Appendix P.5

draft Aquatic Effects Monitoring Program
Completed for the Updated 2021 Beaver Dam Mine EIS

Draft AQUATIC EFFECTS MONITORING PROGRAM
VERSION 1

Beaver Dam Mine Project
Marinette, Nova Scotia
October 2021

REVISION HISTORY

Version	Date	Notes/Revisions
Version 1	October 2021	Submitted with the Beaver Dam Mine Project 2021 Environmental Impact Statement Update application to the Impact Assessment Agency of Canada and Nova Scotia Environment. Outlines the proposed monitoring program which will be used to ensure regulatory compliance, monitor the effectiveness of mitigation measures, and to verify the predictions of the effects assessment.

PLAIN LANGUAGE SUMMARY

Atlantic Mining NS Inc. (AMNS; a wholly owned subsidiary of St Barbara Limited) will be implementing a series of mine and environmental management and monitoring plans to guide the development and operation of the Beaver Dam Gold Mine Project (the Project) in Marinette, Halifax County, Nova Scotia (Figure E-1). The Beaver Dam Mine Site lies within the West River Sheet Harbour watershed, which is directly east of the Musquodoboit River Valley system.

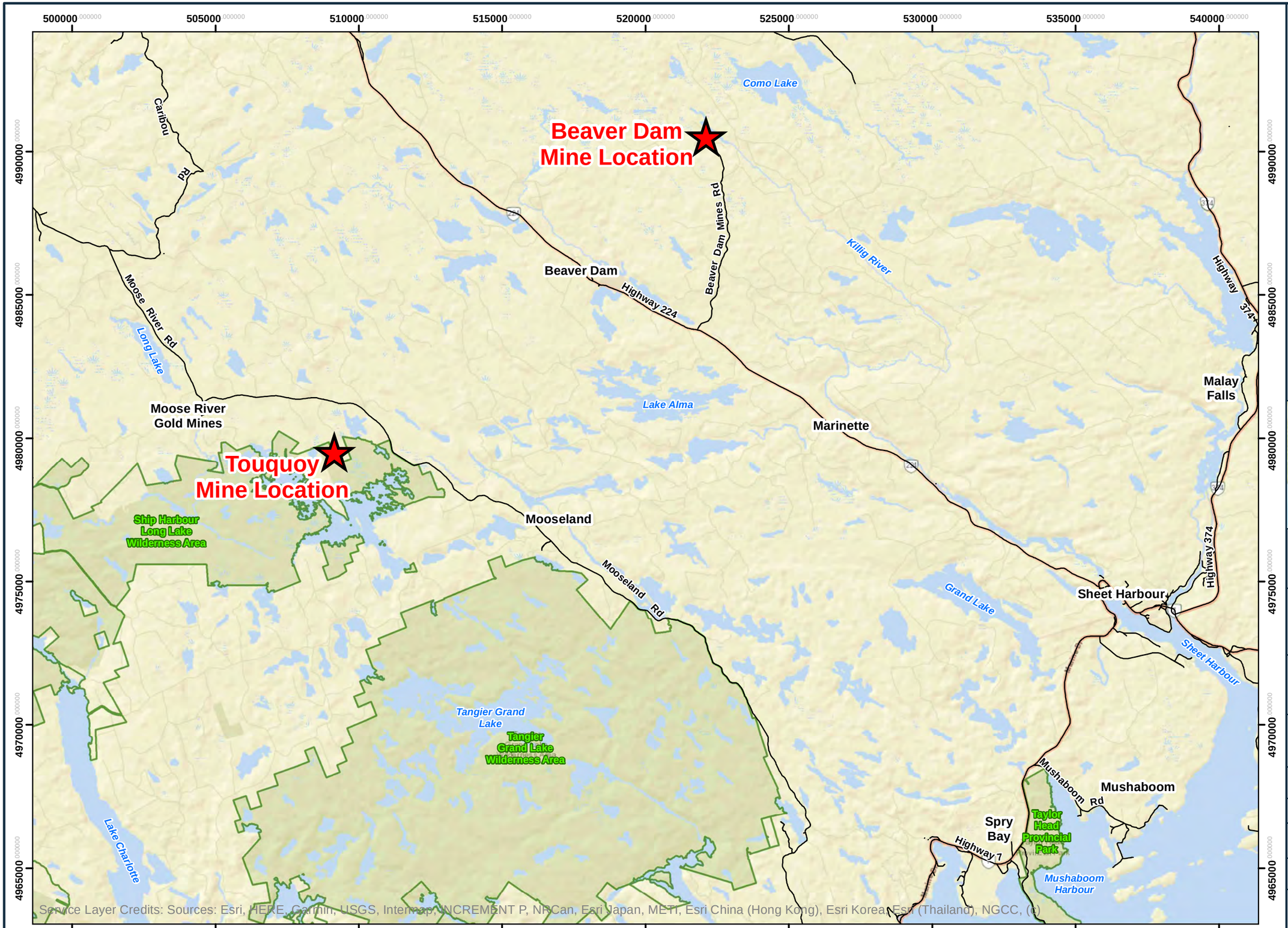
This document presents the Aquatic Effects Monitoring Plan (AEMP) for the Project and outlines proposed monitoring programs for:

- **Surface Water Quality:** constitutes the physical, chemical, biological, and aesthetic characteristics of water.
- **Hydrology**: Surface water hydrology (water quantity, water flow) is a key component of the physical and biological environment because it is linked to other ecosystem components, including surface water quality, fish and fish habitat.
- **Sediment quality**: constitutes the physical, chemical and biological characteristics of sedimentary materials.
- **Periphyton:** refers to the assemblage of algae, bacteria, and other organisms that attach to submerged substrates (e.g., suspended sediments). As primary producers, periphyton are important food sources for grazers, such as zooplankton and benthic invertebrates.
- **Benthic invertebrates**: benthic invertebrate communities (benthos) are small animals living at the bottom of lakes, rivers and streams and provide food for fish. Benthos represent a critical link between primary producer communities and higher trophic levels in aquatic ecosystems. Benthos are widely used as indicators of environmental conditions and change due to their close contact with bottom sediments.
- **Fish Habitat & Community Surveys:** Habitat that are directly or indirectly impacted by the Project, will be monitored to confirm the predictions of the assessment and to monitor the results of mitigation and offsetting measures. The objective of the fish health survey is to determine whether the discharge is having an effect on the growth, reproduction, survival, and condition of fish.

The goal of the AEMP will be to eliminate or minimize potential adverse effects on the aquatic receiving environment, while systematically seeking to enhance positive effects. Spatially, the AEMP will focus on the mine site area and the identified receiving environment for the Project including the Killag River, Cameron Flowage, and Mud Lake, as well as reference sites.

Data collected during monitoring programs will document spatial and temporal trends in monitoring results, and enable a comparison to the predicted project effects. Data and analysis will be provided in annual reports, as well as the mandatory interpretive reports as per the Metal and Diamond Mining Effluent Regulations (MDMER) under the *Fisheries Act*

Further, an AEMP Response Framework will provide a systematic approach for responding to the findings of the AEMP. Indications of possible unacceptable changes trigger Action Levels, with increasing responses required if unacceptable changes become more likely.



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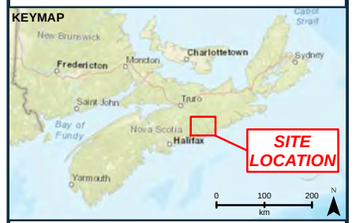
LEGEND:

- Road
- Protected Area

KEYMAP



CLIENT:
ATLANTIC MINING NS INC.

wood.

TITLE:
PROJECT LOCATION

PROJECT:
BEAVER DAM MINE PROJECT - AQUATIC EFFECTS MONITORING PROGRAM

PROJECT NO:	DATE:
TE211047	AUGUST 2021
REV NO: 0	DWN BY: CM
DATUM: NAD83 CSRS 2010	PROJECTION: UTM ZONE 20 N

FIGURE:
FIGURE E-1

SCALE: 1:125,000

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1 INTRODUCTION

1.1 Purpose and Scope

Atlantic Mining NS Inc. (AMNS; a wholly owned subsidiary of St Barbara Limited) will be implementing a series of mine and environmental management and monitoring plans to guide the development and operation of the Beaver Dam Gold Mine Project (the Project) in Marinette, Halifax County, Nova Scotia (Figure 1-1). For the purpose of the application for an environmental assessment certification (the Application), conceptual management and monitoring plans are described for aspects of the Project where potential effects to value components (VCs) were identified during the environment assessment. AMNS submitted an Updated 221 Environmental Impact Statement (2021).

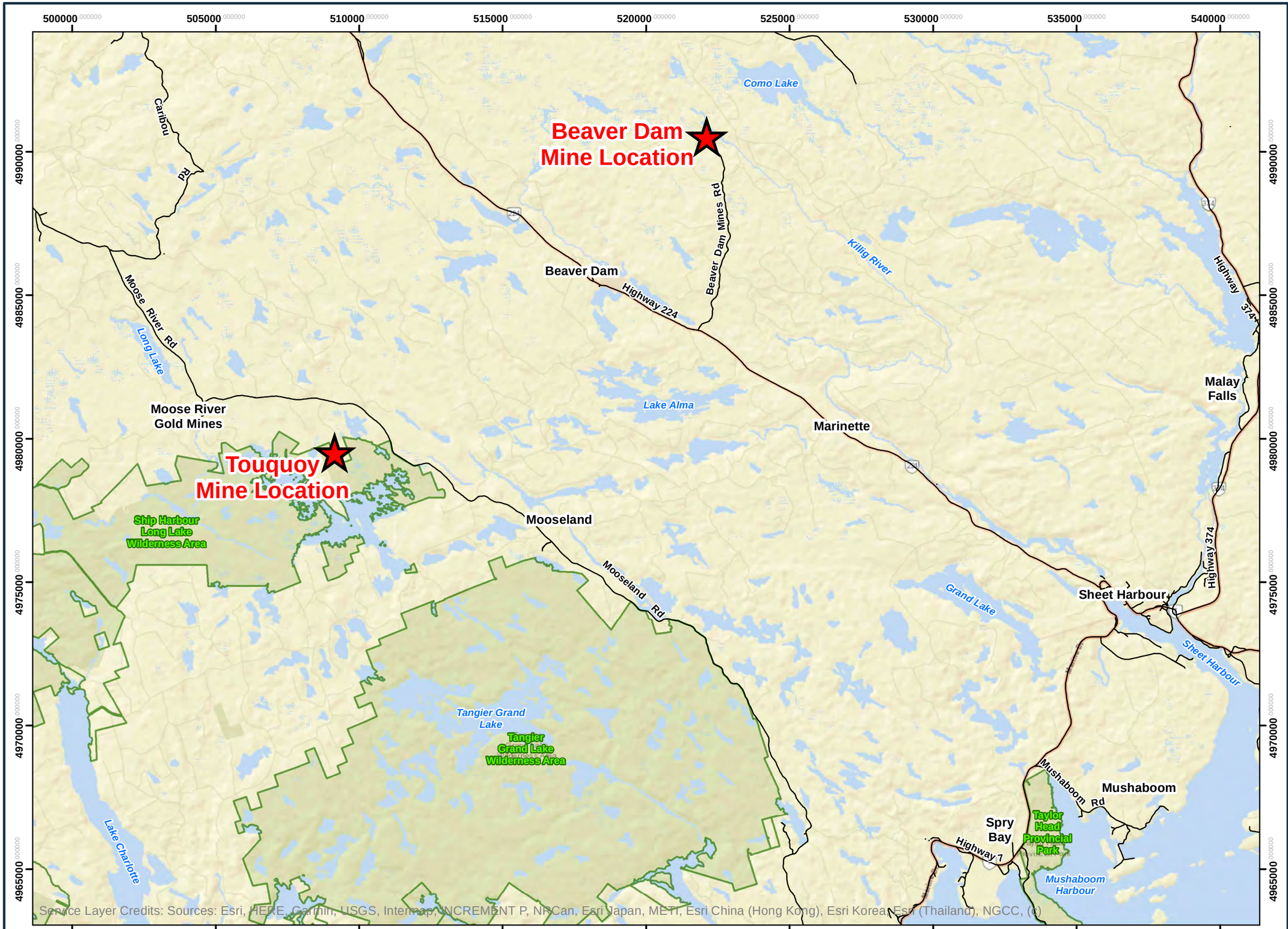
This document presents the Aquatic Effects Monitoring Plan (AEMP) for the Project. The purpose of this plan is to describe the rationale, framework, strategy and scope for the AEMP to be implemented during Construction, Operation, and Closure phases of the proposed Project. The AEMP will be established as a requirement of the permits and licenses under which the proposed Project will operate (e.g., Metal and Diamond Mining Effluent Regulations (MDMER) under the *Fisheries Act*). The focus of the AEMP will be to ensure regulatory compliance, monitor the effectiveness of mitigation measures, and to verify the predictions of the effects assessment. An Environmental Effects Monitoring Plan (EEM) has been initiated by Stantec (2021) and is included here as Appendix A. The EEM will be fully implemented to support compliance with the monitoring requirements in MDMER and will and will form one component of the broader AEMP.

Spatially, the AEMP will focus on the mine site area and the identified receiving environment for the Project including the Killag River, Cameron Flowage, and Mud Lake, as well as reference sites.

The AEMP will complement, and to be used in conjunction with, related mine and environmental management and monitoring plans developed for the Project, including (appendices of the Application):

- Mine Water Management Plan (GHD, 2021, Appendix P.4 of the Application);
- Draft Erosion and Sediment Control Plan (GHD, 2021, Appendix C of Appendix P.4 of the Application); and
- Proposed Groundwater Monitoring Plan (GHD, 2021c, Appendix G of Appendix P.4 of the Application).

AMNS understands that monitoring is a mechanism to gauge Project performance and measure against baseline conditions and effects as predicted in the Application, 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, as defined in the draft Public Engagement Plan (see Appendix A.6 of the Application).



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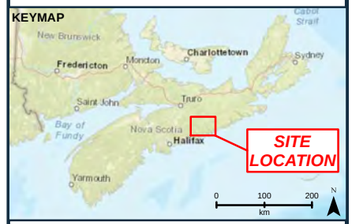
LEGEND:

- Road
- Protected Area

KEYMAP



CLIENT:

ATLANTIC MINING NS INC.

wood.

