a greater than 1 in 10 probability of occurrence per year.

The level of magnitude should these accidents and malfunctions occur is also given a score of 1-5 with an associated rating as defined below:

1. **<u>Negligible</u>**

- preventative requirements are minimal,
- no long term effects are expected, and
- readily remediated with funds in the $0 to $10,000 range;

2. **<u>Low</u>**

- preventative requirements are minimal,
- limited long term effects are expected, and
- limited remediation required with funds in the $10,000 to $100,000 range;

3. **<u>Moderate</u>**

- preventative requirements are moderate,
- moderate long term effects are expected, and
- moderate remediation required with funds in the $100,000 to $1,000,000 range;

4. **<u>High</u>**

- preventative requirements are high,
- significant long term effects are expected, and
- significant remediation required with funds in the $1,000,000 to $10,000,000 range; and

5. **<u>Extreme</u>**

- Preventative requirements are very high,
- permanent effects are expected, and
- highly significant remediation required with funds in the $10,000,000 plus range.

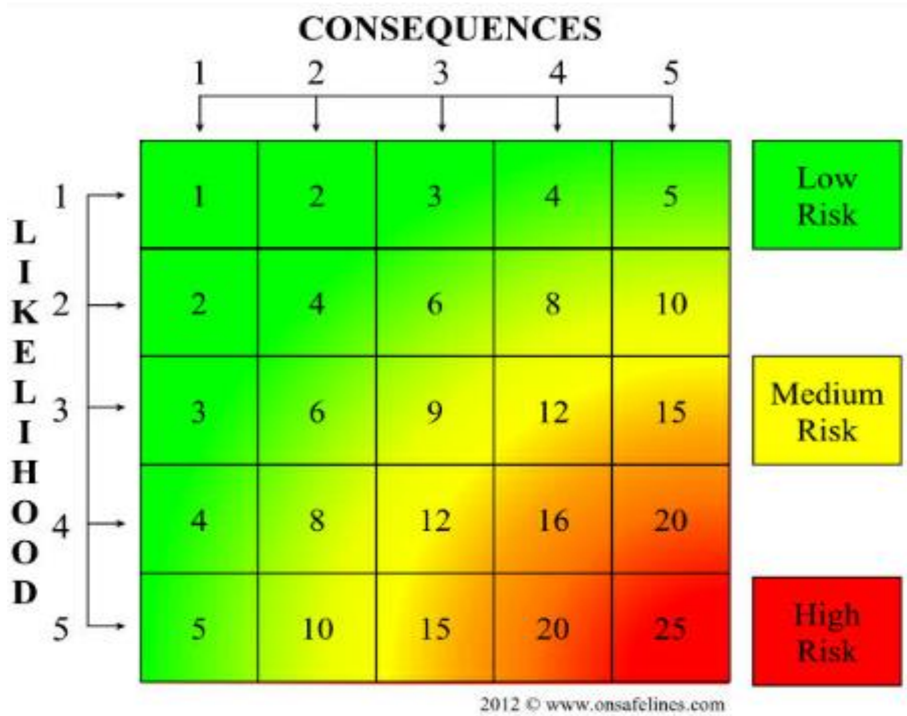

Figure 6.18-1 Risk Ranking Matrix

Each potential accident and malfunction is assigned a likelihood rating and level of magnitude rating based on the definitions provided above, activities associated with the Project, and the professional knowledge and judgement of the EA Study Team. The two ratings are multiplied and plotted on the Risk Rating Matrix provided on Figure 6.18-1 to obtain a risk rating for each accident and malfunction. Risk ratings can range from 1 to 25 – an accident and malfunction having a rating of 1 presents a negligible risk, while an accident and malfunction having a rating of 25 presents an extreme risk. As shown in the Risk Rating Matrix, the level of risk associated with an accident and malfunction is proportionally related to its likelihood of occurrence and the magnitude of effects it causes. Table 6.18-12 provides the breakdown of ratings used to obtain the risk rating for each accident and malfunction, as well as summarizes the key VCs that would likely be affected.

Table 6.18-12 Characterization Criteria for Risk Rating Matrix

Accident/ Malfunction	Worst-case Scenario (Potential Consequences)	Key VC(s) Potentially Affected	Likelihood Rating	Magnitude Rating	Risk Rating 1 = Minimum 25 = Maximum
~~Surface Mine~~ Slope Failure	Ground surface slump of the surrounding area affecting the site's infrastructure, Haul Roads and on-site access roads and worker safety.	Human Health and Socio-economic Considerations	1	4	4
Stockpile Slope Failure	Potential for mine rock and low-grade ore to enter nearby watercourses, damage to infrastructure and to worker safety.	Human Health and Socio-economic Considerations	2	4	8
Settling Pond Failure	Uncontrolled discharge of sediment laden water into the surrounding environment.	Surface Water Quality and Quantity Wetlands Fish and Fish Habitat Species of Conservation Interest/Species at Risk	2	3	6
Infrastructure Failure	Failure of multiple operational components as a result of a natural cause impacting worker health and safety and surrounding environment.	Human Health and Socio-economic Considerations	1	3	3
Fuel and/or Other Spills	Transportation collision causing the entire amount of fuel or hazardous material being transported to be spilled into a water body	Geology, Soil, and Sediment Quality Surface Water Quality and Quantity Groundwater Quality and Quantity Wetlands	2	4	8

Accident/ Malfunction	Worst-case Scenario (Potential Consequences)	Key VC(s) Potentially Affected	Likelihood Rating	Magnitude Rating	Risk Rating 1 = Minimum 25 = Maximum
		Fish and Fish Habitat Species of Conservation Interest/Species at Risk Indigenous Peoples			
Unplanned Explosive Event	Bodily harm and infrastructure damage as a result of improperly handling explosives.	Human Health and Socio-economic Considerations	1	4	4
Mobile Equipment Accident	Severe accident causing injury or death, property damage and environmental impacts.	Surface Water Quality and Quantity Wetlands Fish and Fish Habitat Species of Conservation Interest/Species at Risk Human Health and Socio-economic Considerations	2	4	8
Tailings/Reclaim Water Pipeline Spill	Uncontrolled discharge of tailings and/or contaminated water into the surrounding environment.	Surface Water Quality and Quantity Fish and Fish Habitat	1	3	3
Cyanide Release	Uncontrolled release of cyanide into the workplace and/or surrounding environment resulting in worker injury	Atmospheric Surface Water Quality and Quantity	1	5	5

Accident/ Malfunction	Worst-case Scenario (Potential Consequences)	Key VC(s) Potentially Affected	Likelihood Rating	Magnitude Rating	Risk Rating 1 = Minimum 25 = Maximum
	or death and/or causing significant damage to the environment.	Fish and Fish Habitat Birds Fauna Species of Conservation Interest/Species at Risk Human Health and Socio-economic Considerations			
Forest and/or Site Fire	An extreme fire that results in worker injury or death and causes significant damage to the environment.	Habitat and Flora Birds Fauna Species of Conservation Interest/Species at Risk Human Health and Socio-economic Considerations	1	5	5

6.18.7 Discussion

Potential accidents and malfunctions assigned a risk rating of 1-5 are considered low risk, those assigned a risk rating of 6-15 are considered moderate risk, and those assigned a risk rating of 16-25 are considered high risk. If an accident or malfunction is assigned a risk rating of 16 or higher, it is considered significant and requires further consideration during the Project's detailed design phase. The results of this qualitative analysis indicate that a mobile equipment accident and fuel and/or other spill are considered the most risky; however, all identified accidents and malfunctions have a low or moderate risk rating and are therefore considered not significant.

7 Effects of the Environment on the Project

7.1 Environmental Considerations

The effects of the environment on the Project must also be considered as part of the EIS. This includes how local conditions, natural hazards, climate change and external events could affect the Project. Additionally, it is important to consider how the effects of these local conditions, natural hazards, and external events on the Project may in turn affect the environment, such as accidents or malfunctions occurring on the Project site.

The natural environment has the ability to potentially adversely impact the Project through events which may include the following:

- flooding;
- drought;
- extreme temperatures;
- Severe weather events, including snow, ice, rain, and wind storms;
- lightning strikes;
- landslides, erosion, or subsidence;
- fire; and
- seismic events

Mine Site infrastructure will be designed to accommodate the conditions imposed by the natural environment and to accommodate the effects of external events on the Project, as much as possible.

7.1.1 Climate

Climate refers to average long-term (typically 30 year) weather patterns within a particular area (NASA, 2005). Average weather patterns that define a climate include measures of temperature, humidity, precipitation and wind velocity. Phenomena such as frost, fog and hail storms are also considered when defining the climate of an area (NASA, 2005).

Environment and Climate Change Canada provide typical weather conditions published as Climate Normals datasets for various locations throughout Canada. The values presented in the dataset contain at least 15 years' worth of data of a 30-year period. The datasets include measurements of average and extreme temperature and perception.

As stated in Section 6.2.2, the nearest climate station with historical data is the Middle Musquodoboit climate station (ID# 8203535) operated by the Co-operative Climate Network (CCN). The station is located approximately 15 km northwest of the Mine Site, near Middle Musquodoboit (45° 04'N, 63° 06'N). The following is a summary of average climate conditions at the Middle Musquodoboit station, based on climate normals published by Environment and Climate Change Canada for the period from 1971 to 2000. Wind data is taken from the Halifax Airport climate station (MSC ID# 202250), which is located approximately 45 km west of the Mine Site. This is the closest station to the site for which wind data exists.

Temperature

Temperature data for the Middle Musquodoboit Station is provided in **Table 7.1-1**. The annual mean temperature is estimated as 6.2˚C. The mean summer high temperature is 18.4˚C for July, while the winter mean low temperature is -6.0˚C in January. The lowest extreme minimum temperature was -34.0˚C January 1993 and December 1989, and the highest extreme maximum was in August of 1976 at 35.6˚C (**Table 7.1-2**) There is an average of 312 days per year with an average temperature above 0 °C.

Precipitation

The mean climate normal monthly precipitation data are provided in **Table 7.1-3**. The mean annual average precipitation is 1370 mm. Approximately 88 percent of the total precipitation was in the form of rain and 12 percent as snowfall. The extreme daily participation amounts are shown in **Table 7.1-4**. The highest rainfall experienced was 172.2 mm in 1971 and the highest snowfall experienced was 70.0 cm in 1981. The highest precipitation generally occurs in the months of October, November and December, with lowest precipitation in the month of February. Measurable precipitation occurs on an average of 164 days per year, with 141 days of measurable rainfall and 31 days of measurable snowfall. The lowest precipitation

Table 7.1-1 Mean Temperature Profiles from 1971 to 2000 at Middle Musquodoboit Station

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Daily Average (˚C)	-6.0	-5.7	-1.2	4.2	9.8	14.8	18.4	18.1	13.7	8.1	3.2	-2.8	6.2
Daily Maximum (˚C)	-0.7	-0.3	3.9	9.3	15.9	21.3	24.6	24.3	19.8	14.0	7.8	2.2	12.0
Daily Minimum (˚C)	-11.4	-10.6	-6.4	-0.9	3.7	8.3	12.2	12.2	7.9	2.9	-1.0	-7.1	0.8
Note: Source: ECCC 1971 to 2000 Canadian Climate Normals (climate ID: 8203535)													

Table 7.1-2 Minimum and Maximum Temperature Extremes

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Extreme Maximum (˚C)	16.5	17.0	26.0	27.2	33.3	33.9	34.5	35.6	33.0	26.7	23.5	15.6
Year	1995	1994	1998	1977	1977	1975	1999	1976	2001	1968	1994	1969
Extreme Minimum (˚C)	-34.0	-33.0	-31.0	-15.0	-7.8	-3.0	1.1	-1.5	-4.5	-10.6	-21.0	-34.0
Year	1993	1993	1985	1967	1966	1997	1965	1978	1978	1974	1989	1989
Note: Source: ECCC 1971 to 2000 Canadian Climate Normals (climate ID: 8203535)												

Table 7.1-3 Mean Monthly Precipitation Profiles from 1971 to 2000 at Middle Musquodoboit Station

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Precipitation (mm)	130.5	99.4	125.1	105.6	104.9	99.6	107.4	102.6	102.9	122.6	131.3	138.1	1369.9
Rainfall (mm)	90.4	60.4	94.2	92.8	103.8	99.6	107.4	102.6	102.9	121.6	123.5	108.0	1207.0
Snowfall (cm)	40.1	41.2	30.9	12.8	1.1	0.0	0.0	0.0	0.0	1.0	7.9	30.2	165.2
Note: Source: ECCC 1971 to 2000 Canadian Climate Normals (climate ID: 8203535)													

Table 7.1-4 Extreme Daily Precipitation at Middle Musquodoboit Station

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Extreme Daily Precipitation (mm)	80.8	70.1	76.0	78.2	61.9	64.0	90.0	172.7	61.0	74.0	66.0	71.4
Year	1978	1965	1979	1982	2001	1990	1983	1971	1996	1988	1972	1990
Extreme Daily Rainfall (mm)	80.8	70.1	76.0	78.2	61.9	64.0	90.0	172.7	61.0	74.0	66.0	71.4
Year	1978	1965	1979	1982	2001	1990	1983	1971	1996	1988	1972	1990
Extreme Daily Snowfall (cm)	32.0	70.0	25.0	30.5	11.4	0.0	0.0	0.0	0.0	18.0	23.0	33.0
Year	2001	1981	1993	1963	1972	1962	1961	1961	1961	1972	1989	1970
Note: Source: ECCC 1971 to 2000 Canadian Climate Normals (climate ID: 8203535)												

Wind

Wind direction is generally westerly to northerly in November through April and southerly in May through October. Wind speeds average approximately 16.5 km/h, with an average range of 13.3 km/h in August to 18.5 km/h in March.

7.1.2 Extreme Weather

7.1.2.1 Flood and Drought Conditions

Flooding or drought conditions may occur during the lifespan of the Project. These events can generally be accommodated in the Project design and construction. As stated above ~~T~~the historical mean annual total precipitation for the Middle Musquodoboit climate station is ~~1350~~ 1370 mm. Approximately 1,188 mm fell as rain, while 172 cm fell as snow. Although extreme precipitation events may occur at any time during the year, rainfall in the Project area is generally highest during autumn months ~~fall.~~ ~~E~~xtreme one day precipitation events recorded at the Middle Musquodoboit station ~~is~~ includes 173 mm of rainfall on August 15, 1971 and 70 cm of snowfall on February 8, 1981 (**Table 7.1-3**).

The effects of a drought or flood on the Project may include increased dust and decreased availability of water for site operations or an excess of water on the Mine Site and Haul Road. Potable groundwater will be brought to the site and therefore a reduction in the availability of potable groundwater is not anticipated to be an adverse effect. Minimal volumes of water from the settling ponds are anticipated to be re-used on Site for dust suppression purposes, as required. The majority of water collected in the settling pond will be released to Cameron Flowage. A reduction in water being collected by the settling ponds will result in less water being released to Cameron Flowage and is not anticipated to affect site operations. In the event of a 1 in 100 year precipitation event that creates volumes in excess of the capacity available in ponds and ditching, or infrastructure failure, a spillway into the water diversion structure will be used for overflow. In the case of a storm event or infrastructure failure, settling ponds will be monitored regularly. The Haul Roads could also become flooded and the transportation of ore may temporarily be suspended.

7.1.2.2 Extreme Temperatures, Storms, and Wind

Air temperatures vary seasonally. As stated above, ~~a~~Average local temperatures range between~~range from~~ 6 °C to 18.4 °C. Temperature extremes can range between~~from~~ -34 °C to 35.6 °C (Table 7.1-4). ~~There is an average of 312 days per year with an average temperature above 0 °C.~~ The Project will be designed to accommodate these temperature ranges.

Extreme temperatures and storms (ice, snow) could cause damage to site infrastructure or could directly impact site workers. An Occupational Health and Safety Plan will be implemented to ensure worker safety during extreme temperature events and storm events.

Maximum hourly speeds can range from 56 km/h in August to 89 km/h in February, with maximum gusts of up to 132 km/h recorded. The Project will be designed to accommodate these wind speed ranges.

7.1.2.3 Lightning Strikes

Thunderstorms are not overly common in the Project area. In Nova Scotia, cloud to ground lightning typically occurs between the months of March to November (ECCC 2016e). The average number of days with lightning (years 1999-2013) was 12.1 days in Halifax, and 12.6 days in Truro.

In the event of a lightning strike, damage to site infrastructure or injury to site workers could occur. A power surge or outage could also occur. Designing infrastructure with proper grounding circuits, as per standard practice, would help to prevent damage or injury.

7.1.3 Climate Change

Climate change is anticipated to cause an increase in frequency and intensity of extreme weather events, warmer average temperatures, higher sea levels, and more extreme rainfall and flooding events (DeRomilly and DeRomilly Limited et al. 2005). More frequent and intense extreme weather events could cause an increased risk of flooding and snow and ice storms. Increased flood events would also increase the risk of erosion. Existing infrastructure in Canada was generally not intended to withstand the more extreme and frequent storms that may be experienced in coming years; however, new construction, such as the construction of the Beaver Dam mine can take changing weather patterns and extreme events into consideration. In particular, Nova Scotia Environment's *Guide to Considering Climate Change in Environmental Assessments in Nova Scotia* states the importance of environmental assessments as planning tools for the consideration of climate change into project planning, development, operation and decommission (NSE, 2011).

Over the last several decades, Nova Scotia has already experienced a significant number of adverse impacts of extreme weather events and is experiencing changes in its historical climate. It is very likely that a further increase in temperature, precipitation and other climate drivers will continue to occur throughout the 21st century. It is forecasted that temperature will rise by 2˚C to 4˚C and that storm surges that happened only once in the 20st century could happen up to ten times in the 21st century (NSE, 2009).

To prepare for adaption to climate change, the Nova Scotia Environment Climate Change Unit has published scenarios of possible future climate for 13 regions within Nova Scotia. For each region, historical climate data (1961-1990) and future projections generated using the statistical downscaling method are available. Climate data provided in future projections includes minimum and maximum temperatures, precipitation, extreme precipitation and growing season length. Although advancements in climate modelling projections have occurred over the last decade, the results are not meant to be interpreted as absolutes, but rather used as guidance in the design and planning stages to facilitate climate change adaptation.

Regional Future Projections

The closest of the 13 regions to the Project is the Halifax Regional Municipality (HRM). Future projections are provided for 2020s, 2050s and 2080s. Since the duration for the project is relatively short, approximately 8 years including reclamation (excluding ongoing monitoring) the future climate projections for the 2020s were used for the assessment of the effects of climate change on the Project.

While a significant change in the range of average monthly temperatures is not anticipated for the HRM, it is very likely average temperatures will increase by approximately 1.5˚C on average across all seasons in the 2020s (W. Richards Climate Consulting, 2011). Approximately 2 days a year are projected to be over 30 ˚C with no days reaching a temperature higher than 35 ˚C. Approximately 243 days a year are projected to have daily mean temperature is greater than 0°C and two days a year are projected to be less than -10 ˚C compared to the historical average of 224 days and 3 days respectively(W. Richards Climate Consulting, 2011). The average growing season length in the 2020s is projected to be approximately 209 days, which is an 11 days longer than the average historical growing season (W. Richards Climate Consulting, 2011).

Annual precipitation amounts are projected to be 1453 mm a year, which is an 83 mm increase from the historical average (W. Richards Climate Consulting, 2011). Warmer winter temperatures (14 more days with a daily mean temperature is greater than 0°C) will lead to more precipitation falling as rain instead of snow. Rainstorm events are projected to be more extreme with a 5 percent change in the current 20 year return value of the 24 hour precipitation rate used in building design (W. Richards Climate Consulting, 2011).

Effects of Climate Change on the Project

Key potential effects of climate change that could impact the Project include:

• Increasing frequency of unusually high or low daily temperature extremes.

• Long-term increasing or decreasing mean annual temperatures and/or precipitation.

• Increasing or decreasing frequency of storm events (e.g., rainfall, snowfall, extreme wind).

Although the Project is relatively short in duration (approximately 8 years including reclamation and not including ongoing monitoring) and therefore ~~the interaction of~~ the effects of climate change on the Project ~~with weather events caused by climate change over time will be difficult to assess over the life of the Project~~will likely be insignificant, climate change was still considered for each phase of the Project:~~;~~ site preparation; operation and maintenance; and decommissioning and reclamation.

Site Preparation – Year 1 (2021)

Since site preparation/construction will occur during the first year of the Project and is planned to commence within the near future (2021), rather than considering long term effects of climate change it is more appropriate to consider the potential effects of current weather extremes and variabilities during construction. For the effects of extreme weather events on the Project see Section 7.1.2.

Operation and Maintenance – Years 2- 5 (2022 to 2026)

Average temperatures and precipitation amounts and intensities projected in the future climate scenario for the 2020s as described above is unlikely to impact the operation of the Beaver Dam mine as mines are successful operated in areas with higher/lower mean and extreme temperatures and more frequent precipitation than is outlined in this scenario. However, the Project may be affected by climate change-induced events, such as extreme precipitation events. The Project will be designed to withstand these events, including effects of these events such as flooding and erosion. For details of the effects of extreme weather events on the Project see Section 7.1.2.

Decommissioning and Reclamation – Years 6-8 (2026 to 2028+)

The decommissioning and reclamation of the mine is not anticipated to be effected by higher or lower mean and extreme temperatures or more frequent precipitation. However, the removal of equipment and infrastructure has the potential to be delayed as a result of periods of high precipitation and extreme weather events. The re-vegetated area could be effected from periods of drought, flooding or erosion. ~~However, the Project may be affected by climate change-induced events, such as increased annual precipitation and more frequent extreme weather events.The Project will be designed to withstand more extreme precipitation events, including the effects of these events such as flooding and erosion.~~

~~Although air temperatures are expected to warm over time, extreme warming events are not anticipated to increase significantly (NS 2005). Additionally, due to the limited duration of the Project, warming air~~

~~temperatures are not anticipated to affect the Project. The potential for forest fires is also considered to be low as the Mine Site will be mostly cleared of trees and the limited duration of the Project indicates that warming air temperatures will not affect the Project.~~

7.1.3.1 Forest Fires

Since the limited duration of the Project on a whole indicates that warming air temperatures will not affect the Project, and as the Mine Site is primarily cleared land, the potential for forest fires is considered to be low.

7.1.3.2 Climate Change Mitigation and Adaptation

Mitigation

In order to minimize or offset the effects of the Project on climate change, in particular to reduce the GHG emissions associated with the construction, operation and reclamation of the mine, mitigation measures will be implemented. The federal guidance document *Incorporating Climate Change Considerations in Environmental Assessment: General Guidance for Practitioners* defines mitigation measures as "Measures to eliminate, reduce or control the adverse environmental effects of a project, including restitution for any damage to the environment caused by such effects through replacement, restoration, compensation or any other means" (CCCEAC, 2003, Page 23). Mitigation measures include actions such as utilizing different technologies and construction materials. Impact Management Measures and BMPs to reduce the Project's effect on the environment will be determined and implemented at the onset of each stage of the Project. Possible BMP/ Mitigation measures include:

- Implement and enforce an anti-idling policy for all vehicles and machinery on-Site during the construction stage and operation stage
- Try to utilize materials that have a lower carbon footprint and a long lifespan
- Replace and plant additional native vegetation to create a carbon sink

Further mitigation measures to reduce the potential effects of the environment on the Project are discussed in Section 7.2.

Adaptation

Climate change adaptation is focused on addressing effects of climate change on the Project. The federal guide defines adaptation as an "Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities" (CCCEAC, 2003, Page 23). Although it was determined that climate change will have no significant adverse effects on the Project due to the relatively short duration of the Project, the identification of possible adaptation measures was undertaken to increase both Project and ecosystem resilience to climate change.

Adaptation measures that will be aimed at strengthening and increasing the resilience of the Project include:

- Designing comprehensive water management measures
- Choosing vegetation known to withstand erosion and climatic stressors such as extreme heat, drought tolerance, and flood resistance;
- Planting additional vegetation as required

The above is by no means a comprehensive list of the additional adaption measures that will be considered. The development of BMP's implemented at the mine will be prepared in a way that they can flexible enough to adapt to a changing climate.

7.1.4 Slope Stability

All phases of the Project have the potential for slope failures within the footprint of the ~~surface mine~~ open pit, and the topsoil, till, and waste rock stockpiles. All of these slopes will be designed at an angle determined by geotechnical analysis and acceptable safety factors. However, in the event of an extreme weather event or seismic event, slope failure may be possible.

Features constructed from site materials such as waste rock stockpiles and overburden stockpiles will use ~~the collected~~the site's geotechnical data for final design to produce features with appropriate safety factors to reduce the possibility of landslides, slope erosion and subsidence. With multiple~~any~~ stockpiles, it is common ~~to have~~for minor subsidence to occur in the short term creating a landscape that is varied in topography. This approach aligns with NSL&F reclamation objectives for ~~reclamation to have~~ surfaces that are not uniform but that offer safe long-term landscapes with a variety of features.

7.1.5 Seismic Events

Although seismic activity is unpredictable, the Province ~~all~~ of Nova Scotia as a whole is located in a next-to-lowest hazard zone, with moderate to high-hazard zones located offshore in the southern Bay of Fundy and along the Laurentian Slope (NRCAN 2015).

The Northern Appalachians Seismic Zone is located in southwest Nova Scotia. The Beaver Dam Mine Project is located east of this zone. The nearest earthquake to Marinette, Nova Scotia was recorded with a magnitude of 2.7 in 1999 and was located northeast approximately 20 km north of the Project area. If an earthquake occurs, seismic activity may affect the Beaver Dam Mine Project through primary impacts such as slope and mine wall failures, and infrastructure damage facilitated by ground vibrations and secondary impacts such as fires facilitated by damaged infrastructure. In the unlikely event that a Tsunami~~'s, should they be created by~~ occur in relation to offshore earthquakes, impacts to the Project are highly unlikely~~. to impact the Project~~. The Project is approximately 30 km from the coast and at an elevation of 140 masl. Given that Nova Scotia is located in a low-hazard zone, and given the limited extent and duration of the Project, the potential risk of seismic activity affecting the Project is very low and not considered significant.

Site infrastructure will be built to ~~the~~ National Building Code of Canada standards to aid in mitigating damage to infrastructure or injury to site workers in the event of an earthquake in the Project area.

7.2 Mitigations

The Beaver Dam Mine Site will be designed to use commonly utilized infrastructure which will be designed to consider extreme weather events. Climate change is not anticipated to have a significant effect on the Project, based on the relatively short duration of the Project and on the climatic scenarios and events outlined above.

The following mitigation measures will be applied to reduce the potential effects of the environment on the Project:

- Project design will consider potential flood or drought conditions to minimize the impacts of these events on mine infrastructure.

- Project design will accommodate temperature extremes, storms, and wind speed ranges identified for the Project area.
- Project design will follow industry standards, including the National Building Code of Canada, to prevent damage to equipment or injury to site workers.
- Topsoil, till, and waste rock stockpiles will be designed with slopes designed at an angle determined by geotechnical analysis and acceptable safety factors. Stockpiles will be constructed using collected geological data for final design and reduce the possibility of landslides, slope erosion, and subsidence.
- An Emergency Response Plan will be implemented for the Mine Site and will consider measures that may be required during an extreme weather event to secure site infrastructure, mobile equipment, stockpiles, fuel storage, and electrical equipment
- An Occupational Health and Safety Plan will be implemented for the Mine Site and will consider measures that may be required during an extreme weather or temperature event, flood or drought, or storm event.q3/

Table 7.2-1 Mitigation and Monitoring Program for Effects of the Environment on the Project

Project Activity	Mitigation Measures	Mitigation and Monitoring Program
Site Preparation and Construction	Minimize effects of extreme weather on the Project during the construction phase	• Project design to consider extreme weather events, temperature extremes, wind speed ranges, flood or drought conditions, lightning strikes. • Project design will follow industry standards, including the National Building Code of Canada. • An Emergency Response Plan will be implemented during the construction phase. • An Occupational Health and Safety Plan will be implemented to protect worker health and safety
	Minimize the potential for slope failure	• Stockpile design will consider collected geological data and will be designed with slopes at the angle determined by geotechnical analysis and acceptable safety factors. • An Emergency Action Plan will be implemented during the construction phase
Operation and Maintenance	Minimize effects of extreme weather on the Project during the operations phase	• An Emergency Action Plan will be implemented during the operations phase. • An Occupational Health and Safety Plan will be implemented to protect worker health and safety
	Minimize the potential for slope failure	• Stockpile design will consider collected geological data and will be designed with slopes at the angle determined by geotechnical analysis and acceptable safety factors • An Emergency Action Plan will be implemented during the operation phase
Decommissioning and Reclamation	Minimize the potential for slope failure	• Stockpile design will consider collected geological data and will be designed with slopes at the angle determined by geotechnical analysis and acceptable safety factors.

7.3 Residual Effects

There are no significant adverse environmental effects anticipated due to the environment, once mitigation measures are applied. Potential effects of the environment on the Project will be reduced as much as possible through proper design and planning and mitigation measures outlined above. Extreme weather events cannot be predicted, but through proper design and planning the majority of the effects of these events on the Project may be minimized.

8 Cumulative Effects Assessment

8.1 Introduction

Section 19(1)(a) of the *Canadian Environmental Assessment Act, 2012* (CEAA 2012) requires that an EA of a designated project take into account any cumulative environmental effects that are likely to result from the designated project in combination with the environmental effects of other physical activities that have been or will be carried out[4].

This chapter presents methodology of the Cumulative Effects Assessment that was carried out to meet the general requirements of the CEAA 2012, as well as the specific requirements laid out in the *Guidelines for the Preparation of an Environmental Impact Statement pursuant to the Canadian Environmental Assessment Act, 2012* and *Nova Scotia Registration Document pursuant to the Nova Scotia Environment Act – Beaver Dam Mine – Atlantic Gold Corporation* (EIS Guidelines).

8.2 Types of Cumulative Effects

When considering possible cumulative effects on VCs it is important to understand how the effects may interact and manifest in order to make reasonable and technical sound predictions about the significance of the cumulative effects[5].

There are four main ways that cumulative effects can interact, additive, synergistic, compensatory and masking. They definitions as presented in the draft Technical *Guidance for Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012* (2014) are as follows:

- “An **additive cumulative effect** is the sum of individual effects of two or more physical activities” (page 47).
- “A **synergistic cumulative effect** occurs as a result of the interaction between two or more effects, when the resultant combination is greater or different than the simple addition of the effects” (page 47).
- “**Compensatory cumulative effects** are effects from two or more physical activities that “offset” each other” (page 49).
- **Masking cumulative effects** are “the effects of one project might mask the effects of another in the field” (page 50).

8.3 Cumulative Assessment Methodology

The general approach of the cumulative impact assessment is based on the Agency’s Operational Policy Statement entitled Addressing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012 and the guide entitled Cumulative Effects Assessment Practitioners' Guide, 1999 (Hegmann *et al.,* 1999).

[4] *Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012*. https://www.canada.ca/en/environmental-assessment-agency/news/policy-guidance/assessing-cumulative-environmental-effects-under-canadian-environmental-assessment-act-2012.html

[5] Ibid

The main steps involved in this approach are as follows:

- The initial steps cover the scoping of the Cumulative Effects Assessment and include:
    - Identification of the valued components (VCs) that will constitute the focus of the Cumulative Effects Assessment.
    - Determining the spatial and temporal boundaries for each VC.
    - Identification, selection and description of projects in the area.
    - Confirmation of the VCs to be carried forward to the assessment stage.
- The following steps constitute the analysis of the Cumulative Effects Assessment and are presented separately for each VC selected at the scoping stage:
    - Description of the baseline conditions.
    - Description of the residual effects of the proposed Project.
    - Description of the effects of other projects in the area.
    - Description of the cumulative effects.
    - Proposed mitigation and monitoring.
    - Residual Cumulative Effects and Significance Assessment.
    - Follow-up.

8.3.1 Scoping Approach

The scoping methodology as depicted in the draft Technical *Guidance for Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012* (2014)[6] is presented in Figure 8.3-1 below.

[6] Canadian Environmental Assessment Agency. (2014). *Technical Guidance for Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012*

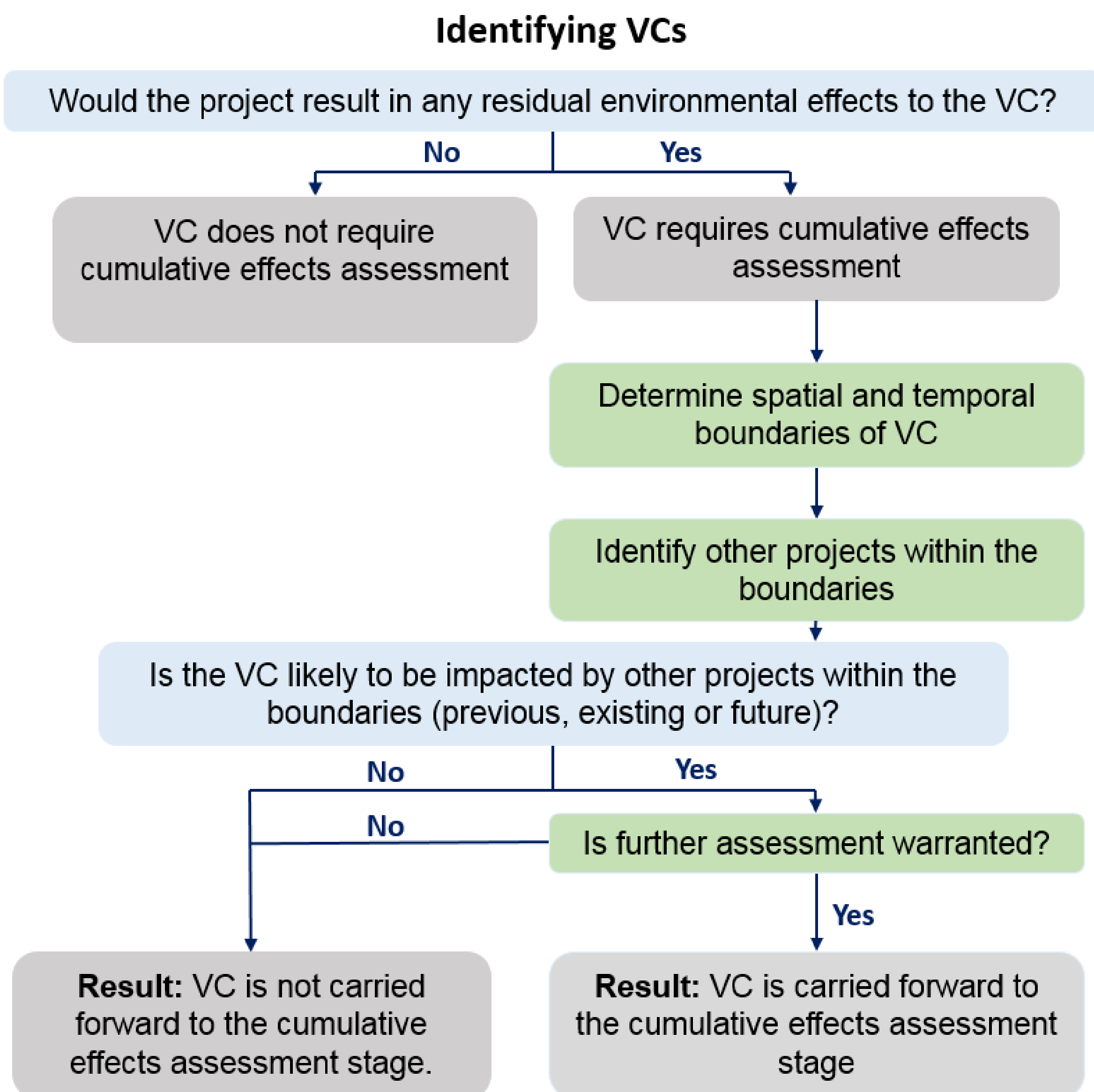

Figure 8.3-1 – Generic Approach to Scoping for Cumulative Effects Assessment Adapted from the *Technical Guidance for Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012*[7].

[7] Ibid.

The methodology followed for the four main steps associated with scoping for cumulative effects assessment, as listed in Section 8.3 and presented in Figure 8.3-1 is described below:

Step 1 - Identification of the Valued Components (VCs) That Will Constitute the Focus of the Cumulative Effects Assessment.

In order to identify the VCs that are likely to be affected by cumulative effects resulting from the proposed Project and other projects in the area, each of the VCs taken into account in the environment effects assessment of the proposed Project (Section 6) was analyzed. In order to be included in the Cumulative Effects Assessment, adverse residual effects must have been identified for the VC. As per the Agency's *Guidelines for the Preparation of an Environmental Impact Statement pursuant to the Canadian Environmental Assessment Act, 2012* and *Nova Scotia Registration Document pursuant to the Nova Scotia Environment Act – Beaver Dam Mine – Atlantic Gold Corporation* the following components at a minimum must be considered:

- fish and fish habitat;
- birds (including migratory birds);
- species at risk; and
- Indigenous peoples.

As stated in the EIS Guidelines "Valued components that would not be affected by the project or would be affected positively by the project can therefore, be omitted from the cumulative effects assessment" (page 34). As such, if any VCs were positively affected they were not carried forward to the assessment phase.

Documentation of the step is provided in Section 8.4.1.

Step 2- Determining the Spatial and Temporal Boundaries for Each VC.

The spatial and temporal boundaries to be considered in the cumulative effects assessment are determined individually for each selected VC. Minimally, these boundaries are those applied in the assessment of Project effects. However, in many cases the cumulative boundaries are larger. This determination is based on the nature of the VC and of the likely cumulative effects.

The main points taken into consideration in determining spatial boundaries were:

- Whether the effects of different projects to a VC could be additive if felt at separate locations;
- The expected geographical extent of the project effects on the VC;
- The determination of the appropriate geographic scale required to assess the effects on a biological population. In most cases, a broad, regional area was considered appropriate, though the existence of physical boundaries between populations was taken into account. For example, effects to fish populations were considered cumulative with a watershed.

In the determination of temporal boundaries, the following points were taken into account:

- Duration of the expected environmental effects.
- The timing of the expected environmental effects.
- Whether or not the effects are only additive if felt simultaneously.

For example, it was considered for most physical VCs that effects could only be cumulative if the effects of two projects overlap in time and space. For example, cumulative effects on water quality that exceed those assessed for an individual project are only possible if two projects affect the same body of water.

However, for other VCs, such as wildlife or bird populations, effects from projects that do not overlap in space may have cumulative effects if their effects reach the same population. The spatial cumulative effects boundaries for such VCs may therefore be wider than those used to assess the effects of an individual project and should generally be determined in a way that is ecologically defensible.

Temporal cumulative effect boundaries take into account the timing at which a type of effect has occurred/is occurring or is expected to occur in the future, as well the expected duration of the effect. For example the cumulative effects of habitat loss could start with the first historical effects on the habitat in question and end with the recovery of the lost habitat.

Documentation of the step is provided in Section 8.4.2.

Step 3 - Identification, Selection and Description of Projects in the Area.

Information regarding upcoming and past projects was obtained from a review of new and existing projects listed on the NSE Environmental Assessment Division website as well as the CEA Agency's online registry. In addition, a generalized internet search was used to identify other anticipated or ongoing projects.

A search was conducted to identify all major projects within the region with a potential to have cumulative effects with the Beaver Dam Mine Project. In order to include projects that overlap the VCs with the largest relevant spatial boundaries, the search area included the region within a 35 km radius of the Beaver Dam Mine Project Area. The chosen 35 km radius extends from the complete Beaver Dam Mine PA (including the Beaver Dam mine site, Haul Road, and Touquoy mine site). A 35 km radius is considered sufficient for the cumulative effect analysis because it captures the watershed boundaries for the project. Further, this radius was selected based on the residual effects determination for each VC described in Section 6 as well as a review of other projects occurring within the vicinity of the Beaver Dam Mine Projects that have the potential to interact with this project.