TITLE:

PROJECT LOCATION

PROJECT:

BEAVER DAM MINE PROJECT - AQUATIC EFFECTS MONITORING PROGRAM

PROJECT NO:	DATE:
TE211047	**AUGUST 2021**
REV NO: **0**	DWN BY: **CM**
DATUM: **NAD83 CSRS 2010**	PROJECTION: **UTM ZONE 20 N**

FIGURE:

FIGURE 1-1

SCALE: 1:125,000

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1.2 Summary of the Environmental Effects Assessment

The proposed Project will operate as a satellite surface mine to the existing and fully permitted Touquoy Gold Mine, located nearby in Moose River Gold Mines, Nova Scotia (Figure 1-1). The ore that is mined at Beaver Dam Mine will be processed at the existing Touquoy plant. It is anticipated that once all permits for the Beaver Dam Mine Project are received, construction will commence and will take one year to complete. Operations will take place over five years and active closure will take two years to complete. Post closure monitoring is expected to be 10+ years with each successive reclamation plan informing the next.

The key components of the proposed Project are as follows:

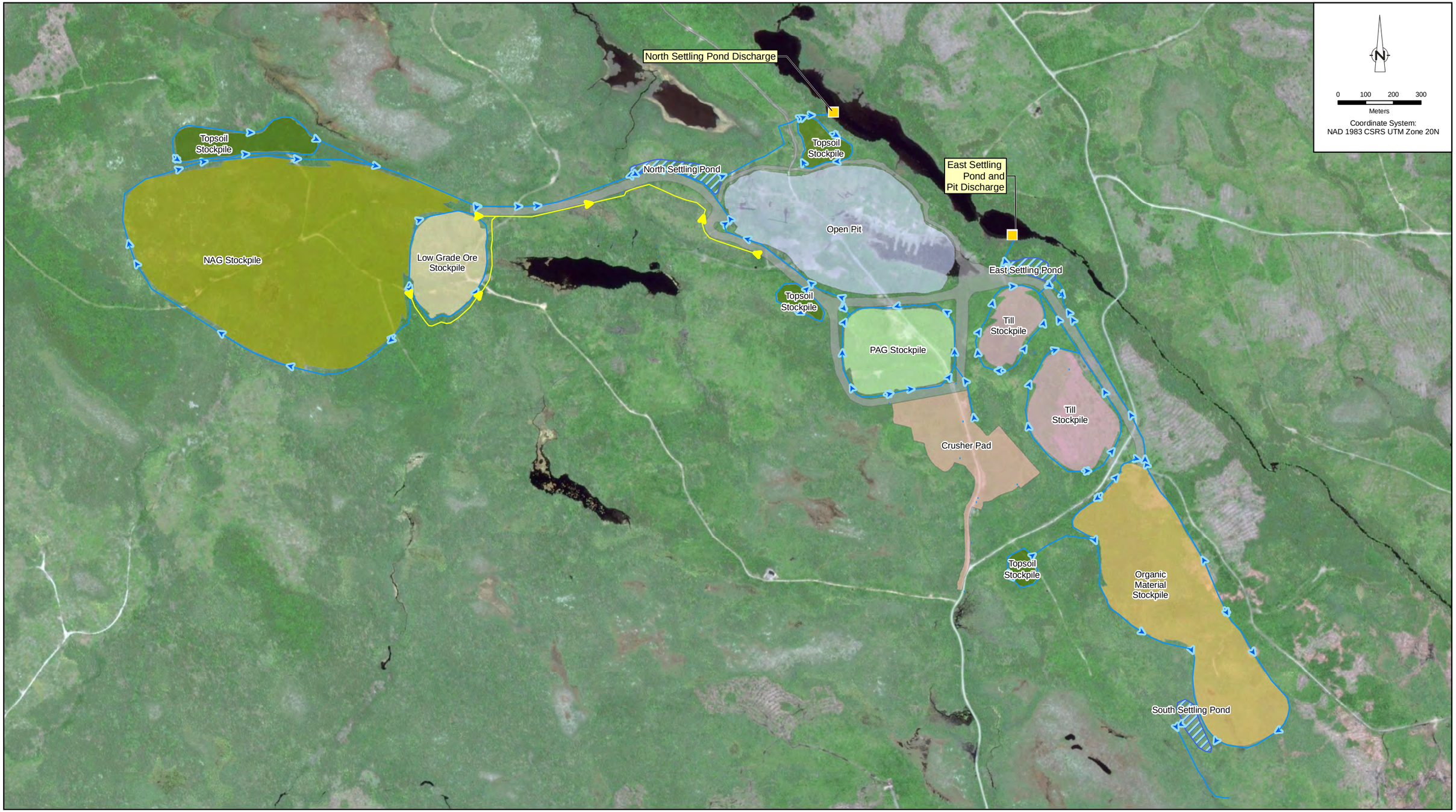
- Open pit
- Potentially Acid Generating (PAG) Waste Rock stockpile
- Non-Acid Generating (NAG) Waste Rock stockpile
- Low Grade Ore (LGO) stockpiles
- Organics, Topsoil and Till stockpiles
- Crusher Pad and Administrative Building area
- Site roads, parking areas and haul roads
- Settling ponds, stormwater (SWM) ditches (contact water and non-contact water), culverts and watercourse crossings
- Water Treatment System (WTS)

Figure 1-2 presents site layout of the Proposed project and proposed discharges in relation to major watercourses; Figure 1-3 presents existing surface water monitoring locations.

The effects assessment for the proposed project is presented in Section 6.0 of the Application. As discussed therein, Project-environment interactions are expected to occur throughout the life of the Project; i.e., during the construction, operations, active closure (i.e., decommissioning and reclamation), and post-closure phases. These interactions are expected and are typical of environmental impacts associated with mineral extraction projects in the region.

The conclusion of the effects assessment was that the Project is not predicted to result in any significant adverse environmental effects after mitigation measures, including water treatment, have been applied. Existing monitoring programs will proceed to gather pre-construction data for select VCs. These 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 determine the effects of the Project on the surrounding environment.

Key mitigation measures that have been identified to specifically mitigate the potential residual effects, including water treatment, are summarized here in Appendix B. Proposed mitigation measures are described in greater detail in the effects assessment for each individual VC in Section 6 of the Application and appendices referenced therein.



- Contact Water Ditch
- Clean Water Ditch
- Settling Pond
- Road
- Bypass Road
- Crusher Pad
- Low Grade Ore Stockpile
- NAG Stockpile
- Open Pit
- Organic Material Stockpile
- PAG Stockpile
- Till Stockpile
- Topsoil Stockpile
- Water Pump Intake
- Discharge Point

ATLANTIC MINING NOVA SCOTIA
BEAVER DAM MINE
AEMP

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PROPOSED MINE DISCHARGE POINTS

FIGURE 1-2

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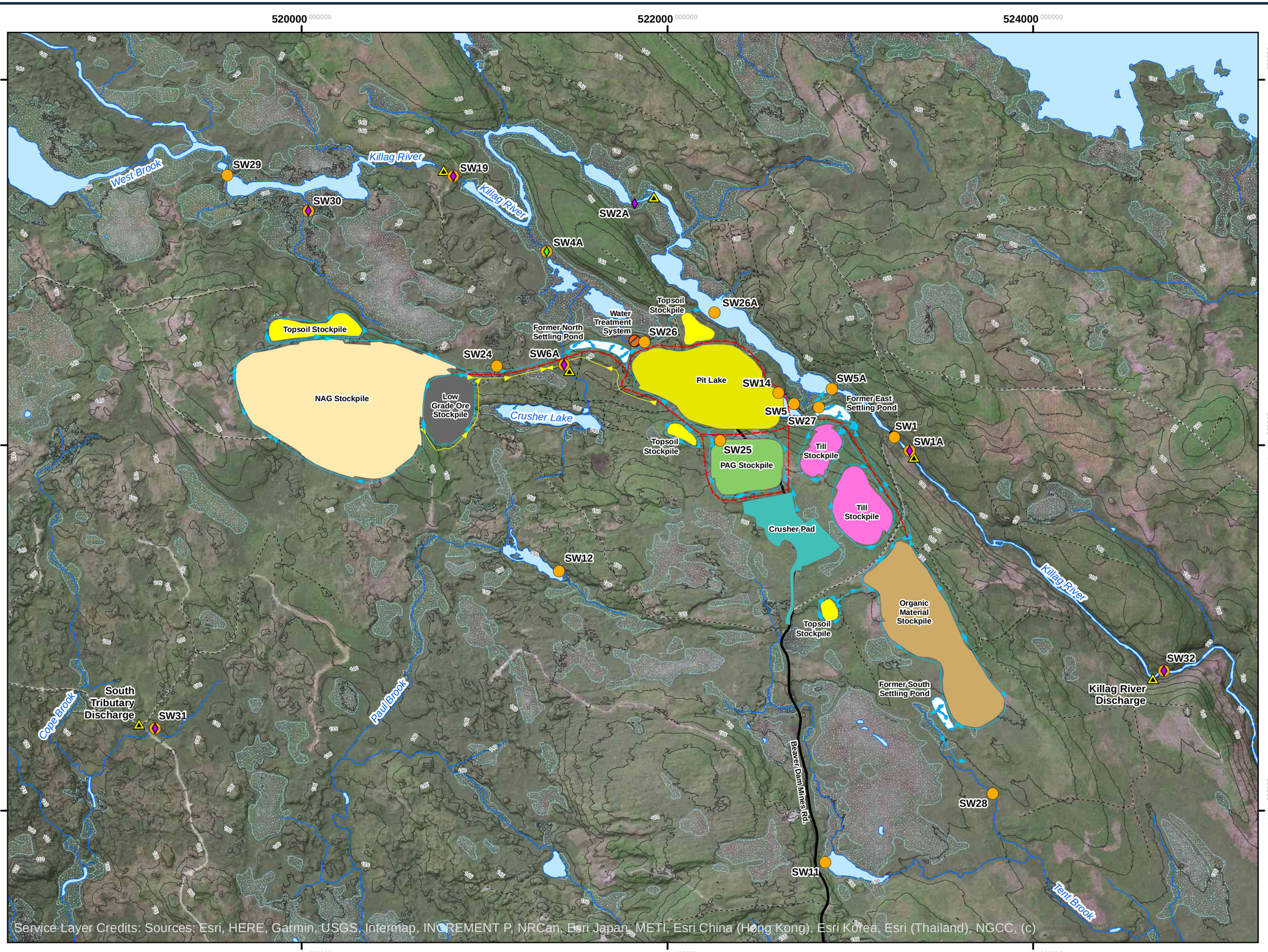

LEGEND:

- Hydrometric Stn. & Volume Discharge Measurement
- Staff Gauge and Level Logger
- Water Quality Location
- Flow Monitoring Location
- Bypass Road
- Clean Water Ditch
- Contact Water Ditch
- Road
- Track/Trail
- 5 m Contours (m CGVD2013)
- Stream/Creek
- Lake
- Wetland
- Crusher Pad
- Low Grade Ore Stockpile
- NAG Stockpile
- Open Pit
- Organic Material Stockpile
- PAG Stockpile
- Settling Pond
- Till Stockpile
- Topsoil Stockpile
- Water Treatment System

KEYMAP

CLIENT:
ATLANTIC MINING NS INC.

wood.

TITLE:
EXISTING SURFACE WATER MONITORING LOCATIONS

PROJECT:
BEAVER DAM MINE PROJECT - AQUATIC EFFECTS MONITORING PROGRAM

PROJECT NO:	DATE:
TE211047	AUGUST 2021
REV NO: 0	DWN BY: CM
DATUM: NAD83 CSRS 2010	PROJECTION: UTM ZONE 20 N

FIGURE:
FIGURE 1-3

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1.3 Document Organization

This document outlines proposed monitoring plans surface water quality, hydrology, sediment quality, periphyton, benthic invertebrates and fish habitat and community surveys that will document spatial and temporal trends over the life of the Project, and enable a comparison to the predicted project effects.

This document is organized as follows:

Section 1: Introduction

Section 2: Environmental Setting: summary presentation of baseline conditions of the aquatic environment to support conceptual design of the AEMP.

Section 3: AEMP Design -Overview: describes AEMP performance objectives and outlines proposed study areas and QA/QC programs that will be applied to all AEMP monitoring components

Section 4: AEMP Design -Monitoring Components: presents additional details specific to the individual AEMP monitoring components i.e., surface water quality, hydrology, sediment quality, periphyton, benthic invertebrates and fish habitat and community surveys

Section 5: AEMP Design-Data Analyses and Reporting: outlines reporting procedures and data analyses for AEMP monitoring components

2 ENVIRONMENTAL SETTING

Baseline characterization studies for the Project are presented in Section 6.0 of the Application, and appendices referenced therein. This section summarizes salient details of baseline conditions of the aquatic environment to support conceptual design of the AEMP.

The proposed Project is in an area of historic gold mining, where exploration and mining activities have occurred intermittently since gold was first discovered in 1868. The Touquoy Gold Mine (located near the proposed Project) lies approximately 19 km away from the Beaver Dam site (straight line) and was officially opened on October 11, 2017 with commercial production achieved in March 2018 and an anticipated life of mine of five years.

Baseline characterization studies for the proposed Project have occurred since 2014; the scope of monitoring programs has varied slightly from year to year to reflect updates to the Project Description (Section 2.0 of the Application) as well as to respond to IR2 requests issued by IAAC (CEAA 2019) and Nova Scotia Environment (NSE 2019). However, characterization studies have continued to be focused in three geographically distinct areas:

- Beaver Dam Mine Site;
- The Haul Road; and
- The existing Touquoy Mine.

Further, the August 2020 aquatic baseline program (Stantec 2021, appended here as Appendix A) was designed to mirror the anticipated requirements for EEM that will be required once the Project proceeds. Baseline data to support the EEM and AEMP has, and continues to be, collected to support ongoing effects assessment over the life of mine.

Hydrological Setting

The Beaver Dam Mine Site lies within the West River Sheet Harbour secondary watershed (1EM-2), which is directly east of the Musquodoboit River Valley system. The watershed occupies an area of roughly 576 km^2. The West River Sheet Harbour watershed (WRSH) discharges to the West River and its tributaries, from north to south. Elevations within the catchment vary from approximately 135 to 165 meters above sea level (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. Within the WRSA secondary watershed, the Project intersects eight tertiary watersheds (Killag River, Tent Brook, Paul Brook, Cope Brook, Tent Brook, Keef Brook, Jack Lowe Brook and Little River).