The Beaver Dam Mine Project is not expected to have any direct adverse effects on any VCs outside of the 35 km radius. In addition, the majority of VCs has an RAA no larger than the considered area, except for Greenhouse Gas (GHG), Indigenous Peoples and Socio-economic. Further description and rationale for these RAAs is provided in Section 8.4.2.

Cumulative effects with a project outside the 35km radius is therefore only possible if the other interacting project has direct effects on a larger scale or if a VC can be affected cumulatively by effects that do not overlap. This type of cumulative effect is already taken into account through the contribution of the projects within the 35 km radius to regional habitat loss and disturbance. With the above in mind, the 35 km radius covers a sufficiently large area in which to assess these broad landscape level effects. Based on the nature and location of the identified projects, an initial assessment of the most likely potential cumulative effects between each project and the Beaver Dam Mine Project has been undertaken.

Documentation of this step is provided in Section 8.4.3.

Step 4 - Confirmation of the VCs to be Carried Forward to the Assessment Stage.

Upon completion of the three steps listed above, the residual effects to VCs that would likely interact with the effects from other past, present, or future physical activities within the spatial and temporal boundaries of each VC were determined through the application of screening criteria.

The following screening criteria were used:

- level of concern noted during engagement;
- current state of the VC (health/status/condition);
- potential for significant cumulative effects;
- uncertainty in predictions of cumulative effects; and
- potential for follow up or additional mitigation.

The results of the application of the screening criteria for each VC were documented along with a rationale for each VC, which describes whether the VC was carried forward to the Cumulative Effects Assessment or not with an accompanying rationale.

Documentation of the step is provided in Section 8.4.3.

8.3.2 Assessment Approach

8.3.2.1 Baseline Conditions

A description of the baseline conditions is given for each of the selected VCs within their designated spatial and temporal boundaries. Emphasis is put on aspects of the VC that are likely to be affected by cumulative effects between the Beaver Dam Mine Project and the other identified projects in the area.

8.3.2.2 Identification and Assessment of the Cumulative Effects

The first step in the assessment of the cumulative effects is to describe the residual effects of the Beaver Dam Project, based on the results of the environmental effects assessment presented in Section 6. The environmental effects assessment methodology used for the Project is presented in Section 5.

This is followed by the identification of any effects of the other projects identified in the area that may act in combination with the residual effects of the Beaver Dam Project. If available, environment impact assessments for identified projects with potential cumulative effects were consulted. In addition, information contained in the baseline conditions for a VC often included a description of the effects of past and ongoing activities as these have left their mark on the current conditions.

In the case of past activities, their effects can be used to contextualize the current state of the VC as described in the baseline conditions. Taking this information into consideration, the total cumulative effects of all projects having an effect on the selected VC is then described as to their nature, scope and intensity. An assessment of the relative contribution of the Beaver Dam Mine Project on the overall cumulative effects is given by comparing these effects with and without the inclusion of the proposed project.

As indicated in the Guidelines for the Preparation of an Environmental Impact Statement pursuant to the Canadian Environmental Assessment Act, 2012 – And Nova Scotia Registration Document pursuant to the Nova Scotia Environment Act – Beaver Dam Mine – Atlantic Gold Corporation, the assessment of cumulative effects on current use of lands and resources for traditional purposes by Indigenous peoples focusses on the effects on specific activities such as hunting, fishing, trapping and plant harvesting.

8.3.2.3 Mitigation

As a first step, an assessment of whether any additional mitigation measures beyond those proposed in the environmental effects assessment of the Project (Section 6) is made. If additional technically and economically feasible measures are warranted to reduce the cumulative effects, these are proposed.

Given the large spatial and temporal cumulative effects boundaries of certain VCs, the implementation of mitigation measures may exceed the scope of the proponent’s responsibility. In such cases the parties that have the authority to act are identified and any discussions that have taken place in order to implement the necessary measures over the long term are summarized.

8.3.2.4 Residual Cumulative Effects and Significance Assessment

The residual cumulative effects, taking into account the implementation of the mitigation measures, are described. These are then compared to the significance thresholds identified for each VC in order to determine if they are significant.

8.3.2.5 Follow-up and Monitoring

If it is considered warranted, after taking into account the confidence level of the predictions of the residual cumulative effects and the expected scale of the effects, a follow-up program is proposed to verify the accuracy of the assessment or to dispel the uncertainty concerning the effectiveness of mitigation measures for certain cumulative effects.

8.3.3 Consideration of Consultation and Engagement Results and Aboriginal Traditional Knowledge

Key issues raised during public consultation and Mi’kmaq engagement relating to Indigenous Peoples include potential habitat loss and effects on individual flora and fauna used in traditional hunting, fishing and trapping activities and medicinal food and plants.

Specific questions were noted on potential effects of accidents and malfunctions on the current use of traditional lands and associated contingency planning for any unplanned releases. Concerns included potential impacts to drinking water at the Mi’kmaq community of Beaver Lake and impacts to natural watercourses and receiving environments which may affect hunting, fishing and trapping activities. Concerns were related to health (including noise, air quality and safety, etc.) were expressed in terms of the originally proposed Haul Road as it was planned to pass Beaver Lake IR 17 along Hwy 224. These concerns were addressed by the Proponent’s decision to construct 4 km of new Haul Road to avoid travel along Hwy 224.

From a socio-economic perspective, interest has been expressed by the Mi’kmaq of Nova Scotia to work toward benefit agreement(s) with the Assembly of Nova Scotia Mi’kmaq Chiefs, as well as the two nearest Mi’kmaq communities of Millbrook and Sipekne’katik which are not currently part of the Assembly.

Further details are provided in Table 8.4-3, which provides a summary of the level of concern raise during consultation relative to each VC.

8.4 Scoping of the Valued Components

8.4.1 Identification of the Valued Components

All of the VCs (as listed below) included in the environmental effects assessment of the Project (Section 6) were taken into consideration.

- Physical Environment
  - Noise
  - Air
  - Light
  - Greenhouse Gas
  - Geology, Soil and Sediment Quality
  - Groundwater Quality and Quantity
  - Surface Water Quality and Quantity
- Biophysical Environment
  - Wetlands
  - Fish and Fish Habitat
  - Habitat and Flora
  - Terrestrial Fauna
  - Birds
  - Species of Conservation Interest and Species at Risk
- Socio-Economic Environment
  - Indigenous Peoples
  - Physical and Cultural Heritage
  - Socio-Economic Conditions

The initial screening of the VCs listed above is based on the outcome of the environmental effects assessment (Section 6) and is summarized in Table 8.4-1. The table provides the possible pathways for VCs to cause cumulative effects as well as possible linkage of the residual effects on a VC to other VCs. Both the pathway of an effect and possible linkages of the residual effect to other VCs are important to consider from a cumulative effects perspective, specifically when determining the possible interaction of the Project's residual effects with the effects from other activities in the area.

The residual effects of 16 VCs were determined not to be significant but were assessed as adverse. These VCs were carried forward for additional consideration in the scoping process, with the exception of Physical and Cultural Heritage (highlighted in orange below). Physical and Cultural heritage was not carried forward because it is not anticipated to have an adverse residual impact.

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Table 8.4-1 Initial Screening of the Valued Components based on the Outcome of the Environmental Effects

PROJECT VC	EIS SECTION	SPATIAL BOUNDARIES		TEMPORAL BOUNDARIES	PATHWAY	ADVERSE RESIDUAL EFFECTS			INCLUDE IN SCOPING EXERCISE	RATIONALE
		LOCAL ASSESSMENT AREA (LAA)	REGIONAL ASSESSMENT AREA (RAA)			SUMMARY	SIGNIFICANCE	LINKAGES TO OTHER VCS (IF APPLICABLE)		
PHYSICAL ENVIRONMENT										
Noise	6.1	The LAA for Noise encompasses the distance at which noise sources from project components diminish to predicted night-time levels (55 dBA), see Figure 6.1-2.	The RAA for Noise encompasses a 9 km maximum radius, see Figure 6.1-2.	The temporal boundary for the assessment of effects to ambient noise levels extends to the end of Project decommissioning and reclamation, including construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	Atmospheric	• Increased ambient noise.	Adverse, not significant	Fauna, birds, SAR/SOCI, Indigenous	Yes	Adverse residual effects were identified
Air	6.2	The LAA encompasses a 15 km zone in all directions from the PA. (Figure 6.2-1).	The RAA encompasses a 35 km buffer from the PA, maximum zone of influence. The RAA covers the extent of the modelling domain, and is anticipated to be the maximum extent of particulate deposition under worst case scenarios (Figure 6.2-1).	The temporal boundary for the assessment of effects to air quality extends to the end of Project decommissioning and reclamation, including construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	Atmospheric	• Increased ambient dust	Adverse, not significant	Flora and Indigenous	Yes	Adverse residual effects were identified
Light	6.3	The LAA for Light is variable based on 1 LUX threshold, see Figure 6.3-1.	The RAA for Light encompasses an area 2 km in all directions surrounding the PA, see Figure 6.3-1.	The temporal boundary for the assessment of effects to ambient light levels extends to the end of Project decommissioning and reclamation, including construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	Atmospheric	• Increased ambient light.	Adverse, not significant	Fauna, birds, SAR/SOCI, Indigenous	Yes	Adverse residual effects were identified
Greenhouse Gases (GHGs)	6.4	The LAA for GHGs encompass a 15 km zone in all directions from the PA, based on the expected maximum extent of potential ground level emissions, see Figure 6.4-1.	The GHGs RAA encompasses the province of Nova Scotia, see Figure 6.4-1.	The temporal boundary for the assessment of effects to GHGs extends to the end of Project decommissioning and reclamation, including construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	Atmospheric	• Increased greenhouse gas emissions	Adverse, not significant	NA	Yes	Adverse residual effects were identified
Geology, Soil and Sediment Quality	6.5	The evaluation of effects was completed at the PA level, as direct and indirect impacts to geology, soils, and sediment are expected only within the PA boundaries (Figure 5.4-1).		The temporal boundary for the assessment of effects to Geology, Soil and Sediment Quality extends to the end of Project decommissioning and reclamation, including construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	Soils and Groundwater	• Soil and sediment quality, increased dust impact (i.e. flora and fauna/habitat, human health, etc.) • Erosion, soil and sediment quality	Adverse, not significant	NA	Yes	Adverse residual effects were identified.

Groundwater	6.6	The LAA for Groundwater Quality and Quantity encompasses an 800 m buffer from the Beaver Dam Mine Site PA, 800 m buffer along the portion of the Haul Road that will be upgraded where receptors are present, and the portion of down-gradient habitat from the Touquoy Mine Site, see Figure 6.6-7.	The RAA for Groundwater Quality and Quantity encompasses Tertiary Watersheds intersecting the PA (includes an approximate 6 km buffer around the PA), see Figure 6.6-8.	The temporal boundary for the assessment of effects to Groundwater Quality and Quantity extends to the end of Project decommissioning and reclamation, including construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	Groundwater	• Disturbance to groundwater quality and quantity	Adverse, not significant	Surface Water, fish, SAR/SOCI, Indigenous	Yes	Adverse residual effects were identified
Surface Water	6.7	The LAA for Surface Water Quality and Quantity encompasses portions of downstream aquatic habitats and headwaters where appropriate, depending on project activities, up to the maximum size of the tertiary watershed(s), see Figure 6.7-12.	The RAA in the context of surface water quality and quantity encompasses Secondary Watersheds (West River Sheet Harbour, Tangier River, and Fish River), see Figure 6.7-13.	The temporal boundary for the assessment of effects to Surface Water Quality and Quantity extends to the end of Project decommissioning and reclamation, including construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	Surface Water	• Change in Water Quality • Habitat Loss and disturbance • Change in hydrology in Cameron Flowage/Killag River	Adverse, not significant	Fish, SAR/SOCI, Indigenous	Yes	Adverse residual effects were identified
BIOPHYSICAL ENVIRONNENT										
Wetlands	6.8	The LAA for Wetlands consists of portions of downstream aquatic habitats and headwaters where appropriate, depending on project activities, up to the maximum size of the tertiary watershed(s), see Figure 6.7-12.	The RAA for Wetlands encompasses the three secondary watersheds that the PA is located within. These watersheds are the West River Sheet Harbour secondary watershed, the Tangier River secondary watershed, and the Fish River secondary watershed, see Figure 6.7-13	The temporal boundary for the assessment of effects to Wetlands extends to the end of Project decommissioning and reclamation, including construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	Vegetation	• Habitat loss and disturbance	Adverse, not significant	Fauna, fish, SAR/SOCI, Indigenous	Yes	Adverse residual effects were identified
Fish and Fish Habitat	6.9	The LAA for Fish and Fish Habitat consists of portions of downstream aquatic habitats and headwaters where appropriate, depending on project activities, up to the maximum size of the tertiary watershed(s), see Figure 6.7-12.	The RAA for Fish and Fish Habitat encompasses the three secondary watersheds that the PA is located within. These watersheds are the West River Sheet Harbour secondary watershed, the Tangier River secondary watershed, and the Fish River secondary watershed, see Figure 6.7-13	The temporal boundary for the assessment of effects to Fish and Fish Habitat extends to the end of Project decommissioning and reclamation, including construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	Aquatic Resources	• Habitat loss and disturbance • Increased habitat connectivity • Decreased water quality	Adverse, not significant	SAR/SOCI, Indigenous	Yes	Adverse residual effects were identified

Habitat and Flora	6.10	The LAA for Habitat and Flora includes a 500m buffer from the Beaver Dam Mine Site and the Haul Road (excluding Moose River Road) plus a focused lichen survey area surrounding the Beaver Dam Mine Site, see Figure 6.10-6.	The RAA for Habitat and Flora encompasses NSL&F's Ecological Land Classification Ecodistricts: 420 (Eastern Drumlins) and 440 (Eastern Interior) within Halifax Regional Municipality (HRM), east and north of Lake Charlotte, see Figure 6.10-7	The temporal boundary for the assessment of effects to Habitat and Flora extends to the end of Project decommissioning and reclamation, including construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	Vegetation	• Disturbance and loss of habitat	Adverse, not significant	Fauna, birds, SAR/SOCI, Indigenous	Yes	Adverse residual effects were identified
Terrestrial Fauna	6.11	The LAA for Terrestrial Fauna consists of a 2 km buffer surrounding the Beaver Dam Mine Site and a 500 m buffer surrounding the Haul Road and Touquoy Mine Site components of the PA, see Figure 6.10-6.	The RAA for Terrestrial Fauna encompasses NSL&F's Ecological Land Classification Ecodistricts: 420 (Eastern Drumlins) and 440 (Eastern Interior) within Halifax Regional Municipality (HRM), east and north of Lake Charlotte, see Figure 6.10-7	The temporal boundary for the assessment of effects to Indigenous Peoples Terrestrial Fauna extends to the end of Project decommissioning and reclamation, including construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	Wildlife	• Disturbance	Adverse, not significant	Birds, SAR/SOCI, Indigenous	Yes	Adverse residual effects were identified
Birds	6.12	The LAA for Birds consists of a 2 km buffer surrounding the Beaver Dam Mine Site and a 500 m buffer surrounding the Haul Road and Touquoy Mine Site components of the PA, see Figure 6.10-6.	The RAA for Birds encompasses NSL&F's Ecological Land Classification Ecodistricts: 420 (Eastern Drumlins) and 440 (Eastern Interior) within Halifax Regional Municipality (HRM), east and north of Lake Charlotte, see Figure 6.10-7	The temporal boundary for the assessment of effects to Birds extends to the end of Project decommissioning and reclamation, including construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	Wildlife	• Disturbance and loss of habitat • Contamination	Adverse, not significant	SAR/SOCI, Indigenous	Yes	Adverse residual effects were identified
Species at Risk (SAR) /Species	6.13	The LAA for SOCI and SAR is equivalent to those described for Habitat and Flora, Terrestrial Fauna, Fish and Fish Habitat, and Birds.	The RAA for SOCI and SAR is equivalent to those described for Habitat and Flora, Terrestrial Fauna, Fish and Fish Habitat, and Birds.	The temporal boundary for the assessment of effects to SOCI and SAR extends to the end of Project decommissioning and reclamation, including construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	Wildlife	• Habitat loss and disturbance	Adverse, not significant	Indigenous	Yes	Adverse residual effects were identified
SOCIO-ECONOMIC ENVIRONMENT										
Indigenous People	6.14	The LAA for Indigenous Peoples encompasses a 5 KM radius from the PA, see Figure 6.14-3.	The RAA for Indigenous Peoples includes the entire province of Nova Scotia, with a particular focus on the Skin Dressers territory noted in the Traditional Land Use Study. See Figure 6.14-4.	The temporal boundary for the assessment of effects to Indigenous Peoples extends to the end of Project decommissioning and reclamation, including construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	Physical and Biophysical pathways and Socio-economic conditions	• Loss of plant specimens and habitat • Loss of fish habitat • Change in species movement pattern • Sensory disturbance • Visual change • Increased Traffic • Loss of Access	Adverse, not significant	NA	Yes	Adverse residual effects were identified

Physical and Cultural Heritage	6.15	The spatial boundary used for the assessment of effects is the disturbed footprint of the project at the Mine site and along the Haul Road. See Figure 5.4-1.		The temporal boundaries used for the assessment of effects to physical and cultural heritage are limited to the construction phase of the Project. Construction is estimated to take approximately one year.	Cultural Heritage	• No adverse residual effects as there is low potential for the Project to interact with identified heritage resources that have been associated with historic mining at or near the Project site	NA	Indigenous	No	As there are no residual effects anticipated there is no potential for third party activities to act in a cumulative nature.
Socio-economic Conditions	6.16	The LAA spatial boundary for Socio-Economic Conditions, extends to parts of Halifax County, Colchester County, and Guysborough County, Nova Scotia, see Figure 6.16-6.	The RAA for Socio-Economic Conditions encompasses all of Nova Scotia. This boundary captures all potential socio-economic considerations from this project relating to the province of Nova Scotia, see Figure 6.16-6.	The temporal boundary for the assessment of effects to Socio-Economic Conditions extends to the end of Project decommissioning and reclamation, including construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	Socio-economic conditions	• Disturbance to recreational usage of site	Adverse, not significant	Indigenous	Yes	Adverse residual effects were identified

8.4.2 Determining the Spatial and Temporal Boundaries

8.4.2.1 Spatial Boundaries

Spatial boundaries for cumulative effects assessment are based on setting adequate spatial boundaries that represent anticipated geographic limits that will aid in defining the scale and range of interactions between Project activities and VCs.

A regional map of the Project area is presented in Figure 1.1-1. The Project Area (PA) used for the environmental effects assessment for all VCs and the Local Assessment Area (LAA) and Regional Assessment Area (RAA) used for each specific VC, as described in Section 6, were established for areas broader than the expected Project impacts to considers other project boundaries as per cumulative effects methodology. Therefore, the spatial boundaries (PA, LAA, and RAA), established for the environmental effects assessment are appropriate for determining potential cumulative effects. Each boundary is discussed below.

It should be noted that there are 3 RAA's that encompass the entire province of Nova Scotia - Greenhouse Gas (GHG), Indigenous Peoples and Socio-economic. With respect to the RAA for Indigenous Peoples, while the RAA includes the entire province, there is a particular focus on the Skin Dressers territory noted in the Traditional Land Use Study. The GHG RAA is also province wide as the reduction targets and evaluation of GHGs are done on a provincial basis.

The RAA for Socio-Economic Conditions encompasses all of Nova Scotia. This boundary captures all potential socio-economic considerations from this Project relating to the province of Nova Scotia.

Project Area (PA)

The PA encompasses the immediate area in which Project activities may occur and are likely to cause direct and indirect effects to VCs. The PA includes three primary components from Marinette to Moose River Gold Mines, Halifax County, NS. The Beaver Dam Mine Site will be located at the north end of the Beaver Dam Mines Road and the Haul Road will span from the Beaver Dam Mine Site west to Moose River Gold Mines, where the Touquoy Mine Site [processing and exhausted pit (to be used to dispose Beaver Dam tailings)] is located.

The PA is the same for each VC.

Local Assessment Area (LAA)

The LAA encompasses adjacent areas outside of the PA where Project related effects to VCs are reasonably expected to occur. Generally, the LAA is limited to the area in which Project activities are likely to have indirect effects on VCs; however, the size of the LAA can vary depending on the VC being considered, and the biological and physical variables present. The LAA for each VC is defined in Table 8.4-1.

Regional Assessment Area (RAA)

The RAA encompasses all Project and VC interactions including diffuse or longer range effects such as those from Project activities on the greenhouse gases, Indigenous Peoples, and socio-economic environments. The RAA varies in size (as described in Section 8.4.2.1) depending on the VC being considered, and the biological and physical variables present. The RAA for each VC is defined in Table

8.4-1.

8.4.2.2 Temporal Boundaries

The Project has four distinct phases - Construction (1 year), Operations (5 years), Reclamation (3 years), Post-Closure (15-20 years[8]), dependent on water quality - that define the temporal boundary for assessment of impacts on each VC. The maximum Project life is 9 years for the construction, operation and reclamation phases.

8.4.3 Identification, Selection and Description of Projects in the Area Past, Present and Future Physical Activities

Major industrial projects that have taking place, taking place or will take place within a 35 km radius of the PA are identified (Figure 8.4-1) and described in the following sections. A preliminary assessment of the potential cumulative effects of these projects with the Beaver Dam Mine Project is presented. A summary of the identified projects and their potential cumulative effects can be found in Table 8.4-1. Where possible the distance of the identified projects from the Beaver Dam Mine Site and the Touquoy Mine Site were determined along with the anticipated duration of the identified projects in order to determine potential interaction of the effects of those projects with the Project's adverse residual effects (Figure 8.4-1)

8.4.3.1 Past Physical Activities

8.4.3.1.1 Past Mining Operations within the Beaver Dam Mine Project Area

The area has been subject to exploration and mining activity since gold was first discovered in 1868. Between 1871 and 1949, there were intermittent attempts to develop and mine the area, initially focused on the Austen Shaft area and later on the Mill Shaft area located approximately 1.2 km west of the Austen Shaft (Figure 2.1-5). The small Papke Pit located approximately 400 m west of the Austen Shaft was excavated in 1926; however, the majority of development was focused on a belt of quartz veins in greywacke and slates that was approximately 23 m wide where intersected from the Austen Shaft. Approximately 967 ounces of gold production is recorded for Beaver Dam between 1889 and 1941. From 1978 until 1988, several companies drilled a combined 251 diamond drill holes for 47,935 m. Some of these drill holes were completed underground via an exploration decline that reached a maximum depth of 100 m below surface. In 1987, a small open pit was also excavated in the Austen Shaft zone. Approximately 2,445 ounces of gold production was also recorded for Beaver Dam between 1986 and 1989. Between 2005 and 2009 two companies drilled a combined 153 diamond drill holes for 22,010 m and also completed several other exploration programs including an aeromagnetic survey, a till survey, and a follow-up reverse circulation drilling program for geochemical purposes. The Proponent secured the mine site in 2014 and immediately executed an exploration program whereby 38 diamond drill holes for 7,810 m were completed over the proposed open pit area with the goal of converting inferred resources to measured or indicated resources.

These past mining activities have been completed or ceased operation. Possible interactions with the Beaver Dam Mine Project are for residual effects of past operations on physical VCs that could have

[8] Duration for Post-Closure is dependent on water quality and treatment requirements. Predictions will be refined through updated modelling as additional geochemistry data is available.

additive or synergistic cumulative effects on biological VCs. These potential residual effects have been captured in the baseline conditions described for the various VC's in Chapter 6.

8.4.3.1.2 Past Forestry Operations

The area has been subjected to extensive logging activity over the past 150 years. The current condition of the Beaver Dam Mine footprint is disturbed and fragmented habitat based on significant timber harvesting, associated road building and yarding areas and historic mining activity. The PA contains a diversity of habitat types and landscape features, but has experienced a considerable amount of disturbance and habitat fragmentation as a result of historic mine operations, and current and historic timber harvesting practices. The level of disturbance within the mine footprint PA disproportionately affects uplands, over wetlands.

These past forestry activities have been completed or ceased operation. Possible interactions with the Beaver Dam Mine Project are for residual effects of past operations on physical VCs that could have additive or synergistic cumulative effects on biological VCs. These potential residual effects have been captured in the baseline conditions described for the various VC's in Chapter 6.

8.4.3.2 Present Physical Activities

8.4.3.2.1 Touquoy Gold Project

The Touquoy Mine Site is a fully permitted and approved facility currently operating as part of the Touquoy Gold Mine Project in Moose River, Halifax County, Nova Scotia. It is located on land owned by the Proponent and NSDL&F and centered at 504599 E and 4981255 N (UTM Zone 20 NAD 83 CSRS). Access to Crown land for the construction of the Touquoy Project has been granted through a Crown Land Lease Agreement with NSDL&F (Lease No. 2794371 and Petition No. 37668).

The processing of ore and the management of tailings (exhausted pit), which will begin with the operation of the Touquoy Project, will continue as part of the Beaver Dam Mine Project. The Touquoy Mine Site will be operational for an additional four years beyond the original production lifespan of 6 years for the Touquoy Project. This will result in four additional years of ore processing, water management, and tailings management (exhausted pit) and disposal. Ore extracted and hauled from the Beaver Dam mine site will be processed at the Touquoy processing facility once reserves at Touquoy have been exhausted.

All residual effects for the Beaver Dam Mine Project resulting from use of the Touquoy processing facility are therefore continuations of effects that began as part of the Touquoy Gold Project. The cumulative impacts must therefore take into account the extension of the temporal boundaries for the effects. Also, any such effects that are lasting could accumulate over time. Possible cumulative effects on the VCs are summarized in Table 8.4-2.

8.4.3.2.2 Current Regional Forestry Operations

Land surrounding the Beaver Dam mine site and majority of the Haul Road is primarily owned by Norther Timber Nova Scotia Corp. with some Crown land. Some portions of the Haul Road are also owned by Musquodoboit Lumber Co. Ltd., Prest Bros. Ltd., Prest Enterprises Ltd., and Forestex Limited. The woodlots on these lands are regularly harvested with clearcutting being a widespread practice throughout the RAA. Due to these operations, the RAA is a mosaic of forested habitats at different stages of regeneration, including some relatively undisturbed mature forest. Harvested wood is transported from the area by road. Most of the proposed Haul Road for the Beaver Dam Mine Project uses existing roads already used by the forestry industry.

Since these regional forestry operations take place throughout the region, including within VC's specific RAAs and LAAs and the PA (notably for use of the Haul Road), there is a potential for cumulative effects with the Beaver Dam Mine Project on the majority of the VCs (see Table 8.4-2).

8.4.3.2.3 **Port of Sheet Harbour**

The Port of Sheet Harbour is a deep water port located 23 km southeast of the Beaver Dam mine site and 35 km southeast of the Touquoy Mine Site on the coast of the Atlantic Ocean. The terminal consists of a 152 m wharf with a minimum draft of 10 m and is capable of handling ships of up to 214 m (Port of Sheet Harbour, 2017).

This facility has the capacity to handle aggregates and dry bulk, scrap metal and a variety of large bulky equipment such as neobulk marshalling and load out, fabrication modules including construction equipment and heavy lift project cargo, pipes and tubulars, boilers and transformers, and wind turbines (Port of Sheet Harbour, 2017).

Given the distance between the Port of Sheet Harbour and the Beaver Dam Mine, as well as the important differences in the types of activities and the potentially affected natural landscapes (coastal and marine as opposed to inland forest, freshwater bodies and isolated wetlands), no cumulative effects between the Port of Sheet Harbour and the Beaver Dam Mine Project are expected for any VCs.

8.4.3.2.4 **Cooks Brook Sand and Gravel Pit**

Gallant Aggregates Limited operates a sand and gravel pit in Cooks Brook, located approximately 47 km west of the Beaver Dam mine site and 29 km west of the Touquoy Mine Site. An eastward extension of the site was approved in 2013 and scheduled to commence that same year. The sand and gravel pit is approximately 500 m long by 250 m wide.

Given the relatively small scale of this operation and the distance between it and the Beaver Dam Mine Project, no significant cumulative effects between Cooks Brook Sand and Gravel Pit and the Beaver Dam Mine Project are expected for any VCs. The only possible cumulative effect is the small contribution of each project to the overall deterioration and loss of natural habitats at the regional scale.

8.4.3.2.5 **ScoZinc Ltd.**

ScoZinc Limited owns and operates a zinc/lead operation in Cooks Brook, approximately 50 km west of the Beaver Dam mine site and 31 km west of the Touquoy Mine Site. The footprint of this mine is approximately 1.6 km by 0.6 km. It is anticipated to be in operation for the next ten plus years.

The mine was first developed in the 1980s, but no active mining is currently taking place. ScoZinc Ltd. continues to monitor zinc and lead prices, the exchange rate between the Canadian and United States dollars, and the financing environment for the potential restart of the mine. ScoZinc Ltd. has all of the necessary permits to restart the mine, which is currently on care and maintenance.

Given the relatively small scale of this operation and the distance between it and the Beaver Dam Mine Project, no significant cumulative effects between the ScoZinc Ltd. mine and the Beaver Dam Mine Project are expected for any VCs. The only possible cumulative effect is the small contribution of each project to the overall deterioration and loss of natural habitats at the regional scale.

8.4.3.2.6 National Gypsum

National Gypsum operates a large quarry in Milford Station, approximately 56 km west of the Beaver Dam mine site and 36 km west of the Touquoy Mine Site. It is the largest gypsum quarry in the world and was first constructed in 1955 (National Gypsum 2015). The footprint of the quarry is approximately 2.5 km by 1.1 km. It is anticipated to be in operation for the next 40 plus years.

Given the distance between it and the Beaver Dam Mine Project, no significant cumulative effects between the National Gypsum quarry and the Beaver Dam Mine Project are expected for any VCs. The only possible cumulative effect is the small contribution of each project to the overall deterioration and loss of natural habitats at the regional scale.

8.4.3.2.7 Murchyville Gypsum Quarry

A small, approximately 275 m by 200 m, gypsum quarry is located in Murchyville, 36 km form the Beaver Dam mine site and 17 km west of the Touquoy Mine Site. This quarry is not currently operational and is currently on care and maintenance.

Given the relatively small scale of this quarry and the distance between it and the Beaver Dam Mine Project, no significant cumulative effects between it and the Beaver Dam Mine Project are expected for any VCs. The only possible cumulative effect is the small contribution of each project to the overall deterioration and loss of natural habitats at the regional scale.

8.4.3.2.8 Tangier Gold Mine

The Tangier Gold Mine is located approximately 19 km south of the Beaver Dam Mine Project Haul Road. The footprint of this mine is approximately 500 m by 150 m, as measured on Google Earth.

The area of the Tangier Gold Mine has seen mining activity since the 1860s. The existing mine began its activities in the 1980s and is currently inactive. However, it was recently was purchased by Resource Capital Gold Corp and plans are being developed for re-opening the mine within the next 18 months. The planned activities are limited to mining as no processing is planned at this site. Processing would take place at the Dufferin Gold Mine (Resource Capital Gold Corp. 2017).

Given the relatively small scale of this operation and the distance between it and the Beaver Dam Mine Project, no significant cumulative effects between the Tangier Gold Mine and the Beaver Dam Mine Project are expected for any VCs. The only possible cumulative effect is the small contribution of each project to the overall deterioration and loss of natural habitats at the regional scale.

8.4.3.2.9 Dufferin Gold Mine

The Dufferin Gold Mine is located approximately 27 km southeast of the Beaver Dam mine site. The footprint of this mine is approximately 375 m by 150 m.

Mining has been active in this area for more than a century. The site of the Dufferin Gold Mine began activity in the 1980s and has had sporadic development over the years. In 2014, the mine operated for a short period of time before closing. It is currently under the same ownership as Tangier Gold Mine and there are plans for re-opening to begin in 2017.

Given the relatively small scale of this operation and the distance between it and the Beaver Dam Mine Project, no significant cumulative effects between the Dufferin Gold Mine and the Beaver Dam Mine

Project are expected for any VCs. The only possible cumulative effect is the small contribution of each project to the overall deterioration and loss of natural habitats at the regional scale.

8.4.3.2.10 Taylor Lumber Co. Ltd.

Taylor Lumber Co. Ltd. has operated a mill in Middle Musquodoboit since 1945. This site, located approximately 33 km west of the Beaver Dam mine site and 16 km northwest of the Touquoy Mine Site, includes a saw mill, a finishing plant, a pallet plant, a power plant, a dry-kiln, and a chipping plant. The power plant is a co-generation facility that burns biomass produced from their operation that provides power to their operation as well as to homes and businesses within a 30 km radius (Taylor Lumber, 2017).

Given the location, distance from Beaver Dam and the type of activity, no significant cumulative effects are expected between the great Taylor Lumber Co facility and the Beaver Dam Mine Project for any of the VCs.

8.4.3.2.11 Great Northern Timber

Great Northern Timber owns and operates a chipping and ship loading facility in Sheet Harbour, approximately 25 km southeast of the Beaver Dam mine site. Great Northern Timber procures wood chips and roundwood fibre from industrial landowners, sawmills, Crown lands, Private land contractors and Private woodlot management organizations in Nova Scotia, Prince Edward Island, New Brunswick and Quebec.

Given the location, distance from Beaver Dam and the type of activity, no significant cumulative effects are expected between the great Northern Timber chip mill facility and the Beaver Dam Mine Project for any of the VCs.

8.4.3.2.12 Gaetz Brook Wind Farm

On October 3, 2013, Natural Forces Wind Inc. registered an Addendum to the Gaetz Brook Wind Project Registration Document originally submitted on July 17, 2013. The purpose of the project was to construct and operate a 2.3 MW wind project at a site in the community of Gaetz Brook, approximately 33 km southwest of the Touquoy Mine Site. The Gaetz Brook Wind Farm environmental assessment was approved on November 15, 2013 by the Minister of Environment. Since 2014, the site has included a single wind turbine located at the end of a 500 m access road.

Given the location, distance from Beaver Dam and the nature of the activity, no significant cumulative effects are expected between the great Gaetz Brook wind farm and the Beaver Dam Mine Project for any of the VCs.

8.4.3.2.13 Mosher Limestone

Mosher Limestone processing facility is located approximately 20 km west of the Beaver Dam Mine and 16 km north of the Touquoy Mine Site. Mosher Limestone processes and sells limestone products in Nova Scotia and Atlantic Canada. Products include pelletized limestone, powdered limestone, granular limestone, powdered gypsum, pelletized gypsum, and traction sand. The processing facility crushes, packages and ships product.

Given the location, distance from Beaver Dam and the nature of the activity, no significant cumulative effects are expected between the Mosher Limestone Facility and the Beaver Dam Mine Project for any of the VCs.

8.4.3.2.14 Great Northern Pellets

Great Northern Timber Group owns and operates a wood pellet manufacturing facility at Upper Musquodoboit – Great Northern Pellets, since 2017, located approximately 33 km northwest of the Beaver Dan mine site and 16 km north of the Touquoy Mine Site. The plant has had a capacity for processing 60,000 tons of wood pellets per year. Past operators shipped product to Europe through the Port of Halifax.

Given the location, distance from the Beaver Dam Project and the nature of the activity, no significant cumulative effects are expected between the Great Northern Pellets and the Beaver Dam Mine Project for any of the VCs.

8.4.3.2.15 Other Current Projects

The Atlantic Salmon Conservation Centre's liming program was reviewed and on the basis that the program is beneficial and a "stand-alone" with no potential impact to the liming program from the Beaver Dam Mine Project, it was excluded from the Cumulative Effects Assessment. Through the assessment of fish and fish habitat, it was determined that the liming program is not affected by anything related to the Beaver Dam Mine Project.

8.4.3.3 Future Physical Activities (Certain, Reasonably Foreseeable or Hypothetical)

It is expected that the forestry industry will continue into the foreseeable future throughout the RAA. The mining industry could become more active if the price of minerals, notably gold, increases. This could hypothetically lead to the expansion of existing projects or the proposal of other new mining projects as exploration for mining is active in the region. However, it is expected that these would continue to be of similar scale to the existing sites and therefore have a relatively small footprint at the regional level.

In addition to the ongoing forestry industry and the potential increase in general mining activities, two projects proposed by the Proponent, the Fifteen Mile Stream Gold Project and the Cochrane Hill Gold Project that are associated with the Touquoy mine were identified as potential future projects. As neither project has been approved, however they are both currently undergoing federal environmental assessments, therefore are determined as reasonably foreseeable projects as they are.

8.4.3.3.1 Fifteen Mile Stream Gold Project

The proposed Fifteen Mile Stream Gold Project, comprises of the development, operation, closure and reclamation of a surface gold mine near Trafalgar, Nova Scotia. The surface gold mine, proposed by Atlantic Gold, to be developed in association with the Touquoy mine, would produce approximately two million tonnes of gold-bearing ore a year. The Fifteen Mile Stream Project is located at the eastern boundary of Halifax County, central Nova Scotia, approximately 95 km northeast of Halifax and 20 km to the northeast of Atlantic Mining's Beaver Dam Mine Project. The property covers the historic Fifteen Mile Stream Gold District located on NTS sheets 11E01/C and 11E02/D and is centered at 45°08'30" north latitude and 62° 32' 00" west longitude. The proposed start date for construction for the Fifteen Mile Stream Gold Project is May 2020 with a scheduled start-up for 2021. The mine is proposed to operate for 6 years to 2026. The total infrastructure footprint of the project is approximately 280 ha.

The Fifteen Mile Stream Gold Project's operations would include mining, crushing, ore processing and concentration, and the operation of a waste rock storage facility (WRSF), ore stockpiles and a TMF at the mine site. Infrastructure will include crushing facilities, fine ore stockpile and reclaim, concentrator facilities, maintenance facilities, fuel storage, office infrastructure and site haul roads.

The gold concentrate produced at the Fifteen Mile Stream mine site is proposed to be transported to the Touquoy processing facility via existing highways and Beaver Dam Haul Road for final processing into gold doré. The concentrate from the Fifteen Mile Stream mine would be processed at the Touquoy mine in conjunction with ore supply from Touquoy mine, and the proposed Beaver Dam and Cochrane Hill surface mines. Processing the gold concentrate produced the Fifteen Mile Stream mine at the Touquoy facility would eliminate the need for a separate processing facility at the Fifteen Mile Stream mine site. The Touquoy Mine Site will be operational during the first year of FMS operations. It is anticipated that 105,000 tonnes of tailings would be deposited into the Touquoy tails management facility as a result of processing the gold concentrate from the Fifteen Mile Stream Gold Project during this overlapping period. Once Touquoy operations are complete additional FMS tailings will be deposited into the exhausted Touquoy pit.

To facilitate the processing of the gold concentrate produced at the Fifteen Mile Stream mine, minor changes to the Touquoy facility would be needed. Additional concentrate storage and a second gravity concentrate leach reactor and a gravity electrowinning cell would have to be added. However, all of these items can be accommodated within existing footprint at the Touquoy mine.

The processing of ore and the management of tailings, which will begin with the operation of the Touquoy Project, would continue as part of the Fifteen Mile Stream Gold Project, Cochrane Hill Gold Project and the Beaver Dam Mine Project. The Touquoy Mine Site will be operational for an additional four years beyond the original production lifespan of 6 years for the Touquoy Project. This will result in four additional years of ore processing, water management, and tailings management (exhausted pit) and disposal.

Both Fifteen Mile Stream Gold and the Beaver Dam Mine Project are proposed to be in operation until 2026, therefore the temporal boundaries for the anticipated residual effects of both projects would overlap and have the potential to act in a cumulative nature. Possible cumulative effects on the VCs are summarized in Table 8.4-2.

Residual effects for the Fifteen Mile Stream Gold Project resulting from use of the Touquoy processing facility would be continuations with the effects that began as part of the Touquoy Gold Project. The cumulative impacts must therefore take into account the extension of the temporal boundaries for the effects and, any such effects that are lasting could accumulate over time. Possible cumulative effects on the VCs are summarized in Table 8.4-2.

8.4.3.3.2 **Cochrane Hill Gold Project**

The proposed Cochrane Hill Gold Project comprises of the development, operation, closure and reclamation of a surface gold mine association with the Touquoy mine, which would produce approximately two million tonnes of gold-bearing ore a year. The Cochrane Hill surface mine is located within Guysborough County, in central Nova Scotia, approximately 145 km northeast of Halifax, 45 km to the northeast of Atlantic Mining’s Fifteen Mile Stream Mine Project and 62 km northeast of the Beaver Dam Mine Project. The property covers the historic Cochrane Hill Gold District located on NTS sheets 11E01/D, 11E08/A, and 11E05/B and is centered at 45° 14’ 57” north latitude and 62° 00’ 48” west longitude. The Touquoy Mine is located on the NTS sheet 11D15 and is centered at 44° 59’ 09” north latitude and 62° 56’ 16” west longitude. The planned start date for construction for the Project is May 2021 with a scheduled start-up for 2022. The mine will operate until 2027.

The proposed Cochrane Hill surface mine would be well outside of the of the 35 km radius established for the Cumulative Effects Assessment. Therefore, the construction, operation and reclamation of the mine itself would not have direct adverse effects on VCs within the 35 km radius area. However, the gold concentrate produced at the Cochrane Hill Gold mine is proposed to be transported to the Touquoy processing facility via existing highways and Beaver Dam Haul Road for final processing into gold doré. Given that, both the Touquoy processing facility and the Beaver Dam Haul Road are both within the 35 km radius, use of both for the Cochrane Hill Gold Project was considered in the Cumulative Effects Assessment.

The concentrate from the Cochrane Hill Gold mine would be processed at the Touquoy mine in conjunction with ore supply from Touquoy mine, and the proposed Beaver Dam and Fifteen Mile Stream surface mines. Processing the gold concentrate produced the Cochrane Hill Gold mine at the Touquoy facility would eliminate the need for a separate processing facility at the Cochrane Hill Gold mine site. It is anticipated that 350,000 tonnes of tailings would be deposited into the exhausted Touquoy pit as a result of processing the gold concentrate from the Cochrane Hill Gold Project.

To facilitate the processing of the gold concentrate produced at the Cochrane Hill Gold mine, minor changes to the Touquoy facility would be needed. Additional concentrate storage and the addition of a second gravity concentrate leach reactor and a gravity electrowinning cell would have to be added. However, all of these items can be accommodated within existing footprint at the Touquoy mine.

The processing of ore and the management of tailings, which will begin with the operation of the Touquoy Project, would continue as part of the Cochrane Hill Gold, Fifteen Mile Stream Project and the Beaver Dam Mine Project. The Touquoy Mine Site will be operational for an additional five years beyond the original production lifespan of 6 years for the Touquoy Project. This will result in five additional years of ore processing, water management, and tailings management (exhausted pit) and disposal.

The possible cumulative effect includes an increase in traffic on the Beaver Dam Haul Road and the small contribution of each project to the overall deterioration and disturbance of natural habitats at the regional scale. There would also be the potential for cumulative effects associated with the effects resulting from the continued use of the Touquoy Mine Site. The residual effects for the Cochrane Hill Gold Project resulting from use of the Touquoy Mine Site would be continuations with of the effects that began as part of the Touquoy Gold Project. Therefore, the cumulative impacts must take into account the extension of the temporal boundaries for the effects. Also, any such effects that are lasting could accumulate over time. Possible cumulative effects on the VCs are summarized in Table 8.4-1.

8.4.3.3.3 **Sheet Harbour Quarry**

On January 31, 2019, Dexter Construction registered an Environmental Registration Document with Nova Scotia Environment.

The Project is located in the community of Mushaboom, Halifax, County, Nova Scotia, approximately 26 km south of the Beaver Dam mine site and 6.6 km south of the community of Sheet Harbour, and 4 km southwest of the Port of Sheet Harbour. Access is via a resource road from Marine Gateway Drive at the Port. The property (PID 40832503) is owned by Tusket Mining for which a lease agreement is in place with Dexter. The coordinates of the center of the Project site are Latitude: 44°51’55”N, Longitude: 62°31'53"W (Figure 1.1-1). The total infrastructure footprint of the project is approximately 85 ha.

The purpose of the undertaking is to meet local and regional aggregate demand for projects carried out by Dexter Construction in the Sheet Harbour regional area. There is future potential for aggregate material to be sold offshore using the Port of Sheet Harbour as a shipping point. This quarry will replace existing smaller quarries in the region that are nearly exhausted and will be reclaimed. The extractable reserves in the quarry as designed is anticipated to be 50 plus years with production commencing at approximately 50,000 tonnes per year and increasing to 500,000 tonnes per year by Year 16 depending on markets.

Site activities will include the drilling, blasting, crushing, stockpiling, and transporting by trucks of aggregate for sale or for use in projects that are contracted to Dexter Construction. The operation will consist of a lay down area for the portable crushing equipment and screens, various aggregate stockpiles, and weigh scales, as well as the physical features of the site such as the quarry floor and active working faces, and site settling pond(s).

Assuming the mitigation, monitoring, and progressive reclamation measures specified in this report are implemented, and the quarry is operated according to provincial guidelines and approvals, no significant adverse residual environmental or socio-economic effects are likely. Effects are expected to be of small magnitude, low frequency, short duration, and/or limited geographical extent. Operation of the quarry will result in economic benefits, including employment and an economic source of quality aggregates to local demand markets.

Environmental effects will include the loss of some habitat within the proposed quarry property area. The property has been the subject of past forestry activities.

Localized impacts on air quality can be expected through the formation of airborne particulate matter. These impacts are readily controlled through standard mitigation measures (e.g., dust suppression) and follow-up monitoring as necessary.

Table 8.4-2– Matrix of Interaction for Current and Future Activities with the Beaver Dam Mine Project

PROJECT VC	RESIDUAL ADVERSE EFFECTS FOR BEAVER DAM MINE PROJECT			DEFINITION OF A SIGNIFICANT CUMULATIVE EFFECT	PRESENT PHYSICAL ACTIVITIES														FORESEEABLE FUTURE PROJECTS			
	ADVERSE RESIDUAL EFFECTS	SPATIAL BOUNDARIES	TEMPORAL BOUNDARIES		Touquoy Gold Project	Current Regional Forestry Operations	Port of Sheet Harbour	Cooks Brook Sand and Gravel Pit	ScoZinc Ltd.	National Gypsum	Murchyville Gypsum Quarry	Tangier Gold Mine	Dufferin Gold Mine	Taylor Lumber Co. Ltd.	Great Northern Timber	Gaetz Brook Wind Farm	Mosher Limestone	Great Northern Pellets	Fifteen Mile Stream Gold Project	Fifteen Mile Stream Gold Project(Use of Touquoy Mine Site and Beaver Dam haul Routes)	Cochrane Hill Gold Project (Use of Touquoy Mine Site and Beaver Dam haul Routes)	Sheet Harbour Quarry
PHYSICAL ENVIRONMENT																						
Noise	• Increased ambient noise	Residual effects related to ambient noise levels are not anticipated to extend outside the LAA.	Residual effects to ambient noise levels may occur throughout the duration of the project including Construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	A repeated or sustained noise level being emitted from the mine site or Haul Road that exceeds the NSE Pit and Quarry Criteria.		X														X	X	
Air	• Increased ambient dust	Residual effects related to air quality are not anticipated to extend outside the LAA.	Residual effects to ambient noise levels may occur throughout the duration of the project including Construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	A repeated or sustained release of contaminants from the mine site or Haul Road to the atmospheric environment that exceeds the NSE Maximum Permissible Ground Level Concentrations listed in the Nova Scotia *Air Quality Regulations* and that exceeds the Canadian Ambient Air Quality Standards for fine particulate matter and ozone.		X														X	X	
Light	• Increased ambient light	Residual effects related to ambient light levels are not anticipated to extend outside the LAA.	Residual effects to ambient light levels may occur throughout the duration of the project including Construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	A repeated or sustained direct light trespass and sky glow that leads to reduced sky quality that extends beyond the LAA		X														X	X	

PROJECT VC	RESIDUAL ADVERSE EFFECTS FOR BEAVER DAM MINE PROJECT			DEFINITION OF A SIGNIFICANT CUMULATIVE EFFECT	PRESENT PHYSICAL ACTIVITIES														FORESEEABLE FUTURE PROJECTS			
	ADVERSE RESIDUAL EFFECTS	SPATIAL BOUNDARIES	TEMPORAL BOUNDARIES		Touquoy Gold Project	Current Regional Forestry Operations	Port of Sheet Harbour	Cooks Brook Sand and Gravel Pit	ScoZinc Ltd.	National Gypsum	Murchyville Gypsum Quarry	Tangier Gold Mine	Dufferin Gold Mine	Taylor Lumber Co. Ltd.	Great Northern Timber	Gaetz Brook Wind Farm	Mosher Limestone	Great Northern Pellets	Fifteen Mile Stream Gold Project	Fifteen Mile Stream Gold Project(Use of Touquoy Mine Site and Beaver Dam haul Routes)	Cochrane Hill Gold Project (Use of Touquoy Mine Site and Beaver Dam haul Routes)	Sheet Harbour Quarry
Greenhouse Gases (GHGs)	• Increased greenhouse gas emissions	Residual effects related to GHG emissions are anticipated to extend throughout the RAA (the Province of Nova Scotia).	Residual effects to GHG emissions may occur throughout the duration of the project including Construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	Contribution of project direct and indirect emissions exceed Provincial and National GHG targets.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Groundwater Quality and Quantity	• Disturbance to groundwater quality and quantity	The potential for residual groundwater quality effects are limited to the PA.	Residual effects to groundwater quality and quantity may occur throughout the duration of the project including Construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	An effect that is likely to cause effects on groundwater quality or quantity including exceeding the applicable CCME groundwater quality criteria and NSEQs for groundwater.	X	X																
Surface Water Quality and Quantity	• Change in Water Quality • Habitat Loss and disturbance • Change in hydrology in Cameron Flowage/Killag River	The potential for residual surface water quality and quantity effects are limited to the PA and LAA.	Residual effects to surface water quality and quantity may occur throughout the duration of the project including Construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	A repeated or sustained exceedance of the CCME FWAL criteria for Total Suspended Solids (TSS) in surface water samples collected in situ.	X	X														X	X	
BIOPHYSICAL ENVIRONMENT																						
Wetlands	• Habitat loss and disturbance	The potential for residual effects to wetlands are limited to the PA and LAA.	Residual effects to wetlands may occur throughout the duration of the project including Construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	An effect that is likely to cause a permanent net loss of wetland function.	X	X																

PROJECT VC	RESIDUAL ADVERSE EFFECTS FOR BEAVER DAM MINE PROJECT			DEFINITION OF A SIGNIFICANT CUMULATIVE EFFECT	PRESENT PHYSICAL ACTIVITIES														FORESEEABLE FUTURE PROJECTS			
	ADVERSE RESIDUAL EFFECTS	SPATIAL BOUNDARIES	TEMPORAL BOUNDARIES		Touquoy Gold Project	Current Regional Forestry Operations	Port of Sheet Harbour	Cooks Brook Sand and Gravel Pit	ScoZinc Ltd.	National Gypsum	Murchyville Gypsum Quarry	Tangier Gold Mine	Dufferin Gold Mine	Taylor Lumber Co. Ltd.	Great Northern Timber	Gaetz Brook Wind Farm	Mosher Limestone	Great Northern Pellets	Fifteen Mile Stream Gold Project	Fifteen Mile Stream Gold Project(Use of Touquoy Mine Site and Beaver Dam haul Routes)	Cochrane Hill Gold Project (Use of Touquoy Mine Site and Beaver Dam haul Routes)	Sheet Harbour Quarry
Fish and Fish Habitat	• Habitat loss and disturbance • Decreased water quality	The potential for adverse residual effects to fish and fish habitat is limited to the PA and LAA.	Residual effects to fish and fish habitat may occur throughout the duration of the project including Construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	An effect that is likely to cause serious harm to fish, as defined by Fisheries and Oceans Canada (DFO).	X	X														X	X	
Habitat and Flora	• Disturbance and loss of habitat	The potential for adverse residual effects to habitat and flora is limited to the PA and LAA.	Residual effects to habitat and flora may occur throughout the duration of the project including Construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	An effect that is likely to cause a permanent alteration to any flora species distribution or abundance.	X	X																
Terrestrial Fauna	• Disturbance and loss of habitat	The potential for adverse residual effects terrestrial fauna occurs within the LAA.	Residual effects to habitat and flora may occur throughout the duration of the project including Construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	An effect that is likely to cause a permanent alteration to any fauna species distribution or abundance at the level of the regional population.	X	X														X	X	
Birds	• Disturbance and loss of habitat • Contamination	The potential for adverse residual effects to birds is limited to the PA and LAA.	Residual effects to birds may occur throughout the duration of the project including Construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	An effect that is likely to cause a permanent alteration to any bird species distribution or abundance at the regional scale.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

PROJECT VC	RESIDUAL ADVERSE EFFECTS FOR BEAVER DAM MINE PROJECT			DEFINITION OF A SIGNIFICANT CUMULATIVE EFFECT	PRESENT PHYSICAL ACTIVITIES														FORESEEABLE FUTURE PROJECTS			
	ADVERSE RESIDUAL EFFECTS	SPATIAL BOUNDARIES	TEMPORAL BOUNDARIES		Touquoy Gold Project	Current Regional Forestry Operations	Port of Sheet Harbour	Cooks Brook Sand and Gravel Pit	ScoZinc Ltd.	National Gypsum	Murchyville Gypsum Quarry	Tangier Gold Mine	Dufferin Gold Mine	Taylor Lumber Co. Ltd.	Great Northern Timber	Gaetz Brook Wind Farm	Mosher Limestone	Great Northern Pellets	Fifteen Mile Stream Gold Project	Fifteen Mile Stream Gold Project(Use of Touquoy Mine Site and Beaver Dam haul Routes)	Cochrane Hill Gold Project (Use of Touquoy Mine Site and Beaver Dam haul Routes)	Sheet Harbour Quarry
Species of Conservation Interest (SOCI) and Species at Risk (SAR)	• Habitat loss and disturbance	The potential for adverse residual effects to SOCI and SAR is limited to the PA and LAA.	Residual effects to SOCI and SAR may occur throughout the duration of the project including Construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	An effect that is likely to cause a permanent alteration to a species' distribution or abundance, or alteration of critical habitat.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
SOCIO-ECONOMIC ENVIRONMENT																						
Indigenous Peoples	• Loss of plant specimens • Habitat loss • Sensory Disturbance • Visual Change • Aesthetics effect • Loss of Access	The potential for adverse residual effects to Indigenous Peoples are limited to the PA and LAA.	Residual effects to Indigenous Peoples may occur throughout the duration of the project including Construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	A disturbance to or destruction of land and resources utilized by Indigenous Peoples, including potable water, surface water, fish, plants, and animals in the area of the mine site due to construction, operations, or accidents and malfunctions	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Socio-Economic Conditions	• Disturbance to recreational usage of site	The potential for adverse residual effects to socio-economic conditions are limited to the PA.	Residual effects to socio-economic conditions may occur throughout the duration of the project including Construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	Temporary removal of all recreational activities such as hunting, fishing, recreational vehicles, etc., within the LAA.		X														X	X	

8.4.4 Confirmation of Valued Components to be Carried Forward Cumulative Effects Assessment

Upon completion of the three steps as documented above, VCs that would likely be affected by other past, present, or future physical activities within the spatial and temporal boundaries were determined. The decision to carry forward a VC for additional assessment or not was based on the geographical extend and the timeframe of the possible residual effects and the screening criteria listed in Section 8.3.1. The rational for the decision on each VC is documented in Table 8.4 -3.

As described in Table 8.4 -3 the following VCs warrant further assessment:

- Physical Environment
  - Air
  - Surface Water Quality and Quantity
- Biophysical Environment
  - Wetlands
  - Fish and Fish Habitat
  - Birds
  - Species of Conservation Interest and Species at Risk
- Socio-Economic Environment
  - Indigenous People

Table 8.4-3 Selection of Valued Components for the Cumulative Effects Assessment

PROJECT VC	RESIDUAL ADVERSE EFFECTS	EIS FINDING	BOUNDARIES		CRITERIA FOR DETERMINING WHETHER FURTHER ASSESSMENT IS REQUIRED					CARRIED FORWARD TO CUMULATIVE EFFECTS ASSESSMENT	
			SPATIAL – GEOGRAPHICAL EXTENT OF RESIDUAL EFFECTS	TEMPORAL - TIMEFRAME ASSOCIATED WITH RESIDUAL EFFECTS	LEVEL OF CONCERN NOTED DURING ENGAGEMENT	CURRENT STATE OF THE VC (HEALTH/STATUS/ CONDITION)	POTENTIAL FOR SIGNIFICANT CUMULATIVE EFFECTS	UNCERTAINTY IN PREDICTION OF CUMULATIVE EFFECTS	POTENTIAL FOR FOLLOW UP OR ADDITIONAL MITIGATION	YES/NO	RATIONALE
PHYSICAL ENVIRONMENT											
Noise	• Increased ambient noise	Not Significant	Residual effects related to ambient noise levels are not anticipated to extend outside the LAA.	Residual effects to ambient noise levels may occur throughout the duration of the project including Construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	**Medium**. The change to the Haul Road greatly reduced concerns about ambient noise levels from trucks passing direct on Highway 224 by existing residences, especially concerns of Millbrook First Nation regarding its residents in Beaver Lake. Local residents and Mi'kmaq are concerned with potential noise along the Haul Road.	**Good**. Noise levels at all sample locations, except for Location #1 at the Beaver Dam Mine Site, met NSE *Pit and Quarry* criteria for all time intervals. Sample Location #1 was approximately 10 feet from a hauling road that was in use during the monitoring period, which contributed to elevated noise level readings.	**No**. It is likely that forestry operations will occasionally coincide with those of the Beaver Dam Mine and cause increased ambient noise levels, compared to the levels that these operations produce individually, especially along the Haul Road. However, such additive periods are likely to be limited in duration and frequency and are not expected to be significant.	**Low**. The principal assumption behind the potential of significant cumulative effects is that local forestry practices will not change in any way throughout the Project. This assumption is considered as having a low uncertainty.	**No**.	**No**.	The predicted cumulative effects are not anticipated to be significant and the residual effects of the Project are anticipated to revert back to baseline conditions upon completion of the project. Therefore, no further assessment is warranted.
Air	• Increased ambient dust	Not Significant	Residual effects related to air quality are not anticipated to extend outside the LAA.	Residual effects to ambient noise levels may occur throughout the duration of the project including Construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	**Medium**. Concerns were specifically expressed by the Mi'kmaq relating to atmospheric environment include potential dust from mining operations at Beaver Dam and trucking along the Haul Road to both residential residences and use of the landscape for traditional harvesting purposes	**Good**. All the baseline measurements for local ambient air quality were below the Nova Scotia Air Quality Standards (NSAQS)	**No**. It is likely that forestry operations will occasionally coincide with those of the Beaver Dam Mine and cause increased ambient dust levels, compared to the levels that these operations produce individually, especially along the Haul Road. However, such additive periods are likely to be limited in duration and frequency and are not expected to be significant.	**Low**. The principal assumption behind the potential of significant cumulative effects is that local forestry practices will not change in any way throughout the Project. This assumption is considered as having a low uncertainty.	**No**.	**Yes**.	Although, the potential for significant cumulative effects to air quality is not anticipated the VC was carried forward due to the concern expressed by the Millbrook First Nation and the nature of the of the other projects in the area.

PROJECT VC	RESIDUAL ADVERSE EFFECTS	EIS FINDING	BOUNDARIES		CRITERIA FOR DETERMINING WHETHER FURTHER ASSESSMENT IS REQUIRED					CARRIED FORWARD TO CUMULATIVE EFFECTS ASSESSMENT	
			SPATIAL – GEOGRAPHICAL EXTENT OF RESIDUAL EFFECTS	TEMPORAL - TIMEFRAME ASSOCIATED WITH RESIDUAL EFFECTS	LEVEL OF CONCERN NOTED DURING ENGAGEMENT	CURRENT STATE OF THE VC (HEALTH/STATUS/ CONDITION)	POTENTIAL FOR SIGNIFICANT CUMULATIVE EFFECTS	UNCERTAINTY IN PREDICTION OF CUMULATIVE EFFECTS	POTENTIAL FOR FOLLOW UP OR ADDITIONAL MITIGATION	YES/NO	RATIONALE
Light	• Increased ambient light	Not Significant	Residual effects related to ambient light levels are not anticipated to extend outside the LAA.	Residual effects to ambient light levels may occur throughout the duration of the project including Construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	**Medium**. The change to the Haul Road greatly reduced concerns about ambient light levels from trucks passing direct on Highway 224 by existing residences, especially concerns of Millbrook First Nation regarding its residents in Beaver Lake. Local residents and Mi'kmaq are concerned with potential light from the Beaver Dam Mine Site and the Haul Road.	**Good**. The LAA is a rural, remote area and is mostly wooded. Ambient nighttime light conditions would be minimal and typical of an undeveloped rural area.	**No**. It is likely that forestry operations will occasionally coincide with those of the Beaver Dam Mine and cause increased ambient light levels, compared to the levels that these operations produce individually, especially along the Haul Road. However, such additive periods are likely to be limited in duration and frequency and are not expected to be significant.	**Low**. The principal assumption behind the potential of significant cumulative effects is that local forestry practices will not change in any way throughout the Project. This assumption is considered as having a low uncertainty.	**No**.	**No**.	As the predicted cumulative effects are not anticipated to be significant and the residual effects of the Project are anticipated to revert, back to baseline conditions upon completion of the project no further assessment is warranted.
Greenhouse Gases (GHGs)	• Increased greenhouse gas emissions	Not Significant	Residual effects related to GHG emissions are anticipated to extend throughout the RAA (the Province of Nova Scotia).	Residual effects to GHG emissions may occur throughout the duration of the project including Construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	**Low**. Limited concern has been noted specific to greenhouse gas emissions associated with the Project.	**Good**. The total GHG emissions from Nova Scotia were identified to be 16,600 kilotonnes CO_2e during 2014, which achieved the legislated reduction goal of 10% below 1990 levels by 2020.	**No**. All phases from this project would represent approximately 1.25% of the total GHG emissions for Nova Scotia. It is therefore considered that the proposed project contributes very little to the overall cumulative effects of regional industry to GHG emissions.	**Low**. Although there is some uncertainty in levels of GHG emissions, there is good confidence in the fact that the Beaver Dam Mine will only contribute a small percentage for Nova Scotia.	**No**.	**No**.	As the predicted cumulative effects are not anticipated to be significant and given the small contribution of the Beaver Dam Project to total GHG emissions, the effects with and without the project are very similar. Therefore, no further assessment is warranted.

PROJECT VC	RESIDUAL ADVERSE EFFECTS	EIS FINDING	BOUNDARIES		CRITERIA FOR DETERMINING WHETHER FURTHER ASSESSMENT IS REQUIRED					CARRIED FORWARD TO CUMULATIVE EFFECTS ASSESSMENT	
			SPATIAL – GEOGRAPHICAL EXTENT OF RESIDUAL EFFECTS	TEMPORAL - TIMEFRAME ASSOCIATED WITH RESIDUAL EFFECTS	LEVEL OF CONCERN NOTED DURING ENGAGEMENT	CURRENT STATE OF THE VC (HEALTH/STATUS/ CONDITION)	POTENTIAL FOR SIGNIFICANT CUMULATIVE EFFECTS	UNCERTAINTY IN PREDICTION OF CUMULATIVE EFFECTS	POTENTIAL FOR FOLLOW UP OR ADDITIONAL MITIGATION	YES/NO	RATIONALE
Geology, Soil and Sediment Quality	• Erosion, soil and sediment quality, increased dust impact (i.e. flora and fauna/habitat, human health, etc.)	Not Significant	Residual effects related to erosion, soil and sediment quality, and increased dust are not anticipated outside of the PA.	Residual effects to GHG emissions may occur throughout the duration of the project including Construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	Medium. Concerns were expressed relating to potential ARD, suspended solids and leaching of metals from the rock at the Beaver Dam Mine Site, which may affect receiving water and its fish habitat.	Good. Geology, soil and sediment quality are good. Soils are being moved on-site, but are being re-used for reclamation purposes to the greatest extent possible, resulting in no net loss.	No. Based on the residual effects being confined to the PA, it is unlikely that other projects would interact with this VC.	Low. Based on the residual effects being confined to the PA, it is unlikely that other projects would interact with this VC. This assumption is considered as having a low uncertainty.	No.	No.	As the predicted cumulative effects are not anticipated to be significant and the residual effects of the Project are anticipated to limited to the PA, no further assessment is warranted.
Groundwater Quality and Quantity	• Disturbance to groundwater quality and quantity	Not Significant	The potential for residual groundwater quality effects are limited to the PA.	Residual effects to groundwater quality and quantity may occur throughout the duration of the project including Construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	**High**. Concerns were specifically expressed by the Millbrook First Nation regarding effects on groundwater quality and quantity in terms of potable water wells and the health of its residents in Beaver Lake IR 17. Concerns were also expressed regarding groundwater drawdown and potential effects on surface water including the Killag River.	**Good**. The site hydrogeology consists of a fractured rock aquifer system which is overlain by a thin till layer. These two hydrogeologic units are present on regional scale and extend beyond the limits of the Beaver Dam site.	**No**. Potential cumulative effects on groundwater are not anticipated at the mine site because of the lack of other activities affecting this VC at this location. The potential for cumulative effects along the Haul Road are not expected to be noticeably greater than those identified for the proposed project and are considered not significant. Furthermore, the potential groundwater contamination at the Touquoy site is anticipated to be negligible.	**Low**. Uncertainty will be addressed through the monitoring and follow-up programs established for the Project.	**No**.	**No**.	The predicted cumulative effects are not anticipated to be significant due to the spatial boundaries of the residual effects. Therefore, no further assessment is warranted.

PROJECT VC	RESIDUAL ADVERSE EFFECTS	EIS FINDING	BOUNDARIES		CRITERIA FOR DETERMINING WHETHER FURTHER ASSESSMENT IS REQUIRED					CARRIED FORWARD TO CUMULATIVE EFFECTS ASSESSMENT	
			SPATIAL – GEOGRAPHICAL EXTENT OF RESIDUAL EFFECTS	TEMPORAL - TIMEFRAME ASSOCIATED WITH RESIDUAL EFFECTS	LEVEL OF CONCERN NOTED DURING ENGAGEMENT	CURRENT STATE OF THE VC (HEALTH/STATUS/ CONDITION)	POTENTIAL FOR SIGNIFICANT CUMULATIVE EFFECTS	UNCERTAINTY IN PREDICTION OF CUMULATIVE EFFECTS	POTENTIAL FOR FOLLOW UP OR ADDITIONAL MITIGATION	YES/NO	RATIONALE
Surface Water Quality and Quantity	• Change in Water Quality • Habitat Loss and disturbance • Change in hydrology in Cameron Flowage/Killag River	Not Significant	The potential for residual surface water quality and quantity effects are limited to the PA and LAA.	Residual effects to surface water quality and quantity may occur throughout the duration of the project including Construction (1 year), Operation (5 years) and Reclamation (3 years) phases..	**High**. Key issues raised during stakeholder engagement was the concern about effect on water quantity in Cameron Flowage from pit development and the concern about metals leaching from waste rock pile, including arsenic, and acid rock drainage. Concerns were also identified related to effects on surface waters along the Haul Road, specifically during construction activities, including River Lake, a segment of the West River Sheet Harbour, near the Beaver Lake IR 17.	**Moderate to poor**. The overall poor culvert conditions has contributed to poor surface water conditions and obstructed fish passage. Water quality throughout the PA is characterized as relatively pristine, with very little influence from past mining activities, local industry, road salting, or local residents. Aluminum and iron exceeded the CCME FWAL guidelines at all sampling locations during most sampling events.	**Yes**. There is a potential for cumulative effects to all surface water systems along Haul Road. Furthermore, the use of the Touquoy processing plant extends the period in which effects to the surrounding surface water may take place by up to 6 years, which will require an extension to the use of Scraggy Lake as one of the sources of fresh water to process ore. The cumulative effect of the combined projects could mean a reduction in the streamflow from Scraggy Lake to the Fish River system.	**Little to no uncertainty**. The effects are already present, and are therefore identical with or without the inclusion of the Beaver Dam Project. In fact, the Beaver Dam Project gives an opportunity to improve surface water conditions.	**Yes**.	**Yes**.	Further assessment is required to determine if there is the possibility of significant residual cumulative effects to Surface Water Quality and Quantity.
BIOPHYSICAL ENVIRONMENT											

PROJECT VC	RESIDUAL ADVERSE EFFECTS	EIS FINDING	BOUNDARIES		CRITERIA FOR DETERMINING WHETHER FURTHER ASSESSMENT IS REQUIRED					CARRIED FORWARD TO CUMULATIVE EFFECTS ASSESSMENT	
			SPATIAL – GEOGRAPHICAL EXTENT OF RESIDUAL EFFECTS	TEMPORAL - TIMEFRAME ASSOCIATED WITH RESIDUAL EFFECTS	LEVEL OF CONCERN NOTED DURING ENGAGEMENT	CURRENT STATE OF THE VC (HEALTH/STATUS/ CONDITION)	POTENTIAL FOR SIGNIFICANT CUMULATIVE EFFECTS	UNCERTAINTY IN PREDICTION OF CUMULATIVE EFFECTS	POTENTIAL FOR FOLLOW UP OR ADDITIONAL MITIGATION	YES/NO	RATIONALE
Wetlands	• Habitat loss and disturbance	Not Significant	The potential for residual effects to wetlands are limited to the PA and LAA.	Residual effects to wetlands may occur throughout the duration of the project including Construction (1 year), Operation (5 years) and Reclamation (3 years) phases..	**High**. Key issues raised during stakeholder engagement was the concern about wetlands being impacted at mine site and future compensation, and potential reduction in water quality and flood control due to loss of wetlands.	**Good**. Wetlands and buffer areas generally offer high quality wildlife habitat and good water quality functions. All wetlands assessed were determined to provide high plant community integrity as the plants are generally composed of native species characteristic of the wetland type with a very minor component of non-native species.	**Yes**. The loss of wetlands from the Beaver Dam Mine Site, the Touquoy Gold Project and along the haul road results in a direct loss of 287,945 m² of wetlands. Other disturbances to wetlands may include stressors from other forestry related activities.	**Little to no uncertainty**. The potential cumulative effects (loss of wetlands within the Project footprint) is based on the planned footprint of the Project which is unlikely to change.	**Yes**.	**Yes**.	Further assessment is required to determine if there is the possibility of significant residual cumulative effects to wetlands.
Fish and Fish Habitat	• Habitat loss and disturbance • Decreased water quality	Not Significant	The potential for adverse residual effects to fish and fish habitat is limited to the PA and LAA.	Residual effects to fish and fish habitat may occur throughout the duration of the project including Construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	**High**. Key issues raised during public consultation and Mi'kmaq engagement relating to fish and fish habitat include potential indirect effects from wetland alteration or changes to surface water and groundwater quality and quantity on fish and fish habitat.	**Moderate**. Poorly installed culverts along the pre-existing portions of the Haul Road have been noted as having adverse effects on fish.	**No**. Since the adverse effects observed with regards to the existing Haul Road will be reduced by the removal and replacement of the poorly installed culverts along this road and the Touquoy Gold project is not a source of significant adverse effects on fish habitat, no cumulative effects on fish habitat beyond the effects assessed for the Beaver Dam Project are anticipated	**Low**. The uncertainty as to the Project effects on fish and fish habitat would be addressed through monitoring and follow-up programs established for the Project.	**Yes**. Culverts that are currently in disrepair will be removing/upgrading where required.	**Yes**.	Although, the potential for significant cumulative effects to fish and fish habitat is not anticipated the VC was carried forward due to the concern expressed by the Millbrook First Nation relating to fish and fish habitat including the potential indirect effects from wetland alteration or changes to surface water and groundwater quality and quantity on fish and fish habitat.

PROJECT VC	RESIDUAL ADVERSE EFFECTS	EIS FINDING	BOUNDARIES		CRITERIA FOR DETERMINING WHETHER FURTHER ASSESSMENT IS REQUIRED					CARRIED FORWARD TO CUMULATIVE EFFECTS ASSESSMENT	
			SPATIAL – GEOGRAPHICAL EXTENT OF RESIDUAL EFFECTS	TEMPORAL - TIMEFRAME ASSOCIATED WITH RESIDUAL EFFECTS	LEVEL OF CONCERN NOTED DURING ENGAGEMENT	CURRENT STATE OF THE VC (HEALTH/STATUS/ CONDITION)	POTENTIAL FOR SIGNIFICANT CUMULATIVE EFFECTS	UNCERTAINTY IN PREDICTION OF CUMULATIVE EFFECTS	POTENTIAL FOR FOLLOW UP OR ADDITIONAL MITIGATION	YES/NO	RATIONALE
Habitat and Flora	• Disturbance and loss of habitat	Not Significant	The potential for adverse residual effects to habitat and flora is limited to the PA and LAA.	Residual effects to habitat and flora may occur throughout the duration of the project including Construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	**Medium**. Concerns were raised during public consultation and Mi'kmaq engagement relating to habitat and flora include potential effect on biodiversity and permanent loss of habitat associated within the Beaver Dam Mine Site and Haul Road.	**Moderate**. Habitat throughout the region exhibits fragmented conditions related to current and historic timber harvesting activity. This has led to habitat fragmentation and an increase in young regenerating stands to the detriment of older undisturbed forest.	**No**. Although both the Beaver Dam Mine Project and the Touquoy Gold Project will cause the loss and disturbance of habitats within the PA, these effects are relatively small given the fact that most of the affected areas are already disturbed with the exception of the construction of the section of the Haul Road immediately southwest of Hwy 224.	**Little to no uncertainty**. The generalized disturbance of the landscape by forestry is well documented in the NSL&F Forest Inventory. Therefore, there is little uncertainty with regards to this information or as to the nature of the predicted Project effects (loss of habitat within the Project footprint).	**No**.	**No**.	Overall, the generalized disturbance of the landscape by forestry activities, past, present and future are the main source of cumulative effects of habitats throughout the area. Without the Project, the loss of habitat in the Beaver Dam Mine footprint during the construction and operation phases would be avoided, however the generalized disturbance of the landscape would be unaffected, therefore further assessment is not warranted.
Terrestrial Fauna	• Disturbance and loss of habitat	Not Significant	The potential for adverse residual effects terrestrial fauna occurs within the LAA.	Residual effects to habitat and flora may occur throughout the duration of the project including Construction (1 year), Operation (5 years) and Reclamation (3 years) phases..	**Medium**. Concerns raised during public consultation and Mi'kmaq engagement relating to terrestrial fauna include potential effects on fauna from permanent loss of habitat associated with the footprint of the Beaver Dam Mine Site and Haul Road, as well as direct mortality associated with the hauling operation.	**Moderate**. The variety of both upland and wetland habitats identified throughout the PA support a range of terrestrial fauna, although existing fragmentation exists with historical logging activity.	**No**. As the Beaver Dam Mine site only contributes to a minority portion of the overall mining activities footprint, and because these effects are considered small compared to the generalized disturbance of the landscape by forestry activities, the cumulative effects with and without the project would be very similar at the regional level.	**Low**. The main assumption behind this assessment is that the overall patterns of land use in the region will remain unchanged in the foreseeable future.	**No**.	**No**.	As the potential cumulative effects are not anticipated to be significant and loss of habitat will be restored during the reclamation stage no further assessment is warranted.

PROJECT VC	RESIDUAL ADVERSE EFFECTS	EIS FINDING	BOUNDARIES		CRITERIA FOR DETERMINING WHETHER FURTHER ASSESSMENT IS REQUIRED					CARRIED FORWARD TO CUMULATIVE EFFECTS ASSESSMENT	
			SPATIAL – GEOGRAPHICAL EXTENT OF RESIDUAL EFFECTS	TEMPORAL - TIMEFRAME ASSOCIATED WITH RESIDUAL EFFECTS	LEVEL OF CONCERN NOTED DURING ENGAGEMENT	CURRENT STATE OF THE VC (HEALTH/STATUS/ CONDITION)	POTENTIAL FOR SIGNIFICANT CUMULATIVE EFFECTS	UNCERTAINTY IN PREDICTION OF CUMULATIVE EFFECTS	POTENTIAL FOR FOLLOW UP OR ADDITIONAL MITIGATION	YES/NO	RATIONALE
Birds	• Disturbance and loss of habitat • Contamination	Not Significant	The potential for adverse residual effects to birds is limited to the PA and LAA.	Residual effects to birds may occur throughout the duration of the project including Construction (1 year), Operation (5 years) and Reclamation (3 years) phases..	**Low to Medium**. Concerns raised during public consultation and Mi'kmaq engagement relating to birds include potential for direct mortality associated with the hauling operation and indirect effects on other VCs, such as dust, noise and light, as well as potential effects on birds associated with permanent loss of habitat from construction of the Beaver Dam Mine and the Haul Road.	**Good**. All of the species identified are native species expected to be found in this area of Nova Scotia and the province in general, and within the typical and common habitat associated with the Project and surrounding landscape.	**No**. The overall footprint of mining activities, including the Beaver Dam and Touquoy sites, is quite small in relation to the available bird habitat within the region. None of the projects in the area are expected to have direct effects on birds beyond their immediate surroundings. Therefore, no significant cumulative effects to birds at the regional scale are anticipated with regards to these activities.	**Low**. The main assumption behind this assessment is that the overall patterns of land use in the region will remain unchanged in the foreseeable future.	**No**.	**Yes**.	Although the predicted cumulative effects are not anticipated to be significant and loss of habitat will be restored during the reclamation stage, the VC was carried forward to the Cumulative Effects Assessment as per the EIS guidelines (See 8.3.1).