The Killag River and Cameron Flowage are the main mapped linear watercourses adjacent to 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. 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.

A portion of the Haul Road lies within the Tangier River secondary watershed (1EL-2, including tertiary watersheds associated with Sandy Pond and the Morgan River), and the Touquoy Mine Site exists within the Fish River-Lake Charlotte secondary watershed (1EL-5, including tertiary watersheds associated with Moose River, Square Lake and Scraggy Lake), detailed in Section 6.7 of the Application.

Surface Water Quality

Overall, the aquatic ecosystem within the Beaver Dam Mine Site and Haul Road areas is characterized by acidic conditions, with aquatic features within the Cope Brook tertiary watershed exhibiting lower pH levels than aquatic features within the Killag River tertiary watershed. Low pH levels, elevated temperatures, low dissolved oxygen concentrations and elevated concentrations of some metal parameters may limit fish habitat quality in the area, particularly within small, sluggish first order streams and shallow open water features that experience with low water depths during the summer months.

The Project is in a highly mineralized region and the geology contributes to naturally acidic pH levels as well as elevated concentrations of many water quality parameters in the area, including iron, arsenic and aluminum (see Section 6.7 of the Application). The occurrence of naturally elevated concentrations in surface waters is commonly observed in regions of planned/proposed mining activities, all over the world (e.g., “Golden Triangle“ of northwestern British Columbia, Canada). In such regions, naturally elevated concentrations of certain water quality parameters generally occur where exposure of rock or other geologic materials to oxygen and water results in natural weathering processes, including chemical oxidation and leaching of solid-phase constituents (e.g., metals), which are then transported to surface waters.

Natural acidity and/or exceedances of water quality guidelines in baseline conditions are not a Project effect and, for these parameters, generic water quality guidelines (WQG) such as Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic life (CCME FAL), do not necessarily apply. That is, WQG generally represent generic criteria that are developed by governments or international organizations to identify the concentrations of parameters in the receiving environment that are not expected to cause an adverse effect on various receptors or uses (e.g., aquatic life, wildlife, livestock/agriculture, drinking water). As WQG are intended to apply universally, they do not necessarily account for site-specific factors including the presence/absence of specific species in the receiving environment, or naturally occurring elevated existing water quality due to mineralization of the watershed.

Monitoring results for the Killag River (identified receiving water for the Project) are summarized here in Appendix B. Results indicated that the concentrations of most metals are typically low, often below detectable levels. However, three of the baseline water quality locations (i.e., SW-5, SW-10 and SW14A, see figure 1-2) located either within, or directly downstream of historic tailings, show metal concentrations exceeding guideline concentrations. During Construction, water impacted by historic activities will be treated as described in Section 6.7.9.

Benthic Community

Detailed results including species identifications, summary statistics, and sediment descriptions are provided in Appendix J.2 of the Application. Results indicate a generally very low density and species diversity observed in the Killag River. In total, twelve different species consisting of eight family taxa were identified. The predominant class of benthic invertebrates was Diptera and included the *Chaoboridae* and *Chironomidae* families. Freshwater sponge colonies (i.e., Spongilla) were observed, but not included in the analysis.

The very low density and species diversity observed in the benthic invertebrate community in the Killag River is likely a reflection of a low-productivity habitat in peat-like sediments. Organisms such as *Hexagenia, Phylocentropus* and *Chaoborus,* which are indicators of good water quality were observed. Water quality parameters, such as acidic pH of the Killag River, may also inhibit the abundance and diversity of the benthic invertebrate community.

Fish Community

Baseline fish and fish habitat surveys have been completed from 2015 - 2020 to support the EIS. Fish habitat potential was determined during field identification/delineation through the collection of key fish habitat characteristics of each watercourse; these results are discussed in Section 6.9 of the Application and appendices referenced therein. In summary, field assessments to complete electrofishing and trapping were initiated in September 2015 at watercourses within the Beaver Dam Mine Site. Fish collection within watercourses along the Haul Road, and in Crusher Lake and Cameron Flowage within the Beaver Dam Mine Site were conducted in June 2016. Sixteen electrofishing sites were selected; nine within the Beaver Dam Mine Site and seven along the Haul Road.

More recently, the August 2020 baseline program (Appendix A) was designed to mirror the requirements for EEM that will be required once the Project proceeds; The following summary points document the main findings of the August 2020 study:

Fish population study:

- White sucker and yellow perch were captured in sufficient numbers and are suitable for use as sentinel species
- Insufficient brook trout were caught for use as a sentinel species
- A sufficient number of females (for both white sucker and yellow perch) in each area were obtained for the EEM fish population effect endpoints

Fish tissue data:

- Mercury concentrations in yellow perch and white sucker whole bodies were similar between the exposure and reference areas and were below the Heath Canada guideline of 0.5 mg/kg
- Mercury concentrations in yellow perch muscle fillets were above the Heath Canada guideline of 0.5 mg/kg in two out of ten samples
- Arsenic concentrations in both yellow perch and white sucker were higher in samples from the exposure area than the reference area and below the Heath Canada guideline of 3.5 mg/kg
- Selenium concentrations in yellow perch and white sucker were below the US EPA selenium criteria for protection of aquatic life of 15.1 and 8.5 µg/g, for muscle tissue and whole body samples, as applicable.

3 AEMP DESIGN- OVERVIEW

3.1 Performance Objectives

The goal of the AEMP will be to eliminate or minimize potential adverse effects on the aquatic receiving environment, while systematically seeking to enhance positive effects. This goal will be achieved by meeting the following objectives;

1. Monitoring of aquatic habitat along the proposed discharge flow pathway, haul road, and mine site area for potential Project effects with identified pathways of interaction between the Project and the aquatic environment (see Section 6.0 of the Application)
2. Ensuring that aquatic monitoring occurs at the frequency and to the extent required by regulations and permits under which the proposed Project will operate, such as the federal MDMER/EEM program and by provincial industrial discharge permits
3. Addressing requirements under the *Impact assessment Act* (IAA; S.C. 2019, c. 28, s.1) related to follow-up monitoring or information needs including :
    a. Evaluating the accuracy of effects predictions from the effects assessment;
    b. assessing the effectiveness of mitigation measures;
    c. providing an early warning system where the results of aquatic monitoring are used to prevent or avoid adverse environmental effects through a Response Framework and regular evaluation of the AEMP.
    d. identifying the need for additional mitigation measures to reduce or eliminate Project-related effects on water resources, if and as applicable.

3.2 Study Areas

Proposed AEMP study areas include watercourses and waterbodies adjacent to planned infrastructure within the Beaver Dam Mine Site including WC5/Crusher Lake, WC23, WC26, WC27/Mud Lake, and Cameron Flowage/Killag River.

An Environmental Effects Monitoring Plan (EEM) has been initiated (Appendix A) and will be fully implemented to support compliance with the monitoring requirements in MDMER. This EEM will form one component of the broader AEMP; for the EEM:

- a before-after control-impact design will be selected, with the control/reference area located upstream of the proposed effluent discharge locations and the impact/exposure area located downstream of the proposed final discharge points (FDPs; see Appendix A).
- There are two proposed FDPs associated with the Project. One FDP is associated with the north settling pond, and the other is associated with the open pit (Appendix A).

3.3 QA/QC

A robust QA/QC program will be implemented to confirm that data produced would be of acceptable and of verifiable quantity and meet the data quality objectives in support of EEM requirements under MDMER as well as anticipated provincial approvals requirements. In general, for the field component of the AEMP:

- the program will include a field plan, standard operating procedures for sampling, consistent sampling techniques, instrument calibration to be followed, and the use of standardized field data collection sheets.
- the field sampling will be conducted by a team experienced staff, including biologists who have conducted lethal fish, benthic invertebrate community, water, and sediment sampling for EEM for metal mining projects.

- the sampling locations will be geo-referenced using GPS and photographs of the sampling areas will be taken.
- Data sheets will be checked at the end of each field day for completeness and accuracy.
- Field duplicates will be incorporated into the monitoring program as a blind method of evaluating analytical precision, field precision and sample homogeneity. As applicable, blind duplicate samples consisting of a field sample will be collected in the same location as the parent sample. Duplicate samples will be collected to evaluate the homogeneity of the sample site and variation in the sample collection each time. Approximately 10% of the water quality, sediment quality, benthic community, periphyton. and fish tissue samples submitted to the laboratory will be blind field duplicates as per the Technical Guidance Document (EC, 2012).
- Samples will be processed as soon as possible after collection. If field processing must be delayed, samples will be held on ice and protected from exposure to light.

For the laboratory analyses for the AEMP:

- All analytical work (e.g., water quality, sediment quality, benthic community, true periphyton, and fish tissue analyses) will be conducted by an accredited laboratory.
- Laboratories, as third parties, will be responsible for their own in-house quality assurance and control programs, as per Canadian Association for Laboratory Accreditation (CALA) requirements.
- The laboratory will conduct internal QA/QC using laboratory blanks, laboratory duplicates, and certified reference materials.
- Samples will be tracked using chain of custody forms. Forms will be double checked for accuracy and completeness before samples are submitted. Samples will be submitted at the earliest practical time within the allowable holding time for the requested analyses.
- Results of analyses will be reviewed by staff not involved in the field data collection.
- To support data analyses and reporting.
- Prior to analysis, data will be checked for transcription errors.
- As applicable, outliers will be detected using visual screening techniques, such as scatterplots, box and whisker plots or normal probability plots. Removal of outliers will also consider the raw data, field conditions, and sampling and analysis procedures. Outlier values not attributed to entry errors or technical problems will be identified and their influence on the results will be determined by performing analyses with and without the extreme values.
- Calculations performed during data analysis will be reviewed for potential errors and to verify the accuracy of calculations.
- Tables and graphs containing summary data and statistical results will be verified by a secondary, independent reviewer.

4 AEMP DESIGN – MONITORING COMPONENTS

This section presents additional details specific to the individual AEMP monitoring components, that is:

- **Hydrology:** The hydrology component will be aligned to the Mine Water Management Plan and will measure stream flows and water levels, which will serve as supporting data for biological components (e.g., fish habitat) and for verifying hydrology predictions made in the Application;

- **Water Quality**: The water quality will characterize potential changes in water quality as a result of Project development, which will serve as supporting data for biological components (e.g., fish habitat) and for verifying predictions made in the Application. The water quality program will measure surface and ground water quality, and be aligned with the Mine Water Management Plan;

- **Sediment Quality**: to characterize changes in sediment quality resulting from the Project development;

- **Periphyton**: to evaluate effects of Project development on community structure due to changes in water quality;

- **Benthic Invertebrates:** to evaluate effects of Project development on the benthic invertebrate community due to changes in water and sediment quality;

- **Fish Habitat and Community:** Habitat that are directly or indirectly impacted by the Project, will be monitored to confirm the predictions of the assessment and to monitor the results of mitigation and offsetting measures; and

- **Fish Health and Fish Tissue**: to evaluate effects of the Project on fish health due to changes in water and sediment quality. This includes evaluation of whether treated effluent discharged from the Mine has altered body burdens.

4.1 Hydrology

4.1.1 Proposed Monitoring Locations

Hydrological monitoring will be completed for the Project on representative watercourses that have been predicted to have direct or indirect effects on fish and fish habitat from Project development.

Hydrology data will be collected through established hydrometric stations in five study areas (WC23, WC26, WC5, Mud Lake/WC27, and Killag River (Downstream)). Additional hydrometric stations will be established at four reference streams (Cope Brook, Killag River (Upstream), WC-N, WC-AH) and the outlet of a reference lake (to be determined). Table 4-1 summarizes monitoring rationale and proposed monitoring frequency. Note, these locations may require some adjustments in the field post-construction, as applicable.

In conjunction with the EEM, discharge volume sites will be selected at locations that best meet the following characteristics:

- Well defined stream bed and banks to allow for accurate flow measurements;
- Laminar flow over a relatively straight reaches with no significant obstructions along the stream bed or banks;
- Lack of significant wetlands contiguous to the stream bank;
- Expected measurable flow (based on upstream catchment area), even under relatively dry conditions;
- Expected depth and flow speeds during high flow periods such that measurements can be taken safely;
- Accessibility to flow monitoring crews;
- Each existing monitoring station, and all future stations has been/will be flagged and coordinates recorded; and
- Hydrometric station (staff gauge and level logger) and discharge volume data will be collected monthly.

4.1.2 Field Methods- Hydrometric Stations

Collection of Field Measurements

Each hydrometric station will be installed in low velocity sections of the stream at established discharge volume monitoring locations. The locations will be chosen where water depth is expected to remain sufficient throughout the driest times of the year. Each hydrometric station will be affixed directly to a rock face or angle iron driven approximately 1 m into the stream. Each hydrometric station hosts a staff gauge graduated in centimeters and automated water level logger. Automated water level loggers will be connected to direct read cables that extend to the watercourse shoreline. Direct read cables will be protected with flexible plastic piping and are affixed to shoreline trees or shrubs.

Water level loggers will be set to record every 15 minutes and are suspended within a 5 cm diameter slotted PVC pipe. A barometric pressure logger set to record every 15 minutes will be installed in a protective 2.5 cm diameter PVC pipe and affixed at a selected, central hydrometric station. Water level loggers will be compensated for barometric pressure using Solinst Levelogger 4.3.3 Software. During each monitoring event staff gauge readings will be recorded and logger data downloaded.

Each new hydrometric station elevation will be recorded for true elevation and compared to two established benchmarks using a survey level and rod. Benchmarks will be flagged and have GPS coordinates. These relative elevation surveys will be confirmed seasonally to ensure stability of each hydrometric station.

Discharge volume will be established using the mid-section method described in The Water Survey of Canada, Hydrometric Technician Career Development Program (1999). The wetted width will be determined with a metered tape secured between

two flagged, fixed station posts installed on either side of the watercourse. The wetted width of the watercourse will be divided into a minimum of 20 cross-sectional intervals when the watercourse is greater than 2.0 m wide. Where the watercourse is less than 2.0 m wide the wetted width will be divided into 10 cm intervals. Point velocities will be determined in each interval with a flow meter that displays average flow velocities over 30 second intervals and depth via meter stick readings. To determine the mean velocity at each interval, the one-point method will be used for water depths less than 1.0 m (i.e., velocity is measured at 0.6 of the total depth below surface). When depth is 1.0 m or greater or upstream obstructions are present, the two-point method will be used (velocity is measured at 0.2 and 0.8 of the total depth then averaged). Multiple flow measurements in the deeper water sections of the channel provide more accurate data than single measurements.