PROJECT VC	RESIDUAL ADVERSE EFFECTS	EIS FINDING	BOUNDARIES		CRITERIA FOR DETERMINING WHETHER FURTHER ASSESSMENT IS REQUIRED					CARRIED FORWARD TO CUMULATIVE EFFECTS ASSESSMENT	
			SPATIAL – GEOGRAPHICAL EXTENT OF RESIDUAL EFFECTS	TEMPORAL - TIMEFRAME ASSOCIATED WITH RESIDUAL EFFECTS	LEVEL OF CONCERN NOTED DURING ENGAGEMENT	CURRENT STATE OF THE VC (HEALTH/STATUS/ CONDITION)	POTENTIAL FOR SIGNIFICANT CUMULATIVE EFFECTS	UNCERTAINTY IN PREDICTION OF CUMULATIVE EFFECTS	POTENTIAL FOR FOLLOW UP OR ADDITIONAL MITIGATION	YES/NO	RATIONALE
Species of Conservation Interest (SOCI) and Species at Risk (SAR)	• Habitat loss and disturbance	Not Significant	The potential for adverse residual effects to SOCI and SAR is limited to the PA and LAA.	Residual effects to SOCI and SAR may occur throughout the duration of the project including Construction (1 year), Operation (5 years) and Reclamation (3 years) phases	**High**. Key issues raised during public consultation and Mi'kmaq engagement relating to SAR and SOCI include potential direct effects on rare flora and fauna associated with construction of the Beaver Dam Mine site and Haul Road and potential indirect effects associated with changes to other VCs, such as wetlands, surface water and groundwater.	**Good**. A number of priority species were identified. Boreal Felt Lichen habitat is present to the south of the PA, however, the thalli have been lost.	**No**. Within the PA, the Beaver Dam Mine Project and the Touquoy Gold Project are not anticipated to have significant cumulative effects.	**Low**. The main assumption behind this assessment is that the overall patterns of land use in the region will remain unchanged in the foreseeable future.	**No**.	**Yes**.	Although, the potential for significant cumulative effects to SOCI and SAR is not anticipated the VC was carried forward due to the concern expressed by the Millbrook First Nation relating to SAR and SOCI and as required by the per the EIS guidelines (See 8.3.1). Concerns included the potential direct effects on rare flora and fauna associated with construction of the Beaver Dam Mine site and Haul Road and the potential indirect effects associated with changes to other VCs, such as wetlands, surface water and groundwater.
SOCIO-ECONOMIC ENVIRONMENT											

PROJECT VC	RESIDUAL ADVERSE EFFECTS	EIS FINDING	BOUNDARIES		CRITERIA FOR DETERMINING WHETHER FURTHER ASSESSMENT IS REQUIRED					CARRIED FORWARD TO CUMULATIVE EFFECTS ASSESSMENT	
			SPATIAL – GEOGRAPHICAL EXTENT OF RESIDUAL EFFECTS	TEMPORAL - TIMEFRAME ASSOCIATED WITH RESIDUAL EFFECTS	LEVEL OF CONCERN NOTED DURING ENGAGEMENT	CURRENT STATE OF THE VC (HEALTH/STATUS/ CONDITION)	POTENTIAL FOR SIGNIFICANT CUMULATIVE EFFECTS	UNCERTAINTY IN PREDICTION OF CUMULATIVE EFFECTS	POTENTIAL FOR FOLLOW UP OR ADDITIONAL MITIGATION	YES/NO	RATIONALE
Indigenous Peoples	• Loss of plant specimens • Habitat loss • Sensory Disturbance • Visual Change • Aesthetics effect • Loss of Access	Not Significant	The potential for adverse residual effects to Indigenous Peoples are limited to the PA and LAA.	Residual effects to Indigenous Peoples may occur throughout the duration of the project including Construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	**High**. Key issues raised during public consultation and Mi'kmaq engagement relating to Indigenous Peoples include concerns related to pathways of adverse effects, primarily related to access and resources and harvesting, from Project activities during construction and operation.	**Moderate**. There are two First Nations (Mi'kmaq) reserves in the area of the Project. Beaver Lake IR 17 (49.4 ha) is located approximately 5 km from the mine site and 3 km from the proposed Haul Road. The 2016 Census reports twenty-one (21) people are living at Beaver Lake and twenty-five (25) people are living at Sheet Harbour (Statistics Canada 2017 and 2017a).	**Yes**. Potential significant adverse cumulative effects to surface water, would cause effects on the use of surface water bodies and the fish inhabiting them by the Mi'kmaq of Nova Scotia. There is also the potential for cumulative effects on habitats, flora, terrestrial fauna and birds to lead to effects on current use of land and resources for traditional purposes.	**Moderate**. Effects are linked to a number of VCs and therefore can be more difficult to predict.	**Yes**. Culverts that are currently in disrepair will be removing/ upgrading where required.	**Yes**.	Further assessment is required to determine if there is the possibility of significant residual cumulative effects to Indigenous Peoples.
Socio-Economic Conditions	• Disturbance to recreational usage of site	Not Significant	The potential for adverse residual effects to socio-economic conditions are limited to the PA.	Residual effects to socio-economic conditions may occur throughout the duration of the project including Construction (1 year), Operation (5 years) and Reclamation (3 years) phases.	**Medium**. Concern about volumes of truck traffic in context of safety on public roadways and recreational vehicles.	**Good**. The area sees public use for access to hunting, fishing and ATV activity.	**No**. Disturbance to recreational usage is restricted to the PA so no cumulative effects are anticipated. In terms of traffic, the all traffic on the Haul Road and any crossroads contribute to the risk of road accidents with the project area. The largest contributor to this traffic during the life of the project will be the trucking of ore from the Beaver Dam mine site to the Touquoy Mine Site As the other sources of road traffic are much smaller, the cumulative effects are essentially the same as those of the proposed project.	**Low**. Prediction made of the assumption that the local road usage will not change.	**No**.	**No**.	As the potential cumulative effects are not anticipated and recreational use of the area will be restored during reclamation stage, no further assessment is warranted.

8.5 Cumulative Effects Assessment of the Valued Components

Using appropriate data and information is critical to the analysis of cumulative effects. Exhaustive baseline studies have been completed to characterize the environment within the PAA, LAA and RAA. Baseline information for all VC's is described in Section 6 of the EIS, but has been summarized in the subsequent sections for those VC's that have been carried forward for the cumulative effects assessment.

8.5.1 Air Cumulative Effects Assessment

8.5.1.1 Baseline Conditions

8.5.1.1.1 Baseline Air Quality Monitoring Program

Total suspended particulate concentrations ranged from 1.7 to 41.7 μg/m^3, with the highest value obtained at Location #2 during monitoring in June 2008. Results for PM_{10} concentrations ranged from 7.1 to 13.1 μg/m^3, with the highest value also obtained at Location #2 during monitoring in June 2008. This monitoring station was located in a recently clear-cut area, which may have contributed to higher particulate levels in comparison to the other locations. This area was resampled in 2014 (AN-2). The 2014 results for that area were 4.6 μg/m^3. All samples collected were below the NSAQS for TSP, there is no NSAQS for PM_{10}.

The data obtained as part of the baseline program reported herein provides a preliminary snapshot of air quality in the area of the Beaver Dam Mine Site and Haul Road, and a general understanding of local air quality. Due to a lack of other sources of data for ambient TSP, the background concentration for TSP is based on the maximum measured 24-hour TSP concentration (there are insufficient data to provide a meaningful 90th percentile value), and the average of all the TSP measurements. There is a great deal of uncertainty in how representative these values might be for background, but they represent the best available data at this time.

8.5.1.1.2 Regional ambient air quality

Recent (2014 – 2016, the most recent three years for which all data are currently available) continuous monitoring data were obtained from the National Pollutant Surveillance Network (NAPS). The nearest representative stations which report concentrations for the indicator compounds identified for this assessment are:

- Lake Major, Nova Scotia (station ID 030120) – $PM_{2.5}$
- Port Hawkesbury, Nova Scotia (station ID 030201) – $PM_{2.5}$
- Aylesford Mountain, Nova Scotia (station ID 030701) – $PM_{2.5}$
- Pictou, Nova Scotia (station ID 030901) – $PM_{2.5}$

PM_{10} is not measured in many areas in Canada. Of the locations which do measure PM_{10}, most are in British Columbia urban centres, four are in Manitoba cities, one is in Regina, Saskatchewan, and four are in the Northwest Territories. In terms of locations that are somewhat comparable to the Project site (human habitation, regional activities that may generate airborne particulate, etc.), Norman Wells NW

Regional Office (Station ID 129102) appears the most appropriate location that has recent data available. As such, this station has been included to provide context for PM_{10}, and $PM_{2.5}$ in this assessment. Total particulates are not measured routinely anywhere in Canada, and so cannot be represented by regional monitoring data. Lacking these data, the highest measured concentration of TSP from the baseline monitoring programs has been used for this assessment.

The background air concentrations used in the cumulative effects assessment are provided in Section 6.3.3. An expanded data set showing the 25th, 50th, 75th, and 90th percentile values, as well as mean average, and maximum concentrations, for the indicator compounds is provided in the Air Quality Technical Memorandum (GHD, 2019).

Table 8.5-1 Background Concentrations of Indicator Compounds for Cumulative Effects Assessment

Compound	Averaging Period	Concentration (µg/m^3)	Source
TSP	24-hour	41.7	On-site monitoring (maximum)
	Annual	12.8	On-site monitoring (average)
PM_{10}	24-hour	31.0	Norman Wells NWT NAPS station
$PM_{2.5}$	24-hour	9.0	Port Hawkesbury NAPS station
	Annual	5.7	Port Hawkesbury NAPS station

Port Hawkesbury was identified as a station in reasonable proximity to the site, that is likely relatively comparable in terms of current human activity. Existing air quality at this location is likely similar to (or slightly worse – higher concentrations) than existing conditions at the Project site, and so for all species except PM_{10}, this location has been selected as "background". It should be noted that the Norman Well station generally had similar ambient air quality concentrations (up to the 90th percentile) as the other stations reporting $PM_{2.5}$, however maximum $PM_{2.5}$ concentrations measured at this location much higher than other locations assessed. The Normal Well station reported 90th percentile PM_{10} roughly double the highest PM_{10} sample collected in the vicinity of the site, however with multiple years of data reporting, the Norman Well station has been used as "background" for PM_{10} due to a paucity of data elsewhere.

8.5.1.2 Analysis of Effects

8.5.1.2.1 Residual Effects of Proposed Project

Dust emissions are the primary atmospheric issue for the Beaver Dam mine site. Air-borne particulate matter will be generated during construction and operation phases of the Project. During operation, most of the dust will be generated at the mine site from crushing processes and trucking operations, and on the Haul Road from trucking operations.

Due to the proposed site operation and configuration, air emissions sources will be close to ground-level or below grade. There will likely be negligible impacts to the residential area due to the surrounding topography, the surrounding forested area, and the distance to the nearest residential area.

The Haul Road between the proposed Beaver Dam Mine and the Touquoy Mine Site is the source primarily responsible for the maximum predicted concentrations at both the gridded receptors and the sensitive receptors. Emissions of particulates from the Haul Road are predicted to result in some exceedances of the assessment criteria, for particulate species, at close proximity to the road. With the addition of regional background concentrations, the effects assessment suggests that these exceedances may extend up to 200 m on either side of the road.

The overall significance of these exceedances is therefore assessed as “low or not significant”, which is to be confirmed by a robust and longer-term air quality monitoring program for TSP and PM_{10}, in particular near the Deepwood Estates sensitive receptor, to confirm that there will be no adverse effects due to dust from the Haul Road.

8.5.1.2.2 **Effects of Other Projects in the Area**

8.5.1.2.2.1 Current Regional Forestry Operations

The local forestry industry has the potential to have cumulative effects on air quality. As the forestry industry is ongoing in the region and has been for many decades, its effects on air quality are already accounted for in the local baseline conditions. The largest effect noted from the baseline data was the measurement of the highest suspended particulate concentrations from a monitoring station located in a recently clear cut area.

8.5.1.2.2.2 Touquoy Mine Site and Beaver Dam Haul Road Use by Fifteen Mile Stream and Cochrane Hill Gold Projects

During the operation phase of the Fifteen Mile Stream Gold Project (2021 to 2026) and the Cochrane Hill Gold Project (2022 to 2027), gold concentrate from each surface mine will be transported to the Touquoy processing site for final processing into gold doré bar. The proposed Haul Road for each project would overlap with the Beaver Dam Mine Haul Road west of the Highway 224. Up to approximately 300 tonnes per day and 175 tonnes per day will be transported to the to the Touquoy processing site using a C Train truck configuration for Fifteen Mile Stream Gold Project and the Cochrane Hill Gold Project respectively.

The trucking operations associated with the Fifteen Mile Stream and Cochrane Hill Gold Projects will generate dust will along the Beaver Dam Haul Road west of Highway 124. Speed limits and dust suppression plans that would be implemented as a part of Beaver Dam Mine Project mitigate the potential increase in ambient dust levels from the trucking operations associated with the Fifteen Mile Stream and Cochrane Hill Gold Projects.

8.5.1.2.3 **Cumulative Effects on Ambient Air Quality**

It is likely that forestry operations will occasionally coincide with those of the Beaver Dam Mine and cause greater disturbance to air quality that these operations produce individually, especially along the Haul Road. However, such additive periods are likely to be limited in duration and frequency and are not expected to be significant.

The gold concentrate processing and transportation activities associated with the Beaver Dam Mine Project, the Fifteen Mile Stream Gold Project and the Cochrane Hill Gold Project overlap in both time and space. Therefore, the potential effects from the transportation and processing of gold from the three projects have the potential to act in an additive and cumulative nature. The operation of Beaver Dam Mine Project (2022-2026), the Fifteen Mile Stream Gold Project (2021 to 2026) and the Cochrane Hill Gold Project (2022 to 2027) are proposed roughly to occur during the same timeframe, with all three mines operating at the same time from 2022 to 2026. During this time all three projects will use the portion of the Beaver Dam Haul Roads west of the Highway 224 to transport gold concentrate to the Touquoy Mine Site resulting in potential additive cumulative effects to air quality through increased ambient dust levels in the PA along the Haul Road.

The principal assumptions behind this assessment is that local forestry practices will not change in any important way during of the Beaver Dam Project and that the Fifteen Mile Stream Gold Project and the Cochrane Hill Gold Project are approved and carried out during the anticipated timelines. These assumptions are considered to have a low uncertainty.

8.5.1.3 Mitigation

As the potential effects are limited to the area surrounding the Beaver Dam Haul Road and given the distance of the Haul Road to surrounding properties/residences, no mitigation measures beyond those already presented to mitigate Project effects (Section 6.2.8) are warranted.

8.5.1.4 Residual Cumulative Effects and Significance Assessment

A significant adverse effect to the atmospheric environment at the Beaver Dam mine site is defined as a repeated or sustained release of contaminants from the mine site or Haul Road to the atmospheric environment that exceeds the NSE Maximum Permissible Ground Level Concentrations listed in the Nova Scotia *Air Quality Regulations* and that exceeds the Canadian Ambient Air Quality Standards for fine particulate matter and ozone.

The residual cumulative effects on the atmospheric environment are considered to be adverse but not significant (Table 8-5.2)

Table 8.5-2 Residual Cumulative Environmental Effects for Air

Residual Adverse Cumulative Effects (After Mitigation)	Significance Levels						Overall Significance of Residual Adverse Effects (and Rationale)
	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	
Increased ambient dust during operation of Beaver Dam Haul Road (Dust from haul trucks)	H Possible exceedance of guidelines or threshold values by more than 20% when forestry operations occasionally coincide with hauling ore along the Beaver Dam Haul Road from the Beaver Dam Mine, Fifteen Mile Stream Mine and Cochrane Hill Mine.	LAA The cumulative effects causing increased ambient dust levels will occur along the Beaver Dam Haul Road and therefore are only likely to extend to the LAA.	N/A VC is not expected to be affected by timing.	LT Effects may extend beyond 3 years.	R Additive periods of potential effects from the Project and forestry operations are likely to be limited in frequency. However, cumulative effects to ambient dust levels from the use Beaver Dam Haul Road Use by Fifteen Mile Stream and Cochrane Hill Gold Projects will occur regularly throughout the operational phase of the Project.	R VC will recover to baseline conditions once operations have stopped.	**Moderate Adverse Effect** **(Not Significant)** Effects are limited to the LAA where there are limited sensitive receptors. Furthermore the VC is anticipated to recover to baseline conditions once the operation of the mine has stopped. Effects would be confirmed through monitoring.
Legend (refer to Table 5.10-1 for definitions)	Magnitude N Negligible L Low M Moderate H High	Geographic Extent PA Project Area LAA Local Assessment Area RAA Regional Assessment Area	Timing N/A Not Applicable A Applicable	Duration ST Short-Term MT Medium-Term LT Long-Term P Permanent	Frequency O Once S Sporadic R Regular C Continuous	Reversibility R Reversible IR Irreversible	

8.5.1.5 Follow-up and Monitoring Programs

No additional follow-up or monitoring beyond that presented in Section 6.2.10 is warranted.

8.5.2 Surface Water Quality and Quantity Cumulative Effects Assessment

8.5.2.1.1 Baseline conditions

8.5.2.1.1.1 Surface Water Features

Beaver Dam Mine Site

The Beaver Dam Mine Project lies within the West River Sheet Harbour drainage basin, which is directly east of the large Musquodoboit River Valley system. The watershed occupies an area of roughly 576 km^2, a moderately sized watershed in the Province. The West River Sheet Harbour drainage basin discharges to the West River and its tributaries, from north to south. Elevations within the catchment vary from approximately 135 to 165 masl in the headwater areas and gradually decrease to sea level at the final outlet located at Sheet Harbour. The West River Sheet Harbour and Tangier River Secondary boundary runs through center of PA along the Haul Road.

The three confirmed waterbodies within the Beaver Dam Mine Site are Crusher Lake, located in the western section of the PA, Mud Lake, located in the northwestern corner, and Cameron Flowage, located within the northeast corner, near the location of the proposed open pit. Tent Lake and Kent Lake are outside the study area but may be affected by changes in wetlands upstream

Haul Road

There are sixteen (16) mapped watercourses, including two major rivers, West River Sheet Harbour and Morgan River, intersect the Haul Road. Five smaller waterbodies are mapped west of Lake Alma. During field assessments, however, these five waterbodies were confirmed to be wetland habitat.

Along the Haul Road, timber bridges and culverts of varying designs and conditions are used to cross watercourses at several locations. An initial assessment of the existing Haul Road identified 23 watercourse crossings: 20 culverts (smaller watercourses) and 3 timber bridges (watercourses 6 to 13 m in width). The bridges were considered to be in good condition. A large number of the culverts were poorly installed (i.e., buried, caved in, plugged, hung, not present, water flowing through the road base and not the culvert). The overall poor culvert conditions have contributed to localized poor surface water hydrology and obstructed fish passage.

Touquoy Mine Site

There are several watercourses in the vicinity of the Touquoy Mine Site. Moose River is the largest watercourse adjacent to the property and flows along the western border of the mine site. A tributary to the Moose River (known as Watercourse No. 4) flows south through the property, between the open pit and tailing management area. Scraggy Lake is located to the south of the property and is a water supply source for the Touquoy Mine Site. Fish River drains Square Lake to Scraggy Lake and both lakes are part of the Fish River Watershed that flows west and then south into Lake Charlotte, eventually emptying into Ship Harbour.

8.5.2.1.1.2 Surface Water Quality

Beaver Dam Mine Site

Water quality at the Beaver Dam Mine Site is characterized as relatively pristine, with very little influence from past mining activities, local industry, road salting, or local residents. Some localized influences from road work (culverts, ditching) or forestry use would have occurred historically (suspended solids for example) but these would be localized and short term variations. The majority of nutrients were below or slightly above detectable concentrations, indicating little to no influence from agricultural operations in the area.

At the Beaver Dam Mine Site, aluminum and iron exceeded the CCME FWAL guidelines and NSEQSs at all sampling locations during most sampling events; however, this is a common feature of surface water in Nova Scotia. Mercury was identified above the CCME FWAL guidelines and NSEQSs at all sampling locations during the last sampling event in August 2015, and arsenic concentrations were identified above the CCME FWAL guidelines and NSEQSs at SW-4A, SW-5, SW-6A, and SW-10 during various sampling events. Arsenic concentrations were variable at all sampling locations but were generally elevated in the summer months. Arsenopyrite, an iron arsenic sulfide compound, is common in the surficial and bedrock geology of the area. Lead, cadmium, and copper fluctuates in surface water at most sampling locations and at times slightly exceeded the CCME FWAL guidelines and NSEQSs at SW-6A (copper) and SW-10 (copper and lead).

Haul Road

The overall poor culvert conditions have contributed to localized poor surface water quality.

Touquoy Mine Site

Based on a review of the 2017 baseline surface water quality results (Stantec 2017b), surface water at the monitoring stations upstream and downstream of the Touquoy Mine Site had elevated baseline concentrations of arsenic, aluminum, iron, cadmium, copper, lead, zinc, and manganese that exceeded Nova Scotia Environment Tier 1 EQS. Table 6.6-8 summarizes parameter exceedances by monitoring locations. In addition, cobalt, manganese, silver and mercury exceeded the Canadian Council of Ministers of the Environment (CCME 2018) guideline for the protection of freshwater aquatic life. These exceedances are considered to be naturally occurring, or the result of historical anthropogenic (i.e., non-Project related) activities, varying seasonally and representing baseline conditions at the Touquoy Mine Site.

8.5.2.1.1.3 Surface Water Quantity

Beaver Dam Mine Site

The primary surface water drainage system through the Beaver Dam Mine Site flows northward from Crusher Lake to Mud Lake and then northeastward into Cameron Flowage that forms part of the Killag River. West Lake and Tait Lake, located northwest of the site, discharge into a series of tributaries that flow southward into Cameron Flowage. Several small, ephemeral tributaries of this water system are also present.

In addition to the major water system, a 16 ha headwater bog is located south/southeast of the Mine Site. The bog discharges south into streams, another wetland system, and into Tent Lake. There is also a surface water system that originates at an unnamed lake/wetland located south/southwest of the Mine Site that continues to flow south through Paul Brook and discharge into the West River Sheet Harbour.

The Beaver Dam Mine Site was divided into three sub-catchment areas for the purpose of calculating the water balance. The Beaver Dam Mine Site ultimately discharges to two major water features including Cameron Flowage and Tent Lake. The baseline contributing drainage areas to Cameron Flowage and Tent Lake are approximately 3870 ha and 28 ha, respectively, at the outfalls of the Mine Site. The Mine Site and contributing drainage area to Cameron Flowage also encompasses the Mud Lake catchment area that is approximately 175 ha under baseline conditions. The Mine Site represents approximately 5% of the contributing drainage area to Cameron Flowage downstream of the PA.

Haul Road

The overall poor culvert conditions have contributed to localized poor surface water hydrology.

Touquoy Mine Site

The Touquoy Mine Site was divided into five sub-catchment areas based on the available LiDAR topography (Leading Edge 2013) and the water management at the site. The catchment areas for each of the mine facilities include the mill site (13.8 ha), TMF (94.0 ha), open pit (40.4 ha), waste rock area (55.1 ha), and polishing pond (16.9 ha).

8.5.2.2 Analysis of Effects

8.5.2.2.1 Residual Effects of Proposed Project

Pollution prevention measures will be employed at the site to prevent accidental spills. Runoff from the surface mine workings will flow to sediment retention ponds. The ponds will allow the water to be reused on-site for dust control. Discharges to the environment will occur at defined locations that can be sampled and tested to ensure the applicable discharge standards are achieved. Thus, the predicted residual adverse impacts on surface water are not expected to be significant.

Considering water treatment, as required, for effluent discharge, the magnitude of the residual effect to the Killag River at the Beaver Dam Mine Site is considered negligible (within established criteria or background concentrations at the 100m compliance point). Effluent is predicted to be of neutral pH, limiting potential impact to Killag River, a low pH river with current efforts to increase pH to support salmon restoration. Changes in flow to the Killag River from pit operations and dewatering have been predicted to be minimal.

Diversion of flows into perimeter ditches and sedimentation ponds will reduce flows. The impacts of any changes will be felt slowly as the mine development proceeds. Given that these potential changes in surface flow to the flowage are relatively minor and short term for mining operations, the impacts of these effects are not considered to be significant.

Changes to surface water quantity are not anticipated at the Touquoy facility as a result of the processing of Beaver Dam ore. The deposition of Beaver Dam tailings into the exhausted Touquoy open pit mine could potentially impact the quality of the water in the shallow lake that will be created in the open pit; however, based on work previously completed for the Touquoy facility, effects on surface water chemistry are not anticipated to be significant, once mitigation measures have been applied.

The overall residual effect of the Project on surface water is assessed as not significant after mitigation measures have been implemented.

8.5.2.2.2 **Effects of Other Projects in the Area**

8.5.2.2.2.1 Touquoy Mine Site and Beaver Dam Haul Road Use by Fifteen Mile Stream and Cochrane Hill Gold Projects

During the operation phase of the Fifteen Mile Stream Gold Project (2021 to 2026) and the Cochrane Hill Gold Project (2022 to 2027), gold concentrate from each surface mine will be transported to the Touquoy processing site along with the gold ore from Beaver Dam Mine for final processing. The proposed Haul Road for each project would overlap with the Beaver Dam Mine Haul Road west of the Highway 224.

Surface water quantity will be affected by the processing of the ore from Beaver Dam Mine, Fifteen Mile Stream mine and the Cochrane Hill mine at the Touquoy facility in that an additional period of surface water extraction will be required. The amounts for this surface water use and time period associated with the Beaver Dame Mine have been previously identified in this document. The amount of surface water extraction required for the Fifteen Mile Stream Gold Project and the Cochrane Hill Gold Project is anticipated to be similar to the amount required for processing the Beaver Dam ore. The use of surface water for industrial purposes is highly regulated in NS and involves a proponent making application to NSE and providing rationale for the use of the water and information on the lack of impacts associated with the water use. The Proponent is familiar with the process and will provide NSE with information associated with the extended water use period prior to the need for the extended period beyond the currently approved period for Touquoy operation.

8.5.2.2.2.2 Touquoy Gold Project

The effects of the Touquoy project on surface water include (based on CRA 2007 and GHD 2017):

- Reduced water quality from sedimentation/siltation, deposition of fines during construction, operation and decommissioning;
- Introduction of contaminants (e.g., nitrate) from blasting operations and pit dewatering;
- Contaminated effluent released into Scraggy Lake from the tailings and polishing ponds;
- Excessive water withdrawal from Scraggy Lake; and
- Contamination of surface water from spills of hazardous materials stored on site during mine construction and operation.

In summary, assuming that the mitigation measures to control erosion and sedimentation are applied, significant adverse effects from construction and operation of the Touquoy Project are not anticipated on surface water resources. Water withdrawal from Scraggy Lake will only occur during initial site set-up over a five month period and only periodically on an as-needed basis of such low volumes as to be negligible to measurable. For two months, six and three percent of the lake volume will be required. Therefore, no significant adverse effects on Scraggy Lake aquatic resources are expected. The discharge of treated mine effluent is controlled by legislation under Environment and Climate Change Canada for metal mines. The effluent must meet the limits put in place to protect the aquatic environment and the effects monitoring program will ensure that operational discharges are compliant. Therefore, no significant adverse effects on fish resources from tailings effluent on Scraggy Lake are expected.

8.5.2.2.2.3 Local Forestry Operations

Forestry operations have been ongoing through the region for many decades. As such, the effects of these operations are included in the baseline conditions. Since the water quality throughout the PA is characterized as relatively pristine, these effects seem to be minimal to the water bodies affected by the Beaver Dam Mine Project. The noted exceptions are the poorly installed culverts along the pre-existing portions of the Haul Road.

8.5.2.2.3 **Cumulative Effects on the Surface Water Quality and Quantity**

The use of the Touquoy processing plant by the Beaver Dame Mine Project, the Fifteen Mile Stream Gold Project (2021 to 2026), and the Cochrane Hill Gold Project extends the period in which effects to the surrounding surface water may take place by up to 7 years (3 to 4 years of operation and 1 to 2 years for decommissioning and reclamation). Water withdrawal from Scraggy Lake will require to be extended for an additional 3 years for processing Beaver Dam ore. An extension to the existing approval will be requested by the Proponent. Incremental effects to surface water quantity at Scraggy Lake is not expected, due to the extended withdrawal period. Water will also be recycled from the Fifteen Mile Stream and the Cochrane Hill tailings (Touquoy Pit) when sufficient supply is available. However, with the application of the mitigation measures proposed for the operation of the site for both projects, the residual effects of both projects are predicted to be not significant.

The cumulative effect of the combined projects could mean a reduction in the streamflow from Scraggy Lake to the Fish River system; however, assuming that the rate of withdrawal is consistent with current needs of the project, then it has been shown that the withdrawal from Scraggy Lake is sustainable given the current level of inputs to the watershed. The cumulative effects of the three projects using the Touquoy processing facilities and the Touquoy Gold Project itself are therefore also expected to be not significant. There is some uncertainty as to the effects assessments for these projects. These would be addressed through the monitoring and follow-up programs established for the Project (Section 6.9.10).

The additional effects of the Beaver Dam project to the water courses crossed by the Haul Road are not expected to be significant. However, adverse effects from the existing portions of the Haul Road have been observed with regards to poorly installed culverts. As these effects have been directly observed there is little to no uncertainty surrounding them. These effects are already present, and are therefore identical with and without the inclusion of the Beaver Dam Project. In fact, the Beaver Dam Project gives an opportunity to improve the observed conditions.

The increase in truck traffic from the Fifteen Mile Stream and Cochrane Hill Gold Projects use of the Beaver Dam Haul Road has the potential into increase the potential for accidents and collisions along the Haul Road that could result in a spill that could affect surface water quality.

8.5.2.3 Mitigation

As part of the design process associated with the new Haul Road, the proponent has committed to identifying culverts that are currently in disrepair and removing/upgrading them where required. This will be undertaken as part of the preparation of the Haul Road during the construction phase of the project.

8.5.2.4 Residual Cumulative Effects and Significance Assessment

A significant adverse effect to surface water quality along the Haul Road is defined as a repeated or sustained exceedance of the CCME FWAL criteria for Total Suspended Solids (TSS) in surface water samples collected in situ.

There is a potential for residual cumulative effects to all surface water systems along the Haul Road. However, the proposed improvements to the culverts in disrepair should improve existing surface water conditions at the affected locations. Overall, the residual cumulative effects are considered to be not significant (Table 8.5-3).

Table 8.5-3 Residual Cumulative Environmental Effects for Surface Water

Residual Adverse Cumulative Effects (After Mitigation)	Significance Levels						Overall Significance of Residual Adverse Effects (and Rationale)
	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	
Potential for residual cumulative effects to all surface water systems along Haul Road.	N Negligible change in water quality.	LAA Cumulative effects are confined to the LAA (Beaver Dam Mine Site and Haul Road)	A Cumulative effect would be more significant during low flow conditions and/or sensitive spawning windows.	LT Effects may extend beyond 3 years.	R Effects will occur at regular intervals throughout operations.	R VC will recover to baseline conditions upon the completion of the operations.	**Minor Adverse Effect** **(Not Significant)** The proposed improvements to the culverts in disrepair that will occur as part of this Project should improve existing surface water conditions at the affected locations Furthermore, the VC is anticipated to recover to baseline conditions once the operation of the mine has stopped.
Legend (refer to Table 5.10-1 for definitions)	Magnitude N Negligible L Low M Moderate H High	Geographic Extent PA Project Area LAA Local Assessment Area RAA Regional Assessment Area	Timing N/A Not Applicable A Applicable	Duration ST Short-Term MT Medium-Term LT Long-Term P Permanent	Frequency O Once S Sporadic R Regular C Continuous	Reversibility R Reversible IR Irreversible	

8.5.2.5 Follow-up and Monitoring Programs

In addition to the follow-up or monitoring presented in Section 6.9.10, monitoring and follow-up of the upgrading of the culverts along the Haul Road will be undertaken. Monitoring will ensure that the culverts along the Haul Road are upgraded in accordance with best practices during the construction phase. Follow-up after construction will ensure that the culverts are stable, functioning properly and that water quality is not adversely affected.

8.5.3 Wetlands Cumulative Effects Assessment

8.5.3.1 Baseline conditions

A total of 83 wetlands were identified within the mine footprint and 116 wetlands were identified along the Haul Road footprint for a total of 197 freshwater wetlands. A description of these wetlands is given in Table 8.5-1. The majority (65%) of wetlands identified within the Beaver Dam Mine Site were classified as swamps. Similarly, the majority of wetlands identified along the Haul Road were also classified swamp habitat (65%). There were several wetland complexes within the Beaver Dam Mine Site and Haul Road that comprised of some combination of shrub and treed bog and swamp and fen habitat. Many of these extended beyond the PA boundaries.

In general, hydrological flow within wetlands present in the Beaver Dam Mine Site initiates at the southern extent of the PA, at the division of three tertiary watershed boundaries. Larger wetland complexes straddle the watershed boundaries and act as the primary outflow water source for downgradient wetlands, watercourses, and lower lying lakes. Wetlands 1 and 2 exist as bog complexes, which intercept and store precipitation and small scale water seepage from surrounding land prior to draining via additional aquatic features to the north and south. As is typical of these habitats in Nova Scotia, bog formations located on higher land have the ability to source water to more than one tertiary watershed.

Due to its extensive length and intersection with seven separate tertiary watersheds, wetlands along the Haul Road ~~PA~~ vary between outflow wetlands located at headwater locations, throughflow wetlands that drain water toward lower reaches of the watersheds, and some instances of wetlands within lower portions of the watershed. As is typical of the Nova Scotia landscape, however, smaller isolated wetlands were also identified in all regions of all watersheds.

The functional assessments conducted for the 179 wetlands located within the Beaver Dam Mine Site and the Haul Road determined that the overall watershed condition of the nine relevant tertiary watersheds is in a relatively unaltered state (Table 6.5-2). Urban/commercial development is not present within the watersheds and, therefore, existing roads account for the impervious surfaces calculated within the watershed evaluation, resulting in a range of 0% to 0.62%, with the higher percentages being along the existing Haul Road. Therefore, condition is classified as low. Wetland habitat cover ranges from 3.40% to 22.19% of the total land area of the watersheds. Four of the watersheds provide a high ability to contribute to floodwater protection (<10% wetland cover), all of which comprise the future Haul Road. Moderate floodwater protection (10 to 20% wetland cover) is afforded by four watersheds (of which two comprise the future Beaver Dam Mine Site and two comprise the Haul Road), and one watershed provides low floodwater protection (>20% wetland cover) and comprises the Haul Road.

Most buffer areas surrounding the wetlands are highly vegetated. These wetlands and buffers generally offer high quality wildlife habitat and good water quality functions. Forestry activity was documented in habitat along the Haul Road and is also present surrounding the Beaver Dam Mine Site. All wetlands assessed were determined to provide high plant community integrity as the plants are generally composed of native species characteristic of the wetland type with a minor component of non-native species.

Touquoy Mine Site

Six wetlands were identified within the Touquoy Mine Site in 2006 as part of the EARD process, five of which were assessed. One of these wetlands was deemed to not be affected from Project development and therefore was not evaluated (CRA 2007).

A total of 52 wetlands were identified within the Touquoy Mine Site (including the western bypass road) during field studies by MEL biologists from 2015-2017. These wetlands were identified for wetland permitting process and functional assessments were completed to support permitting. Evaluation will be limited to riparian wetlands along Moose River, downstream of the discharge location, to confirm potential indirect impacts from the Beaver Dam Mine Project.

Table 8.5-4 Wetland Types and Approximate Sizes

Wetland	Wetland Type	Wetland Area* (m2)	Footprint PA Component	Tertiary Watershed
Beaver Dam Mine Site				
1	complex: mixed wood treed bog, tall shrub bog, open low shrub bog	37,188	Beaver Dam Mine Site	Tent Lake and Kent Lake
2	complex: coniferous treed bog, graminoid bog, low shrub bog, shrub bog	196,857	Beaver Dam Mine Site	Tent Lake, Kent Lake, and Cameron Flowage
3	shrub bog	4,658	Beaver Dam Mine Site	Cameron Flowage
4	complex: treed swamp/ treed fen, mixed wood treed swamp	13,139	Beaver Dam Mine Site	Cameron Flowage
5	mixed wood treed swamp	6,202	Beaver Dam Mine Site	Cameron Flowage
6	mixed wood treed swamp	262	Beaver Dam Mine Site	Cameron Flowage
7	cut treed swamp	306	Beaver Dam Mine Site	Cameron Flowage
8	complex: coniferous treed swamp, graminoid fen, low shrub fen, shrub swamp	16,603	Beaver Dam Mine Site	Cameron Flowage
9	open bog	307	Beaver Dam Mine Site	Kent Lake
10	low shrub fen	18,817	Beaver Dam Mine Site	Cameron Flowage

Wetland	Wetland Type	Wetland Area* (m2)	Footprint PA Component	Tertiary Watershed
11	complex: low shrub bog, mixed wood treed swamp	2,955	Beaver Dam Mine Site	Cameron Flowage
12	complex: open mixed wood treed swamp, coniferous treed swamp	4,475	Beaver Dam Mine Site	Cameron Flowage
13	complex: treed swamp, coniferous treed swamp	4,816	Beaver Dam Mine Site	Cameron Flowage
14	complex: shrub bog, mixed wood treed swamp, low shrub fen	31,655	Beaver Dam Mine Site	Cameron Flowage
15	graminoid fen	1,249	Beaver Dam Mine Site	Cameron Flowage
16	open shrub swamp	3,670	Beaver Dam Mine Site	Cameron Flowage
17*	complex: tall shrub swamp, coniferous treed bog	76,341	Beaver Dam Mine Site	Cameron Flowage
18	coniferous treed swamp	1,864	Beaver Dam Mine Site	Cameron Flowage
19	shrub bog	11,428	Beaver Dam Mine Site	Cameron Flowage
20	mixed wood treed fen	10,106	Beaver Dam Mine Site	Cameron Flowage
21	mixed wood treed swamp	202	Beaver Dam Mine Site	Kent Lake
22	mixed wood treed swamp	274	Beaver Dam Mine Site	Kent Lake
23	coniferous treed swamp	419	Beaver Dam Mine Site	Kent Lake
24	coniferous treed swamp	328	Beaver Dam Mine Site	Kent Lake
25	coniferous treed swamp	1,416	Beaver Dam Mine Site	Kent Lake
26	coniferous treed swamp	658	Beaver Dam Mine Site	Kent Lake
27	mixed wood treed swamp	493	Beaver Dam Mine Site	Kent Lake
28	coniferous treed swamp	222	Beaver Dam Mine Site	Kent Lake
29	complex: mixed wood treed swamp, low shrub fen, open bog, coniferous treed swamp, coniferous raised bog, graminoid fen	112,835	Beaver Dam Mine Site	Kent Lake and Cameron Flowage
30	coniferous treed swamp	964	Beaver Dam Mine Site	Kent Lake

Wetland	Wetland Type	Wetland Area* (m2)	Footprint PA Component	Tertiary Watershed
31	coniferous treed swamp	10,473	Beaver Dam Mine Site	Kent Lake and Cameron Flowage
32	coniferous treed swamp	120	Beaver Dam Mine Site	Kent Lake
33	coniferous treed swamp	1,900	Beaver Dam Mine Site	Kent Lake
34	mixed wood treed swamp	1,382	Beaver Dam Mine Site	Cameron Flowage
35	coniferous treed swamp	3,376	Beaver Dam Mine Site	Kent Lake and Cameron Flowage
36	coniferous treed swamp	916	Beaver Dam Mine Site	Kent Lake
37	deciduous treed swamp	253	Beaver Dam Mine Site	Kent Lake
38	coniferous treed swamp	388	Beaver Dam Mine Site	Kent Lake and Cameron Flowage
39	coniferous treed swamp	1,857	Beaver Dam Mine Site	Cameron Flowage
40	coniferous treed swamp	8,091	Beaver Dam Mine Site	Cameron Flowage
41	graminoid marsh	910	Beaver Dam Mine Site	Cameron Flowage
42	coniferous treed swamp	1,879	Beaver Dam Mine Site	Cameron Flowage
43	mixed wood treed swamp	81	Beaver Dam Mine Site	Cameron Flowage
44	coniferous treed bog	10,611	Beaver Dam Mine Site	Cameron Flowage
45	coniferous treed swamp	295	Beaver Dam Mine Site	Cameron Flowage
46	coniferous treed riverine swamp	754	Beaver Dam Mine Site	Cameron Flowage
47	fresh water marsh	1,029	Beaver Dam Mine Site	Cameron Flowage
48	coniferous treed swamp	2,876	Beaver Dam Mine Site	Cameron Flowage
49	coniferous treed swamp	117	Beaver Dam Mine Site	Cameron Flowage
50	coniferous tall shrub swamp	117	Beaver Dam Mine Site	Cameron Flowage
51	mixed wood treed swamp	898	Beaver Dam Mine Site	Cameron Flowage

Wetland	Wetland Type	Wetland Area* (m2)	Footprint PA Component	Tertiary Watershed
52	coniferous treed swamp	1,620	Beaver Dam Mine Site	Cameron Flowage
53	low shrub swamp	824	Beaver Dam Mine Site	Cameron Flowage
54	coniferous treed bog	416	Beaver Dam Mine Site	Kent Lake
55	mixed wood treed swamp	616	Beaver Dam Mine Site	Cameron Flowage
56	complex: coniferous treed swamp, tall shrub swamp, low shrub bog	16,275	Beaver Dam Mine Site	Cameron Flowage
57*	complex: coniferous treed swamp, deciduous treed swamp	88,717	Beaver Dam Mine Site	Tent Lake and Cameron Flowage
58	deciduous treed swamp	581	Beaver Dam Mine Site	Cameron Flowage
59	coniferous treed swamp	65,348	Beaver Dam Mine Site	Cameron Flowage
60	coniferous treed swamp	2,963	Beaver Dam Mine Site	Cameron Flowage
61*	complex: deciduous treed swamp, tall shrub swamp, open low shrub fen	25,953	Beaver Dam Mine Site	Cameron Flowage
62	coniferous treed swamp	832	Beaver Dam Mine Site	Cameron Flowage
63	coniferous treed swamp	486	Beaver Dam Mine Site	Kent Lake
200	soft wood swamp	1,677	Beaver Dam Mine Site	Cameron Flowage
201	mixed wood swamp	284	Beaver Dam Mine Site	Cameron Flowage
202	soft wood swamp	571	Beaver Dam Mine Site	Cameron Flowage
203	open bog	3,925	Beaver Dam Mine Site	Cameron Flowage
204	soft wood swamp	8,295	Beaver Dam Mine Site	Cameron Flowage
205	mixed wood swamp	1,371	Beaver Dam Mine Site	Cope Brook
206	shrub swamp	3,298	Beaver Dam Mine Site	Cameron Flowage
207	complex: mixed wood treed swamp, bog	67,613	Beaver Dam Mine Site	Cameron Flowage
208	soft wood bog	6,478	Beaver Dam Mine Site	Cameron Flowage
209	shrub bog	2,024	Beaver Dam Mine Site	Cameron Flowage

Wetland	Wetland Type	Wetland Area* (m2)	Footprint PA Component	Tertiary Watershed
210	soft wood bog	11,058	Beaver Dam Mine Site	Cameron Flowage
211	soft wood swamp	10,474	Beaver Dam Mine Site	Cameron Flowage
212	shrub swamp	13,987	Beaver Dam Mine Site	Cameron Flowage
213	shrub swamp	992	Beaver Dam Mine Site	Cameron Flowage
214	mixed wood swamp	6,041	Beaver Dam Mine Site	Cameron Flowage
215	shrub swamp	16,447	Beaver Dam Mine Site	Cameron Flowage
216	shrub swamp	1,397	Beaver Dam Mine Site	Cameron Flowage
217	soft wood swamp	5,230	Beaver Dam Mine Site	Cameron Flowage
Total Delineated Wetland Habitat within Beaver Dam Mine Site: 974,825 m2 (97.48 ha)				
Haul Road				
64*	complex: low shrub bog, mixed wood treed swamp	15,979	Haul Road	Tent Lake
65	open bog	65	Haul Road	Tent Lake
66*	complex: graminoid fen, mixed wood treed swamp, high shrub fen	15,423	Haul Road	Tent Lake
67*	complex: low shrub fen, tall shrub fen	1,433	Haul Road	Tent Lake
68*	complex: shrub fen, graminoid fen and mixed wood treed swamp	5,579	Haul Road	Tent Lake
69*	complex: shrub fen, graminoid fen, and mixed wood treed swamp	3,899	Haul Road	Tent Lake
70*	tall shrub swamp	631	Haul Road	Tent Lake
71	deciduous treed swamp	425	Haul Road	Brandon Lake
72	deciduous treed swamp	1,471	Haul Road	Brandon Lake
73*	complex: tall shrub swamp, tall shrub fen	26,893	Haul Road	Brandon Lake
74*	complex: mixed wood treed swamp, fresh water marsh	12,340	Haul Road	Brandon Lake
75	mixed wood treed swamp	144	Haul Road	Brandon Lake
76*	complex: mixed wood treed swamp, open graminoid fen	10,405	Haul Road	Brandon Lake
77*	mixed wood treed swamp	1,204	Haul Road	Brandon Lake
78	mixed wood treed swamp	194	Haul Road	Brandon Lake
79*	coniferous treed swamp	3,703	Haul Road	Brandon Lake
80*	coniferous bog	979	Haul Road	Brandon Lake

Wetland	Wetland Type	Wetland Area* (m2)	Footprint PA Component	Tertiary Watershed
81	tall shrub swamp	154	Haul Road	Brandon Lake
82*	mixed wood treed swamp	616	Haul Road	Brandon Lake
83*	mixed wood treed swamp	535	Haul Road	Brandon Lake
84*	low shrub swamp	695	Haul Road	Brandon Lake
85*	low shrub swamp	322	Haul Road	Brandon Lake
86*	mixed wood swamp	4,684	Haul Road	Brandon Lake
87*	open bog	362	Haul Road	Brandon Lake
88	tall shrub swamp	417	Haul Road	Brandon Lake
89*	treed swamp	6,194	Haul Road	Brandon Lake
90*	mixed wood treed swamp	4,495	Haul Road	Brandon Lake
91*	mixed wood treed swamp	1,060	Haul Road	Brandon Lake
92*	mixed wood treed swamp	1,943	Haul Road	Brandon Lake
93	graminoid marsh	166	Haul Road	Brandon Lake
94*	mixed wood treed swamp	1,748	Haul Road	Brandon Lake
95*	mixed wood treed swamp	263	Haul Road	Brandon Lake
96*	mixed wood treed swamp	861	Haul Road	Brandon Lake
97	mixed wood treed swamp	107	Haul Road	Brandon Lake
98*	mixed wood treed swamp	1,540	Haul Road	Rocky Brook Lake
99*	mixed wood treed swamp	694	Haul Road	Rocky Brook Lake
100	shrub swamp	1,582	Haul Road	Rocky Brook Lake
101	clear cut swamp	219	Haul Road	Rocky Brook Lake
102	complex; mixed wood treed bog, mixed wood treed swamp	5,439	Haul Road	Rocky Brook Lake
103	low shrub bog	455	Haul Road	Rocky Brook Lake
104	low shrub swamp	102	Haul Road	Rocky Brook Lake
105	low shrub bog	284	Haul Road	Rocky Brook Lake
106*	low shrub bog	1,701	Haul Road	Rocky Brook Lake
107	coniferous treed swamp	186	Haul Road	Lake Alma
108	tall shrub swamp	183	Haul Road	Lake Alma
109	coniferous treed swamp	1,606	Haul Road	Lake Alma and Rocky Brook Lake
110*	shrub bog	912	Haul Road	Lake Alma
111*	mixed wood swamp	1,060	Haul Road	Lake Alma
112*	mixed wood swamp	3,595	Haul Road	Lake Alma
113*	mixed wood treed swamp	1,940	Haul Road	Lake Alma
114	coniferous swamp	242	Haul Road	Lake Alma

Wetland	Wetland Type	Wetland Area* (m2)	Footprint PA Component	Tertiary Watershed
115*	mixed wood treed swamp	582	Haul Road	Lake Alma
116	coniferous swamp	892	Haul Road	Lake Alma
117	coniferous swamp	147	Haul Road	Lake Alma
118	coniferous swamp	428	Haul Road	Lake Alma
119	coniferous treed swamp	328	Haul Road	Lake Alma
120	low shrub swamp	115	Haul Road	Lake Alma
121	coniferous swamp	466	Haul Road	Lake Alma
122	coniferous treed swamp	200	Haul Road	Lake Alma
123	mixed wood treed swamp	818	Haul Road	Lake Alma
124*	mixed wood treed swamp	528	Haul Road	Lake Alma
125	mixed wood treed swamp	344	Haul Road	Lake Alma
126	mixed wood treed swamp	63	Haul Road	Lake Alma
127*	treed bog	185	Haul Road	Lake Alma
128	tall shrub bog	409	Haul Road	Lake Alma
129	treed bog	2,006	Haul Road	Lake Alma
130	coniferous treed swamp	1,092	Haul Road	Middle Beaver Lake and Lake Alma
131	mixed wood treed swamp	1,087	Haul Road	Middle Beaver Lake
132	mixed wood treed swamp	2,425	Haul Road	Lake Alma
133	low shrub bog	102	Haul Road	Lake Alma
134	treed swamp	398	Haul Road	Lake Alma
135*	shrub fen	934	Haul Road	Lake Alma
136	mixed wood treed swamp	522	Haul Road	Lake Alma
137*	mixed wood treed swamp	2,404	Haul Road	Lake Alma
138	shrub bog	1,521	Haul Road	Lake Alma
139	tall shrub bog	106	Haul Road	Lake Alma
140	treed bog	230	Haul Road	Lake Alma
141	high shrub bog	60	Haul Road	Lake Alma
142	low shrub bog	342	Haul Road	Lake Alma
143	complex: graminoid bog, deciduous treed swamp	526	Haul Road	Lake Alma
144*	tall shrub fen	2,034	Haul Road	Lake Alma
145*	low shrub bog	1,462	Haul Road	Lake Alma
146*	complex: graminoid fen, mixed wood treed swamp	2,653	Haul Road	Lake Alma
147*	complex: low shrub bog, mixed wood treed swamp	2,708	Haul Road	Lake Alma
148*	low shrub bog	9,220	Haul Road	Lake Alma
149*	low shrub bog	1,811	Haul Road	Lake Alma
150	marsh	145	Haul Road	Lake Alma
151*	tall shrub bog	2,959	Haul Road	Lake Alma
152*	clear cut mixed wood swamp	2,046	Haul Road	Lake Alma

Wetland	Wetland Type	Wetland Area* (m2)	Footprint PA Component	Tertiary Watershed
153*	shrub swamp	2,416	Haul Road	Lake Alma
154*	open bog	1,991	Haul Road	Lake Alma
155*	mixed wood treed swamp	717	Haul Road	Lake Alma
156*	shrub bog	14,756	Haul Road	Lake Alma and Eagles Nest Basin
157*	complex: shrub fen, shrub swamp	7,006	Haul Road	Lake Alma and Eagles Nest Basin
158	shrub swamp	575	Haul Road	Eagles Nest Basin
159*	mixed wood treed swamp	1,995	Haul Road	Eagles Nest Basin
160*	freshwater marsh	1,237	Haul Road	Eagles Nest Basin
161	mixed wood swamp	1,618	Haul Road	Eagles Nest Basin
162*	mixed wood treed swamp	1,756	Haul Road	Eagles Nest Basin
163*	clear-cut swamp	1,107	Haul Road	Eagles Nest Basin
164*	mixed wood treed swamp	3,320	Haul Road	Eagles Nest Basin
165*	mixed wood treed swamp	1,623	Haul Road	Eagles Nest Basin
166	shrub swamp	68	Haul Road	Eagles Nest Basin
167*	mixed wood treed swamp	875	Haul Road	Eagles Nest Basin
168*	open bog	664	Haul Road	Eagles Nest Basin
169*	mixed wood treed swamp	607	Haul Road	Eagles Nest Basin
170*	mixed wood treed swamp	1,893	Haul Road	Eagles Nest Basin
171*	mixed wood treed swamp	4,329	Haul Road	Rocky Lake
172	mixed wood treed swamp	229	Haul Road	Rocky Lake
173*	mixed wood treed swamp	4,814	Haul Road	Rocky Lake
174*	mixed wood treed swamp	2,513	Haul Road	Rocky Lake
175*	shrub swamp	611	Haul Road	Rocky Lake
176*	mixed wood treed swamp	446	Haul Road	Rocky Lake
177*	shrub swamp	755	Haul Road	Rocky Lake
178*	mixed wood treed swamp	4,439	Haul Road	Rocky Lake
179*	mixed wood treed swamp	3,412	Haul Road	Rocky Lake
Total Delineated Wetland Habitat within Haul Road: 257,199 m2 (25.72 ha)				

Wetland	Wetland Type	Wetland Area* (m2)	Footprint PA Component	Tertiary Watershed
Total Delineated Wetland Habitat within the Beaver Dam Mine Site and Haul Road component: 123.20 ha *wetland extends beyond the PA boundary – total size has not been calculated Wetlands 180-199 are located within the Preferred Alternative Haul Road and are not included in the table				

8.5.3.2 Analysis of Effects

8.5.3.2.1 Residual Effects of Proposed Project

Clearing and grubbing is limited to the Beaver Dam Mine Site and along the Haul Road during the construction phase. No clearing and grubbing is required at Touquoy Mine Site. Clearing and grubbing has the potential to reduce rates of infiltration, introduce invasive species, and cause sedimentation. Mitigation measures such as sediment and erosion control and best management practices will reduce the likelihood of impact. Given the expected success of these mitigation measures, and because clearing and grubbing is confined to the PA, it is expected to have a low magnitude of impact.

Heavy machinery operation will occur in all three project components during the construction, operation, and decommissioning phases. Heavy machinery operation can cause impacts to wetlands from dust, sediments, accidents, and contamination. Sediment and erosion control, spill preparedness, emergency response measures, and best management practices will minimize the likelihood of an impact to wetlands, deeming the magnitude for residual environmental effects as low.

Direct wetland alteration includes infilling, draining, flooding, altering function, and altering groundwater recharge capacity. These alterations will occur in the PA at the Beaver Dam Mine Site and the Haul Road during the construction phase. No direct wetland alteration will occur at the Touquoy Mine Site. The alterations will occur directly to several wetlands as well as to watercourses that have a hydrological connection with wetlands. Continued wetland and surface water monitoring will be conducted to monitor the direct effects of the alterations. The magnitude is considered high because there is a direct loss of wetland habitat, however, the appropriate permitting and mitigations will be followed, and compensation will be provided. Furthermore, completion of the wetland cumulative effects modelling exercise has determined that in comparison to the LAA and RAA, wetland area loss is very low (i.e. 4% and 0.01% respectively). The modelling also determined that loss of wetland wildlife habitat for birds, turtles and moose is also low in comparison to the LAA (ranging between 1-5%). Apart from turtles, site clearing and future regeneration of habitat may introduce new habitat for some of these species, and potentially others. This in conjunction with the mitigation and monitoring steps (as described in Section 6.8.8), result in the determination that adverse effects are occurring as a result of wetland loss, but are not considered significant as it relates to wetlands and their functions within the cumulative effects modelling PA.

Altered hydrology includes changes to water quantity (via groundwater and surface water), sedimentation, and hydrological imbalances. These impacts can be associated with all of the PA components and have the potential to occur throughout the life of the project and into post closure, in some instances. Indirect alterations from altered hydrology have a larger geographic extent, across the LAA, because groundwater drawdown can affect wetlands outside of the Beaver Dam Mine Site and increases in surface water flow, particularly at the Tent Lake outfall, have the potential to affect wetlands outside of the Haul Road. .

Altered hydrology is considered a moderate magnitude because there is a small change relative to baseline conditions. Wetland and surface water monitoring will be conducted to monitor the effects of the alterations.

Impacts to wetlands associated with the widening and construction of new portions of the Haul Road (construction phase) include the removal of vegetation, hydrological changes, sedimentation, and wetland and watercourse alteration. Mitigation associated with the Haul Road include sediment and erosion control, wetland permitting, and wetland and surface water monitoring. The geographic extent of impacts associated with the widening and construction of the Haul Road occur in the LAA. Hydrological changes such as potential sediment released from the Haul Road can migrate to downstream receiving surface water systems outside of the PA. The magnitude of this VC interaction is moderate because effects may marginally exceed appropriate guidelines or threshold values.

Blasting and drilling of in-situ rock is expected to occur weekly at the Beaver Dam Mine Site during the operational phase. A pre-blasting plan and impact evaluation will mitigate impacts to wetlands. Blasting is restricted to the PA and is expected to have a low impact based on mitigation strategies and best management practices.

The Project will result in the loss of wetland habitat at the Beaver Dam Mine Site and along the Haul Road during the construction phase. Wetlands that are altered are affected directly and other, hydrologically connected wetlands, could be affected by changes in water quantity and quality. The overall residual effect of the Project on wetlands is assessed as not significant after mitigation measures have been implemented.

8.5.3.2.2 **Effects of Other Projects in the Area**

8.5.3.2.2.1 Touquoy Gold Project

The development of the Touquoy Gold Project will result in the removal of the four wetlands and a small portion of a fifth wetland located within the proposed Project area (CRA 2007). This will result in the loss of 4.33 ha of wetlands on the Project site.

However, assuming that the proposed compensation and mine site reclamation mitigation measures are applied, and that existing site drainage conditions are maintained, the Touquoy Gold Project is not likely to have significant adverse effects on wetland functional attributes in the area.

8.5.3.2.2.2 Local Forestry Operations

Stressors relating to forestry activities were observed in several wetlands with the Project area (see Table 6.8-4). These stressors included clearcutting, rutting, roads and the presence of skidder tracks.

8.5.3.2.3 **Cumulative Effects on the Wetlands**

The loss of wetlands from the Touquoy Gold Project (543,779 m^2) is cumulative with the wetland losses at the Beaver Dam Mine site (221,080 m^3) and along the Haul Road (23,565 m^2) for a total loss of 788,424 m^2. The majority of this loss (69 %) comes from the losses connected to the Touquoy Gold

Project. In the absence of the Beaver Dam Project, the cumulative effects would be the 543,779 m² loss of habitat from the Touquoy Gold Project

In addition to the direct loss of wetlands there are potential effects related to stressors from other activities, predominantly forestry operations. However, it is important to note that the stressors are mostly of limited impact and are not equivalent to loss of the habitat. Stressors from other activities occur within a large portion of the area directly impacted by the Beaver Dam Mine or the Haul Road improvement works.

This assessment is based on the planned footprint of the project and the detailed assessment of the affected wetlands as presented in the baseline conditions. There is little uncertainty with regards to this information or as to the nature of the predicted effects (loss of wetlands within the Project footprint).

8.5.3.3 Mitigation

The proponent is committed to engaging in wetland compensation activities for the wetland loss associated with the Project as required by the provincial wetland alteration process (see Section 6.8.8). Wetlands compensation is also planned for the losses resulting from the Touquoy Gold project (CRA 2007). As these are the main sources of cumulative effects to wetlands, no additional mitigation measures are proposed.

The goal of the compensation activities is to achieve no net loss of wetland function.

8.5.3.4 Residual Cumulative Effects and Significance Assessment

A significant adverse cumulative effect is defined as an effect that is likely to cause a permanent net loss of wetland function.

Assuming that the proposed compensation measures are applied for both the Beaver Dam Mine Project and the Touquoy Gold Project and that they achieve their objectives, no significant cumulative effects to wetlands are expected (Table 8.5-4).

Table 8.5-5 Residual Cumulative Environmental Effects for Wetlands

Residual Adverse Cumulative Effects (After Mitigation)	Significance Levels						Overall Significance of Residual Adverse Effects (and Rationale)
	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	
Direct loss of wetlands	L The direct loss of wetland habitat would be restored during the reclamation stage.	PA Direct cumulative loss of wetland habitat would be largely concentrated to the PA (Beaver Dam Mine Site and Touquoy Mine Site, haul road).	A Seasonal aspects may affect VC.	LT Effects may extend beyond 3 years	O Direct loss of wetlands would occur during the construction of the Beaver Dam Mine and the Touquoy Mine Site and restoration of the wetland would occur once during the reclamation phase.	R VC will recover to baseline condition.	**Minor Adverse Effect** **(Not Significant)** No net loss of wetland function through implementation of proposed wetland compensation activities.
Legend (refer to Table 5.10-1 for definitions)	Magnitude N Negligible L Low M Moderate H High	Geographic Extent PA Project Area LAA Local Assessment ,Area RAA Regional Assessment Area	Timing N/A Not Applicable A Applicable	Duration ST Short-Term MT Medium-Term LT Long-Term P Permanent	Frequency O Once S Sporadic R Regular C Continuous	Reversibility R Reversible IR Irreversible	

8.5.3.5 Follow-up and Monitoring Programs

A comprehensive wetland monitoring program is planned for the Beaver Dam Mine Project (see Section 6.8.10). It is expected that the Touquoy Gold Project's compensation program will also include monitoring and follow-up. As these two projects are the main sources of cumulative effects to wetlands, no additional monitoring or follow-up is proposed.

8.5.4 Fish and Fish Habitat Cumulative Effects Assessment

8.5.4.1 Baseline conditions

8.5.4.1.1 Fish Habitat

Beaver Dam Mine Site

Table 6.6-3 describes the fish habitat potential at each identified watercourse within the Project Area.

Twelve of the 18 linear watercourses, as described in Table 6.9-3, within the Beaver Dam Mine Site are classified as poor juvenile salmonid rearing habitat with no spawning capability. These streams would provide shelter and feeding habitat for larger, older salmonids (especially brook trout). Watercourse 4, located south of Crusher Lake, watercourse 5 (lower portion), located north of Crusher Lake, and its tributaries (watercourse 7 and watercourse 9) are all classified as good salmonid rearing habitat with limited spawning, usually only in isolated gravel pockets, good feeding and holding areas for larger fish in deeper pools, pockets, or backwater eddies (Sooley et al., 1998). Watercourse 12, located west of Wetland 59 with direct connectivity to Cameron Flowage, also provides good salmonid rearing habitat with limited spawning potential. Watercourse 14, a small watercourse located south of Cameron Flowage, is classified as good salmonid spawning and rearing habitat, often with some feeding pools for larger age classes. However, although substrate and flow meet the requirements for this classification, its small size and average and expected low water depths limit potential for spawning within this tributary.

Mud Lake and Crusher Lake are classified as poor juvenile salmonid rearing habitat based on their sluggish flows, substrate, and depth. These lakes primarily provide shelter and feeding opportunities for larger, older brook trout. Cameron Flowage is classified as good salmonid rearing habitat with some limited potential for spawning. Overwintering could also occur within Cameron Flowage based on observed water depths.

There is a 6.9 km section of the West River Sheet Harbour downstream of the confluence with the Killag River to Sheet Harbour Lake, which is wide, shallow and exposed without holding habitat for adult fish, that was identified by NSSA as a partial migration barrier (NSLC Adopt A Stream, 2017). Remediation of this area is currently ongoing through the NSLC Adopt A Stream Project.

Nineteen of the thirty four linear watercourses evaluated within the Haul Road PA are classified as good salmonid rearing habitat with some limited spawning opportunities. Four watercourses are classified as poor rearing habitat and no spawning potential. Watercourse E, located in the upper reaches of the Brandon Lake Tertiary Watershed on the north side of Cope Pond, is classified as good salmonid spawning and rearing habitat. Watercourse L is also located in the Brandon Lake Tertiary Watershed and is a tributary to the West River Sheet Harbour. This watercourse is also classified as good spawning and rearing habitat.

The West River Sheet Harbour (Watercourse N) runs through the PA and is known to support all life stages associated with the Salmonidae family, including spawning. In addition to salmonids, the West River Sheet Harbour is also known to support American eel (*Anguilla rostrada),* brown bullhead (*Ameiurus nebulosus*), yellow perch (*Perca flavescens*), creek chub (*Semotilus atromaculatus*), and white sucker (*Catostomus commersonii*) (NSFA, 2016).

Watercourse Q is a tributary that drains directly to Lake Alma in the Lake Alma Tertiary Watershed. Inside the PA, this watercourse was classified as good salmonid rearing and spawning habitat; however, this watercourse was observed to be subterranean downstream within the PA draining towards Lake Alma, which would act as a barrier to fish passage.

The Morgan River (watercourse AD) is located near the south end of the Haul Road ~~PA~~ in Eagle's Nest Tertiary Watershed. Like the West River Sheet Harbour, the Morgan River is also known to support all life stages of salmonids, including spawning. Its direct tributary, watercourse AH, located in the Rocky Lake Tertiary Watershed, is also good rearing and spawning habitat. The Morgan River is known to support white sucker, brook trout, white perch, yellow perch, banded killifish, rainbow trout, American eel, golden shiner, sticklebacks, alewife, northern redbelly dace, and brown bullhead (Alexander, Kerekes, & Sabean, 1986). The Atlantic Salmon Federation has indicated that the salmon is extirpated from the Tangier Watershed (https://www.asf.ca/main.html).

Table 6.6-4 describes the fish habitat present within each wetland and its associated watercourse in the Beaver Dam Mine Site and Haul Road.

Twenty-six wetlands and associated watercourses have been evaluated to provide potential fish habitat based on the NL Guide for the salmonid family within the Beaver Dam Mine Site. These wetlands are associated with the following surface water systems:

- Crusher Lake: Wetlands 8 and 10
- Mud Lake: Wetland 17
- Cameron Flowage: Wetlands 61 and 62
- Watercourse 2: Wetlands 4 and 5
- Watercourse 3: Wetlands 2, 4, 14, and 20
- Watercourse 4: Wetlands 8, 11, 13, 14, 48
- Watercourse 5 (and smaller tributaries): Wetlands 2, 8, 14, 17, 44, 46, 52, and 53
- Watercourse 7: Wetland 14
- Watercourse 8: Wetland14, and 15
- Watercourse 10: Wetland 29
- Watercourse 11: Wetlands 29 and 33
- Watercourse 12: Wetlands 56 and 59
- Watercourse 13: Wetland 61
- Watercourse 14: Wetland 57 and 59
- Watercourse 15: Wetland 210

- Watercourse 16: Wetland 207
- Watercourse 17: Wetland 206

Most of these wetlands provide habitat that supports feeding, refuge and passage within and through the Beaver Dam Mine Site surface water systems. Wetlands that provide potential overwintering and rearing habitat are associated with waterbodies and open water features on site. These wetlands include Wetland 8 and 10 (Crusher Lake), Wetland 17 (Mud Lake), Wetland 29 open water section just south of the PA, Wetland 44 (beaver impoundment), Wetland 59 (previous dug waterbody for historical mining activities), and Wetland 62 (Cameron Flowage).

Touquoy Mine Site

Moose River, which runs along the western extent of the Touquoy Mine Site, was determined to provide habitat for Atlantic salmon and brook trout during surveys conducted in 2005 as part of the Environmental Assessment (CRA, 2007). Atlantic salmon (juveniles) were observed and suitable rearing and potential spawning habitat is available for the species. It was presumed that the Atlantic salmon observed were landlocked due to their proximity to a known landlocked population within Scraggy Lake. American eel, white sucker, and minnow species were also observed in Moose River. Although not observed, surveys determined that there is good adult and juvenile brook trout feeding habitat, fair rearing habitat, and potential spawning habitat available within Moose River (CRA, 2007).

8.5.4.1.2 **Fish Species**

Beaver Dam Mine Site

Within the eight electrofishing locations in the mine footprint, a total of 44 individual fish were captured at five watercourse locations including. The captured species were: brook trout (*Salvelinus fontinalis*), ninespine stickleback (*Pungitius pungitius*), northern redbelly dace (*Chrosomus eos*), Banded Killifish (*Fundulus diaphanous*), lake chub (*Couesius plumbeus*), and brown bullhead (*Ictalurus nebulosus*). Fish collection within Crusher Lake showed a relative abundance for the banded killifish of 42.9%, for the golden shiner of 35.7% and for the brown bullhead of 21.4%. Within Cameron Flowage (both sampling locations) the relative abundance of the yellow perch is 66.7%, golden shiner is 18.5% and the white sucker and brown bullhead are both at 7.4%.

Within the Beaver Dam Mine Site, three species of commercial, aboriginal, or recreational (CAR) interest was confirmed; the brook trout, white sucker, and yellow perch. Furthermore, brook trout ranked by the ACCDC as S3 and is therefore a species of conservation interest (SOCI). No fish species at risk (SAR) were captured within the Beaver Dam Mine Site during electrofishing surveys.

Haul Road

Within the seven electrofishing locations in the Haul Road, a total of 53 individual fish were captured. The captured species were: American eel (*Anguilla rostrata*), banded killifish (*Fundulus diaphanous*), brook trout (*Salvelinus fontinalis*), golden shiner (*Notemigonus crysoleucas*), lake chub (*Couesius plumbeus*), white sucker (*Catostomus commersoni*) and yellow perch (*Perca flavescens*).

Two fish species at risk (SAR) or species of conservation interest (SOCI) were captured within the Haul Road during electrofishing surveys: the American eel (COSEWIC T) and brook trout (S3). Within the Haul

Road, four species of CAR interest were confirmed: the brook trout, American eel, white sucker and yellow perch.

Touquoy Mine Site

Fish observed from 2006 electrofishing surveys of Moose River as part of the EARD include; American eel, white sucker, and minnow species (CRA 2007).

8.5.4.1.2.1 Benthic Organisms

Overall abundance and taxon richness within PA watercourses were low to moderate (110-947 individuals/sample and 10-31 taxon, respectively), and EPT ratios low at eight of the sites (0.5-8.4%) and moderate (16.1-50.2%) at the remaining sites (Watercourse N, V, AH, O). The occurrence of Mollusca at some of the sites, in addition to the EPT groups (Trichoptera, Ephemeroptera and Plecoptera) at most sites suggests that dissolved oxygen and water quality is acceptable, as these groups generally are associated with aquatic habitat having good water quality.

8.5.4.2 Analysis of Effects

8.5.4.2.1 Residual Effects of Proposed Project

Clearing and grubbing is limited to the Beaver Dam Mine Site and along the Haul Road during the construction phase. No clearing and grubbing is required at Touquoy Mine Site to support the Beaver Dam Mine Project. Clearing and grubbing has the potential to affect fish and fish habitat through changes in water quality. Sedimentation to downstream surface water systems is the most likely impact to occur to fish and fish habitat during construction. Loss of riparian vegetation can also lead to changes in water temperature that could negatively affect fish or fish habitat. Mitigation measures such as sediment and erosion control, a commitment to maintaining a 30 m watercourse buffer will reduce the likelihood of impact. With appropriate mitigation, and because clearing and grubbing is limited to a footprint within the PA only, clearing and grubbing is expected to have a low residual impact on fish and fish habitat.

Heavy machinery operation will occur in all three project components during the construction, operation, and decommissioning phases. Heavy machinery operation can cause impacts to water quality from dust, sediments, accidents, and contamination which could affect fish and fish habitat quality. Sediment and erosion control, spill preparedness, emergency response measures, and best management practices will minimize the likelihood of an impact to fish and fish habitat, deeming the potential for residual environmental effects as low.

Direct fish habitat alteration includes infilling, draining, or flooding of aquatic features (watercourses and wetlands), and altering wetland function. Alterations which have the potential to directly impact fish will occur during the construction phase within the Beaver Dam Mine Site. The alterations will occur to several watercourses and wetlands. Within the Haul Road, direct fish habitat alteration is restricted to the infilling of small portions of wetland habitat during construction. Continued wetland and surface water monitoring will be conducted to monitor direct fish habitat alterations. Along the Haul Road, it is expected that fish habitat direct impact can be minimized through proper planning, micro-sighting of the upgraded road footprint, and installation of culverts in accordance with the Nova Scotia Watercourse Alteration Standard (2015). Small areas of fish habitat within wetland habitat may be directly impacted by the project, but overall, this impact will be low. No direct impact to fish habitat will occur at the Touquoy Mine Site from project activities during construction, operation or decommissioning. The residual impact to fish and fish habitat is considered moderate from direct fish habitat alteration, because although there will be a direct loss of habitat the appropriate permitting will be followed, impact will not occur during sensitive times for fish, and compensation will be provided should a serious harm to fish threshold be confirmed.

Altered hydrology can indirectly alter fish habitat from changes to water quantity, sedimentation, and changes to water course hydrology at the Beaver Dam Mine Site, the Haul Road and the Touquoy Mine Site. Downstream water quantity is unlikely to be affected through inputs to Moose River at the Touquoy Mine Site (Appendix G.6 Stantec, 2018). Groundwater seepages and surface water discharge into Cameron Flowage are not predicted to affect water quantity.(Appendix G.5, GHD, 2018). A decrease in water quantity is expected at WC-5 which will reduce suitable fish habitat between Crusher and Mud Lake. Conversely, an increase in flow from the Tent Lake outfall will increase fish habitat within WC-B and adjacent wetlands. Wetland and surface water monitoring will be conducted to monitor potential indirect fish habitat alterations. Water quality sampling will be completed prior to release to the receiving environment at the Beaver Dam Mine Site and Touquoy Mine Site, and water will not be released until such time its quality meets regulatory requirements. Indirect alterations have a larger geographic extent, across the LAA, because sediment or water with reduced water quality released from site can migrate to downstream receiving surface water systems outside of the PA. Indirect fish habitat alterations are considered low magnitude because mitigation will reduce the likelihood of residual environmental effects.

Altered water quality is expected to have a negligible impact on fish and fish habitat because discharge will be treated, where required, and meet MDMER, CCME, baseline, or site specific objectives.

Impacts to fish and fish habitat associated with the widening and construction of new portions of the Haul Road (construction phase) include potential hydrological changes, sedimentation, wetland and watercourse alteration and vegetation removal. Mitigation associated with the Haul Road include sediment and erosion control, maintenance of existing hydrology during road construction/widening and road upgrades, wetland and watercourse permitting, and wetland and surface water monitoring. No upgrades or installation of culverts will occur during sensitive periods for fish. The geographic extent of impacts associated with the widening and construction of the Haul Road occur in the LAA. Hydrological changes such as potential sediment released from the Haul Road can migrate to downstream receiving surface water systems outside of the PA. The potential residual effects to fish and fish habitat related to the Haul Road construction, operation and decommissioning has been determined to be low because construction and upgrade of the preexisting portions of Haul Road will allow for improvement in fish passage and reconnection of more natural hydrology (replacement of poorly installed and damaged culverts).

Blasting and drilling of in-situ rock is expected to occur weekly at the Beaver Dam Mine Site during the operational phase. A pre-blasting plan and impact evaluation will mitigate impacts to fish and fish health. Blasting will be minimized where possible. Blasting is restricted to the PA and is expected to have a low impact based on mitigation strategies and best management practices.

The ecological and social context of the VC were included throughout this evaluation. Ecological and social context entails ecosystem health and function as well as the general setting and influence of past and current human activity and its associated disturbance. Ecological factors considered include fish health (species and abundance), fish habitat, fish food source, and water quality. Social factors considered included the impact to commercial, aboriginal and recreational fisheries. These factors were qualitatively assessed based on impacts to fish and fish habitat (e.g. no barriers to fish passage).

Ecological context considered in determining the residual environmental impacts include the loss of fish habitat at the Beaver Dam Mine Site and along the Haul Road during the construction phase. Fish habitat that is altered is affected directly (e.g. loss of habitat) and indirectly (e.g. erosion and sedimentation). Although there is a loss of fish habitat associated with Project infrastructure within the Beaver Dam Mine Site, fish habitat within the pre-existing portions of the Haul Road are expected to be increase the quality of habitat from the repair/installation of damaged and new culverts. Additionally, complete fish rescue within Beaver Dam Mine Site prior to commencement of mine development with DFO approval will occur, if required.

Considerations for social context include the fact that there is Mi'kmaq current use within and surrounding the PA. Project development will result in the loss of potential fish habitat that may be of significance to the Mi'kmaq. However, the watercourses affected within the Beaver Dam Mine Site are first order streams and similar fish habitat is present in surrounding areas, outside of the PA. Overall, the loss of fish habitat is not expected to significantly impact the Mi'kmaq. Additionally, although commercial and recreational resources within the PA may be affected by alterations to fish habitat, the LAA will remain unaffected post mitigation.

The overall residual effect of the Project on fish and fish habitat is assessed as not significant after mitigation measures have been implemented.

8.5.4.2.2 **Effects of Other Projects in the Area**

8.5.4.2.2.1 Touquoy Gold Project

The effects of the Touquoy Gold Project on Fish and their habitat are those summarized for the effects of the Project on water quality (see section 6.9). Overall, no significant adverse effects on fish resources from tailings effluent on Scraggy Lake are expected.

8.5.4.2.2.2 Local Forestry Operations

Forestry operations have been ongoing through the region for many decades. As such, the effects of these operations are included in the baseline conditions. Since the water quality throughout the PA is characterized as relatively pristine, these effects seem to be minimal to the water bodies, and therefore the fish habitat, affected by the Beaver Dam Mine Project. The noted exceptions are the poorly installed culverts along the pre-existing portions of the Haul Road.

8.5.4.2.3 **Cumulative Effects on the Fish and Fish Habitat**

Since the adverse effects observed with regards to the existing Haul Road will be reduced by the removal and replacement of the poorly installed culverts along this road and the Touquoy Gold project is not a source of significant adverse effects on fish habitat, no cumulative effects on fish habitat beyond the effects assessed for the Beaver Dam Project are anticipated.

In the absence of the Project, the conditions along the Haul Road are less likely to be improved. However the effects assessed for the Beaver Dam Project (Section 8.5.2.2.1) would be avoided.

There is some uncertainty as to the Project effects on fish and fish habitat. This uncertainty is addressed through the monitoring and follow-up programs established for the Project (Section 6.7.9).

8.5.4.3 Mitigation

No mitigation measures beyond those proposed in Section 6.9.8 are warranted.

8.5.4.4 Residual Cumulative Effects and Significance Assessment

A significant adverse cumulative effect on fish and fish habitat is defined as an effect that is likely to cause serious harm to fish, as defined by Fisheries and Oceans Canada (DFO).

The predicted residual cumulative effects on fish and fish habitat are assessed to be adverse, but not significant (Table 8.5-5).

Table 8.5-6 Residual Cumulative Environmental Effects for Fish and Fish Habitat

Residual Adverse Cumulative Effects (After Mitigation)	Significance Levels						Overall Significance of Residual Adverse Effects (and Rationale)
	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	
Disturbance to fish and fish habitat.	N Change in baseline conditions to a small degree.	LAA Potential adverse cumulative effect to fish habitat outside of the PA.	A Cumulative effect would be more significant during sensitive spawning windows.	LT Effects may extend beyond 3 years.	R Effects will occur at regular intervals throughout operations.	R VC will recover to baseline conditions upon the completion wetland restoration.	**Minor Adverse Effect** **(Not Significant)** The proposed improvements to the culverts in disrepair that will occur as part of this Project will improve fish habitat connectivity and water quality. Furthermore the wetland restoration activities that will occur during the reclamation stage are anticipated to return the VC to its baseline conditions.
Legend (refer to Table 5.10-1 for definitions)	Magnitude N Negligible L Low M Moderate H High	Geographic Extent PA Project Area LAA Local Assessment Area RAA Regional Assessment Area	Timing N/A Not Applicable A Applicable	Duration ST Short-Term MT Medium-Term LT Long-Term P Permanent	Frequency O Once S Sporadic R Regular C Continuous	Reversibility R Reversible IR Irreversible	

8.5.4.5 Follow-up and Monitoring Programs

As indicated in Section 6.9.8, a fish and fish habitat monitoring program will be developed in association with requirements of wetland and watercourse alteration permits issued for direct wetland and watercourse alterations associated with the Project. Monitoring of surface water will also be completed which will support monitoring for potential impacts to fish and fish habitat. This monitoring program is described in Section 6.7.10.

8.5.5 Birds Cumulative Effects Assessment

8.5.5.1 Baseline conditions

8.5.5.1.1 Beaver Dam Mine Site

Of the 100 avian species observed during dedicated surveys (i.e., fall migration, spring migration, and breeding, excluding incidentals) within the PA, 77 (75% of species) are protected under the *Migratory Bird Convention Act* (1994). Ninety-eight percent (98%) of all individual birds observed during dedicated surveys (i.e., fall migration, spring migration, and breeding) are migratory birds. Birds observed that are not protected under the *Migratory Bird Convention Act* (1994) were from the Accipitridae (e.g., harriers and hawks), Alcedinidae (e.g., kingfisher), Corvidae (e.g., jays, crows and ravens), Phasianidae (e.g., grouse and pheasants), and Strigidae (e.g., owls) families.

Avian diversity was relatively higher along the Haul Road than within the Beaver Dam Mine Site. This is likely attributable to the fact that the Beaver Dam Mine Site is more extensively disturbed and fragmented as a result of historic mine operations and current and historic timber harvesting practices. Overall, avian diversity and abundance was moderate and fell within expectations for the habitats available and for forests in Halifax County in general.