The volume (m^3/s) of water flowing within a watercourse past a given point will be calculated by multiplying its flow velocity (m/s) by the cross-sectional water depth (m) and width (m). To obtain the volume flowing across the entire width of the river, a series (generally a minimum of 20) of single point velocity and depth measurements will be combined to create a cross-sectional flow profile of the river. The data will be used to calculate volume discharge by combining the individual depth and interval measurements (flow and width) of the stream. A secondary pass will also be completed to determine the confidence level of the data collected.

During winter (frozen) conditions thin river ice is removed from the discharge volume cross sections and hydrometric station prior to monitoring.

During winter conditions (January to March) and spring freshet conditions (April – May) snow accumulation or weak ice cover and high flow velocities or depth can cause unsafe monitoring conditions, therefore data may not be retrievable monthly or seasonally. Water quality samples will resume when suitable conditions are present.

Field Methods – Transects

Transect/cross-sectional measurements will be taken to support hydrological monitoring in combination with the locations of fish community surveys. Transects are anticipated to be established at the upstream and downstream ends of each closed electrofishing reach within tour study area streams (WC23, WC26, WC5, and Killag River (Downstream)) and four reference streams (Cope Brook, Killag River (Upstream), WC-N, and WC-AH). Transects within these features will collect data to support the Wetted Perimeter Method (WPM) and includes surveying bank heights and the entire width of the river at a minimum of 10 intervals.

The Wetted Perimeter Method (WPM) is a fixed flow hydraulic rating method based on the hydraulic relationship between flow (i.e. discharge) and wetted river perimeter at selected transects (Stalnaker et al. 1994). Using the relationship, the flow corresponding to the wetted perimeter (i.e., wetted width of the stream transects), will be estimated.

The selected transects for assessment will be an index habitat for the rest of the river or river section being assessed (Stalnaker et al. 1994). Riffles are typically selected because cross sections in these areas exhibit sensitivity to width, depth and velocity to changes in flow. Because the shape of the channel can influence the results of the analysis, attempts will be made to locate transects in areas that are wide, shallow, and rectangular.

The following assumptions apply to the WPM:

- the selected transect(s) is a suitable index of habitat for the rest of the river being assessed, i.e., if the minimum flow requirement is satisfied at the chosen sensitive location, it will be satisfied in other habitat types. The greater the number of transect locations, the higher the level of confidence in the minimum flow estimation;
- the point of inflection is a suitable surrogate for acceptable habitat, i.e., flow reductions below that point on the graph will result in loss of habitat quality; and
- all wetted area is equally important as habitat or to satisfy other biological criteria.

Bathymetry data and water level loggers will be used in tandem within Mud Lake/WC27 and the selected reference lake to identify any habitat losses associated with unnatural water level decreases within Mud Lake/WC27.

Transects within lotic habitats have already been established and cross-sectional data has been measured as part of baseline EEM studies in both reference and exposure locations. Data collected include habitat unit type (e.g., pool), wetted and channel widths, and water depths take at 25%, 50%, and 75% widths of the wetted channel. Cross-sectional data will continue to be recorded within EEM reference and exposure locations as required through the MDMER and are expected to support hydrological monitoring within these systems.

Field Methods – Cameron Flowage Baseflow

Baseflow monitoring in Cameron Flowage will employ similar methodologies for hydrometric stations as outlined above. Monitoring in Cameron Flowage will comprise the installation of water level data loggers (number to be determined) capable of recording both water level and temperature measurements on a continual basis. The locations of these data loggers will be selected based on potential locations of cold-water refugia to be identified through baseline thermal imaging and field verification. Thermal imaging is being considered for select internals. The thermal imaging will be assessed once baseline is collected to determine the suitability for continued monitoring as part of the AEMP.

Each monitoring station in Cameron Flowage will include an automated water level logger. Automated water level loggers will be connected to direct read cables that extend to the watercourse shoreline. Direct read cables will be protected with flexible plastic piping and are affixed to shoreline trees or shrubs.

Water level loggers will be set to record every 15 minutes and are suspended within a 5 cm diameter slotted PVC pipe. Water level loggers will be compensated for barometric pressure using Solinst Levelogger 4.3.3 Software. During each monitoring event staff gauge readings will be recorded and logger data downloaded.

Field Methods – Cameron Flowage Thermal Monitoring

Cold-water fish, including salmonids, require that surface water temperatures remain within a certain range for maximal suitability and survival. Under low-flow conditions during summer months, groundwater discharge (baseflow) to Cameron Flowage may sustain a significant portion of the total flow within Cameron Flowage; therefore, the potential reduction in baseflow as a result of the Beaver Dam Mine Site development may impact the average temperature within Cameron Flowage. While all water pumped from the proposed open pit will be rerouted via surface water ditches to maintain the same total flow within Cameron Flowage relative to baseline conditions, water entering Cameron Flowage via the surface water ditches may be at a higher temperature than if that water reached Cameron Flowage through subsurface baseflow. Therefore, measured groundwater and surface water temperatures were evaluated relative to the predicted reduction in baseflow to predict the potential average temperature change in Cameron Flowage under low-flow conditions that could result from development of the Beaver Dam Mine Site (see Appendix P.4 of the Application).

The potential temperature change in Cameron Flowage as a result of the development of the Beaver Dam Mine Site based on the measured flow rates and temperatures in Cameron Flowage, the measured groundwater temperatures and the predicted baseflow reduction at EOM and PC as presented in Appendix P.4. Cameron Flowage will likely be most sensitive to potential reductions in baseflow during low-flow conditions in summer months when baseflow makes up the largest proportion of total stream flow and surface water temperatures within Cameron Flowages are near their maximum. Therefore, GHD selected the two-week period with the lowest average flow rate recorded at surface water monitoring stations (SW-1A and SW-2A), corresponding to August 16 through August 29, 2019, as being representative of low-flow conditions in Cameron Flowage. By applying heat and mass balance modelling, the predicted temperature increase during the identified low-flow conditions is 0.5°C under EOM conditions relative to baseline, and 0.26°C under PC conditions relative to baseline. These predicted increases correspond to an increase from mean baseline water temperature 20.21 to 20.71°C and 20.47°C for EOM and PC, respectively.

Monitoring will be completed to demonstrate that temperature changes within Cameron Flowage are within the predicted range. The collection of continuous water levels (automated transducers) and manual flow data is proposed to continue through all stages of the Mine development to support and improve the existing stage-discharge relationship/rating curves and

further help validate modelling completed for the Beaver Dam Mine. This monitoring will continue until the completion of active closure.

4.1.3 Frequency

Selected study areas and reference areas will be monitored continuously using pressure transducers and data loggers. During quarterly scheduled field visits, volume discharge measurements will be taken at established hydrometric stations in lotic systems; manual flow measurements will be completed quarterly until sufficient points are developed for rating curve.

Periodic monitoring of selected lakes will consist of water surface elevation surveys during scheduled field visits.

Monitoring plans for the post-closure phase will be established closer to the planned closure of the Mine, as a requirement of the permits and licenses under which the proposed Project will operate.

4.1.4 Trigger Criteria

For final effluent compliance, mitigation / contingency measures would be implemented if three consecutive final effluent sampling results, for any parameter, exceed 85 percent of the monthly average effluent limit, to be established during the permitting/approvals process.

Table 4-1 Summary of Proposed AEMP Design – Hydrology

Proposed Location	Name of Watercourse	Station I.D.*	Sampling Rationale	Timing	Frequency
Mine Site Area, Local Tributaries	• WC-23 • WC-26, • WC-5 • WC-27	• SW-31 (tributary to Cope Brook) • SW-30 (Outlet to the Killag) • SW-6a (Watercourse between Crusher and Mud Lakes) • SW-4a (Outlet of Mud Lake)	monitored to evaluate changes in baseflow over time and in comparison with impact predictions.	• monitoring of flow and water levels will occur during construction, operations and active closure	• The collection of continuous water levels (automated transducers) and manual flow data at seven locations is proposed to continue through all stages of the Mine development to support and improve the existing stage-discharge relationship/rating curves and further help validate modelling completed for the Beaver Dam Mine.
Mine Site Area, Discharge Areas	• Cameron Flowage	• SW-2a , upstream • SW-1a, downstream	to be monitored to evaluate changes in baseflow as well as context for other monitoring parameters such as water quality and fish habitat Water level data loggers (number to be determined) capable of recording both water level and thermal monitoring on a continual basis.		
	• Killag River	• SW-19 • SW-32	to be monitored to evaluate changes in baseflow as well as context for other monitoring parameters such as water quality and fish habitat		
References Areas	• Cope Brook	• t.b.d.	Proposed Reference Area		
	• WC-N,	• t.b.d.	Proposed Reference Area		
	• WC-AH	• t.b.d.	Proposed Reference Area		

** These I.D. represent existing surface water stations (see Figure 1-3). Monitoring locations for the AEMP, and related follow-up programs, may require some adjustments in the field post-construction, as applicable, as well as finalization during the provincial approvals process (GHD 2021c). Proposed reference areas and reference lake monitoring locations lake to be finalized (t.b.d.)*

4.2 Water Quality

4.2.1 Proposed Monitoring Locations

Surface water quality monitoring will be completed for the Project in conjunction with the Mine Water Management Plan on selected representative watercourses that have been predicted to have direct or indirect effects on fish and fish habitat from Project development. The locations of these stations may require some adjustments in the field post-construction, where applicable.

Monitoring during the post-closure phase will be established closer to the planned closure of the Mine, as a requirement of the permits and licenses under which the proposed Project will operate.

Surface water quality monitoring will be aligned with the hydrological monitoring program (described above). Table 4-2 summarizes monitoring rationale and proposed monitoring frequency.

Table 4-2 Summary of Proposed AEMP Design – Surface Water Quality

Proposed Location	Name of Watercourse	Station I.D.*	Sampling Rationale	Timing and Frequency**
Mine Site Area, Local Tributaries	• WC-23 • WC-26, • WC-5 • WC-27	• SW-31 • SW-30 • SW-6a • SW-4a	• tributary to Cope Brook, downgradient of the NAG Stockpile, • down gradient of proposed NAG Stockpile, upstream of the Killag, • Watercourse between Crusher and Mud Lakes • Outlet of Mud Lake - Quarterly profile monitoring of Mud Lake	Monthly
Mine Site Area, Discharge Areas	Cameron Flowage	• SW-26A	• Downstream of a proposed site discharge location, north of mine activities - Quarterly profile monitoring of Cameron flowage	Monthly
	Killag River	• SW-29 • SW-19 • SW-1, SW-1A • SW-2A • SW-5A • SW-32	• upstream of proposed mine activities • downstream of SW-30 inflows • Mid-field stations, downstream of mine activities • upstream of Cameron Flowage • downstream of Cameron Flowage • Far-field station located where the NSSA lime doser mixing occurs	Monthly
Haul Road Area	• Tent Lake • Un-named	• SW-11 • SW-41, SW-42	• South of mine, proximate to Haul road • Proximate to greenfield construction portion of the Haul Road	Quarterly
References Areas	Cope Brook	• t.b.d.	• Proposed Reference Area aligned with hydrology program	Quarterly
	WC-N,	• t.b.d.	• Proposed Reference Area aligned with hydrology program	Quarterly
	WC-AH	• t.b.d.	• Proposed Reference Area aligned with hydrology program	Quarterly

** These I.D. represent existing surface water stations (see Figure 1.3). Monitoring locations for the AEMP, and related follow-up programs may require some adjustments in the field post-construction, as applicable, as well as finalization during the provincial approvals process (GHD 2021c). Proposed reference areas and reference lake monitoring locations lake to be finalized (t.b.d.)*

***Surface water quality monitoring will occur during construction, operations and active closure.*

4.2.2 Methods

Sampling

Surface water samples (and water quality measurements using probes or meters such as for dissolved oxygen or pH) will be collected in accordance with the federal "Protocols Manual for Water Quality Sampling in Canada" (Canadian Council of the Ministers of the Environment [CCME] 2011).

Where monthly surface water grab samples are collected from lakes, the samples are to be collected from the lake outlets. Quarterly lake profile sampling will also include *in-situ* measures of temperature and dissolved oxygen, with meter readings conducted a 1 m intervals.

Parameters

Water quality sampling parameters are listed in Table 4-3.

In the case of water samples collected from receiving water and downstream waterbodies, and peripheral waterbodies and control lakes, the method detection limits will be a minimum of 5 to 10 times lower than the identified protection of aquatic life criterion, in accordance with CCME (2011) protocols.

Table 4-3- Surface Water Quality Monitoring Parameters

General parameters: - pH, - Total Suspended Solids (TSS) - Total Dissolved Solids (TDS) - Biological Oxygen Demand (BOD5), - Dissolved Oxygen (DO), - acidity - hardness - alkalinity	Anions & Nutrients - Chloride (Cl) - Fluoride (F) - Sulphate (SO_4) - Total and un-ionized ammonia, - nitrate, - nitrite
Metals (filtered and unfiltered) - Al, Sb, As, Ba, Be, B, Bi, Cd, Ca, Cr, Co, Cu, Fe, Hg, Pb, Li, Mg, Mn, Hg, Mo, Ni, P, K, ,Se, Si, Ag, Na, Sr, S, Te, Th, Sn, Ti, W, U, V, Zn and Zr - Mercury (total, dissolved, methyl-mercury) - Radium-226	Organics - Dissolved Organic Carbon (DOC) - total and free cyanide - Chlorophyll a

4.2.3 Frequency

Sample collection frequency are shown in Table 4-2. Monitoring during the post-closure phase will be established closer to the planned closure of the Mine, as a requirement of the permits and licenses under which the proposed Project will operate.

All surface water stations are to be sampled at monthly intervals with the exception of lake profile samples and identified reference locations, which are to be sampled quarterly.

Monitoring plans for the post-closure phase will be established closer to the planned closure of the Mine, as a requirement of the permits and licenses under which the proposed Project will operate.

4.2.4 Trigger Criteria

A root cause investigation will be undertaken in the event that:

- Protection of aquatic life, or background water quality values are exceeded on a consistent basis; or
- Where a data trend is shown to be developing which is likely to result in protection of aquatic life criteria being exceeded in the longer-term, unrelated to background conditions.

4.3 Sediment Quality

4.3.1 Proposed Monitoring Locations

Table 4-4 summarizes proposed monitoring for the sediment quality component of the AEMP. Sediment quality will serve as an indicator of benthic invertebrate exposure to contaminants and fish habitat quality within the proposed EEM exposure area and reference areas. Locations of proposed sediment sampling locations include:

- those identified in the EEM and include a location approximately 500 m downstream of the proposed EEM exposure area (Killag River (Downstream)) to verify the effluent treatment mitigation measures proposed in the EIS and to evaluate any potential downstream impacts to fish habitat.
- in Cameron Flowage and the Killag River (EEM) through the various phases of the EEM program, with frequency and timing of sampling events to be determined as required through the MDMER.

4.3.2 Methods

Sampling

Sediment samples will be collected in accordance with the federal Mining Technical Guidance for Environmental Effects Monitoring (Environment Canada, 2012).

A composite sediment sample from a depositional location will be collected from both of the EEM exposure and reference areas and the Killag River (Downstream) study area simultaneously with benthic invertebrate collection. Sediment samples will be stored in laboratory-issued sample bottles on ice and/or refrigerated at 4 °C until analysis.

Parameters

Sediment samples will be analyzed for particle size distribution, total organic carbon content (TOC), and total metal concentrations, including mercury. Results will be compared to the Canadian Sediment Quality Guideline Probable Effects Levels. Sediment characteristics such as colour, odour, texture, and presence of debris will be recorded.

4.3.3 Frequency

Monitoring during the post-closure phase will be established closer to the planned closure of the Mine, as a requirement of the permits and licenses under which the proposed Project will operate.

Samples will be collected once annually (early fall) in tandem with benthic invertebrate sampling.

Monitoring plans for the post-closure phase will be established closer to the planned closure of the Mine, as a requirement of the permits and licenses under which the proposed Project will operate.

Table 4-4. Summary of Proposed AEMP Design – Sediment Quality*

Watercourse/Waterbody	Station ID*/Rationale	Timing**	Frequency
• Study Areas			
• Mine site area tributaries (WC-27)	• SW-4a: Assess potential impacts due to potential flow reductions and/or changes to hydrology	• Once – early fall (September – October)	• annual
• Mine site area tributaries (WC-23)	• SW-31: Assess potential impacts due to potential flow reductions and/or changes to hydrology	• Once – early fall (September – October)	• annual
• Cameron Flowage	• SW-26A:monitor sediment quality near the point of effluent discharge	• Once – early fall (September – October)	• annual
• Killag River (Downstream)	• SW1: monitor sediment quality downstream of effluent discharge	• Once – early fall (September – October)	• annual
• Potential Reference Areas			
• Killag River (EEM)	• EEM reference	• Once – early fall (September – October)	• annual

** These I.D. represent existing surface water stations (see Figure 1-3). Sediment monitoring locations for the AEMP, and related follow-up programs may require some adjustments in the field post-construction, as applicable, as well as finalization during the provincial approvals process (GHD 2021c). Proposed reference areas and reference lake monitoring locations lake to be finalized (t.b.d.)*

***Sediment quality monitoring will occur during construction, operations and active closure.*

4.4 Periphyton

Periphyton, or biofilm, refers to the assemblage of algae, bacteria, and other organisms that attach to submerged substrates (Stevenson et al., 1996). This biofilm comprises primary producers (photosynthetic organisms) who form the basis of food webs within lotic ecosystems and are considered an indicator of environmental and ecological conditions. They represent the lowest trophic level in stream food webs and exhibit a different range of sensitivities to environmental stressors. Changes in periphyton can affect higher trophic levels in streams (benthic invertebrates, fish), because biofilm form the basis of the food chain upon which higher trophic levels rely. Such changes can happen before fish are affected, which makes periphyton a good early warning indicator of alterations to fish habitat (e.g., eutrophication).

In lentic systems, the level of primary productivity (i.e., trophic status) can be inferred from several algal biomass related indices, including turbidity, TDS, colour, chlorophyll a, and limiting nutrient (phosphorus and nitrogen) concentrations.

4.4.1 Proposed Monitoring Locations

Table 4-5 summarizes proposed monitoring for the periphyton component of the AEMP. Periphyton sampling will be conducted in watercourses as a supporting environmental variable for fish habitat monitoring due to precited reductions in flow (WC23, WC26, WC5), and to verify the prediction of no change to the aquatic ecosystem downstream of treated effluent discharge (Killag River (Downstream)). Reference watercourses (Cope Brook, Killag River (Upstream), WC-N, and WC-AH) will also be monitored to provide regional context.

Primary productivity monitoring in lentic or lentic-like systems (Mud Lake/WC27, Cameron Flowage, Killag River (EEM), and a reference lake) will be accomplished through the water quality monitoring component described in Section 4.2

Periphyton sampling in lotic systems will occur in tandem with benthic invertebrate and fish habitat and community surveys. Frequency will be annual during the initial years of the AEMP, but may re-evaluated and adjusted through subsequent mine phases as determined to be required.

4.4.2 Methods

Methods to complete periphyton sampling will adopted from the US EPA Rapid Bioassessment Protocols for Use in Streams and Wadable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish (Barbour et al. 1999).

Field sampling will employ the Multihabitat Sampling approach (Barbour et al. 1999). At each sampling location, a survey reach will be established calculated as 30-40 bankfull widths of the linear watercourse. Periphyton samples will collected by scraping periphyton biomass from rocks, woody debris and vegetation at representative locations along the assessment reach and placed into a common container until approximately 200 ml of biomass is collected. Each surface scraped will measured for area and then combined to give a total sample area. A single composite sample will be collected for each survey area, kept on ice, then transported to the field laboratory.

At the field laboratory, each sample will be made to be 1.5 L using stream water as required, homogenized with an immersion blender, then transferred into laboratory supplied sample bottles. Samples will be kept on ice and delivered to an accredited laboratory on the same day as sample collection to be analyzed for chlorophyll a, TSS, and Total Volatile Solids.

4.4.3 Frequency

Periphyton samples in three lotic, wadable study areas (WC23, WC26, and Killag River (Downstream)), as well as four proposed reference streams (Cope Brook, Killag River (Upstream)), WC-N, and WC-AH) Cameron Flowage). Sampling will occur in tandem with fish community monitoring (Section 4.6).

Periphyton samples should be collected during periods of stable stream flow. High flows can scour the stream bed, flushing the periphyton downstream. In addition, assessment area selection will need to be confirmed in field for the following:

- Assessment areas are stream reaches that best represent general stream characteristics (flow rate, substrate composition, etc.)
- Assessment areas are stream reaches that best represent all fish habitat types/stream morphologies within the system (riffles, runs, pools, etc.)
- The stream reaches that provide best characteristics to meet the requirements of sampling methodologies (wadable, appropriate substrate).

Monitoring plans for post-closure phase will be established closer to the planned closure of the Mine, as a requirement of the permits and licenses under which the proposed Project will operate.

Table 4-5 Summary of Proposed AEMP Design – Periphyton

Watercourse/Waterbody*	Station ID*/Rationale	Timing**
• Mine site area tributaries (WC-23)	• SW-31; monitor effect of reduced flow on fish habitat	• Twice – late spring/early summer and late summer/early fall (June – September)
• WC-26	• monitor effect of reduced flow on fish habitat	• Twice – late spring/early summer and late summer/early fall (June – September)
• Mud Lake/WC27	• SW-4a: monitor effect of reduced flow on fish habitat	• Twice – late spring/early summer and late summer/early fall (June – September)
• WC5	• SW-6a:monitor effect of reduced flow on fish habitat	• Twice – late spring/early summer and late summer/early fall (June – September)
• Killag River (Downstream)	• monitor fish habitat downstream of effluent discharge	• Twice – late spring/early summer and late summer/early fall (June – September))
• Cope Brook	• reference stream	• Twice – late spring/early summer and late summer/early fall (June – September)
• Killag River (Upstream)	• reference stream	• Twice – late spring/early summer and late summer/early fall (June – September)
• WC-N (West River)	• reference stream	• Twice – late spring/early summer and late summer/early fall (June – September)
• WC-AH (Tributary to Morgan River)	• reference stream	• Twice – late spring/early summer and late summer/early fall (June – September)

** These I.D. represent existing surface water stations (see Figure 1.3). Monitoring locations for the AEMP, and related follow-up programs, may require some adjustments in the field post-construction, as applicable, as well as finalization during the provincial approvals process (GHD 2021c). Proposed reference areas and reference lake monitoring locations lake to be finalized (t.b.d.)*

***Monitoring will occur during construction, operations and active closure.*

4.5 Benthic Invertebrates

Benthic macroinvertebrates are common inhabitants of streams and lakes and are important in moving energy through food webs as the dominant source of secondary production. Benthic macroinvertebrates have life spans of approximately one to three years, and therefore can reflect cumulative impacts to aquatic ecosystems. Benthic macroinvertebrate communities are good indicators of localized conditions. Many benthic macroinvertebrates have limited migration patterns or a sessile mode of life, so they are particularly well-suited for assessing local, site-specific conditions and impacts (Barbour et al., 1999).

4.5.1 Proposed Monitoring Locations

Table 4-6 summarizes proposed monitoring for the benthic invertebrate component of the AEMP. Benthic invertebrate sampling will be conducted in watercourses and waterbodies as a supporting environmental variable for fish habitat monitoring due to precited reductions in flow or water levels (WC23, WC26, WC5, Mud Lake/WC27), and to verify the prediction of no change to the aquatic ecosystem downstream of treated effluent discharge (Killag River (Downstream)). Reference areas (Cope Brook, Killag River (Upstream), WC-N, WC-AH, and a reference lake) will also be monitored to provide regional context.

Benthic invertebrate sampling will commence in the following study and reference areas during baseline/pre-construction to establish baseline conditions:

- WC23
- WC26
- WC5
- Mud Lake/WC27
- Killag River (Downstream)

- Cope Brook
- Killag River (Upstream)
- Reference Lake

Benthic invertebrate sampling will continue through mine construction, operations, and reclamation and post closure (as determined to be required). Benthic sampling will occur concurrently with periphyton and fish habitat and community surveys, which is anticipated to occur twice over the course of the summer fishing period (June 1 – September 30). Frequency will be twice annually during the initial years of the AEMP, but may re-evaluated and adjusted through subsequent mine phases as determined to be required. Sediment samples will be taken at the same time as benthic invertebrate samples.

Benthic invertebrate monitoring will be continued in Cameron Flowage and the Killag River (EEM) through the various phases of the EEM program, with frequency and timing of sampling events to be determined as required through the MDMER.

4.5.2 Methods

Sampling

Samples will be collected in accordance with the federal Mining Technical Guidance for Environmental Effects Monitoring (Environment Canada, 2012).

Benthic invertebrate samples in lakes and open water, un-wadable areas of rivers (i.e. Cameron Flowage) will be collected at mid-depth by boat using a petit ponar grab (surface area of 0.0255 m^2). Depths of samples will be verified and recorded using a digital depth sounder. Five petit ponar grab samples will be collected at each sampling location. Each sample will consist of a composite of three subsamples taken at least 5 m apart as judged from the surface. Exact station locations will be collected by GPS as UTMs.

In streams, benthic invertebrate sampled will be collected with grab sampler; if a grab sampler cannot be utilized due field conditions, a Surber sampler of 0.093 m^2 bottom area, equipped with a 500 µm mesh collecting net will be used instead. Five samples will be collected at each sampling location.

Samples will be sieved through a 500 µm mesh size bucket sieve prior to preservation.

Laboratory Methods

Lake and stream benthic invertebrate samples will be sent to a qualified taxonomy laboratory, for identification and enumeration. The samples will be sorted and sub-sorted as required and a measure of sub-sorting efficiency will be provided if sub-sorting is required. Prior to sorting, samples were rinsed on a 500 µm mesh sieve to remove preservative.

Benthic invertebrates will be identified to the lowest practical level, typically to genus, using conventional literature for the groups involved (Clarke, 1981; Johannsen, 1978; Mackie, undated; McAlpine et al., 1981; Merritt, Cummins, and Berg, 2008; Pecharsky et al., 1990; Saether, 1972; Usinger, 1963; Wiggins, 1977).

Samples will be examined at 6 - 6.4x magnification on a stereomicroscope, with a final brief check at 16x. Removal efficiency for lab personnel is checked by resorting 10% of samples to ensure a sorting efficiency of 90% or better. Organisms will be subsequently stored in labeled vials in 70% Isopropyl alcohol. A reference collection will be retained in archive for potential future taxonomic verification and calculations of sorting.

4.5.3 Frequency

Benthic invertebrate community sampling will occur in the late spring and early fall (September-October) to provide more mature forms of benthic invertebrates for identification. Samples will be taken from all study areas (WC23, WC26, WC5, Mud Lake/WC27, Killag River (Downstream)) and proposed reference areas (Cope Brook, Killag River (Upstream), WC-N, WC-AH,

and a reference lake). Benthic invertebrate monitoring will be continued in Cameron Flowage and the Killag River (EEM) (proposed reference and exposure locations) through the various phases of the EEM program, with frequency and timing of sampling events to be determined as required through the MDMER.

Monitoring plans for the post-closure phase will be established closer to the planned closure of the Mine, as a requirement of the permits and licenses under which the proposed Project will operate.