Passerines were the dominant species group across all season within the PA, which is expected based on the variety of suitable habitats present within the PA. Non-passerine landbirds were the second most abundant species group observed within the PA and consisted primarily of grouse and woodpecker species. Habitats for these species are present throughout the PA.

No large congregations of waterfowl or shorebirds were observed roosting or staging within the PA during either the spring or fall migration periods. Wetland habitats suitable for migrating shorebirds and waterfowl were limited within the PA.

Raptors, both diurnal and nocturnal, were observed in low numbers within the PA throughout the year. Throughout the migrations period, this suggests that there are no major migration corridors over the PA. As for the breeding season, suitable breeding habitat is present for several forest raptors, including Northern Goshawk, Cooper's Hawk, Sharp-shinned Hawk, Red-tailed Hawk, Merlin, American Kestrel, Great Horned Owl, Barred Owl, and Northern Saw-whet Owl. Many of these forest raptor species are difficult to census; therefore it is not surprising that documented species richness and abundance were low within the PA.

8.5.5.1.2 Touquoy Mine Site

The 2005 breeding bird surveys of the Touquoy Mine Site found 398 birds representing 52 species over 11 point count stations. The most abundant species were the magnolia warbler (*Setophaga magnolia*, 7.5% of the total) and the common grackle (*Quiscalus quiscula*, 7.3%) (CRA 2007). Ten of the 52 species observed are priority species. They are as follows; pine grosbeak (*Pinicola enucleator*), willow flycatcher (*Empidonax traillii*), yellow-bellied flycatcher, barn swallow, boreal chickadee, ruby-crowned kinglet, rusty blackbird, bay-breasted warbler, Swainson's thrush, and pine siskin.

8.5.5.2 Analysis of Effects

8.5.5.2.1 Residual Effects of Proposed Project

Clearing and grubbing is limited to the Beaver Dam Mine Site and along the Haul Road during the construction phase. No clearing and grubbing is required at the Touquoy Mine Site. Clearing and grubbing will result in habitat loss for avifauna. Mitigation measures such as bird awareness and best management practices will be used. Best management practices include the avoidance of clearing and grubbing during the breeding season for migratory birds where practical (beginning of April to end of August for migratory birds; ECCC 2015). Where this is not possible, a bird nest mitigation plan should be developed prior to construction and in consultation with ECCC and provincial regulators. Grubbed Material will be stockpiled and used for remedial efforts during the reclamation and decommissioning phase of the Project.

The widening and construction of new portions of the Haul Road will occur once during the construction phase. Impacts to birds associated with the construction include the irreversible loss of habitat, including a portion of a patch of old forest. Mitigation associated with the Haul Road include sediment and erosion control and limiting the footprint of new construction. The geographic extent of impacts associated with this VC interaction occur in the PA.

Heavy machinery operation and vehicle activity will occur within the Beaver Dam Mine Site and Haul Road during the construction phase and throughout the PA during the operation and decommissioning phases. Both heavy machinery operation and vehicle activity can impact avifauna through wildlife vehicle collisions, contamination (e.g. spills), dust and, noise. These impacts have the potential to affect birds within the Project's LAA. Impacts such as wildlife vehicle collisions can directly affect birds and others such as noise can indirectly affect birds by encouraging avoidance behavior. Mitigation measures such as spill preparedness, emergency response measures, and best management practices (e.g. noise/dust control, speed limits) will minimize the likelihood of a negative impact from vehicle activity and heavy machinery operation.

Construction and commissioning of support infrastructure is confined to the Beaver Dam Mine Site and will occur during the construction phase of the Project. Potential impacts to birds include noise and dust. Mitigation during the construction and commissioning of support infrastructure include bird awareness and best management practices. The timeframe associated with the construction of support infrastructure will be between 1 to 3 years (medium-term).

Blasting and drilling of in-situ rock is expected to occur weekly at the Beaver Dam Mine Site during the operational phase of the Project. Blasting could negatively affect birds from the noise associated with the activity. A pre-blasting plan and impact evaluation will mitigate impacts to birds. Although blasting is restricted to the PA the sound disturbance to birds has the potential to extend into the LAA.

Taking the noise associated with all of the aforementioned Project interactions into account, noise levels are predicted to range between 51.5 to 65.6 dBA at the boundaries of the Beaver Dam Mine Site (Appendix B.1). The Environment Code of Practice for Metal Mines (Environment Canada, 2012) has established recommended parameters for ambient noise levels for wildlife. These parameters indicate that ambient noise observed above 55 dBA during the day and 45 dBA at night can affect wildlife. The predicted noise levels presented in the Noise Impact Study (Appendix B.1) exceed the levels outlined by Environment Canada (2012). Additionally, a literature review conducted by Shannon et al. (2016) found that birds have the potential to exhibit changes in song characteristics, reproduction, abundance, stress levels, and species richness at levels greater than 45 dBA.

According to the results of the Noise Impact Study, noise generated from Project activities diminishes to 45 dBA (the most conservative guideline) at approximate ranges of 0 – 1000 m outside of the Beaver Dam Mine Site. At the Haul Road, noise at that same sound level is predicted to travel approximately 180 - 350 m from the center line of the road and at the Touquoy Mine Site noise at 45 dBA is predicted to travel approximately 0 - 850 m outside of this component of the PA. These ranges of noise distribution are due to changes in local topography. Birds within these approximate ranges of noise distribution surrounding the PA have the potential to be affected by noise during the day and overnight.

Project lighting is located at the Beaver Dam Mine Site and the Touquoy Mine Site (operational facilities). The only light related with the Haul Road are those associated with haul trucks. Lighting has the potential to disturb birds by affecting behavior (e.g. predation, migration, and nesting). According to the Light Impact Assessment (Appendix D.1), light impacts from trucks on the Haul Road are expected to be insignificant compared to baseline daylight illuminance and the amount of light blocked by the surrounding woodland and topographic changes at the Beaver Dam Mine Site will likely be >90% (Appendix D.1). In order to mitigate the potential impacts of light on birds, best management practices will be followed. Light pollution on site will be reduced by installing downward-facing lights on site infrastructure. Wherever possible, motion-sensing lights will be installed to ensure lights only used when necessary.

Tailings deposited in the Touquoy Mine Site open pit are confined to that component of the PA. Tailings will be deposited during the operational phase of the Project. Birds that land in the tailings of the Touquoy Mine Site open pit have the potential to be impacted as a result of the surface water quality. A bird deterrent plan, similar to the one being implemented in the spring of 2018 for the current Touquoy Mine Site TMF, will be developed for the Touquoy Mine Site open pit (storage of Beaver Dam Mine Site tailings). Additionally, water quality in the shallow lake is not anticipated to be affected by the disposal of Beaver Dam Mine Site tailings.

The ecological and social context of the VC were included throughout this evaluation. Ecological and social context entails ecosystem health and function as well as the general setting and influence of past and current human activity and its associated disturbance. Ecological factors considered include bird diversity, abundance, and habitat availability. Social factors considered included the impact to commercial, aboriginal and recreational resources. These factors were qualitatively assessed based on Project VC interactions.

Ecological context considered in determining the residual environmental impacts include the loss of available habitat for avifauna at the Beaver Dam Mine Site and along the Haul Road. Although there is a loss of habitat associated with Project construction, forestry activity has previously disturbed avifauna habitat within the PA. Additionally, portions of the Haul Road are pre-existing and therefore the impact has been reduced in comparison to constructing a whole new Haul Road through intact forest.

Considerations for social context include the fact that there is Mi'kmaq current use. Disturbance or loss of avifauna within the PA should not have a significant impact commercially, recreationally, or to the Mi'kmaq because these species are not limited to the PA and can be found in surrounding areas.

The overall residual effect of the Project on birds and bird habitat is assessed as not significant after mitigation measures have been implemented.

8.5.5.2.1 Effects of Other Projects in the Area

8.5.5.2.1.1 Current Regional Forestry Operations

Habitat throughout the region exhibits fragmented conditions related to current and historic timber harvesting activity. This has led to habitat fragmentation and an increase in young regenerating stands to the detriment of older undisturbed forest.

8.5.5.2.1.2 Touquoy Gold Project

Potential impacts to migratory birds could include direct mortality or disruptions with potential to affect populations such as loss of habitat, habitat fragmentation or significant disruption of migration or reproduction (CRA 2007).

Habitat loss may occur, if present, through site development/clearing activities. Habitat fragmentation in the local Project area is not expected to add significantly to existing habitat fragmentation in the local area. The area is currently intersected by an existing paved road and by forestry roads and ATV trails. Similar habitat is extensive surrounding the site to the extent of several hundred thousand hectares (CRA 2007).

The tailings management facility is not expected to have a significant adverse impact on migratory or breeding birds (CRA 2007).

8.5.5.2.1.3 Touquoy Mine Site and Beaver Dam Haul Road Use by Fifteen Mile Stream and Cochrane Hill Gold Projects

As stated above, during the operation phase of the Fifteen Mile Stream Gold Project (2021 to 2026) and the Cochrane Hill Gold Project (2022 to 2027), gold concentrate from each surface mine will be transported to the Touquoy processing site for final processing into gold doré bar. The proposed Haul Road for each project would overlap with the Beaver Dam Mine Haul Road west of the Highway 224. Up to approximately 300 tonnes per day and 175 tonnes per day will be transported to the to the Touquoy processing site using a C Train truck configuration for Fifteen Mile Stream Gold Project and the Cochrane Hill Gold Project respectively.

The trucking operations associated with the Fifteen Mile Stream and Cochrane Hill Gold Projects along the Beaver Dam Haul Road west of Highway 124 have the potential to impact birds from wildlife vehicle collisions, dust, noise, and accidents (e.g. spills). Noise generated from the additional truck activity can extend beyond the PA and affect the LAA. Mitigation measures proposed for the Beaver Dam Mine Project such as spill preparedness, emergency response measures, and best management practices (e.g. speed limits) will also minimize the likelihood of an impact from trucking operations associated with the Fifteen Mile Stream and Cochrane Hill Gold Projects, resulting in reduced potential effects to birds.

8.5.5.2.1.4 Other Regional Projects Contributing to Habitat Loss

A review of documentation from other projects and activities in the area provided qualitative analysis demonstrating that various projects have caused visible loss of wildlife habitat within the region. This will result in an increase overall cumulative loss of habitat.

8.5.5.2.2 Cumulative Effects on Birds

The increase in truck traffic from the use of a of the portion of the Beaver Dam Haul Road by Fifteen Mile Stream and Cochrane Hill Gold Projects has the potential to cause additive cumulative effects to birds from wildlife vehicle collisions, dust, noise, and accidents (e.g. spills). However, the cumulative effects are anticipated not to be significant as the mitigation measures proposed for the Beaver Dam Mine Project would likely minimize the potential effects of the other two projects using the Touquoy Mine Site.

Overall, the generalized disturbance of the landscape by forestry activities, past, present and future are the main source of cumulative effects to birds throughout the area. The largest adverse effects expected would be to species preferring undisturbed and unfragmented habitats. It should be noted that these effects are smaller than they would be in a landscape dominated by agriculture or urban development, which lead to a much greater, and often permanent, loss of natural habitat.

The overall footprint of mining activities, including the Beaver Dam and Touquoy sites, is quite small in relation to the available bird habitat within the region. None of these projects are expected to have direct effects on birds beyond their immediate surroundings. Therefore, no significant cumulative effects to birds at the regional scale are anticipated with regards to these activities.

The main assumptions behind this assessment is that the overall patterns of land use in the region will remain unchanged in the foreseeable future and that the Fifteen Mile Stream Gold Project and the Cochrane Hill Gold Project are approved and carried out during the anticipated timelines. With regards to the first assumption the generalized disturbance of the landscape by forestry is well documented in the NSDNR Forest Inventory, therefore there is little uncertainty with regards to this information. Overall, the assessment is considered as having low uncertainty.

8.5.5.3 Mitigation

The relatively minor contribution of the Beaver Dam Mine Project to habitat loss is already mitigated by the measures presented in section 6.10.8 and direct effects to birds are mitigated through the measures presented in section 6.12.9. The mitigation of the effects originating from regional forestry and land management practices falls outside the scope of the Project proponent’s authority and responsibility.

8.5.5.4 Residual Cumulative Effects and Significance Assessment

A significant adverse cumulative effect on birds is defined as an effect that is likely to cause a permanent alteration to any bird species distribution or abundance at the regional scale.

Historical and current land use in the region has likely affected the local habitats in ways that have affected the local distribution and abundance of several species of birds, however as the overall footprint of mining activities in the area, including the Beaver Dam and Touquoy sites, is quite small in relation to the available bird habitat within the region no significant residual cumulative effects are anticipated (Table 8.5-6).

Table 8.5-7 Residual Cumulative Environmental Effects for Birds

Residual Adverse Cumulative Effects (After Mitigation)	Significance Levels						Overall Significance of Residual Adverse Effects (and Rationale)
	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	
Loss of regional habitat	L Overall, a small portion of the overall available bird habitat in the RAA has been lost due to regional activities.	RAA Loss of bird habitat is on the regional scale.	A Cumulative effect would be more significant during sensitive period for birds.	LT Effects may extend beyond 3 years.	S The loss of additional habitat associated with the Beaver Dam Mine Site will occur once. However, the potential future loss of habitat associated with the Fifteen Mile Stream Gold Project and other projects in the future could occur throughout the lifetime of the Project.	R VC will recover to baseline conditions upon the completion wetland restoration.	**Minor Adverse Effect** **(Not Significant)** The small proportion of regional bird habitat lost as a result of this Project will be restored during the reclamation stage.
Legend (refer to Table 5.10-1 for definitions)	Magnitude N Negligible L Low M Moderate H High	Geographic Extent PA Project Area LAA Local Assessment Area RAA Regional Assessment Area	Timing N/A Not Applicable A Applicable	Duration ST Short-Term MT Medium-Term LT Long-Term P Permanent	Frequency O Once S Sporadic R Regular C Continuous	Reversibility R Reversible IR Irreversible	

8.5.5.5 Follow-up and Monitoring Programs

The monitoring and follow-up of the residual cumulative effects, primarily caused by past and ongoing forestry practices, falls outside the scope of the Project proponent's authority and responsibility.

No additional monitoring beyond that indicated for the Project in Section 6.12.9 is proposed.

8.5.6 Species of Conservation Interest and Species at Risk Cumulative Effects Assessment

8.5.6.1 Baseline conditions

8.5.6.1.1 Priority Fish Species

Within the Beaver Dam Mine Site, one priority species, brook trout, was identified during electrofishing and fish collection. Priority fish species identified as having an elevated potential to be located within the Project Area, based on habitat preferences, and broad geographic range, include *Anguilla rostrata* (American eel), *Salmo salar* (Atlantic salmon), *Culaea inconstans* (brook stickleback), and *Osmerus mordax* (landlocked rainbow smelt).

Two SOCI were identified during electrofishing within watercourses within the Haul Road ~~PA~~. The American eel is currently listed as threatened by COSEWIC. It was identified during electrofishing surveys in watercourses N, V, and AH. Brook trout, listed as S3 by the ACCDC, were also observed in watercourses N, V, and AH. Atlantic salmon have been documented within the WRSH watershed and are expected to be present within contiguous surface water with the West River Sheet Harbour where suitable habitat is present within the Haul Road.

8.5.6.1.2 Priority Vascular Flora Species

Surveys of the Touquoy site did not detect any plant species of special status within surveyed area (CRA 2007).

During field assessments throughout the PA, a total of 294 species of vascular flora have been identified in field assessments within the Beaver Dam Mine Site and Haul Road. No SAR vascular plant species were observed within the PA. Of the 294 species identified, five are priority species (SOCI), based on provincial status ranks (S3 and S3S4). No SAR vascular plant species were observed. Five plants are priority species (SOCI), based on provincial status ranks (S3 and S3S4). These SOCI identified within the Beaver Dam Mine Site and Haul Road are outlined in Table 6.13-4.

Wiegand's sedge (*Carex wiegandii)* was identified in three locations within the Beaver Dam Mine Site. This species is a member of the Stellulatae section of the genus Carex. This species grows in a tuft formation in acidic peatlands, black spruce and larch bogs, and conifer and alder thickets. Within the PA, it was located in two wetlands and one nearby upland area.

Lesser rattlesnake plantain (*Goodyera repens*) is a small, inconspicuous member of the orchid family (Orchidaceae), found in coniferous forests throughout Nova Scotia. Within the PA, two individuals were identified on the upland edge of wetland 29, in a coniferous forest, adjacent to recent timber harvesting.

Southern twayblade (*Listera australis*, syn. *Neottia bifolia*) is a small inconspicuous member of the orchid family (Orchidaceae), which has been found in eight locations (wetlands 80, 115, 129, 137, 135, 147, and 161, and in upland habitat north of wetland 136) within the PA. This species belongs to the Atlantic Coastal Plain Flora community and its primary habitat is shaded sphagnum mosses in bogs or coniferous treed swamps.

Appalachian polypody (*Polypodium appalachianum*) is a member of the Polypody fern family (Polypodiaceae). Its habitat is restricted to cliffs, rocky slopes, bedrock outcrops, and boulders. A population of approximately seven individuals was identified in upland habitat adjacent to wetland 137 (a mixed wood treed swamp) within the Haul Road.

Highbush blueberry (*Vaccinium corymbosum*) is an ericaceous shrub (family Ericaceae) in the Atlantic Coastal Plain Flora community. This species is usually limited to bogs, rock barrens, and lakeshores around Digby and Queens Counties, but it can be found in other locations with remnant populations of Atlantic Coastal Plain Flora. Within the Haul Road ~~PA~~, two individuals were identified in wetland 157. This wetland is a treed swamp which is immediately adjacent to Upper Kidney Lake.

8.5.6.1.3 **Priority Lichen Species**

A total of eleven priority lichen species were observed within the broader LSA as described in Section 6.13.3.3. Of the nine species, three lichen SAR were observed, as well as eight SOCI species, as provided in; Table 6.13-6. Of the three SAR identified, two are located within the PA. Blue felt lichen was observed in the Beaver Dam Mine Site and Haul Road and in the broader LSA, while frosted glass whiskers was identified within the Beaver Dam Mine Site. Boreal felt lichen was identified in the LSA, but not within the PA.

8.5.6.1.4 **Priority Mammal Species**

The desktop evaluation for priority species of terrestrial fauna revealed that mainland moose (*Alces alces americanus)* has been documented within 5 km of the PA by the ACCDC. Three records were available for moose within 5 km of the Beaver Dam Mine Site, while the mainland moose was not documented within 5 km of the Haul Road or the Touquoy Mine Site. Mainland moose are listed as endangered under the NSESA and is provincially ranked S1.

Moose are known to occur in the general area of the proposed Touquoy mining area. Mainland moose tracks were observed within the Touquoy Mine Site in a bog during field surveys to support the Touquoy Environmental Assessment in 2006. Moose are known to the Tangier Grand Lake Wilderness Area, and evidence of moose is reported every year by NSDNR in the Moose River Gold Mines area during deer pellet surveys (CRA, 2007).

Nine (9) mammal priority species have elevated potential to be located within the PA, based on habitat preferences and known distribution. These include 6 bat species, Eastern Pipistrelle, Eastern Red Bat, Hoary Bat, Little Brown Myotis, Northern Long-eared Myotis and Silver-haired Bat, as well as the Maritime

Shrew, the Rock Vole and the Moose (see Table 6.13-8). However, no bat hibernacula were identified within the mine footprint PA or along the Haul Road.

8.5.6.1.5 **Priority Herpetofauna Species**

The Snapping Turtle and the Wood Turtle have an elevated potential for being located within the PA based on broad geographic range and habitat preferences.

Targeted surveys for wood turtles within the Beaver Dam Mine Site did not reveal any sightings of wood turtles or suitable nesting habitat. No opportunistic observations of wood turtles or suitable nesting habitat were documented during any wetland or watercourse surveys throughout the entirety of the PA.

Within the PA, one snapping turtle was incidentally observed along the Haul Road during bird surveys on June 26, 2016. This snapping turtle was observed along Mooseland Road near PC45 (20T 507085E, 4981506N). Suitable habitat for snapping turtles has been observed in wetlands 8, 10, 17, 29, 59, 61, 66, 68, 69, 159, 168,171, and 207. These wetlands all provide standing water to a depth exceeding 0.5 m. As such, it is presumed that the open water portions of these wetlands provide overwintering habitat for snapping turtles.

No wood turtle or suitable habitat were observed within the Touquoy Mine Site during wood turtle habitat surveys conducted in 2004 (CRA 2007). No snapping turtles were recorded within the Touquoy Mine Site during the EARD process, however, on the June 26, 2016 a snapping turtle was observed within the LAA, north of the Touquoy Mine Site, on Moose River Road (20T 504304E, 4981602N). From June 19 to mid July 2017 two snapping turtles were frequently observed. One was found along Moose River Road (20T 504304E, 4981602N), at the location identified above. The second snapping turtle was observed on Higgins Mines Road (20T 504380E, 4980699N) west of the PA but within the LAA.

8.5.6.1.6 **Priority Invertebrates**

Table 6.13-10 provides a list of invertebrate fauna priority species which have elevated potential to be located within the PA, based on habitat preferences and known distribution. None of these species has been confirmed within the PA, though the Monarch (*Danaus plexippus*) has been observed in the10km x 10km Maritime Butterfly Atlas survey grid that covers Mud Lake and Crusher Lake, extending north to Beaver Lake, and east to Smith Lake and Rocky Lake.

8.5.6.1.7 **Priority Birds**

A desktop review for priority species revealed that 33 priority bird species were identified as having the potential to occur within the Beaver Dam Mine Site and Haul Road based on habitat availability and geographic distribution (see Table 6.13-11). Eighteen species have been documented within 5 km of the Beaver Dam Mine Site and Haul Road by ACCDC. These species are underlined in Table 6.13-11.

An additional five species considered SOCI in the breeding season (i.e., ACCDC only ranks these species with a breeding status S-rank) were observed within the Beaver Dam Mine Site and Haul Road only during migration periods: common goldeneye, American coot, American kestrel, brown-headed cowbird, and pine grosbeak. Though not observed during the breeding season, the desktop review for priority species found that the Wilson's warbler and pine grosbeak (*Pinicola enucleator*) could be present within the Beaver Dam Mine Site and Haul Road during breeding season based on habitat availability and geographic distribution.

Common nighthawks were not detected during the dedicated species surveys completed within the Beaver Dam Mine Site in 2015; however, preferred breeding habitat, specifically logged areas, peat bogs and forest clearings, were observed within the Beaver Dam Mine Site. Suitable breeding habitats were observed within the Haul Road and four common nighthawks were observed during both breeding bird (n=1) and dedicated species surveys (n=3) in 2016. Common nighthawks were observed within the Haul Road, in habitats with expansive gravelly areas adjacent to clear cuts or disturbed areas (Haul Road PC26, CONI1, and CONI9). There were no signs of breeding evidence (e.g., booming display) observed, but breeding is still possible as these birds were observed near suitable nesting habitat, specifically clear cuts and gravel on expanded roadsides.

Two peregrine falcons were observed incidentally (n=1) and during the dedicated fall migration surveys (n=1) adjacent to the Beaver Dam Mine Site, in 2014. Both observations were documented immediately north of the Beaver Dam Mine Site, between Mud Lake and Cameron Flowage. Suitable breeding habitat was not present within the Beaver Dam Mine Site and Haul Road.

Two chimney swifts were observed incidentally during the breeding season in 2015, within the Beaver Dam Mine Site and there were no signs observed of Chimney Swifts breeding.

Olive-sided flycatcher observations were sparse, yet scattered across the Beaver Dam Mine Site and Haul Road. This species was documented near wetland boundaries, typically with disturbed habitats nearby. Suitable habitat, including logged areas and forest edges near natural and human-made openings, are present within the Beaver Dam Mine Site and Haul Road. No evidence of breeding was observed, however, 10 males were heard singing within the ~~PA~~ Beaver Dam Mine Site during the 2015 breeding bird surveys, and incidentally within the Haul Road in 2016, suggesting possible breeding within the associated habitats.

The Canada Warbler’s preferred habitat, moist mixed forests, was observed within the Beaver Dam Mine Site and Haul Road. Sixteen Canada warblers were observed during the 2015 and 2016 breeding bird surveys within the Beaver Dam Mine Site and Haul Road. Within the Beaver Dam Mine Site, probable breeding behavior (i.e., agitated behavior and anxiety calls of an adult) was observed by one Canada warbler and possible breeding was exhibited by singing males during breeding season.

One rusty blackbird was observed incidentally within the Beaver Dam Mine Site during the 2014 fall migration survey in a large wetland complex to the northwest of the Beaver Dam Mine Site (PC15). Breeding habitat, including forested wetlands, swamps, and peat bogs are present within the Beaver Dam Mine Site and Haul Road, however, no evidence of breeding was observed.

One barn swallow was observed within the Haul Road during the 2016 spring migration surveys, near wetland 159, between Highway 224 and the Beaver Dam Mine Site. Nesting habitat is available within the Beaver Dam Mine Site and Haul Road, particularly artificial structures including a cabin, bridges, and road culverts.

Two eastern wood-pewees were incidentally observed within the PA during the breeding season in 2016. One was identified at the outlet of Cameron Flowage, to the east of the Beaver Dam Mine Site, while the second was observed incidentally within the Haul Road, east of wetland 114. No breeding evidence was observed, although suitable habitat is present within the PA. As such, it is identified as a possible breeder.

8.5.6.2 Analysis of Effects

8.5.6.2.1 Residual Effects of Proposed Project

8.5.6.2.1.1 Priority Fish Species

The geographic extent, timing, duration, frequency, and reversibility of direct impacts to priority fish species remains the same as is with non-priority specific fish and fish habitat, however, the magnitude of impact increases. Direct fish habitat alteration includes infilling, draining, or flooding of aquatic features (watercourses and wetlands), and altering wetland function. Alterations which have the potential to directly impact fish will occur during the construction phase within the Beaver Dam Mine Site. The alterations will occur to several watercourses and wetlands. Within the Haul Road, direct fish habitat alteration is restricted to the infilling of small portions of wetland habitat during construction. Continued wetland and surface water monitoring will be conducted to monitor direct fish habitat alterations. Along the Haul Road, it is expected that fish habitat direct impact can be minimized through proper planning, micro-sighting of the upgraded road footprint, and installation of culverts in accordance with the Nova Scotia Watercourse Alteration Standard (2015). Small areas of fish habitat within wetland habitat may be directly impacted by the project, but overall, this impact will be low. No direct impact to fish habitat will occur at the Touquoy Mine Site from project activities during construction, operation or decommissioning. The residual impact to priority fish and priority fish habitat has been upgraded to high because loss of habitat has a greater potential to impact priority species. For example, Atlantic salmon have specific habitat requirements and habitat within the province is limited. Loss of this habitat has the potential to affect Atlantic salmon greater than it would a non-priority fish species (e.g. white sucker). Appropriate permitting will be followed, impact will not occur during sensitive times for priority fish, and compensation will be provided should a serious harm to fish threshold be confirmed.

Similar to the direct impacts to priority fish habitat, the significance criteria for residual environmental effects in relation to indirect impacts to priority fish species remains the same as is with non-priority specific fish and fish habitat, except for an increase in magnitude of impact. Indirect fish habitat alteration includes changes to water quality, sedimentation, and changes to water course hydrology at the Beaver Dam Mine Site, the Haul Road and the Touquoy Mine Site. Downstream water quantity/quality is unlikely to be affected through groundwater seepages to Moose River at the Touquoy Mine Site (Appendix F.6 Stantec, 2018). Groundwater seepages from the Beaver Dam Mine Site open pit are not predicted to affect water quantity within Cameron Flowage but may affect quality, particularly at the east end of Crusher Lake (Appendix G.3 GHD, 2018). Wetland and surface water monitoring will be conducted to monitor potential indirect fish habitat alterations. Water quality sampling will be completed prior to release to the receiving environment at the Beaver Dam Mine Site and Touquoy Mine Site, and water will not be released until such time its quality meets regulatory requirements. Indirect alterations have a larger geographic extent, across the LAA, because sediment or water with reduced water quality released from site can migrate to downstream receiving surface water systems outside of the PA. The magnitude of impact on priority fish species from indirect fish habitat alterations has increased to moderate because priority fish species, Atlantic salmon in particular, are very sensitive to changes in water quality.

8.5.6.2.1.2 Priority Vascular Flora and Lichens

Clearing and grubbing will occur during the construction phase of the Project and is limited to the Beaver Dam Mine Site and along the Haul Road. No additional clearing and grubbing is required at Touquoy Mine Site to support the Beaver Dam Mine project. Clearing and grubbing requires full vegetative removal which will directly affect vascular and non-vascular individuals, and to flora communities at the full or partial forest stand level. For this reason, the magnitude of residual environmental effects is classified as high. Mitigation measures such as sediment and erosion control will limit further indirect habitat loss from erosion.

Heavy machinery operation and vehicle activity will occur within the Beaver Dam Mine Site and Haul Road during the construction phase and throughout the PA during the operation and decommissioning phases. Both heavy machinery operation and vehicle activity can cause impacts to vascular and non-vascular flora from dust, erosion, and accidents (e.g. spills). Sediment and erosion control, spill preparedness, emergency response measures, and best management practices will minimize the likelihood of a broader indirect impact to habitat and flora, deeming the magnitude for residual environmental effects as low.

8.5.6.2.1.3 Priority Terrestrial Fauna

Clearing and grubbing is limited to the Beaver Dam Mine Site and along the Haul Road during the construction phase. No clearing and grubbing is required at the Touquoy Mine Site. Clearing and grubbing will result in habitat loss for priority fauna. Best management practices will be used to limit unnecessary loss of habitat. Grubbed material will be stockpiled and used for remedial efforts during the reclamation and decommissioning phase of the Project. Clearing and grubbing is expected to have a high magnitude of impact on priority fauna because it is associated with a direct loss of habitat. Clearing and grubbing will reduce cover for priority turtle species (e.g. snapping turtle), indirectly affect water quality, and can isolate populations (ECCC, 2016), Regarding mainland moose, habitat loss and fragmentation caused by clearing and grubbing interferes with the long-term population viability and is a serious threat to the species (NSDNR, 2007).

Vehicle and haul truck activity will occur throughout the PA during the construction, operation, and decommissioning phases. Vehicle and haul truck activity can cause impacts to priority fauna from wildlife vehicle collisions, dust, noise, and accidents (e.g. spills). Wildlife vehicle collisions can directly affect priority fauna and noise can indirectly affect priority fauna by encouraging avoidance behaviour. Mitigation measures such as spill preparedness, emergency response measures, and best management practices (e.g. noise/dust control, speed limits) will minimize the likelihood of a negative impact. Since priority fauna species are rare and populations are less viable than non-priority fauna species the magnitude of impact from vehicle and haul truck activity are both considered moderate.

Blasting and drilling of in-situ rock is expected to occur weekly at the Beaver Dam Mine Site during the operational phase of the Project. Blasting could negatively affect priority fauna from the noise associated with the activity. A pre-blasting plan and impact evaluation will mitigate impacts to terrestrial fauna. Although blasting is restricted to the PA the sound disturbance to terrestrial fauna has the potential to extend into the LAA. Overall, blasting is expected to have a higher impact (moderate) on priority fauna in comparison to non-priority fauna species. For example, a noise disturbance can cause flight behaviour in all terrestrial fauna but the impact to the energy balance of a mainland moose may have more severe consequences compared to a non-priority fauna species because stress on an already endangered (NSESA) population may impede its biological success in turn having a greater impact on the species.

8.5.6.2.1.4 Priority Birds

The geographic extent, timing, duration, frequency, and reversibility of the effects of clearing and grubbing to priority birds remains the same as is with non-priority specific birds. Clearing and grubbing is limited to the Beaver Dam Mine Site and along the Haul Road during the construction phase. No clearing and grubbing is required at the Touquoy Mine Site. Clearing and grubbing will result in habitat loss for avifauna.

Mitigation measures such as bird awareness and best management practices will be used. Best management practices include the avoidance of clearing and grubbing during the breeding season for migratory birds where practical (beginning of April to end of August for migratory birds; ECCC 2015). Where this is not possible, a bird nest mitigation plan should be developed prior to construction and in consultation with ECCC and provincial regulators. Material will be stockpiled and used for remedial efforts during the reclamation and decommissioning phase of the Project. Clearing and grubbing is expected to have a high magnitude of impact because it is associated with a direct loss of habitat. Although similar habitat is available adjacent to the PA the effect of habitat loss has the potential to have a greater impact on priority bird species. For instance, the habitat requirements for rusty blackbird are very specific and include forested wetlands with standing water and riparian areas and clearing and grubbing in these habitats is a major threat to the species (Environment Canada, 2014).

8.5.6.2.2 **Effects of Other Projects in the Area**

8.5.6.2.2.1 Current Regional Forestry Operations

Habitat throughout the region exhibits fragmented conditions related to current and historic timber harvesting activity. This has led to habitat fragmentation and an increase in young regenerating stands to the detriment of older undisturbed forest.

The existing roads that service the regional forestry industry contribute to the disturbance and risk of collision to species such that the Moose. Poorly installed culverts along the pre-existing portions of the Haul Road were also noted as having adverse effects on fish that provide habitat for American Eel and Atlantic salmon.

8.5.6.2.2.2 Touquoy Gold Project

Some loss of moose habitat, although limited to the Project footprint, will occur. This area represents less than 1% of the moose habitat available in eastern Halifax County, and habitat quality on the Project site is marginal. Potential impacts to moose may include direct mortality (vehicles), alteration or loss of habitat, disturbance of reproductive or feeding activities (generally due to noise or site activity), increased predation (natural predators, vehicle collision or hunting/trapping) due to improved access and traffic or disruption of migration patterns and habitat fragmentation. Accidental events could result in similar impacts. Vehicle use on-site could result in accidental mortality of moose. As few moose are in the area, it is unlikely that encounters will occur; however, the importance of individual moose within this herd is recognized. As collisions can be avoided by ensuring on-site vehicle speeds are under 50 km/hour, speed limits below this level will be enforced year round (CRA 2007).

No suitable habitat for any at-risk reptile or amphibian species has been encountered on the site of the Touquoy Gold Project (CRA 2007).

The environmental screening conducted by the NSM found no records of rare or endangered birds on the site of the Touquoy Gold Project (CRA 2007).

No rare or endangered vascular plant species as none have been observed on the site of the Touquoy Gold Project (CRA 2007).

8.5.6.2.2.3 Touquoy Mine Site and Beaver Dam Haul Road Use by Fifteen Mile Stream and Cochrane Hill Gold Projects

As stated above, during the operation phase of the Fifteen Mile Stream Gold Project (2021 to 2026) and the Cochrane Hill Gold Project (2022 to 2027), gold concentrate from each surface mine will be transported to the Touquoy Mine Site for final processing into gold doré bar. The proposed Haul Road for each project would overlap with the Beaver Dam Mine Haul Road west of the Highway 224. Up to approximately 300 tonnes per day and 175 tonnes per day will be transported to the to the Touquoy Mine Site using a C Train truck configuration for Fifteen Mile Stream Gold Project and the Cochrane Hill Gold Project respectively.

The trucking operations associated with the Fifteen Mile Stream and Cochrane Hill Gold Projects along the Beaver Dam Haul Road west of Highway 124 has the potential to impact SAR and SOCI from wildlife vehicle collisions, dust, noise, and accidents (e.g. spills). Mitigation measures proposed for the Beaver Dam Mine Project such as spill preparedness, emergency response measures, and best management practices (e.g. speed limits) will also minimize the likelihood of impacts from trucking operations associated with the Fifteen Mile Stream and Cochrane Hill Gold Projects, resulting in reduced potential effects to SAR and SOCI.

8.5.6.2.2.4 Other Regional Projects Contributing to Habitat Loss

A review of documentation from other projects and activities in the area provided qualitative analysis demonstrating that various projects have caused visible loss of wildlife habitat within the region. This will result in an increase overall cumulative loss of habitat.

8.5.6.2.3 Cumulative Effects on the Species of Conservation Interest and Species at Risk

Cumulative effects to SAR and SOCI are specific to each species, meaning that cumulative effects are only considered for species on which the Beaver Dam Mine Project has adverse residual effects and for which adverse effects from other identified projects in the area are expected.

8.5.6.2.3.1 Priority Fish

The cumulative effects to priority fish primarily result from the potential effects on watercourse as a result of road construction. Given that the adverse effects observed with regards to the existing Haul Road will be reduced by the removal and replacement of the poorly installed culverts, the final cumulative effects on

American Eel and Atlantic salmon may be lower following the undertaking of the Beaver Dam Mine Project.

In the absence of the Project, the conditions along the Haul Road are less likely to be improved. However the effects assessed for the Beaver Dam Project (Section 8.5.6.2.1) would be avoided.

There is some uncertainty as to the Project effects on fish and fish habitat, which includes effects on priority fish. This uncertainty is addressed through the monitoring and follow-up programs established for the Project (Section 6.13.10).

8.5.6.2.3.2 Priority Vascular Flora and Lichens

Several species of priority terrestrial plans and lichens may be affected by the Beaver Dam Project (see section 8.5.6.2.1). No other specific project with the area is known to have had direct effects on these species, but little information is available. The general habitat disturbances from historic and ongoing forestry activities are likely to have had some effect on species that prefer undisturbed habitat, such as the priority lichens.

There is a significant level of uncertainty as to the cumulative effects, especially as to the effects from past disturbances and other projects in the region. However, given the small footprint of the project on the regional scale there is some confidence that the Project's effects on priority flora contributes only a small portion to the total cumulative effects and that the cumulative effects with and without the project are similar in scale.

8.5.6.2.3.3 Priority Terrestrial Fauna

Both the Beaver Dam Project and the Touquoy Gold Project are expected to have some effect on the Mainland Moose. The effects are the result of loss of habitat and from the risk of collision with vehicles. Habitat loss and disturbance, and traffic from other activities in the region contribute to the resulting cumulative effects.

Similar cumulative effects are expected for the snapping turtle, though no other specific project causing loss of habitat for this species has been identified.

There is a significant level of uncertainty as to the cumulative effects on priority terrestrial fauna. Given the small footprint of the project on the regional scale there is some confidence that the Project's effects on priority terrestrial fauna contributes only a small portion to the total cumulative effects and that the cumulative effects with and without the project are similar in scale.

8.5.6.2.3.4 Priority Birds

No projects with important direct impacts to a priority bird species has been identified in the region. The cumulative effects to priority birds are therefore driven by habitat loss and disturbance and are essentially the same as those noted for birds in general. Overall, the generalized disturbance of the landscape by forestry activities, past, present and future are the main source of cumulative effects to birds throughout the area. The largest adverse effects expected would be to species preferring undisturbed and unfragmented habitats.

As the Beaver Dam Mine site only contributes to a minority portion of the overall mining activities footprint, and because these effects are considered small compared to the generalized disturbance of the landscape by forestry activities, the cumulative effects with and without the project would be very similar at the regional level.

The main assumptions behind this assessment is that the overall patterns of land use in the region will remain unchanged in the foreseeable future and that the Fifteen Mile Stream Gold Project and the Cochrane Hill Gold Project are approved and carried out during the anticipated timelines. With regards to the first assumption the generalized disturbance of the landscape by forestry is well documented in the NSDNR Forest Inventory, therefore there is little uncertainty with regards to this information. Overall, the assessment is considered as having low uncertainty.

8.5.6.3 Mitigation

The contribution of the Beaver Dam Mine Project to the cumulative effect to potentially affected priority species is already presented in Section 6.13.6. Mitigation measures to reduce effects to Moose are also planned for the Touquoy Gold Project (CRA 2007).

The mitigation of the effects originating from regional forestry and land management practices falls outside the scope of the Project proponent's authority and responsibility.