Table 4-6 Summary of Proposed AEMP Design – Benthic Invertebrates

Watercourse/Waterbody	Station I.D*/Rationale	Timing**
• WC23	• SW-31;monitor effect of reduced flow on fish habitat	• Twice – late spring/early summer and late summer/early fall (June – September)
• WC26	• SW-30;monitor effect of reduced flow on fish habitat	• Twice – late spring/early summer and late summer/early fall (June – September)
• WC5	• SW-6a; monitor effect of reduced flow on fish habitat	• Twice – late spring/early summer and late summer/early fall (June – September)
• Mud Lake/WC27	• SW-4a; monitor effect of reduced flow/water level reduction on fish habitat	• Twice – late spring/early summer and late summer/early fall (June – September)
• Cameron Flowage	• monitor fish habitat near the point of effluent discharge (EEM)	• Once – early Fall (September – October)
• Killag River (Downstream)	• monitor fish habitat downstream the point of effluent discharge	• Once – early Fall (September – October)
• Cope Brook	• reference stream	• Twice – late spring/early summer and late summer/early fall (June – September)
• Killag River (Upstream)	• reference stream	• Twice – late spring/early summer and late summer/early fall (June – September)
• Killag River (EEM)	• EEM reference	• Twice – late spring/early summer and late summer/early fall (June – September)
• WC-N (West River)	• reference stream	• Twice – late spring/early summer and late summer/early fall (June – September)
• WC-AH (Tributary to Morgan River)	• reference stream	• Twice – late spring/early summer and late summer/early fall (June – September)
• Reference Lake (Kent or Tait Lake)	• reference lake	• Twice – late spring/early summer and late summer/early fall (June – September)

** These I.D. represent existing surface water stations (see Figure 1.3). Monitoring locations for the AEMP, and related follow-up programs may require some adjustments in the field post-construction, as applicable, as well as finalization during the provincial approvals process (GHD 2021c). Proposed reference areas and reference lake monitoring locations lake to be finalized (t.b.d)*

***Monitoring will occur during construction, operations and active closure.*

4.6 Fish Habitat and Community

Habitat that are directly or indirectly impacted by the Project, will be monitored to confirm the predictions of the assessment and to monitor the results of mitigation and offsetting measure. Fish and fish habitat surveys will be completed in the areas of reduced flow in in addition to appropriate reference location. Additional monitoring associated with fish offset measures will be specified in the final Fish Habitat Offset Plan and the Fisheries Authorization for the Project.

4.6.1 Methods

Fish Sampling

Quantitative electrofishing surveys within isolated reaches is the preferred method of fish community sampling (e.g., installation of temporary block nets/barriers to quantify stream reach length and to determine relative abundance of fish per area of stream). Whenever electrofishing surveys are not possible (i.e., in systems that are not wadable), trapping will be conducted and standardized using Catch Per Unit Effort (CPUE) per trap hour.

Field sampling will be designed to limit mortality of the existing species. In wadable streams, fish population assessments will be conducted through quantitative electrofishing (i.e. the depletion method). The depletion method (also known as the "Zippin" method, see Zippin, 1958) is a suitable method for population estimates when the stream is very small, it is expedient to collect all data within a short time such as one day, and the population being estimated is relatively small (roughly less than 2,000 individuals).

The following conditions must be met for accurate depletion method estimates:

1. Emigration and immigration by fish during the sampling period must be negligible. This is accomplished by installing barrier nets at both upstream and downstream ends of the electrofishing reach.
2. All fish within a specified sample group must be equally vulnerable to capture during a pass.
3. Vulnerability to capture of fish in a specified sample group must remain constant for each pass (e.g. fish do not become warier of capture).
4. Collection effort and conditions which affect collection efficiency, such as water clarity, must remain constant. To minimize error, the amount of effort used on each pass should be as constant as possible.

Fish will be sampled using a backpack electrofishing unit with un-pulsed direct current. Sampling reaches of approximately 100 m in length will be established and isolated using barrier nets (1/8" mesh) secured to the stream bed. Within each isolated reach, a minimum of three passes with the electrofisher will be completed. Additional passes will be completed if depletion in catch is not obtained after the first three passes. If no fish are captured after two passes, the third pass will not be conducted.

In waterbodies and un-wadable, open-water areas of river (i.e., Cameron Flowage), fish community sampling will consist of trapping using a variety of non-lethal trap types (e.g., minnow traps, fyke nets, eel pots). During each field survey, traps will be set overnight and retrieved the following day. A consistent effort using the same gear (e.g., using the same number of gear each overnight set) and consistent set durations will be used for equitable comparability among survey events.

All fish captured will be enumerated, identified to species, and measured for total length and weight. The number of fish collected during each pass will be recorded so that quantitative fish population estimates can be calculated. The total amount of effort (electrofishing seconds or trapping hours) will also be recorded. All fish sampling will be conducted in accordance to the specific terms and conditions of the Fisheries and Oceans Canada Scientific Fishing License.

Physical and Physicochemical Habitat

One of the key monitoring goals will be confirming that the altered habitats due to indirect impacts are still functioning as predicted and able to support the existing fish communities. To do this it will be important to monitor physical and chemical properties of the habitat during low flow conditions when the predicted impacts may exacerbate existing limitations within the creeks. Appropriate habitat parameters including the physical condition as well as physicochemical parameters will be

monitored both during regular flows and during low flow events. The following supporting data will be collected at each fish community sampling station:

- exact station location as UTMs;
- physical habitat observations;
- weather conditions;
- in situ physicochemical water quality parameters (i.e., dissolved oxygen, water temperature, conductivity, pH);
- photographs of the sampling reach and a representative photo of each species captured; and
- Additional physical and biological fish habitat characteristics (i.e., substrate, channel measurements, water depths, water velocities, and vegetation) within each electrofishing and trapping site will be recorded at the time of each fish community sampling event.

To evaluate the potential effects of increased temperatures within Cameron Flowage on the habitat suitability of cold-water refugia, any potential refugia identified within Cameron Flowage through the water quality monitoring program and supporting thermal imagery will be monitored for fish usage, including continuous temperature loggers. Drone surveys capable of thermal imaging will be conducted to document the presence cold-water reaches based on thermal temperature data. These may be supplemented by underwater camera and/or snorkel surveys if deemed necessary. The survey will be conducted during peak low-flow/summer temperatures (i.e., at less than 30% MAD), at which point refugia are anticipated to provide critical thermal habitats for cold-water species like brook trout and Atlantic salmon.

The upstream and downstream ends of each electrofishing reach will serve as the locations of transects for cross-sectional channel measurements which will serve as supporting data for hydrological monitoring (Section 4.1)

4.6.2 Frequency

Monitoring of fish and fish habitat in the study and reference areas will be monitored and informed through all other physical and biological monitoring components of the AEMP (hydrology, water quality, sediment quality, periphyton, and benthic invertebrates). In addition, physical fish habitat characteristics will be documented specifically at during each fish community monitoring survey. Targeted monitoring of habitat conditions during low flow will also occur.

During construction, operations and active closure, fish habitat and community monitoring will occur at least twice per year over the course of the permitted summer fishing season; timing of sampling events are expected to occur once in early summer (June) and once in late summer (September). Monitoring frequency will be annual during the initial years of the AEMP, but may re-evaluated and adjusted through subsequent mine phases as determined to be required. Monitoring during the post-closure phase will be established closer to the planned closure of the Mine, as a requirement of the permits and licenses under which the proposed Project will operate.

In addition to the above annual sampling, fish community sampling for compliance with MDMER EEM requirements will be conducted according to the regulated cycles (e.g., every three years).

Note, due to the extremely low catch numbers observed in WC23 and WC26, during baseline sampling, it is anticipated that one additional electrofishing reach will be established further downstream in both watercourses during baseline/pre-construction. Whether the second electrofishing reach will be carried forward through the monitoring program will be determined based on catch results in comparison to upstream survey reaches. Baseline fish sampling will be performed in all reference areas not already included through baseline surveys conducted as part of the EIS, including Cope Brook, Killag River (Upstream), and a reference lake.

4.6.3 Proposed Monitoring Locations

Table 4-7 summarizes proposed monitoring for the fish habitat and community component of the AEMP. Habitat for fish in study and reference areas will also be monitored through the physical and biological monitoring components of the AEMP described above.

The proposed AEMP design for fish habitat and community and its rationale are as follows:

- WC23, WC26, WC5, and Mud Lake/WC27 – to evaluate the potential effects of reduced flows/water levels on fish communities and to verify predictions made in the EIS.
- Cameron Flowage and Killag River (Downstream) – to be monitored to determine the effectiveness of mitigation measures (i.e., effluent treatment) and impacts to fish communities as a result of changes to groundwater baseflows.
- Reference areas – to be monitored to provide fish and fish habitat context (e.g., regional trends) for the monitoring program.

Table 4-7 Summary of Proposed AEMP Design – Fish Habitat and Community

Watercourse/Waterbody	Rationale	Timing	Frequency
• Study Areas			
• WC23	• monitor effect of reduced flow on fish habitat and fish populations	• Minimum twice – late spring/early summer and late summer/early fall (June – September)	• annually
• WC26	• monitor effect of reduced flow on fish habitat and fish populations	• Twice – late spring/early summer and late summer/early fall (June – September)	• annually
• WC5	• monitor effect of reduced flow on fish habitat and fish populations	• Twice – late spring/early summer and late summer/early fall (June – September)	• annually
• Mud Lake/WC27	• monitor effect of reduced flow/water level reduction on fish habitat and fish populations	• Twice – late spring/early summer and late summer/early fall (June – September)	• annually
• Cameron Flowage	• monitor fish habitat and fish populations near the point of effluent discharge (EEM) • Thermal monitoring (See Section 4.1.2)	• Once – September to early October	• annually
• Killag River (Downstream)	• monitor fish habitat and fish populations downstream the point of effluent discharge	• Twice – late spring/early summer and late summer/early fall (June – September)	• annually
• Potential Reference Areas			
• Cope Brook	• reference stream	• Twice – late spring/early summer and late summer/early fall (June – September)	• annually
• Killag River (Upstream)	• reference stream	• Twice – late spring/early summer and late summer/early fall (June – September)	• annually
• Killag River (EEM)	• EEM reference	• Once – September to early October	• annually
• WC-N (West River)	• reference stream	• Twice – late spring/early summer and late summer/early fall (June – September)	• annually
• WC-AH (Tributary to Morgan River)	• reference stream	• Twice – late spring/early summer and late summer/early fall (June – September)	• annually
• Reference Lake (Kent or Tait Lake)	• reference lake	• Twice – late spring/early summer and late summer/early fall (June – September)	• annually

4.7 Fish Health and Fish Tissue

Fish health and tissue studies are required components of biological monitoring studies conducted during EEM programs under MDMER. Note, these are only required if Mercury or Selenium analysis in effluent characterization are greater than prescribed MDLs or trigger concentrations. The objective of fish health and tissue monitoring through EEM is to determine if mine effluent is having an effect on fish and fisheries resources. The fish health survey provides an assessment of whether there are differences in the growth, reproduction, condition, and survival of the fish population between exposed and reference areas, while fish tissue studies assess whether effluent has altered fish in such a way as to limit their use by humans (i.e., consumption).

4.7.1 Proposed Monitoring Locations

As noted in Section 8.1.1, baseline sampling for fish health and tissue in 2020 resulted insufficient numbers of mature males of one (1) sentinel species. Additional baseline sampling for mature male white sucker and yellow perch is recommended in 2021 at both the reference and exposure locations (see Appendix A).

Table 4-8 summarizes the proposed monitoring for the fish health and tissue component of the AEMP. The design and analysis of the fish health and fish tissue monitoring program will be based on guidance from the federal EEM program (EC, 2012a), with schedules for each component through the life of the mine set out in the MDMER. Since adult fish of a reproductive age would be the target for sampling, sampling will occur at a suitable time of year to measure gonad size and developing eggs of sentinel species as recommended in the technical guidance document (EC, 2012a).

Table 4-8 Summary of Proposed AEMP Design – Fish Health and Tissue

Watercourse/Waterbody	Rationale	Timing	Frequency
• Study Areas			
• Cameron Flowage	• monitor changes in local resident fish health and fish tissue quality due to mine effluent discharge	• Once – September to early October	• annual
• Potential Reference Areas			
• Killag River (EEM)	• EEM reference	• Once – September to early October	• 3-year intervals

As outlined in the MDMER (Schedule 5, s. 1), a fish tissue study is required if the mean annual effluent concentration of selenium exceeds 5 µg/L or exceeds 10 µg/L in two of four grab samples or if the mean annual effluent concentration of mercury exceeds 0.10 µg/L or exceeds 0.10 µg/L in two of four grabs. Water quality results in final effluent will therefore dictate the requirement for fish tissue studies to be completed.

4.7.2 Methods

Fish Health

The design and analysis of the fish health monitoring program is based on guidance from the federal EEM program (EC, 2012a).

Selection of Sentinel Species

Species collected during baseline surveys in the Cameron Flowage/Killag River system during 2015-2020 fish surveys included American eel, white sucker, yellow perch, brook trout, Atlantic salmon, banded killifish, golden shiner, creek chub, lake chub, and brown bullhead.

White sucker and yellow perch have been selected as the two sentinel fish species (one forage fish and one angled fish) based on expected sufficient abundance in Cameron Flowage/Killag River for use in the fish health monitoring program. These species were also specifically selected avoid impacts to Atlantic salmon and brook trout as a result of the monitoring program. The ecology of these two species is well understood (Scott and Crossman, 1973) and they are broadly used for EEM studies

across Canada (EC, 2012a). Based on their ecology and habitat needs for feeding and spawning, white sucker and yellow perch are likely to remain resident for a substantial portion of their lives within the study and reference areas.

The fish health assessment will include a lethal survey of the two sentinel fish species in accordance with EEM guidelines (EC, 2012a).

Target Sample Sizes

The target samples sizes for the lethal fish health survey for the AEMP have been selected with consideration of minimum recommended sample sizes from EEM guidance (EC, 2012a). Samples will consist of a minimum of 20 sexually mature males and 20 sexually mature females of each sentinel species per sampling area. Non-target species will be identified, counted and released live back into the sampling area. Non-target species or immature yellow perch and white sucker will be enumerated and measured as time permits, taking care to measure the smallest and largest fish to assess the size range of species within the sampling areas.

Collection Methods

Sampling will be conducted using non-lethal trapping methods – e.g., fyke nets – due to the potential presence of Atlantic salmon within the study and reference areas. Fyke nets and minnow traps will be baited with small quantities of cat food and set overnight by foot where depths allow, and by boat in deeper areas. The following information will be recorded for each day of fishing:

- time (in hours) as fishing for all gear types;
- GPS coordinates of each trap/net location;
- water quality field profile measurements (e.g., DO, water temperature, pH, conductivity, and turbidity);
- number and species of fish captured;
- photographs of representative habitat types and fish species captured.

Fish Health Parameters - Lethal Fish Health Survey

Mature white sucker and yellow perch will be euthanized by a blow to the head and stored immediately on ice in labelled bags. Mature males will be those with opaque white gonads and mature females will be those with opaque orange gonads where developing eggs are visible. Mature white sucker and yellow perch will be processed for fork length, total body weight, liver weight, gonad weight, age, and fecundity EEM endpoints.

Fish measurement precision will be in accordance with EEM Technical Guidance Document (EC, 2012; see Table 4-9).