8.5.6.4 Residual Cumulative Effects and Significance Assessment

A significant adverse cumulative effect on SAR and SOCI is defined as an effect that is likely to cause a permanent alteration to a species' distribution or abundance, or alteration of critical habitat. Sedentary species such as vascular and non-vascular flora do not have the opportunity to move to avoid direct or indirect impact. For these species, the loss of a population of species that is important in the context of the Province, or that species' overall abundance or distribution, is considered significant. Mortality of a single SAR could, under some circumstances, be considered a significant effect.

Within the PA, the Beaver Dam Mine Project, the Touquoy Gold Project and the use of the Touquoy Mine Site and Beaver Dam Haul Road by Fifteen Mile Stream and Cochrane Hill Gold Projects are not expected to have significant cumulative effects.

The alteration of the disturbance of habitats throughout the region from historic and current land use is likely to have affected the local distribution and abundance of various species, especially those associated with undisturbed mature habitats. However, as the overall footprint of mining activities in the area, including the Beaver Dam and Touquoy sites, is quite small in relation to the available habitat within the region no significant residual cumulative effects are anticipated (Table 8.5-6).

Table 8.5-8 Residual Cumulative Environmental Effects for SOCI and SAR

Residual Adverse Cumulative Effects (After Mitigation)	Significance Levels						Overall Significance of Residual Adverse Effects (and Rationale)
	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	
Loss, alteration and the disturbance of habitats throughout the region	L Overall, a small portion of the overall available bird habitat in the RAA has been lost due to regional activities	RAA Loss of habitat used by priority species has occurred on a regional scale.	A Cumulative effect would be more significant during sensitive period for each priority species.	LT Effects may extend beyond 3 years.	S The loss of additional habitat associated with the Beaver Dam Mine Site will occur once. However, the potential future loss of habitat associated with the Fifteen Mile Stream Gold Project and other regional projects in the future could occur throughout the lifetime of the Project.	R VC will recover to baseline conditions upon reclamation phase.	**Minor Adverse Effect** **(Not Significant)** The small proportion of regional habitat that supports priority species that would be lost as a result of this Project will be restored during the reclamation stage.
Legend (refer to Table 5.10-1 for definitions)	Magnitude N Negligible L Low M Moderate H High	Geographic Extent PA Project Area LAA Local Assessment Area RAA Regional Assessment Area	Timing N/A Not Applicable A Applicable	Duration ST Short-Term MT Medium-Term LT Long-Term P Permanent	Frequency O Once S Sporadic R Regular C Continuous	Reversibility R Reversible IR Irreversible	

8.5.6.5 Follow-up and Monitoring Programs

No additional monitoring beyond that indicated for the Project in section 6.13.8 is proposed.

8.5.7 Indigenous Peoples Cumulative Effects Assessment

8.5.7.1 Baseline conditions

There are 13 Mi'kmaq communities in Nova Scotia, with two First Nation (Mi'kmaq) reserves in the vicinity of the Project: Beaver Lake IR 17 (49.4 ha) is located approximately 5.5 km from the mine site and 3 km from the proposed Haul Road, and Sheet Harbour IR 36 (32.7 ha) is located 20 km south of the Project. Both these reserves belong to the Millbrook First Nation in Truro, Nova Scotia, part of the broader Mi'kmaw Nation. The 2017 Census reports 21 and 25 Mi'kmaw residents at Beaver Lake and Sheet Harbour, respectively (Statistics Canada 2017, 2017a).

The Sipekne'katik First Nation, located in Indian Brook, Nova Scotia, is the next closest First Nation to the Project, approximately 85 km northwest of the Beaver Dam mine site. The 2016 Census reports a total of 1,268 people living on reserve at Indian Brook IR 14, New Ross IR 20, Pennal IR 19, Shubenacadie IR 13, and Wallace Hill IR 14A.

8.5.7.1.1 Historic Mi'kmaq Land and Resource Use

Based on the proximity to watercourses and fish habitat, the existence of a number of species the Mi'kmaq would have, and continue to harvest, and the proximity of Mi'kmaq settlements, it is likely that the Mi'kmaq settled in and used the PA and the broader LSA. Traditional use of the land in Nova Scotia included permanent and semi-permanent settlements, as well as harvesting areas with high biodiversity that were used for subsistence and cultural purposes (for example, hunting, gathering, trapping for food, social and ceremonial purposes). In terms of hunting and gathering, the area contains a variety of spruce, fir, birch, ash, maple pine and shrubs inland, which would have been used in making baskets and building shelters. Fauna such as lynx, moose, beaver, deer, marten and hare were known to be drawn to the area; these animals were harvested for food and pelts by the Mi'kmaq.

The Mi'kmaq Ecological Knowledge Study (MEKS) provides a description of Mi'kmaq use of land post-contact which is summarized as follows:

- In 1762, a proclamation was issued protecting the traditional hunting and fishing territories of Indigenous Peoples including a portion of Canso as far west as Musquodoboit. In 1783, a license of occupation was issued for 11,520 acres to protect fishing and hunting rights. Encroachment of European settlers occurred until the purchase of land to establish a formal reserve in 1915 at Sheet Harbour.
- In 1852, 100 acres at Beaver Dam was set aside on the Sheet Harbour Road at the head of Beaver Lake. The reserve was formally set aside to Millbrook Band in 1960. Based on a survey in 1973 at Beaver Lake, it was found that the reserve contained 122 acres instead of the initial 100 acres granted.
- In the first half of the 19th century, there is documentation of land laid out in the Ship Harbour area for Mi'kmaw individuals. As noted in the MEKS, the Mi'kmaq continued to use the area at Ship Harbour; however, the government centralized the Mi'kmaq on two main reserves at Shubenacadie and Indian Brook in 1919.

While there is currently no pre-contact archaeological activity recorded within the MEKS study area, it is noted that due to harsh winters, strong winds, and erosion, little evidence remains of early Mi'kmaq use and occupation.

8.5.7.1.2 **Current Mi'kmaq Land and Resource Use**

Cultural continuity through practice is of great importance to the Mi'kmaq – and the connection of that continued practice for their cultural survival. According to the Indigenous Traditional Land and Resource Use Study (ITLRUS), the area is used significantly by the Mi'kmaq of Nova Scotia for the following purposes:

- Hunting deer, bear, rabbit and grouse for food;
- Trapping rabbits, fox and other small fur bearing animals for pelts and food;
- Gathering/harvesting various plants for medicinal and sustenance purposes;
- Gathering/harvesting fallen wood and birchbark for handicrafts and cultural items;
- Fishing for trout and other freshwater species; and,
- Modern-day camps for recreational purposes.

Additionally, the MEKS provided the following information related to current Mi'kmaq land and resource use sites, species of significance to Mi'kmaq, and Mi'kmaw communities, with the current Mi'kmaq land and resource uses categorized and identified as:

- Kill/hunting: trout, eel, bear, rabbit, deer, porcupine, partridge, coyote, mink, muskrat, weasels, raccoon, fox, otter and beaver;
- Burial/birth: potential burial sites recorded within the MEKS study area on the western side of the Beaver Dam Mine Road but not within the Project area;
- Ceremonial: none identified;
- Gathering: wild fruit, berries, water, food plant, specialty wood, logs, feathers, quills; and
- Habitation: anchored boat, travel route, overnight site.

Species of significance to the Mi'kmaq are associated with three categories; these are listed below with the number of occurrences in the study area based on field work completed by CMM in summer 2016:

- Medicinal: 49 species present
- Food/beverage: 27 species present
- Craft/art: 11 species present

The ITLRUS states that local residents of the Beaver Dam, Sheet Harbour and Millbrook IR's frequently use the area (range of use from weekly to yearly, depending on availability of species) for hunting and rely on the wild harvest as an important food and dietary source. Equally, community members harvest berries when in season, and a number of plants that are also used for sustenance, as well as traditional medicines. The seasonal and recreational use of animals and plants important to the Mi'kmaq supports the continuity of traditional practices, and is very important to the maintenance of their culture and the practice of their rights. Mi'kmaw harvesting activities and practices are culturally important within themselves as they ensure the sharing and maintenance of cultural values and their practice. The

Mi'kmaq use plants and animals harvested in the area for traditional sustenance purposes, health-related medicinal purposes, and spiritual and cultural purposes.

8.5.7.2 Analysis of Effects

8.5.7.2.1 Residual Effects of Proposed Project

With regards to direct effects to the closest Indigenous community at Beaver Lake, which is part of Millbrook First Nation, no effects on potable water quality, human health or socio-economic conditions are expected given distance from the Project Area.

The predicted residual environmental effects of the Project on the Mi'kmaq of Nova Scotia are assessed to be adverse, but not significant following implementation of applicable mitigation measures. Potential residual effects to Indigenous peoples' physical health from Project-related changes to the environment (e.g., changes to country foods, water, and soils) are anticipated to be not significant. Potential pathways of effects on human health associated with consumption of or contact with country foods, water and soils will be minimized by implementing mitigation measures such as dust control and water management infrastructure and processes. Mitigation measures to reduce atmospheric emissions will be implemented to minimize potential related effects on human health, and the residual risk to human health from inhalation of Project-related dust and airborne contaminants is considered low. Access issues will be discussed during engagement with the Mi'kmaq of Nova Scotia, and appropriate mitigation and/or compensation measures developed.

Loss of wetland habitat may result in the removal of plant species of significance to the Mi'kmaq. However, these plant species are not limited to the PA can be found in surrounding areas therefore the loss of these species is not expected to significantly impact the Mi'kmaq. Additionally, commercial and recreational resources within the PA will likely remain unaffected by altering wetlands.

Project development will result in the removal of fish habitat that may be of significance to the Mi'kmaq. However, the watercourses affected within the Beaver Dam Mine Site are first order streams and similar fish habitat is present in surrounding areas, outside of the PA. Overall, the loss of fish habitat is not expected to significantly impact the Mi'kmaq. Additionally, although commercial and recreational resources within the PA may be affected by alterations to fish habitat, the LAA will remain unaffected post mitigation.

Project development may result in the removal of plant species of significance to the Mi'kmaq. However, these plant species are not limited to the PA and can be found in surrounding areas. Therefore, the loss of these species is not expected to significantly impact the Mi'kmaq. Additionally, although commercial and recreational resources within the PA may be affected by alterations to habitat and vegetation, the LAA will remain unaffected post mitigation.

8.5.7.2.2 Effects of Other Projects in the Area

8.5.7.2.2.1 Current Regional Forestry Operations

Habitat throughout the region exhibits fragmented conditions related to current and historic timber harvesting activity. This has led to habitat fragmentation and an increase in young regenerating stands to the detriment of older undisturbed forest.

The existing Haul Road is used by lumber trucks, but the level of traffic varies seasonally and annually depending on which areas are undergoing timber harvesting. The existing roads that service the regional forestry industry contribute to the disturbance and risk of collision to species such as the Moose.

Poorly installed culverts along the pre-existing portions of the Haul Road have been noted as having adverse effects on fish.

The traffic on the existing Haul Road by lumber trucks contributes to the overall risk of road accidents.

8.5.7.2.2.2 Touquoy Gold Project

As with the Beaver Dam Project, the main potential effects of the Touquoy Gold Project on Indigenous Peoples are indirect and caused by effects to other VCs:

- The effects of the Touquoy Gold Project on surface water, which can affect the use of surface water bodies and the fish inhabiting them by the Mi'kmaq of Nova Scotia, are presented in Section 8.5.2.2.2. No significant adverse effects on aquatic resources are expected.
- The effects of the Touquoy Gold Project on wetlands are presented in Section 8.5.3.2.2. The project will cause a loss of 4.33 ha of wetlands, but is not likely to have significant adverse effects on wetland functional attributes in the area.
- The tailings management facility is not expected to have a significant adverse impact on migratory or breeding birds (CRA 2007), see Section 8.5.8.1.3.
- The effects of the Touquoy Gold Project on SOCI and SAR are presented in section 8.5.6.2.2

8.5.7.2.2.3 Touquoy Mine Site and Beaver Dam Haul Road Use by Fifteen Mile Stream and Cochrane Hill Gold Projects

As stated above, during the operation phase of the Fifteen Mile Stream Gold Project (2021 to 2026) and the Cochrane Hill Gold Project (2022 to 2027), gold concentrate from each surface mine will be transported to the Touquoy processing site for final processing into gold doré bar. The proposed Haul Road for each project would overlap with the Beaver Dam Mine Haul Road west of the Highway 224. Up to approximately 300 tonnes per day and 175 tonnes per day will be transported to the to the Touquoy processing site using a C Train truck configuration for Fifteen Mile Stream Gold Project and the Cochrane Hill Gold Project respectively.

The trucking operations associated with the Fifteen Mile Stream and Cochrane Hill Gold Projects along the Beaver Dam Haul Road west of Highway 124 have the potential to effect VCs of importance to Indigenous Peoples from wildlife vehicle collisions, dust, noise, and accidents (e.g. spills). Noise generated from the additional truck activity can extend beyond the PA and affect the LAA. However, mitigation measures proposed for the Beaver Dam Mine Project such as spill preparedness, emergency response measures, and best management practices (e.g. speed limits) will also minimize the likelihood of an impact from trucking operations associated with the Fifteen Mile Stream and Cochrane Hill Gold Projects, resulting in reduced potential effects to VCs.

8.5.7.2.2.4 Other Regional Projects Contributing to Habitat Loss

A review of documentation from other projects and activities in the area provided qualitative analysis demonstrating that various projects have caused visible loss of wildlife habitat within the region. This will result in an increase overall cumulative loss of habitat.

8.5.7.2.3 **Cumulative Effects on Indigenous Peoples**

Adverse cumulative effects to surface water, which would cause effects on the use of surface water bodies and the fish inhabiting them by the Mi'kmaq of Nova Scotia, have been identified as a result of the poorly installed culverts along the Haul Road, see Section 8.5.2.2.3. As these effects have been directly observed there is little to no uncertainty surrounding them. These effects are already present, and are therefore identical with and without the inclusion of the Beaver Dam Project. In fact, the Beaver Dam Project gives an opportunity to improve the observed conditions.

The cumulative effects on habitats, flora, terrestrial fauna and birds can lead to effects on current use of land and resources for traditional purposes:

- As indicated in section 8.5.3.2.3, the total cumulative impacts on wetland habitats following the construction of the Beaver Dam Project are a direct loss of 221,080 m² of wetlands. The majority of the habitat loss (69 %) results from the Touquoy Gold Project.
- Although both the Beaver Dam Project and the Touquoy Gold Project will cause the loss and disturbance of habitats within the PA, these effects are relatively small given the fact that most of the affected areas are already disturbed with the exception of the construction of the section of the Haul Road immediately southwest of Hwy 224. The new road construction will decrease the habitat quality for those species that rely on interior forest. The long term effects of the projects are reduced by the long term reclamation and remediation, which will involve re-vegetation of the mine sites at the end of their operation. Overall, the generalized disturbance of the landscape by forestry activities, past, present and future are the main source of cumulative effects to habitats, flora, terrestrial fauna, and birds throughout the area. As the Beaver Dam Mine site only contributes to a minority portion of the overall mining activities footprint, and because these effects are considered small compared to the generalized disturbance of the landscape by forestry activities, the cumulative effects with and without the project would be very similar at the regional level. The main assumption behind this assessment is that the overall patterns of land use in the region will remain unchanged in the foreseeable future. The generalized disturbance of the landscape by forestry is well documented in the NSDNR Forest Inventory. There is little uncertainty with regards to this information. Overall, the assessment is considered as having low uncertainty.

All traffic on the Haul Road and any crossroads contribute to the risk of road accidents with the project area. The largest contributor to this traffic during the life of the project will be the trucking of ore from the

Beaver Dam Mine Site to the Touquoy Mine Site. Because the other sources of road traffic are much smaller, the cumulative effects are essentially the same as those of the proposed project. Without the Beaver Dam Project, the cumulative effects would therefore be smaller. The principal assumption behind this assessment is that local road usage will not change in any important way during the life of the Beaver Dam Project. This assumption is considered as having a low uncertainty.

8.5.7.3 Mitigation

To mitigate the adverse effects on the use of surface waters and the fish that inhabit them for traditional purposes, the proponent has committed to identifying culverts that are currently in disrepair and removing/upgrading them where required.

The proponent is committed to engaging in wetland compensation activities for the wetland loss associated with the project as required by the provincial wetland alteration process (see Section 6.8.7). Wetlands compensation is also planned for the losses resulting from the Touquoy Gold project (CRA 2007).

The mitigation of the effects on land use and resources for traditional purposes originating from regional forestry and land management practices falls outside the scope of the project proponent's authority and responsibility.

A potential adverse effect is related to a risk for mobile vehicle accidents along the Haul Road, in particular at the Hwy 224 crossing. Speed limit and right-of-way signage will be installed and all haul truck operators will receive operator training to minimize the risk of collisions. Intersection requirements and additional mitigation measures will be determined through discussions with NSTIR.

8.5.7.4 Residual Cumulative Effects and Significance Assessment

A significant cumulative effect is defined as a disturbance to or destruction of land and resources utilized by Indigenous Peoples, including potable water, surface water, fish, plants, and animals in the area of the mine site due to construction, operations, or accidents and malfunctions. A significant cumulative effect is also defined as a negative effect to health or socio-economic conditions for Indigenous Peoples.

Assuming that the proposed compensation measures are applied for both the Beaver Dam project and the Touquoy Gold Project and that they achieve their objectives, the predicted residual cumulative effects on Indigenous Peoples with regards to indirect effects from impacts to water quality, wetland habitats, and road safety, are assessed to be adverse, but not significant (Table 8.5-7).

Historical and current land use with the region has undeniably affected the local habitats in ways that have affected the local distribution and abundance of several species of flora and fauna.

Table 8.5-9 Residual Cumulative Environmental Effects on the Mi'kmaq of Nova Scotia

Residual Adverse Cumulative Effects (After Mitigation)	Significance Levels						Overall Significance of Residual Adverse Effects (and Rationale)
	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	
Effects to Indigenous Peoples and their traditional land use as a result from impacts to water quality, wetland habitats, and road safety.	M Mitigation and best management strategies reduce magnitude of impact.	PA/LAA Direct cumulative effects within PA, indirect cumulative effects within LAA	A Seasonal windows applicable.	LT Effects may extend beyond 3 years.	R VC interaction will occur regularly.	R VC interaction will recover to baseline after Project activities are completed.	**Moderate Adverse Effect** **(Not Significant)** Assuming that the proposed compensation measures are applied for both the Beaver Dam project and the Touquoy Gold Project and that they achieve their objectives, the predicted residual cumulative effects on Indigenous Peoples with regards to indirect effects from impacts to water quality, wetland habitats, and road safety, are assessed to be adverse, but not significant.
Legend (refer to Table 5.10-1 for definitions)	Magnitude N Negligible L Low M Moderate H High	Geographic Extent PA Project Area LAA Local Assessment Area RAA Regional Assessment Area	Timing N/A Not Applicable A Applicable	Duration ST Short-Term MT Medium-Term LT Long-Term P Permanent	Frequency O Once S Sporadic R Regular C Continuous	Reversibility R Reversible IR Irreversible	

8.5.7.5 Follow-up and Monitoring Programs

The monitoring and follow-up of the residual cumulative effects, primarily caused by past and ongoing forestry practices, falls outside the scope of the project proponent's authority and responsibility.

However, follow-up and monitoring of the site reclamation program for the mine site will need to be undertaken. In addition, it is expected that the development of benefit agreement(s) and implementation of the overall Mi'kmaq engagement strategy with regards to the Beaver Dam Project, see Section 6.14.10, will include regular review of compliance and effects monitoring programs associated with other VCs, as well as monitoring of Project benefits to the Mi'kmaq of Nova Scotia.

8.6 Cumulative Effects Summary

A Cumulative Effects Assessment was carried out in order to meet the general requirements of the CEAA 2012, as well as the specific requirements laid out in the *Guidelines for the Preparation of an Environmental Impact Statement pursuant to the Canadian Environmental Assessment Act, 2012* and *Nova Scotia Registration Document pursuant to the Nova Scotia Environment Act – Beaver Dam Mine – Atlantic Gold Corporation*.

The VCs included in the Cumulative Effects Assessment into consideration were the following:

- Physical Environment
  - Air
  - Surface Water Quality and Quantity.
- Biophysical Environment
  - Wetlands
  - Fish and Fish Habitat
  - Birds
  - Species of Conservation Interest and Species at Risk
- Socio-Economic Environment
  - Indigenous Peoples

Major industrial projects that have or are taking place within a 35 km radius of the PA were identified. The following projects were considered as having cumulative effects on at least one VC:

- Past mining activities
- Regional Forestry Operations (Current, Past and Future)
- Touquoy Gold Project
- Cook's Brook Sand and Gravel Pit
- ScoZinc Ltd.
- National Gypsum
- Murchyville Gypsum Quarry
- Tangier Gold Mine
- Dufferin Gold Mine
- Taylor Lumber Co. Ltd.

- Great Northern Timber
- Gaetz Brook Wind Farm
- Mosher Limestone
- Fifteen Mile Stream Gold Project
- Cochrane Hill Gold Project (use of the Touquoy Mine Site)
- Sheet Harbour Quarry
- New mining operations (hypothetical)

The main conclusions of the Cumulative Effects Assessments are as follows:

- The proposed project contributes very little to the overall cumulative effects of regional industry to GHG emissions.
- The cumulative effects to surface water quality and to fish and fish habitat, including priority fish species are not expected to be significant, particularly considering that the proponent has committed to identifying culverts along the Haul Road that are currently in disrepair and removing/upgrading them where required. These cumulative effects also apply to the use of the surface water bodies and the fish inhabiting them by the Mi'kmaq of Nova Scotia.

- The loss of wetlands from the Touquoy Gold Project (543,779 m^2) is cumulative with the wetland losses at the Beaver Dam Mine site (221,080 m^3) and along the Haul Road (23,565 m^2) for a total loss of 788,424 m^2. The majority of this loss (69 %) comes from the losses connected to the Touquoy Gold Project. In the absence of the Beaver Dam Project, the cumulative effects would be the 543,779 m^2 loss of habitat from the Touquoy Gold Project

- Overall, the generalized disturbance of the landscape by forestry activities, past, present and future are the main source of cumulative effects of habitats, flora, terrestrial fauna and birds throughout the area. These cumulative effects also lead to effects on current use of land and resources for traditional purposes by indigenous peoples and to effects to priority species (SOCI and SAR). As the Beaver Dam Mine site only contributes to a minority portion of the overall mining activities footprint, and because these effects are considered small compared to the generalized disturbance of the landscape by forestry activities, the cumulative effects with and without the project would be very similar at the regional level.
- All traffic on the Haul Road and any crossroads contribute to the risk of road accidents with the project area. This leads to effects to terrestrial fauna and health of both Indigenous and non-indigenous peoples. The largest contributor to this traffic during the life of the project will be the trucking of ore from the Beaver Dam Mine Site to the Touquoy Mine Site.

Once the mitigation measures are taken into account, there are no significant residual cumulative effects anticipated for air, surface water, wetlands and fish and fish habitat.

Historical and current land use within the region has undeniably affected the local habitats in ways that have affected the local distribution and abundance of several species of flora terrestrial fauna and birds, including SOCI and SAR. However, the mitigation of the effects originating from regional forestry and land management practices falls outside the scope of the project proponent's authority and responsibility.

The predicted residual cumulative effects on Indigenous Peoples with regards to indirect effects from impacts to water quality, wetland habitats, and road safety, are assessed to be adverse, but not significant. The significant residual effects of historical and current land use within the region to the local distribution and abundance of several species of flora and fauna has presumably affected there use for traditional purposes.

A summary of the cumulative effects assessment is provided in Section 10.Summary of Compliance and Effects Monitoring Programs

9 Environmental Impact Statement Summary and Conclusions

9.1 Environmental Follow-Up Program

The Proponent understands that monitoring is a mechanism to gauge Project performance and measure against baseline conditions and effects as predicted in the EA, as well as expectations of regulators, the public, the Mi’kmaq of Nova Scotia and interested parties. Results of programs will be documented and where appropriate, summaries of compliance and effects monitoring programs will be available via stakeholder and Mi’kmaq engagement mechanisms, such as CLC. The CLC provides a mechanism to disseminate follow-up results and to share data.

The CLC is one of the primary opportunities for Atlantic Gold to include the participation of the local community, including First Nations communities wherever possible, during development and implementation of the Project. Beyond the CLC, Atlantic Gold will engage with local community groups and the Mi’kmaq of Nova Scotia, as well as sharing information with the pubic. The Proponent recognizes the inherent value in an open and flexible approach to engagement and monitoring. The Proponent views engagement and monitoring programs as dynamic and not static, such as collection of data, review of data, and refinement of programs, as well as mechanisms to share the results of programs. Atlantic Gold’s approach to engagement is presented in Sections 3 and 4 of the EIS.

Prior to the start of construction activities, monitoring programs for select VCs will be undertaken. These monitoring programs will be undertaken to further design the mitigation measures that will be required during the construction phase of the Project, as well as defining sampling program components, locations, frequency, and parameters related to the MDMER program and related to the other permitting, such as those required for wetland and watercourse alterations.

The results of follow-up monitoring programs will be provided to regulators as per the conditions of the EA and other approvals and permits. The CLC and other interested stakeholders will be informed of the results of the follow-up programs, and will be involved in the planning and implementation of these programs, where deemed appropriate.

In the event that an unexpected deterioration of the environment is observed, the results will be discussed with regulators and mitigation programs and operational practices will be reviewed to determine the appropriate course of action.

9.2 Environmental Monitoring Plans

The Proponent recognized that the responsibility for all monitoring programs and mitigation commitments ultimately rest with Atlantic Gold. Many aspects of monitoring and mitigation that will occur during all phases of the Project (earthworks, construction, well installation, etc.) may be conducted through a subcontract but Atlantic Gold ultimately has responsibility for implementing mitigation and monitoring strategies committed to in the EIS and for items added by regulators.

Attached to this EIS in Appendix O.1 is a Preliminary Environmental Effects Monitoring Program, outlining the proposed monitoring programs for the Project. The VCs that will are proposed to be included in the environmental follow-up program include noise, air, sediment, groundwater, surface water, wetlands, fish and fish habitat, habitat and flora, birds, and SAR and SOCI. The Proponent is committed to involvement of the Mi'kmaq in monitoring programs for the Project.

The follow-up monitoring programs may be implemented up to one year prior to the start of construction; however, details of these programs will be determined following discussions with regulators. Pre-construction monitoring will be completed based on seasonality as required (e.g., breeding seasons, winter track surveys, vegetation surveys, etc.).

The Proponent also recognizes that there may be additional requirements identified in approvals, such as the Industrial Approval that would be applied for from the Province of Nova Scotia through Part V – Approvals. Monitoring reports will be completed at a frequency determined by NSE. This is anticipated to be annual based on the existing IA for the Touquoy Gold Project. The regulatory agencies will provide guidelines for preparing monitoring reports, such as the number, content, frequency, and format.

In the event that non-compliance with regulatory requirements is observed, operational practices and compliance programs will be reviewed to determine the appropriate course of action.

10 Environmental Impact Statement Summary and Conclusions

10.1 Summary of the Environmental Impact Statement

As described throughout the EIS, Project-environment interactions are expected to occur throughout the life of the Project during the construction, operations, reclamation and decommissioning, and post-closure phases. These interactions are expected and are typical of environmental impacts associated with mineral extraction projects in the region.

Given the considerations identified above and based on significant baseline studies completed for each of the identified VCs, the Project is not predicted to result in any significant adverse environmental effects after mitigation measures have been applied. Monitoring programs will proceed to gather pre-construction data for select VCs. This data will be used to refine mitigation measures and monitoring programs for the construction, operation, reclamation and decommissioning, and post-closure phases. Monitoring programs will continue throughout the life of the Project to verify baseline conditions and to determine the effects of the Project on the surrounding environment.

A summary of the potential adverse residual effects associated with the Project, and their associated significance, and the Project's cumulative effects is summarized in Table 10.1-1 and Table 10.1-2. Key mitigation measures that will specifically mitigate the potential adverse residual effects are summarized in Table 10.1-3. Proposed mitigation measures are described in greater detail in the effects assessment for each individual VC in Section 6.

The Proponent acknowledges that responsibility for all mitigation commitments ultimately rest with Atlantic Gold.

Table 10.1-1 Residual Cumulative Effects by VC

Valued Component Affected	Area of Federal Jurisdiction	Potential Effects of the Project on the Environment	Mitigation and Compensation Measures	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
				Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Noise		Construction – Beaver Dam Mine Site and Haul Road (Noise from haul trucks, Haul Road widening and construction, and from blasting and drilling of in-situ rocks	Additional mitigation measures as described in Table 10-3	M	LAA	N/A	MT	R	R	Increased ambient noise	Not significant
		Operational – Beaver Dam Mine Site, Haul Road, and Touquoy Mine Site at Points of Reception (Noise from haul trucks, from blasting and drilling of in-situ rocks and the crushing of ore)		L	LAA	N/A	LT	R	R		
		Operational – Haul Road at Property Lines (Noise from haul trucks, and site vehicles)		M	LAA	N/A	LT	R	R		
		Operational – Beaver Dam Mine Site at Property Lines (Noise from blasting, crushing of ore, heavy machinery operation, and site vehicles)		H	LAA	N/A	LT	R	R		
		Operational – Touquoy Mine Site at Property Lines (Noise from blasting, crushing of ore, heavy machinery operation, and site vehicles)		N	LAA	N/A	LT	R	R		
		Reclamation – Beaver Dam Mine Site (heavy machinery operation for infilling of pit, reclaiming stockpiles, etc.)		L	LAA	N/A	MT	R	R		
Air	-	Construction – Beaver Dam Mine Site and Haul Road (Dust from haul trucks, Haul Road widening and construction, and on-site operations and material handling)	Commitment to 75% effective dust control on the Haul Road during operations to minimize dust Additional mitigation measures as described in Table 10-3	N	LAA	N/A	MT	R	R	Increased ambient dust	Not Significant
	-	Operational – Beaver Dam Mine Site and Touquoy Mine Site at Property Lines (Dust from onsite activities, vehicle travel, material handling and the crushing of ore)		N	LAA	N/A	LT	R	R		
	-	Operational – Beaver Dam Mine Site and Touquoy Mine Site at Points of Reception (Dust from onsite activities, vehicle travel, material handling and the crushing of ore)		N	LAA	N/A	LT	R	R		
	-	Operational – Haul Road at Property Lines (Dust from haul trucks)		H	LAA	N/A	LT	R	R		

Valued Component Affected	Area of Federal Jurisdiction	Potential Effects of the Project on the Environment	Mitigation and Compensation Measures	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
				Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
	-	Operational – Haul Road at Points of Reception (Dust from haul trucks)		L	LAA	N/A	LT	R	R		
		Reclamation – Beaver Dam Mine Site (heavy machinery operation for infilling of pit, reclaiming stockpiles, etc.)		N	LAA	N/A	MT	R	R		
Light	-	Construction – Beaver Dam Mine Site and Haul Road (Lights from haul trucks, site lighting)	Additional mitigation measures as described in Table 10-3	N	LAA	A	MT	S	R	Increased ambient light	Not significant
		Operational – Beaver Dam Mine Site, Haul Road, Touquoy Mine Site (Lights from haul trucks, site lighting)		N	LAA	A	LT	S	R		
		Operational – Beaver Dam Mine Site, Haul Road (Light at sensitive receptors)		N	LAA	A	LT	S	R		
		Operation – Touquoy Mine Site (site lighting)		N	LAA	A	LT	S	R		
		Reclamation – Beaver Dam Mine Site (Lights from haul trucks and site vehicles, site lighting)		N	LAA	A	MT	S	R		
Greenhouse Gases	-	Construction – Beaver Dam Mine Site and Haul Road (Haul Road widening and construction, use of heavy machinery, haul trucks and site vehicle emissions)	Mitigation measures as described in Table 10-3	L	RAA	N/A	MT	S	IR	Increased greenhouse gas emissions	Not significant
		Operational – Beaver Dam Mine Site, Haul Road, Touquoy Mine Site (Emissions from haul trucks, site vehicles, heavy machinery, blasting and drilling of in-situ rocks)		L	RAA	N/A	LT	S	IR		
		Reclamation – Beaver Dam Mine Site (Emissions from haul trucks, site vehicles, heavy machinery,		L	RAA	N/A	MT	S	IR		
Geology, Soil, and Sediment Quality	-	Construction and Operational – Beaver Dam Mine Site (exposure of acid generating material, impacted soil/sediment through migration of contaminants, downstream sediment quality, and sediment quality impacts)	Mitigation measures as described in Table 10-3	L	LAA	A	LT	S	IR	Soil and sediment quality, increased dust impact (i.e. flora and fauna/habitat, human health, etc.)	Not significant
		Construction and Operational – Haul Road (Haul Road widening and construction, trucking activity, and sediment quality impacts)		L	PA	N/A	MT	O	IR	Erosion, soil and sediment quality	Not significant

Valued Component Affected	Area of Federal Jurisdiction	Potential Effects of the Project on the Environment	Mitigation and Compensation Measures	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
				Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
		Operational – Touquoy Mine Site (soil/sediment quality)		L	LAA	A	LT	S	IR	Soil and sediment quality, increased dust impact (i.e. flora and fauna/habitat, human health, etc.)	Not significant
		Reclamation – Beaver Dam Mine Site (reclaiming/spreading stockpiles, soil/sediment quality, accidents/malfunctions)		L	LAA	A	MT	S	IR	Impact soil and sediment quality, increased dust impact (i.e. flora and fauna/habitat, human health, etc.)	Not significant
Groundwater Quality and Quantity	-	Construction – Beaver Dam Mine Site and Haul Road (Surface Water Alteration resulting in reduction of recharge to groundwater, blasting effects on GW, elevated nitrogen in GW from blasting residue)	Mitigation measures as described in Table 10-3	M	PA	N/A	LT	R	PR	Reduction in Water Quantity	Not Significant
		Post-Closure – Beaver Dam Mine Site (Groundwater seepage from stockpiles discharge to surface water (Mud Lake, outlet watercourse from Mud Lake, Crusher Lake))		L	PA	N/A	LT	R	PR		
Surface Water Quality and Quantity	-	Construction – Beaver Dam Mine Site and Haul Road (Direct loss of habitat)	Mitigation measures as described in Table 10-3	M	PA	A	P	R	IR	Disturbance, Habitat Loss	Not Significant
		Construction – Beaver Dam Mine Site and Haul Road (Indirect changes in hydrology, water quality, and impacts from blasting)		L	PA	A	MT	S	R	Change in Water Quality Disturbance	Not Significant
		Operational – Beaver Dam Mine Site (Drawdown from pit dewatering and resulting predicted reduction in baseflow of Cameron Flowage (Killag River))		L	LAA	A	LT	R	R	Change in hydrology in Cameron Flowage/Killag River	Not Significant
		Operational – Beaver Dam Mine Site (Surface water quality of Killag River from effluent discharge through north settling pond and groundwater seepage)		N	LAA	A	P	R	IR	Change in water quality in the Killag	Not significant
		Operational – Beaver Dam Mine Site (Reduction in surface flow to WC-5)		H	PA	A	P	C	IR	Disturbance	Not Significant
		Operational – Beaver Dam Mine Site (Reduction in surface flow to Mud Lake and Crusher Lake)		L	PA	A	LT	C	PR		

Valued Component Affected	Area of Federal Jurisdiction	Potential Effects of the Project on the Environment	Mitigation and Compensation Measures	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
				Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
		Operational – Beaver Dam Mine Site (Blasting and drilling of in-situ rock)		L	PA	A	ST	R	R		
		Operations Beaver Dam Mine Site and Haul Road (Release of non-mine-contact surface water to receiving waters resulting in reduction in water quality)		L	LAA	A	LT	S	R		
		Closure – Beaver Dam Mine Site (Surface water quality of Killag River from pit from effluent discharge)		N	LAA	N/A	P	R	IR		
		Closure – Beaver Dam Mine Site (Reduction in water quantity in Killag due to surface water flows directed to pit to facilitate pit filling)		L	LAA	A	LT	R	R	Change in hydrology in Cameron Flowage/Killag River	Not Significant
		Closure – Touquoy Mine Site (Storage of Beaver Dam tailings in the Touquoy open pit mine and surface water quality of Moose River from effluent discharge and groundwater seepage)		N	LAA	A	P	R	IR	Disturbance	Not Significant
Wetlands	-	Construction – Beaver Dam Mine Site and Haul Road (clearing and grubbing, direct wetland alteration, and widening and new Haul Road construction)	Mitigation measures as described in Table 10-3	H	PA	A	P	O	IR	Habitat Loss and disturbance	Not Significant
		Operational – Beaver Dam Mine Site (groundwater drawdown and surface water quantity)		M	LAA	A	LT	R	PR	Disturbance	Not significant
		Operational – Haul Road (surface water quantity)		L	LAA	A	LT	S	R		
		Post Closure – Touquoy Mine Site (altered hydrology in Moose River and associated riparian wetlands)		N	LAA	A	P	R	R		
	-	Reclamation – Beaver Dam Mine Site (wetland restoration)		M	PA	A	ST	R	R	N/A	Not Significant
Fish and Fish Habitat	☑ 5(1)(a)(i)	Construction – Beaver Dam Mine Site and Haul Road (direct watercourse alteration)	Mitigation measures as described in Table 10-3	L	LAA	A	P	O	IR	Habitat Loss and Disturbance	Not Significant
		Construction – Beaver Dam Mine Site and Haul Road (clearing and grubbing, altered hydrology, and altered surface water quality)		N	LAA	A	MT	S	PR	Disturbance	Not Significant

Valued Component Affected	Area of Federal Jurisdiction	Potential Effects of the Project on the Environment	Mitigation and Compensation Measures	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
				Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
		Construction – Haul Road (Haul Road culvert repairs/replacement)		H	RAA	N/A	P	O	PR	Increased habitat connectivity	Significant
		Operational – Beaver Dam Mine Site (indirect impacts including: groundwater drawdown, altered surface water hydrology, altered surface water quality)		L	LAA	A	P	R	IR	Habitat Loss and Disturbance	Not Significant
		Operational – Beaver Dam Mine Site (indirect impacts to WC-5, Mud Lake, and Crusher Lake from adjusted surface water flow)		M	PA	A	P	O	IR	Loss of habitat and disturbance	Not Significant
		Operational – Haul Road (surface water quality)		N	LAA	A	LT	S	R	Disturbance	Not Significant
		Post Closure – Beaver Dam Mine Site (surface water quality)		N	LAA	A	P	R	R	Water quality	Not Significant
		Operational and Post Closure – Touquoy Mine Site (altered surface water hydrology and surface water quality)		N	LAA	A	P	R	R	Water quality	Not Significant
		Reclamation – Beaver Dam Mine Site (wetland restoration)		N	PA	A	ST	O	R	N/A	Not Significant
Habitat and Flora	-	Construction – Beaver Dam Mine Site and Haul Road (clearing and grubbing, and Haul Road widening and construction)	Mitigation measures as described in Table 10-3	H	PA	N/A	P	O	PR	Disturbance and loss of habitat	Not Significant
		Operational – Beaver Dam Mine Site, Haul Road and Touquoy Mine Site (dust from haul trucks, heavy machinery, and crushing of ore)		M	LAA	N/A	LT	S	R	Disturbance	Not Significant
		Reclamation – Beaver Dam Mine Site (grubbing piles spread)		N	LAA	N/A	MT	O	R	Disturbance, habitat gained	Not Significant
Terrestrial Fauna	-	Construction – Beaver Dam Mine Site and Haul Road (habitat loss and fragmentation from clearing and grubbing and disturbance (noise, light, and wildlife vehicle collisions) from construction activities)	Mitigation measures as described in Table 10-3	M	LAA	A	LT	O	PR	Disturbance and loss of habitat	Not Significant
		Operational – Beaver Dam Mine Site, Haul Road and Touquoy Mine Site (disturbance (light and wildlife vehicle collisions) from haul trucks and heavy machinery)		L	LAA	A	LT	R	R	Disturbance	Not Significant