Two aging structures per fish will also be retained for determination of age. The first pectoral ray and scales will be retained for white sucker and the first three dorsal spines and scales will be retained for yellow perch. The pectoral rays and dorsal spines will be used as the primary aging structure with the scales used as back up if and as needed to verify or confirm fish ages.

Fecundity estimates and the average egg size (i.e., weight) per female will be determined. A subsample consisting of a minimum of 100 eggs will be weighed and counted. The average egg weight per female will be determined by dividing the subsample weight by the number of eggs counted in the subsample. The average egg weight per female will then be divided into the total gonad weight to provide an estimate of fecundity.

Table 4-9. Fish Measurements and Required Precision

Measurement	Target Precision
• Length (fork or total or standard)	• +/- 1 mm
• Total body weight (fresh) +/- 1.0%	• +/- 1.0%
• Age	• +/- 1 year (10% to be independently confirmed)
• Gonad weight (if fish are sexually mature)	• +/- 0.1 g for large-bodied fish species
• Fecundity (if fish are sexually mature)	• +/- 1.0%
• Liver Weight	• +/- 0.1 g for large-bodied fish species
• Abnormalities (i.e., lesions, tumours, parasites, other)	• Not applicable
• Sex	• Not applicable

Fish Tissue

As outlined in the MDMER *(*Schedule 5, s. 1) a fish tissue study is required if the mean annual effluent concentration of selenium exceeds 5 µg/L or exceeds 10 µg/L in two of four grab samples or if the mean annual effluent concentration of mercury exceeds 0.10 µg/L or exceeds 0.10 µg/L in two of four grabs. The design and analysis of the fish tissue monitoring program is based on guidance from the federal EEM program (EC, 2012a).

Fish collection for large-bodied tissue analyses will be conducted concurrently with the fish health program.

Fish will be measured to the nearest 1 mm and weighed using a scale accurate to 0.01 g. Tissue of white sucker (forage species) will be analyzed based on whole body levels, while tissue of yellow perch (angled species) will be analyzed based on whole body and muscle (human consumption). The skinless, boneless muscle fillet of yellow perch will be removed using a scalpel, tweezers, and a fillet knife, then weighed and placed in an appropriate container. The remaining carcass will put in a separate container for analysis. Samples will be clearly labelled with a unique sample number and placed immediately into a freezer for storage prior to being submitted in a cooler on ice for trace metals analysis. Fish carcass samples will be sent to an accredited laboratory for analysis (e.g., Bureau Veritas).

Laboratory Methods

Fish tissue samples will be analyzed for several parameters, including a complete scan for metals, using Inductively Coupled Plasma Mass Spectrometry (ICP-MS), lipids (i.e., crude fat), and moisture.

4.7.3 Frequency

The sampling locations for the fish health surveys include the exposure area of Cameron Flowage/Killag River downstream of proposed treated effluent discharge locations and the Killag River reference area. If sufficient numbers of fish cannot be collected in the lakes, then sampling will move further downstream until enough fish are captured.

The study will be conducted in late summer / early fall, which is a suitable time of year to measure gonad size and developing eggs (size and fecundity) because this is several months after spawning and gonad tissues will be rebuilding.

The fish health survey will be conducted every three years, with subsequent sampling frequency being re-evaluated throughout the life of the Mine.

Monitoring plans for the post-closure phase will be established closer to the planned closure of the Mine, as a requirement of the permits and licenses under which the proposed Project will operate.

5 AEMP DESIGN -DATA ANALYSIS AND REPORTING

5.1 Data analyses and Reporting

Data collected during surface water, hydrology, sediment quality, periphyton, benthic invertebrates and fish community surveys will document spatial and temporal trends in monitoring results including and enable a comparison to the predicted project effects. Data and analysis will be provided in annual reports, as well as the mandatory MDMER EEM interpretive reports.

At minimum, data analyses will include the following:

- Results of all monitoring results including, as applicable.
- Minimum, maximum, average and 75th percentile values.
- Comparison with protection of aquatic life criteria, and background values.
- Comparison with Provincial Sediment Quality Guidelines (PSQG) and CCME Canadian Sediment Quality Guidelines (CSQG).
- Comparison with final effluent daily and monthly average effluent limits.
- Documentation of exceedance (if any) of effluent limits.
- Documentation of excursions (if any) from protection of aquatic life and/or background values.
- Documentation of any data trends which are likely to result in protection of aquatic life criteria being exceeded in the longer-term, unrelated to background conditions.
- Results of aquatic resources monitoring including species richness, fish abundance, and fish tissue metals.
- Summary of final effluent discharge volumes.

Reporting will include:

- Project background and reporting period activities summary;
- Description of water management facilities and their operation;
- Summary of data collection methods and analytical procedures;
- Summary of monitoring data and comparisons to final effluent limits and protection of aquatic life criteria, as applicable;
- Sediment and BIC quality assurance and control outcomes;
- Quality assurance and control outcomes;
- Documentation of any root cause analysis undertaken during the reporting period.
- Documentation of contingency and mitigation measures implemented during the reporting period, or planned in future.
- Operating problems and corrective actions;
- Maintenance conducted on treatment works and water management facilities;
- Calibration and maintenance activities;
- Laboratory certificates of analysis (will be provided in appendices).

5.2 Annual Report Organization

The AEMP annual reports will provide results and interpretation updates for the AEMP components monitored in those years. A summary of the most important results will be communicated in a plain-language summary that will be presented at the front of the AEMP as an executive summary.

A series of technical sections within the AEMP will provide the technical and scientific description of the analyses conducted and the results obtained. The sections will consist of:

- Section 1 – Introduction
- Section 2- Water Quality
- Section 3 – Sediment Quality
- Section 4 – Plankton
- Section 5 – Benthic Invertebrates
- Section 6 – Fish Health
- Section 7- Fish Tissue
- Section 8 – Weight of Evidence
- Section 9 – Action Levels

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APPENDIX A
BEAVER DAM MINE: 2020 BASELINE AQUATIC ENVIRONMENT TECHNICAL REPORT

Beaver Dam Mine: 2020 Baseline Aquatic Environment Technical Report

Draft Report

April 27, 2021

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EXECUTIVE SUMMARY

Atlantic Mining NS Inc. (AMNS) currently operates the Touquoy Gold Mine, located in Moose River Gold Mines, approximately 110 km northeast of Halifax, Nova Scotia (NS). The proposed Beaver Dam Mine Project (the Beaver Dam Mine or the Project) is located approximately 19 km (straight-line distance) from the existing Touquoy mine, in a rural forested area near the community of Marinette. The Project site is located 7 km northeast of Route 224 along Beaver Dam Mine Road, a gravel road located approximately 17 km north-northwest of Sheet Harbour (Figure 1).

The Project is currently undergoing provincial and federal environmental assessment. If approved, the Beaver Dam Mine will operate as a satellite surface mine where gold ore will be extracted and undergo primary crushing before being transported by truck (~30 km) to the existing Touquoy Gold Mine for processing.

Stantec Consulting Ltd. (Stantec) was contracted by AMNS to collect baseline aquatic environmental effects monitoring (EEM) at the Beaver Dam Site in 2020. This report provides background information on AMNS operations, describes the general Project area, and presents the results of the baseline aquatic monitoring conducted in 2020. The baseline program describes existing conditions in the future aquatic receiving environment for effluent downstream of the proposed Beaver Dam Mine in Cameron Flowage, a named portion of the Killag River. Two final discharge points (FDPs) are proposed for the Project. One is associated with the north settling pond and the other is associated with the open pit (Figure 2). Discharge will vary with Project phase.

The baseline program was designed to mirror the requirements for EEM that will be required once the Project proceeds. In accordance with the Metal and Diamond Mining Effluent Regulations (MDMER) under the *Fisheries Act*, metal and diamond mines in Canada must undertake aquatic EEM at any location when the effluent flow rate from all final discharge points exceeds 50 m^3/day and includes a deleterious substance, as defined under Section 36(3) of the *Fisheries Act*. Results of the baseline program will be used to support design and interpretation of future EEM results when the Beaver Dam Mine becomes subject to MDMER.

The baseline program design included the following components:

- Fish population study, including fish habitat assessment
- Fish tissue analysis for metals
- Benthic invertebrate community (BIC) study
- Supporting environmental variables: water and sediment quality

The following summary points document the main findings of the baseline study:

- Sampling Locations in the Killag River
  - Exposure area close to the proposed effluent final discharge points (in Cameron Flowage)
  - Reference area approximately 4 km upstream of the exposure area
  - The reference and exposure areas are suitable as they contain similar types of habitat

- Fish population study
  - White sucker and yellow perch were captured in sufficient numbers and are suitable for use as sentinel species
  - Insufficient brook trout were caught for use as a sentinel species
  - A sufficient number of females (for both white sucker and yellow perch) in each area were obtained for the EEM fish population effect endpoints
- Fish tissue data were collected for metals and mercury
  - Mercury concentrations in yellow perch and white sucker whole bodies were similar between the exposure and reference areas and were below the Heath Canada guideline of 0.5 mg/kg
  - Mercury concentrations in yellow perch muscle fillets were above the Heath Canada guideline of 0.5 mg/kg in two out of ten samples
  - Arsenic concentrations in both yellow perch and white sucker were higher in samples from the exposure area than the reference area and below the Heath Canada guideline of 3.5 mg/kg
  - Selenium concentrations in yellow perch and white sucker were below the US EPA selenium criteria for protection of aquatic life of 15.1 and 8.5 µg/g, for muscle tissue and whole body samples, as applicable
- Benthic invertebrate community (BIC) survey
  - Generally very low density and species diversity observed in the peat-like sediments in the reference and exposure areas
  - Invertebrates that are indicative of good water quality were observed (e.g., *Hexagenia, Phylocentropus* and *Chaoborus)*
  - Water quality parameters such as low pH may inhibit the abundance and diversity of the BIC
- Supporting environmental variables (water and sediment quality) were collected to establish baseline conditions in the Killag River
  - Water quality was indicative of a low nutrient and low productivity environment
  - Water had low hardness and low pH
  - Water clarity was brown/yellow with low nutrient levels
  - Trace metal concentrations of key parameters and general chemistry were similar among samples and between reference and exposure areas
  - Aluminum and iron concentrations in surface water exceeded Canadian Water Quality Guidelines for the Protection of Aquatic Life (freshwater), under baseline conditions
  - Arsenic and mercury concentrations in sediment samples collected from the exposure area exceeded Sediment Quality Guidelines for the Protection of [Freshwater] Aquatic Life
  - Grain size distribution for the reference area showed sand as the dominant feature (65%), followed by silt and clay (both 16%), and a small amount of gravel (3.9%)
  - Grain size distribution for the exposure area showed that sand, silt and clay are the dominant size fractions (depending on location), with minimal gravel
  - Water and sediment quality are reflective of the natural geological conditions in the area

The results of the 2020 baseline sampling program will be used to support design and interpretation of future EEM programs following approval of the Beaver Dam Mine and triggering of MDMER. Additional field work may be recommended to supplement this baseline information.

1.0 INTRODUCTION

Atlantic Mining NS Inc. (AMNS) currently operates the Touquoy Gold Mine, located in Moose River Gold Mines, approximately 110 km northeast of Halifax, Nova Scotia (NS), in a historic gold mining district. The proposed Beaver Dam Mine Project (the Beaver Dam Mine or the Project) is located approximately 19 km (straight-line distance) from the existing Touquoy mine, in a rural forested area near the community of Marinette. The Project site is located 7 km northeast of Route 224 along Beaver Dam Mine Road, a gravel road located approximately 17 km north-northwest of Sheet Harbour (Figure 1). There has been little development in the area, except for forestry operations and historical mining.

The Project is currently undergoing provincial and federal environmental assessment. The Beaver Dam Environmental Impact Statement (EIS), prepared by GHD Limited (GHD) and McCallum Environmental Limited (MEL), was submitted to the Canadian Environmental Assessment Agency (CEAA) and Nova Scotia Environment (NSE) in June 2017.

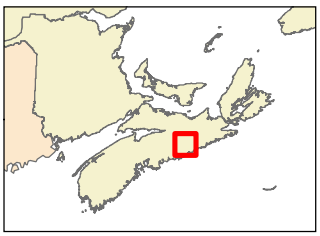
If approved, the Beaver Dam Mine will operate as a satellite surface mine where gold ore will be extracted and undergo primary crushing before being transported by truck (~30 km) to the existing Touquoy Gold Mine for processing. Both Touquoy and Beaver Dam are part of the Moose River Consolidated (MRC) Project.

The Project site will encompass approximately 145 hectares (ha) and primary project components include a surface mine, mine site roads, waste material storage piles, stockpiles (for run of mine [ROM], high- and low-grade ore), crusher and operational facilities, and water management (GHD and MEL 2017). Proposed Project components are presented on Figure 2.

It is anticipated that approximately 550 to 1,450 kL/day will be removed from the open pit each day by dewatering. This, along with surface water run-off, rainfall, and other sources of water from the mine, will ultimately be discharged into Cameron Flowage and the Killag River (GHD and MEL 2017). Two final discharge points (FDPs) are proposed. One is associated with the north settling pond, and the other is associated with the open pit (Figure 2). Discharge will vary with Project phase.

Stantec Consulting Ltd. (Stantec) was contracted by AMNS to collect baseline aquatic environmental effects monitoring (EEM) at the Beaver Dam site in 2020. Once approved, the Project will be required to conduct EEM in accordance with the Metal and Diamond Mining Effluent Regulations (MDMER) when the effluent flow rate from all final discharge points exceeds 50 m^3/day and includes a deleterious substance, as defined under Section 36(3) of the *Fisheries Act*. The baseline EEM program was conducted to establish existing conditions in the Killag River prior to effluent discharge to support design and interpretation of future EEM results.

This report provides background information on AMNS operations, describes the general Project area, and presents results of the baseline aquatic monitoring conducted in 2020.



★ Project Location

0 3,900 7,800 metres

(At original document size of 8.5x11)
1:306,578

N

Stantec

Project Location
Beaver Dam Mine
Nova Scotia, Canada

Client/Project 121619250_001bd
Atlantic Moning NS Corp.
Baseline Aqiatic Study
2020 Baseline Aquatic Environmental Techncial Report

Figure No.
1

Title
Site Overivew

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: Gov. of NS
3. Background: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and

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2.0 SITE CHARACTERIZATION

2.1 HISTORICAL LAND USE

The proposed Beaver Dam Mine Project is in an area of historic gold mining, where exploration and mining activities have occurred intermittently since gold was first discovered in 1868. The Touquoy Gold Mine (located near the proposed Project) lies approximately 19 km away from the Beaver Dam site (straight line) and was officially opened on October 11, 2017 with commercial production achieved in March 2018 and an anticipated life of mine of five years. The proposed Project involves open pit mining of gold ore, which will be crushed on site and then trucked (~30 km) to the Touquoy Gold Mine for processing.