Valued Component Affected	Area of Federal Jurisdiction	Potential Effects of the Project on the Environment	Mitigation and Compensation Measures	Residual Environmental Effects Characteristics: Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Residual Effect	Significance of Residual Effect
		Operational – Beaver Dam Mine Site, Haul Road and Touquoy Mine Site (Noise disturbance from haul trucks, heavy machinery, and, crushing of ore)		H	LAA	A	LT	R	R		
	-	Reclamation – Beaver Dam Mine Site (disturbance (noise, light, and wildlife vehicle collisions) from construction activities)		L	LAA	A	MT	O	R	Disturbance, habitat gained	Not Significant
Birds	☑ 5(1)(a)(iii)	Construction – Beaver Dam Mine Site and Haul Road (loss of habitat from clearing and grubbing and disturbance (noise, light and wildlife vehicle collisions) from construction activities)	Mitigation measures as described in Table 10-3	M	LAA	A	MT	O	PR	Disturbance and Habitat Loss	Not Significant
		Operational – Beaver Dam Mine Site and Haul Road (disturbance from light and wildlife vehicle collisions) from haul trucks and heavy machinery)		L	LAA	A	LT	R	R	Disturbance	Not Significant
		Operational – Beaver Dam Mine Site and Haul Road (noise disturbance from haul trucks, heavy machinery, and, crushing of ore)		H	LAA	A	LT	R	R		
		Operational – Touquoy Mine Site (Tailings deposited in Touquoy Mine Site open pit)		L	PA	A	LT	R	PR	Contamination	Not Significant
		Reclamation – Beaver Dam Mine Site (disturbance (noise, light, dust and wildlife vehicle collisions) from construction activities)		L	LAA	A	MT	O	R	Disturbance, habitat gained	Not Significant
Species of Conservation Interest and Species at Risk	☑ 5(1)(a)(ii)	Construction – Beaver Dam Mine Site and Haul Road (direct watercourse alteration)	Mitigation measures as described in Table 10-3	M	LAA	A	P	O	IR	Habitat Loss and Disturbance	Not Significant
	☑ 5(1)(a)(ii)	Operational – Beaver Dam Mine Site (indirect impacts to WC-5 from adjusted surface water flow)		H	PA	A	P	O	IR		
Indigenous Peoples	☑ 5(1)(c)	Construction - Beaver Dam Mine Site and Haul Road (Direct effect on archaeological resources and burial site)	Mitigation measures as described in Table 10-3	N	PA	N/A	ST	O	IR	None	Not Significant
		Construction - Beaver Dam Mine Site and Haul Road		M	PA	A	ST	O	IR	Loss of plant specimens, habitat loss	Not Significant

Valued Component Affected	Area of Federal Jurisdiction	Potential Effects of the Project on the Environment	Mitigation and Compensation Measures	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
				Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
		(Direct habitat loss, including wetlands, and loss of plants of significance to the Mi'kmaq)									
		Construction and Operations - Beaver Dam Mine Site and Haul Road (direct and indirect impacts to fish and fish habitat)		L	PA/LAA	A	LT	O/S	IR	Loss of fish habitat, change in water quality/quantity	Not Significant
		Construction and Operations - Beaver Dam Mine Site and Haul Road (direct and indirect impacts to fauna- loss of habitat; noise and fragmentation)		M	PA/LAA	A	LT	O/R	PR	Loss of habitat, potential changes in species movement patterns	Not Significant
		Construction and Operation - Beaver Dam Mine Site, Haul Road and Touquoy Mine Site (Predicted Noise levels and potential interaction with traditional practices surrounding the Project)		H	LAA	N/A	LT	S	R	Sensory Disturbance	Not Significant
		Operations and Closure - Beaver Dam Mine Site (Predicted Visual Assessment for Beaver Lake IR)		L	LAA	A	P	C	IR	Visual change	Not Significant
		Construction and Operation - Beaver Dam Mine Site, Haul Road and Touquoy Mine Site (Predicted Light levels and potential interaction with traditional practices surrounding the project)		M	LAA	A	LT	S	R	Sensory Disturbances	Not Significant
		Operation - Haul Road (Predicted Dust Deposition in lands surrounding the Project)		H	LAA	A	LT	S	PR	Aesthetics effect	Not Significant
		Operation - Haul Road (Predicted change in traffic volumes and vehicle types at Highway 224 junction with Haul Road)		L	PA	N/A	LT	R	R	Increased Vehicle Traffic at Junction	Not Significant
		Construction, Operation and Closure - Beaver Dam Mine Site, Haul Road, and Touquoy Mine Site (Restriction and loss of access during construction and operations of the Mine (approx. 8 years))		L	LAA	N/A	MT	R	R	Loss of Access	Not Significant
		Construction, Operation and Closure - Beaver Dam Mine Site, Haul Road, and Touquoy Mine Site (Construction and operations of the Mine (approx. 8 years))		H	RAA	N/A	LT	C	R	Benefits to the Mi'kmaq	Not Significant

Valued Component Affected	Area of Federal Jurisdiction	Potential Effects of the Project on the Environment	Mitigation and Compensation Measures	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
				Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Physical and Cultural Heritage	-	Construction – Beaver Dam Mine Site and Haul Road (Identification and/or damage to physical and cultural heritage resources – Site 6)	Mitigation measures as described in Table 10-3	M	PA	N/A	P	O	IR	Loss of Resource	Not Significant
Socioeconomic Conditions	-	Construction – Beaver Dam Mine Site and Haul Road (Interior road network upgrades)	Mitigation measures as described in Table 10-3	M	PA	N/A	P	O	IR	Upgrade to interior road network	Not significant
	-	Construction, Operational, and Reclamation – Beaver Dam Mine Site and Haul Road (Direct and indirect employment opportunities)		M	RAA	N/A	LT	C	R	Employment opportunities	Not significant
	-	Construction and Operational – Beaver Dam Mine Site and Haul Road (Restriction of recreational activities within the PA, haul truck activity, potential mobile equipment accidents)	•	L	PA	N/A	LT	C	R	Disturbance to recreational usage of site	Not significant

Legend (refer to Table 5.10-1 for definitions)

Nature of Effect	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
A Adverse	N Negligible	PA Project Area	N/A Not Applicable	ST Short-Term	O Once	R Reversible
P Positive	L Low	LAA Local Assessment Area	A Applicable	MT Medium-Term	S Sporadic	IR Irreversible
	M Moderate	RAA Regional Assessment Area		LT Long-Term	R Regular	PR Partially Reversible
	H High			P Permanent	C Continuous	

Table 10.1-2 Summary of Cumulative Effects Assessment

PROJECT VC	ANALYSIS OF EFFECTS			MITIGATION	RESIDUAL CUMULATIVE EFFECTS	SIGNIFICANCE	FOLLOW-UP AND MONITORING PROGRAMS
	RESIDUAL EFFECTS OF PROPOSED PROJECT	EFFECTS OF OTHER PROJECTS IN THE AREA	CUMULATIVE EFFECTS				
PHYSICAL ENVIRONMENT							
Air	• Increased ambient dust	• Local forestry industry has the potential to have cumulative effects on air quality. • Trucking operations associated with the Fifteen Mile Stream Gold Project (2021 to 2026) and Cochrane Hill Gold Projects (2022 to 2027) will generate dust along the Beaver Dam haul road west of Highway 124.	• Forestry operations likely to only occasionally coincide with Beaver Dam Mine operations and cause greater disturbance to air quality, especially along the haul road. Such additive periods are likely to be limited in duration and frequency and are not expected to be significant. • From 2022 to 2026 the concurrent operation of the Beaver Dam Min Project, Fifteen Mile Stream Gold Project, and Cochrane Hill Gold Project, and in particular the use of the portion of the Beaver Dam haul roads west of the Highway 224 to transport gold concentrate to the Touquoy processing site, will result in the potential for additive cumulative effects to air quality through increased ambient dust levels in the PA along the Haul Road.	• No additional mitigation measures	• Moderate Adverse Effect	• Not significant	• No additional follow-up or monitoring

PROJECT VC	ANALYSIS OF EFFECTS			MITIGATION	RESIDUAL CUMULATIVE EFFECTS	SIGNIFICANCE	FOLLOW-UP AND MONITIORING PROGRAMS
	RESIDUAL EFFECTS OF PROPOSED PROJECT	EFFECTS OF OTHER PROJECTS IN THE AREA	CUMULATIVE EFFECTS				
Surface Water Quality and Quantity	• Change in Water Quality • Habitat Loss and disturbance • Change in hydrology in Cameron Flowage/Killag River	• Surface water quantity will be affected by the processing of the ore from Beaver Dam Mine, Fifteen Mile Stream mine and the Cochrane Hill mine at the Touquoy facility in that an additional period of surface water extraction will be required. The amount of surface water extraction required for the Fifteen Mile Stream Gold Project and the Cochrane Hill Gold Project is anticipated to be similar to the amount required for processing the Beaver Dam ore. • Assuming that the mitigation measures to control erosion and sedimentation are applied, significant adverse effects from construction and operation of the Touquoy Project are not anticipated on surface water resources. • Local forestry industry has the potential to have cumulative effects on water quality.	• Potential for reduced streamflow from Scraggy Lake to the Fish River system resulting from cumulative effect of the Beaver Dame Mine Project, Fifteen Mile Stream Gold Project, and Cochrane Hill Gold Project. • Potential for additional effects from the Beaver Dam project to the water courses crossed by the haul road. • Potential for increased accidents and collisions along the haul road that could result in spills that could affect surface water quality due to increased truck traffic during concurrent operation of the Beaver Dam Min Project, Fifteen Mile Stream Gold Project, and Cochrane Hill Gold Project.	• Identify culverts that are currently in disrepair and remove/upgrade where required during the construction phase. • Implement appropriate erosion and sedimentation controls	• Minor Adverse Effect ▪ Potential for residual cumulative effects to all surface water systems along Haul Road. ▪ However, the proposed improvements to the culverts in disrepair should improve existing surface water conditions at the affected locations.	• Not significant	• No additional follow-up or monitoring
BIOPHYSICAL ENVIRONMENT							
Wetlands	• Habitat loss and disturbance	• Touquoy Gold Project development will result in the removal of 4.33 ha of wetlands (four wetlands and a small portion of a fifth wetland) located within the proposed Project area. • Stressors relating to forestry activities (i.e., clearcutting, rutting, roads and the presence of skidder tracks) observed in several wetlands within the Project area.	• The total cumulative impacts on wetlands following the construction of the Beaver Dam Project are a direct loss of 287,945 m² of wetlands and disturbance to wetlands through stressors caused other activities (predominantly forestry operations). In the absence of the Beaver Dam Project, the cumulative effects would be the 43,300 m² loss of habitat from the Touquoy Gold Project.	• Wetland compensation activities will be carried out for the wetland loss associated with the Project, as required by the provincial wetland alteration process. • Wetlands compensation is also planned for the losses resulting from the Touquoy Gold project. • The goal of the compensation activities is to achieve no net loss of wetland function.	• Minor Adverse Effect ▪ No net loss of wetland function through wetland compensation activities.	• Not significant	• No additional follow-up or monitoring

PROJECT VC	ANALYSIS OF EFFECTS			MITIGATION	RESIDUAL CUMULATIVE EFFECTS	SIGNIFICANCE	FOLLOW-UP AND MONITORING PROGRAMS
	RESIDUAL EFFECTS OF PROPOSED PROJECT	EFFECTS OF OTHER PROJECTS IN THE AREA	CUMULATIVE EFFECTS				
Fish and Fish Habitat	• Habitat loss and disturbance • Decreased water quality	• The effects of the Touquoy Gold Project on Fish and their habitat are those summarized for the effects of the project on surface water quality. • Local forestry industry has the potential to have cumulative effects on water bodies, and therefore fish and fish habitat, through the use of haul roads.	• Since the adverse effects observed with regards to the existing haul road will be reduced by the removal and replacement of the poorly installed culverts along this road and the Touquoy Gold project is not a source of significant adverse effects on fish habitat, no cumulative effects on fish habitat beyond the effects assessed for the Beaver Dam Project are anticipated. • In the absence of the Project, the conditions along the haul road are less likely to be improved. However the surface water effects assessed for the Beaver Dam Project would be avoided.	• No additional mitigation measures	• Minor Adverse Effect ▪ The proposed improvements to the culverts in disrepair that will occur as part of this Project will improve fish habitat connectivity and water quality. Furthermore the wetland restoration activities that will occur during the reclamation stage are anticipated to return the VC to its baseline conditions.	• Not significant	• No additional follow-up or monitoring

PROJECT VC	ANALYSIS OF EFFECTS			MITIGATION	RESIDUAL CUMULATIVE EFFECTS	SIGNIFICANCE	FOLLOW-UP AND MONITIORING PROGRAMS
	RESIDUAL EFFECTS OF PROPOSED PROJECT	EFFECTS OF OTHER PROJECTS IN THE AREA	CUMULATIVE EFFECTS				
Birds	• Disturbance and loss of habitat • Contamination	• Habitat throughout the region exhibits fragmented conditions related to current and historic timber harvesting activity. This has led to habitat fragmentation and an increase in young regenerating stands to the detriment of older undisturbed forest. • Potential impacts to migratory birds could include direct mortality or disruptions with potential to affect populations such as loss of habitat, habitat fragmentation or significant disruption of migration or reproduction through site development/clearing activities. • The trucking operations associated with the Fifteen Mile Stream and Cochrane Hill Gold Projects along the Beaver Dam haul road west of Highway 124 have the potential to impact birds from wildlife vehicle collisions, dust, noise, and accidents (e.g. spills). Noise generated from the additional truck activity can extend beyond the PA and affect the LAA. • Various projects having caused visible loss of wildlife habitat within the region have been identified. Overall, a small portion of the overall available bird habitat in the RAA has been lost due to regional activities.	• The increase in truck traffic from the use of a of the portion of the Beaver Dam haul road by Fifteen Mile Stream and Cochrane Hill Gold Projects has the potential to cause additive cumulative effects to birds from wildlife vehicle collisions, dust, noise, and accidents (e.g. spills). • The generalized disturbance of the landscape by forestry activities, past, present and future are the main source of cumulative effects to birds throughout the area. The largest adverse effects expected would be to species preferring undisturbed and unfragmented habitats. These effects are smaller than they would be in a landscape dominated by agriculture or urban development, which lead to a much greater, and often permanent, loss of natural habitat. • The overall footprint of mining activities, including the Beaver Dam and Touquoy sites, is quite small in relation to the available bird habitat within the region. None of these projects are expected to have direct effects on birds beyond their immediate surroundings.	• No additional mitigation measures	• Minor Adverse Effect ▪ The small proportion of regional bird habitat lost as a result of this Project will be restored during the reclamation stage.	• Not significant	• No additional follow-up or monitoring

PROJECT VC	ANALYSIS OF EFFECTS			MITIGATION	RESIDUAL CUMULATIVE EFFECTS	SIGNIFICANCE	FOLLOW-UP AND MONITIORING PROGRAMS
	RESIDUAL EFFECTS OF PROPOSED PROJECT	EFFECTS OF OTHER PROJECTS IN THE AREA	CUMULATIVE EFFECTS				
Species of Conservation Interest (SOCI) and Species at Risk (SAR)	• Habitat loss and disturbance	• Habitat throughout the region exhibits fragmented conditions related to current and historic timber harvesting activity. This has led to habitat fragmentation and an increase in young regenerating stands to the detriment of older undisturbed forest. • Some loss of moose habitat, although limited to the Project footprint, will occur. This area represents less than 1% of the moose habitat available in eastern Halifax County, and habitat quality on the Project site is marginal. • The trucking operations associated with the Fifteen Mile Stream and Cochrane Hill Gold Projects along the Beaver Dam haul road west of Highway 124 has the potential to impact SAR and SOCI from wildlife vehicle collisions, dust, noise, and accidents (e.g. spills). • Various projects having caused visible loss of wildlife habitat within the region have been identified. Overall, a small portion of the overall available bird habitat in the RAA has been lost due to regional activities.	• The cumulative effects to priority fish primarily result from the potential effects on watercourse as a result of road construction. Given that the adverse effects observed with regards to the existing haul road will be reduced by the removal and replacement of the poorly installed culverts, the final cumulative effects on American Eel and Atlantic salmon may be lower following the undertaking of the Beaver Dam Mine Project • Several species of priority terrestrial plans and lichens may be affected by the Beaver Dam Project as well as general habitat disturbances from historic and ongoing forestry activities that have likely had some effect on species that prefer undisturbed habitat, such as the priority lichens. • Habitat loss and disturbance, and traffic from other activities in the region contribute to the resulting cumulative effects to mainland Moose and snapping turtles.	• No additional mitigation measures	• Minor Adverse Effect ▪ The small proportion of regional habitat that supports priority species that would be lost as a result of this Project will be restored during the reclamation stage.	• Not significant	• No additional follow-up or monitoring
SOCIO-ECONOMIC ENVIRONMENT							

PROJECT VC	ANALYSIS OF EFFECTS			MITIGATION	RESIDUAL CUMULATIVE EFFECTS	SIGNIFICANCE	FOLLOW-UP AND MONITIORING PROGRAMS
	RESIDUAL EFFECTS OF PROPOSED PROJECT	EFFECTS OF OTHER PROJECTS IN THE AREA	CUMULATIVE EFFECTS				
Indigenous Peoples	• Loss of plant specimens and habitat • Loss of fish habitat • Change in species movement pattern • Sensory disturbance • Visual change • Increased Traffic • Loss of Access	• Habitat throughout the region exhibits fragmented conditions related to current and historic timber harvesting activity. • Effects of the Touquoy Gold Project on surface water, which can affect the use of surface water bodies and the fish inhabiting them by the Mi'kmaq of Nova Scotia • Effects of the Touquoy Gold Project on removal of wetlands and associated plant species of significance • The trucking operations associated with the Fifteen Mile Stream and Cochrane Hill Gold Projects along the Beaver Dam haul road west of Highway 124 have the potential to effect VCs of importance to Indigenous Peoples from wildlife vehicle collisions, dust, noise, and accidents • Various projects having caused visible loss of wildlife habitat within the region have been identified. Overall, a small portion of the overall available bird habitat in the RAA has been lost due to regional activities..	• Cumulative effects to priority fish primarily result from the potential effects on watercourse as a result of road construction. Can lead to effects on use of land and resources for traditional purposes, but will be reduced by the removal and replacement of the poorly installed culverts • Cumulative effects on habitats, flora, terrestrial fauna and birds can lead to effects on current use of land and resources for traditional purposes • Loss of wetlands and associated plant species of significance to Mi'kmaq • The long term effects of the projects are reduced by the long term reclamation and remediation, which will involve re-vegetation of the mine sites at the end of their operation. • Because the other sources of road traffic are much smaller, the cumulative effects are essentially the same as those of the proposed project. Without the Beaver Dam Project, the cumulative effects would therefore be smaller.	• No additional mitigation measures	• Moderate Adverse Effect ▪ Assuming that the proposed compensation measures are applied for both the Beaver Dam project and the Touquoy Gold Project and that they achieve their objectives, the predicted residual cumulative effects on Indigenous Peoples with regards to indirect effects from impacts to water quality, wetland habitats, and road safety, are assessed to be adverse, but not significant	• Not significant	• No additional follow-up or monitoring

Table 10.1-3 Summary of Key Mitigation Measures and Commitments

Valued Component Affected	Residual Effect	Mitigation and Compensation Measures
Noise	Increase in Ambient Noise	Minimize noise through: • Restrict blasting to a specific and regular daytime schedule during weekdays • Communicate general blasting schedule to the local community • Consider placement of stockpiles and infrastructure to mitigate noise migration from processing equipment • Consider the use of natural landforms when available as noise barriers when designing final site details and when placing fixed equipment • Operating hours for processing plants and trucking on the Haul Road will be limited to reduce nighttime noise levels • Regular check by site manager for excessive noise on site and in relation to sensitive receptors so that resolution can be timely • Implement preventative maintenance plans for all mobile and stationary equipment • Noise-reduction as criteria in equipment selection • Speed reduction • Use equipment that meets appropriate noise emission standards for off-road diesel equipment • Subcontractor agreements will include an obligation to comply with environmental protection including noise reduction • Site design to reduce need for reversing and vehicle reversing alarms A procedure, including a response plan, will be available for public to be able to register complaints regarding noise concerns
Air	Reduction in Ambient Air Quality	Minimize dust through: • Use wet suppression controls on unpaved surfaces • Maintaining hardened surfaces where practical • Utilize paved surfaces where available • Speed reduction • Apply stabilized covers on inactive stockpiles • Apply dust suppressants, when and where practicable, to target 75% effectiveness • Size haul vehicles appropriately to minimize trip frequency • Implement appropriate dust suppression measures for crusher trains and associated activities/stockpiles • Cover haul trucks to minimize dust during transportation between the mine site and the Touquoy facility • Implement Dust Suppression Plan • A procedure, including a response plan, will be available for public to be able to register complaints regarding dust concerns • Stabilize slopes on inactive stockpiles to a safe and long-term angle of repose • Use soil and organics stockpiles for final capping and stabilization. Hydroseed as required
Light	Increase in Ambient Light	• Temporary lighting will be directly focused on work areas and shielded where practicable to avoid light trespass • Use of only downward-facing lights on site infrastructure and Mine Site roads • Install motion-sensing lights, where practicable • Only use direct and focused light when needed for worker safety • All floodlights will employ full horizontal cutoff, as appropriate • Lighting not in use will be turned off, whenever practicable • Site perimeter lighting will be directed to minimize light offsite light trespass • Utilize efficient sources of light, such as LED, to reduce overall magnitude of light, wherever practicable A procedure, including a response plan, will be available for public to be able to register complaints regarding light concerns

Valued Component Affected	Residual Effect	Mitigation and Compensation Measures
Greenhouse Gases	Reduction in Air Quality	Minimize GHG emissions: • Limited engine idling where practicable • Implementing fuel efficiencies where practicable • Implement preventative maintenance plans for all mobile and stationary equipment • Use renewable energy where reasonable – eg: solar-powered lights

Geology, Soil, and Sediment Quality	Sediment quality impacted by Project beyond natural fluctuations that affects aquatic habitats and or species negatively.	• Use of the following routine controls, as needed:
		  ○ Silt fences
		  ○ Silt curtains
		  ○ Riprap
		  ○ Check dams
		• Implement Erosion and Sediment Control Plan
		• Secure overburden stockpiles using a combination of mulching, hydroseeding, and slope stabilization
		• Limit exposed soil
		• Use soil and organics stockpiles for final capping and stabilization. Hydroseed as required

Groundwater Quality and Quantity	Reduction in GW Quantity or Quality	• Conduct pre-construction well survey at Beaver Lake IR • Use above ground fuel storage tanks that meet applicable regulatory standards • Select appropriate type of explosive that will minimize nitrogen release to surface water and groundwater • Sub-aqueous deposition of mine tailings to reduce/prevent oxides and leaching • In the event of acid rock drainage and metal leaching, implement mitigative measures that will manage the source material and drainage effectively utilizing methods such as segregation and encapsulation • Based on evaluation of predicted aquatic risk, pump and treatment of groundwater (if required based on monitoring results) from installed groundwater wells at Beaver Dam Mine Site including those at Crusher Lake, Mud Lake, outlet from Mud Lake to the Killag, and Cameron Flowage, and existing groundwater wells at Touquoy between the open pit and the Moose River. The purpose of this groundwater treatment is to intersect groundwater seepage impacted with COCs above Tier II pathway specific guidelines or groundwater baseline/background prior to seepage discharging into surface water bodies. • Use blasting and pit construction techniques that minimize the potential for negatively interacting the adjacent groundwater table and nearby surface water • Implement water conservation program for onsite facilities • Recycle site water for reuse wherever practical to reduce water withdrawal from lakes or streams • Recycled water must meet acceptable water quality criteria for its intended use

Surface Water Quality and Quantity	Habitat loss
	
	Reduction in SW Quantity or Quality
		• Use of the following structures, as needed:
		  ○ Silt fences
		  ○ Silt curtains
		  ○ Riprap
		  ○ Check dams
		• Limit exposed soil
		• Implement Erosion and Sediment Control Plan
		• Segregate and manage waste rock with the potential for acid generation
		• Use adequately sized settling and containment ponds as required
		• Use flocculants and coagulants as required
		• Install perimeter ditches around site infrastructure
		• Provide appropriate settling time for suspended solids prior to discharge
		• Ensure pit water meets applicable regulatory quality criteria for discharge – otherwise treat water prior to discharge
		• Direct drainage ditches to designated settling ponds or other locations

Valued Component Affected	Residual Effect	Mitigation and Compensation Measures
		• Use above ground fuel storage tanks that meet applicable regulatory standards • Select appropriate type of explosive that will minimize nitrogen release to surface water and groundwater • Implement Surface Water Management Plan • Develop and implement an Emergency Response Spill Contingency Plan • Use clean, non-ore-bearing, non-watercourse derived and non-toxic materials for erosion control methods • Sub-aqueous deposition of mine tailings to reduce/prevent oxides and leaching • In the event of the potential for acid rock drainage and metal leaching, implement additional studies required to assess to actual risk and, as warranted, implement mitigative measures that will manage the source material and drainage effectively utilizing methods such as segregation and encapsulation • Minimize snow deposition into watercourses during snow removal activities • Construct drainage ditches and ponds to maintain natural flow directions when practical • Control release of settling ponds to mimic natural hydrograph, where practicable • Recycle site water for reuse wherever practical to reduce water withdrawal from lakes or streams • Recycled water must meet acceptable water quality criteria for its intended use
Wetlands	Disturbance Habitat Loss Change in Hydrology	• Complete pre-construction site meetings for all relevant staff/contractors related to working around wetlands and watercourses to minimize unauthorized disturbance • Ensure all wetlands are visually delineated (e.g. - flagged) • Complete detailed design of Haul Road and micro siting of Beaver Dam Mine Site infrastructure to avoid or minimize wetland impact • Acquire and adhere to wetland alteration permits • Implement construction methods that reduce the potential to drain or flood surrounding wetlands • Complete work within Wetland 64 (Potential WSS) outside of the breeding season for Olive-sided Flycatcher • Direct runoff through natural vegetation, wherever practicable • Minimize erosion of wetland soils by limiting flow velocities by means of hydraulic dissipation techniques • Minimize the rutting of wetland habitat by limiting the use of machinery within wetland habitat and use of swamp mats/corduroy bridges as required • Conduct vegetation management (cutting and clearing) in or near wetlands and watercourses in accordance with applicable guidelines • Implement Erosion and Sediment Control Plan • Maintain pre-construction hydrological flows through wetland habitats and partially altered wetlands, wherever practicable • Re-vegetate slopes adjacent to wetlands to limit erosion and sediment release • Compensate for permanent loss of wetland function through implementation of the site specific wetland compensation plan, subject to NSE approval
Fish and Fish Habitat	Disturbance Habitat Loss	• Complete site meetings with relevant staff/contractors to educate and confirm policies related to working around fish bearing surface water systems including schedule of construction activities to minimize unauthorized disturbance and limit vegetation clearing • Provide signage on fish habitat streams • Complete detailed design of Haul Road and micro siting of mine infrastructure to avoid or minimize fish habitat impact • Complete fish rescue within Beaver Dam Mine Site prior to commencement of mine development with DFO approval if required • Implement construction methods that reduce potential interaction with fish habitat and limit vegetation clearing around watercourses • Complete culvert installations and upgrades in accordance with the NSE Watercourse Standard (2015) or as updated at time of construction. Limit vegetation clearing • Maintain 30 m riparian wetland and watercourse buffers, where practicable • Minimize the removal of vegetation upgradient of watercourses • Follow DFO-advised *Measures to avoid causing harm to fish and fish habitat including aquatic species at risk* pertaining to blasting • Select appropriate type of explosive that will minimize nitrogen release to surface water and groundwater • Use clean, non-ore-bearing, non-watercourse derived and non-toxic materials for erosion control methods

Valued Component Affected	Residual Effect	Mitigation and Compensation Measures
		• Incorporate drainage structures, where necessary, to dissipate hydraulic energy and maintain flow velocities sufficiently low to prevent erosion of native soil material • Limit clearing within confirmed fish habitat outside of approved alteration areas • Acquire and follow watercourse alteration permits • Adhere to applicable timing windows, as directed by DFO, for construction where infilling has been approved in wetlands and watercourses where fish habitat is present. • Ensure fueling areas are a minimum of 30 m from waterbodies • Use and maintain properly sized screens on any water intakes or outlet pipes to prevent entrainment or impingement of fish • Implement Surface Water Management Plan • Implement Sediment and Erosion Control Plan • Maintain pre-construction hydrological flows into and out of down-stream surface water habitats, to the extent practicable, to limit indirect impacts to fish habitat • Complete offsetting for serious harm including for permanent loss of fish habitat through fish habitat restoration activities, subject to DFO approval, based on the *Fisheries Act* current at time of the Project construction
Habitat and Flora	Disturbance Habitat Loss	• Maintain existing vegetation cover whenever practicable and minimize overall areas of disturbance • Implement Erosion and Sediment Control Plan • Avoid frequent or unnecessary travel over erosion prone areas through communication with personnel and project planning • Conduct vegetation management by cutting (e.g., no use of herbicides) • Implement dust suppression mitigation (refer to Atmospheric Environment Mitigation) • Employ measures to reduce the spread of invasive species (such as cleaning and inspecting vehicles) to maintain the quality of remaining habitat • Hydroseed areas that have erosion potential to return the area to pre-disturbance conditions in a timely fashion upon final reclamation • Implement reclamation program within the Beaver Dam Mine Site to re-establish native vegetation communities
Terrestrial Fauna	Habitat Loss Disturbance Direct Mortality	• Provide wildlife awareness training to site personnel to reduce interactions between site personnel and wildlife • Reduce habitat fragmentation by minimizing new road construction wherever practicable • Complete detailed design of Haul Road and micro siting of mine infrastructure to avoid major faunal habitat • Upgrade culverts to improve habitat and connectivity • Maintain existing vegetation cover whenever practicable and minimize overall areas of disturbance • Implement Erosion and Sediment Control Plan • Implement Emergency Response and Spill Contingency Plans to protect fauna and their habitat from accidental spills • Store hazardous and non-hazardous waste in designated locations, in appropriate containers to reduce potential for spills, and to prevent attracting wildlife (e.g., food waste in bear proof containers) • Vehicles will yield to wildlife on roads • Implement speed limits within the Beaver Dam Mine Site and Haul Road at 40 km/hr and 70 km/hr, respectively, to reduce potential collisions with fauna • Install signage where specific wildlife concerns have been identified • Monitor and manage road conditions through dust suppression and traction control (sand on icy roads) to reduce potential for collisions with wildlife • Clear vegetation within a 10 m buffer of roadsides, where needed, to improve visibility and reduce wildlife collisions • Install fencing, where practical, to prevent wildlife from accessing areas with increased risk of injuries to wildlife • Monitor in and around site infrastructure for wildlife and if present work to relocate in accordance with the Wildlife Management Plan • Implement Wildlife Management Plan • Follow the *Pit and Quarry Guidelines* to reduce impact of noise and vibration on wildlife • Limit use of lights to the amount necessary to ensure safe operation within the PA, with the recognition that excessive lighting can be disruptive to wildlife • Restrict blasting to a specific and regular daytime schedule during weekdays to allow time for wildlife to recover from potential noise disturbance

Valued Component Affected	Residual Effect	Mitigation and Compensation Measures
		• Implement remediation plans to restore natural habitat and food source re-establishment to support fauna
Birds	Disturbance Habitat Loss Attraction and disorientation Mortality	• Avoid construction on native vegetation during the regional breeding season for migratory birds where practicable (beginning of April to end of August for migratory birds; ECCC 2015). Where this is not practicable, a bird nest mitigation plan will be developed • If a raptor nest is found within the forested areas to be cleared, a buffer zone appropriate to the species (as determined in consultation with NSDNR) would be placed around the nest • Limit the amount of exposed soil during nesting season • Discourage ground-nesting or burrow-nesting species (such as common nighthawk and bank swallows), by limiting large piles or patches of bare soil during the breeding season, wherever practicable • Should any ground- or burrow-nesting species initiate breeding activities on stockpiles or exposed areas, the Proponent will work with ECCC and NSE to develop buffer zones that incorporate adaptive management • Maintain speed limits on mine roads (max. 40 km/hr. within Beaver Dam Mine Site, 70 km/hr. along Haul Road) to minimize collisions with birds • Implement dust suppression mitigation (refer to Air Mitigation) • Install downward-facing lights on site infrastructure and haul roads. Wherever practicable, install motion-sensing lights to ensure lights are not turned on when they are not necessary • Conduct mobile refueling at least 30 m from any identified breeding locations • Monitor known nests around stockpiles and exposed areas from a distance with a spotting scope or binoculars to verify the effectiveness of an identified buffer until the nests are inactive • Conduct routine inspections of the open pit area to remove any trapped or injured birds. If identified, determine a plan for removal in consultation with an avian expert • Notify ECCC within 24 hours in the event of the mortality or injury of ten or more migratory birds in a single event or in the event of the mortality or injury of a migratory bird SAR
Species of Conservation Interest and Species at Risk	Habitat Loss Disturbance	• Standard mitigation for fish and fish habitat is expected to generally mitigate effects on priority fish species • Specific and detailed mitigation measures for Atlantic Salmon, Brook trout, and American eel are described in Section 6.13
		• Standard mitigation measures for wetlands and habitat and flora is expected to generally mitigate effects on priority vascular flora and lichens • Specific and detailed mitigation measures for Blue Felt Lichen, Boreal Felt Lichen, and Frosted Glass Whiskers are described in Section 6.13
		• Standard mitigation for terrestrial fauna generally apply to SAR and SOCI; • Specific and detailed mitigation measures for Snapping Turtle and Mainland Moose are described in Section 6.13
		• Standard mitigation for birds generally apply to SAR and SOCI; • Specific and detailed mitigation measures for Common Nighthawk, Canada Warbler, Olive-sided Flycatcher, Eastern Wood-Peewee, Greater Yellowlegs, Peregrine Falcon, Chimney Swift, Rusty Blackbird, and Barn Swallow are described in Section 6.13
Indigenous Peoples	Loss of plant species, habitat loss, Reduction in Access	• Provide Millbrook land users the opportunity to walk the Haul Road with Proponent representatives to identify and document sensitive sites prior to construction • Provide a tour of Beaver Dam Mine Site and information on Project operations to interested Mi'kmaq peoples. • The Proponent will develop a Complaints Management and Action Program for Millbrook input in advance of Project commencement. • Preparation of a Haul Road Operational Management Plan, with Mi'kmaq participation. • Work collaboratively with Millbrook to create a Water Protection Plan for the West River (with a focus on River Lake) • During the construction phase, as part of expected IA conditions, the Proponent will prepare an Emergency Response Plan for the Project and work with Millbrook to provide and fund appropriate training to interested participants. • In the event that Mi'kmaw archaeological features are encountered during construction or operation of the Project, all work in the area will be halted and immediate notification made to the Special Places Coordinator, Nova Scotia Museum, the KMKNO and the communities of Sipekne'katik and Millbrook • Engagement with the Mi'kmaq of NS as per the engagement strategy, including specific participation in environmental monitoring and wetland compensation

Valued Component Affected	Residual Effect	Mitigation and Compensation Measures
		• Implement specific community engagement activities to address interests of the residents of Beaver Lake, including information sharing, site tour, etc. • The Proponent will support Millbrook First Nation in actively participating in the Reclamation Plan for the Project including a reclamation working group, the opportunity for Millbrook members to provide input on species used in revegetation, reclamation techniques, and the opportunity for Millbrook members to join the reclamation team to execute this Project phase. • All vehicle operators will receive driver training as related to health, safety, and environment. The training will involve measures to minimize wildlife-vehicular interactions. • The Proponent commits to conducting an employee and contractor Mi'kmaq Cross Cultural Awareness Training Program. Scope to be determined based on further discussions • Engage in in-depth access management planning, including traffic management and enforcement strategies, with Millbrook to ensure continued access to preferred harvest and occupancy areas, where possible. This includes a meaningful, and documented discussions/seminar with Millbrook First Nation technicians on the range of access options available. This may include the use of an agreed-upon third party, funded by the Proponent
Physical and Cultural Heritage	Loss of Resources	• Either a program of shovel testing be conducted around the possible cookhouse (Feature 5) or a buffer of 20 metres should be put in place around the feature to protect it from any mining activities • If any development is to occur within 100 metres of Crusher Lake, intensified reconnaissance should be conducted to identify any additional features • If any development is to occur specifically around the historic features (e.g. Feature 4 and 6) identified during the 2008, 2014, and/or 2015 and/or 2018 reconnaissance intensified historical research and archaeological shovel testing should be conducted in advance of disturbance • Any further changes in the layout of the mine and associated facilities be evaluated as to potential impacts to archaeological resources
Socio-economic Conditions	Disturbance	• Restriction of recreational activities within the property boundaries of the Project. Notification will be provided by signage. • Liaison with any local recreation groups, such as ATV associations

		• Regular equipment maintenance as specified by suppliers;
		• Limiting haul truck operational hours to 12 to 16 hours per day;
		• Reduce risks of a mobile equipment or haul truck accident through:
		  ○ operator training;
		  ○ installation of speed limit signage on the mine site and along the Haul Road;
		  ○ installation of right-of-way signage at intersections and along the Haul Road;
		  ○ design of intersections to NSTIR Standards;
		  ○ provision of radios to all haul truck drivers for communications; and
		  ○ discussions with NSTIR

10.2 Conclusions of the Proponent

The Project proposed by the Proponent will operate as a satellite surface mine with an approximate ore extraction rate of an average of 2 million tonnes per year.

Processing of ore from the Beaver Dam gold deposit at the existing Touquoy Mine Site will begin upon completion of mining from the Touquoy gold deposit. The Project is anticipated to begin construction in 2021, come into production in 2022, cease operations in 2026 and then be reclaimed. Reclamation would occur at the Beaver Dam Mine site following cessation of ore removal, and at the Touquoy Mine Site when ore processing and tailings management (exhausted pit) from processing Beaver Dam ore is completed. Required treatment and monitoring will continue into a post-closure phases where required at both the Beaver Dam Mine Site and the Touquoy Mine Site.

Atlantic Gold wishes to develop this resource in line with all applicable regulatory requirements and recognizes the significant benefits to the local economy, the Province of Nova Scotia, the Mi’kmaq of Nova Scotia, and the company in completing this Project. Atlantic Gold has designed a project that is in line with the intent of NSDNR for efficient use of mineral resources and to "*promote the concepts of environmental responsibility and sustainable development, stewardship of the mineral resource sector, and integrated resource planning.*"

All phases of the Project will provide employment opportunities for local residents and Indigenous Peoples, as well as provide tax revenue for the municipal, provincial, and federal levels of government. It is anticipated that additional labour force will be required during construction and a smaller, but still significant, labour force will be required during operation. Indirect employment will be generated by the Project through the use of external contractors and suppliers. Tax revenue in the millions of dollars per year will be generated through corporate income taxes paid by the Proponent, as well as its contractors and suppliers.

As described throughout the EIS, Project-environment interactions are expected to occur throughout the life of the Project during the construction, operations, reclamation and decommissioning, and post-closure phases. These interactions are expected, manageable and are typical of environmental impacts associated with mineral extraction projects in the region.

Given the considerations identified above and based on baseline studies completed for each of the identified VCs, the Project is not predicted to result in any significant residual adverse environmental effects once mitigation measures have been applied. Monitoring programs will continue throughout the life of the Project to verify the effects of the Project on the surrounding environment relative to predictions made in the environmental effects assessment. The Proponent is committed to implementing the planned mitigation measures and monitoring programs, as well as ongoing stakeholder and Mi’kmaq engagement as outlined in this submission.

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