The Project site consists of portions of several properties currently owned by Northern Timber Nova Scotia Corporation. Toward the western end of the site, the property crosses a portion of provincial Crown land (Stantec 2021). Logging has been widely carried out somewhat recently including clear cutting in the immediate area of the proposed footprint.

The Project lies between Cameron Flowage to the east, which is part of the Killag River, and Crusher Lake to the west. Constructed or remains of various dams are present along local water ways (Stantec 2021).

The proposed open pit partially encompasses the area of historical mine workings and is located immediately south of the Cameron Flowage in the vicinity of an historical shaft (former Austen shaft) and northwest of an historical two-stage settling pond and associated earthen dam (Stantec 2021). The dam has the remains of a control structure with a discharge to Cameron Flowage (Stantec 2021).

There is evidence of human use and historical mining at the site, including access roads/laydown areas, abandoned cabins, hunting blinds, old mine workings, dam structures, apparent building foundations, waste rock piles, and an old mining excavation. There are currently no permanent buildings in use and the site is not serviced.

2.2 LOCAL GEOLOGY

The proposed Project lies largely within the sandstone turbidites and slate:continental rise prism (in places metamorphosed to schist and gneiss) of the Goldenville Formation, with some granitoid in the west (Keppie 2000). The Beaver Dam deposit is hosted in the southern limb of a north-dipping overturned anticline that hosts the vein gold mineralization. Based on available surficial geology maps, the native surficial soils in the area consist of glacial till organic deposits (bogs and swamps), hummocky ground moraine, stony till plain, and silty drumlin (Stea 1992).

2.3 TOPOGRAPHY, VEGETATION, AND LOCAL DRAINAGE

Based on available topographic maps and observed site topography, the proposed Project is in an area of low topographic relief around an elevation of 140 metres above sea level (masl) with scattered drumlins reaching 165 to 175 masl (Stantec 2021; GHD and MEL 2017)). Cameron Flowage channels through a topographic low of 130 masl (GHD and MEL 2017).

The surface habitat consists of a combination of open wetland, rock piles and forested woodland, with vegetation consisting of spruce, fir, and some hardwood (Stantec 2021). Adjacent land includes forest in various stages of regrowth (due to logging), various types of waterbodies and wetland habitat (GHD and MEL 2017).

Drainage in the area generally flows to the southeast along a number of poorly drained streams, shallow lakes, and wetlands that eventually drain into Cameron Flowage and the Killag River (GHD and MEL 2017). A drainage divide is present within the proposed mine footprint, with drainage towards the south through Paul Brook (GHD and MEL 2017). Locally, water in the eastern portion of the Site is directed toward an artificial historical settling pond with the remains of a dam which is maintaining the water level in the pond. Overflow from the historical settling pond is directed into Cameron Flowage and the Killag River (Stantec 2021).

It should be noted that the direction of the shallow groundwater flow in limited areas can also be influenced by the presence of underground mine workings and is not necessarily a reflection of regional or local groundwater flow or a replica of the site or area topography (Stantec 2021).

2.4 AQUATIC ENVIRONMENT

Part of the Moose River Watershed, the Killag River is surrounded by forested land and wetlands. The Killag River is comprised of narrow portions and sections of lake-like pools and its width varies greatly throughout its extent. Approximately 27 km long, it starts at West Lake (~4 km west-northwest of the Project) and flows in an easterly direction. It eventually runs through a section referred to as Cameron Flowage before eventually turning south and then west, where it drains into the West River (Figure 1). The Killag River is one of the three main tributaries to the West River, which eventually drains into the Northwest Arm of Sheet Harbour on the eastern shore of Nova Scotia. There has been little development along the Killag River, except for forestry operations and historical mining.

The Nova Scotia Salmon Association (NSSA) leads the West River Sheet Harbour Acid Mitigation Project, which involves the operation and maintenance of automated lime dosers on both the Killag River and the West River (NSSA 2020). The lime dosers are intended to buffer the naturally low pH of river water downstream to a more suitable pH to support Atlantic salmon and brook trout (NSSA 2020). In addition to these liming efforts, the NSSA conducts monitoring of Atlantic salmon (e.g., annual smolt monitoring, adult monitoring, electrofishing surveys) as well as other ecosystem components, such as invertebrates and water chemistry (NSSA 2020).

3.0 EEM FRAMEWORK & BASELINE AQUATIC EEM STUDY DESIGN

The proposed Beaver Dam Mine will operate as a satellite surface mine where gold ore will be extracted and undergo primary crushing before being transported by truck approximately 30 km along existing roads to the existing Touquoy Gold Mine for processing.

Once the Project is approved, the MDMER will come into effect when effluent discharge from all sources for the Project exceeds a flow rate of 50 m^3/day into the receiving environment. Discharge from the Beaver Dam Mine will ultimately be discharged into Cameron Flowage and the Killag River (GHD and MEL 2017).

Environment and Climate Change Canada (ECCC) administers the MDMER, for which the basic requirements include reporting on compliance with authorized limits for effluent parameters and acute lethality, effluent characterization, sublethal toxicity testing, and water quality monitoring in the receiving environment, and a cyclical EEM program to evaluate the potential for effluent effects to fish and fish habitat. The present baseline program will establish existing conditions in the receiving environment prior to the discharge of mine effluent to support design and interpretation of future EEM results when the Project becomes subject to MDMER.

The baseline EEM program was conducted to establish existing conditions in the aquatic receiving environment of Cameron Flowage into which effluent would be discharged in the future for the proposed Beaver Dam Project, when approved. The baseline EEM program was designed to mirror the requirements for EEM under MDMER to support design and interpretation of future EEM results when the Project becomes subject to MDMER. The Metal Mining Technical Guidance for EEM (Environment Canada [EC] 2012) was used as a resource for baseline design and methods.

A before-after control-impact design was selected, with the control/reference area located upstream of the proposed effluent discharge locations and the impact/exposure area located downstream of the proposed final discharge points (FDPs). There are two proposed FDPs associated with the Project. One FDP is associated with the north settling pond, and the other is associated with the open pit (Figure 2). Discharge will vary with Project phase.

The focus was on slow moving steady aquatic habitat which was the dominant habitat type immediately upstream and downstream of the proposed FDPs. The before-after design allows observed effects to be compared to pre-development conditions to assess whether effects are potentially related to exposure to mine effluent or to other environmental conditions.

The baseline program design included the following components to be implemented at the future effluent exposure and reference locations:

- Fish population study, including fish habitat assessment;
- Fish tissue analysis for metals;
- Benthic invertebrate community (BIC) study; and
- Supporting environmental variables: water and sediment quality.

Results of a fish community survey suggested that yellow perch (*Perca flavescens*) and white sucker (*Catostomus commersonii*) would be suitable for use as sentinel species for the baseline sampling. These species were chosen because it was anticipated that there would be a sufficient number of adults in both locations, these species are routinely used in EEM programs across Canada, and they are expected to be resident in the capture area for a substantial portion of their adult lives and therefore exposed to site conditions.

Following the Technical Guidance (EC 2012), approximately 45 fish of each species were targeted per location for EEM endpoints, consisting of a minimum of 20 males and 20 females, with an additional five fish of varying sizes retained for fish tissue analysis (refer to Sections 4.0 and 5.0 of this report). For the BIC study, five samples were collected at each the exposure and reference locations (refer to Section 6.0). Samples were sent to an experienced benthic taxonomist to be sorted and identified. With respect to supporting variables (i.e., surface water and sediment), samples were collected and analyzed for parameters outlined in Schedule 2, Parts 1 and 2 of the MDMER.

A QA/QC program was implemented to confirm that data produced would be of acceptable and of verifiable quantity and meet the data quality objectives in support of future EEM requirements under MDMER. For the field component of the study, the program included a field plan, standard operating procedures for sampling, consistent sampling techniques, and the use of standardized field data collection sheets. The field sampling was conducted by a team of four experienced staff, including two biologists who have conducted lethal fish, benthic invertebrate community, water, and sediment sampling for EEM for metal mining projects.

The program was completed by Stantec between August 25 and September 2, 2020. The following sections describe the selection of exposure and reference areas and methods/results for the adult fish survey, BIC survey, fish tissue analysis, and supporting environmental variables. A discussion of quality assurance/quality control procedures is provided within each Section.

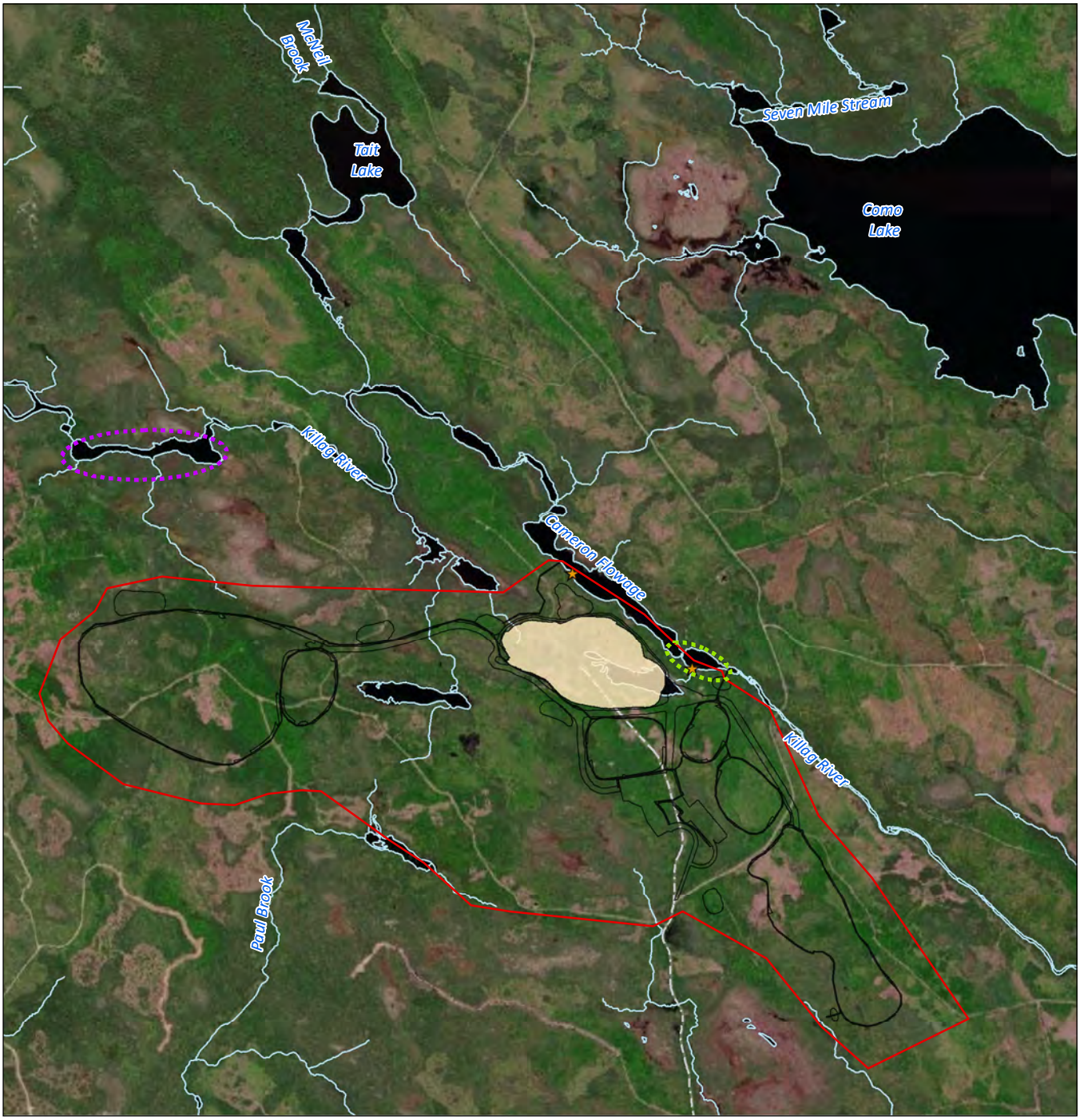
3.1 SELECTION OF EXPOSURE AND REFERENCE AREAS

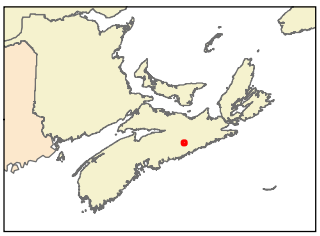
As described in Schedule 5 (Interpretation) of the MDMER, exposure area "means all fish habitat and waters frequented by fish that are exposed to effluent" and reference area "means water frequented by fish that is not exposed to effluent and that has fish habitat that, as far as practicable, is most similar to that of the exposure area".

Based on the definition indicated above, the exposure area was determined to be a 1.5 ha pool in the southeastern end of Cameron Flowage, a named lake-like portion of the Killag River (Figure 2). Water enters the pool through a narrow portion of the river and water depth is generally shallow (<2 m); the maximum depth measured was 3.1 m in the center of the pool. The exposure area is fringed by shallow water wetland dominated by emergent (i.e., pickerel weed and three-way sedge) and floating-leafed vegetation (i.e., lily pads). Submergent vegetation is also present. Substrate is a mix of organic material and some fine sediment, with small boulders prevalent in some areas. Wetland habitat is present along the southern shoreline. Banks surrounding the pool are generally stable, with varying amounts of small

boulders, cobble, organics, and fines. Adjacent vegetation is dominated by conifers, with some deciduous trees, as well as a mix of shrubs and grasses.

To align with the MDMER, a reference area with similar habitat to the exposure was sought. The chosen reference area is a pool in a lake-like portion of the Killag River, approximately 4 km upstream of the exposure area (Figure 2). Water depth is generally shallow (<1.4 m) in this portion of the river. Wetland habitat dominated by ericaceous shrubs is present along the shoreline in some locations. Substrate is a mix of organic material with some fine sediment. Banks are generally stable and consist of organics, and fines. Surrounding vegetation is a mix of coniferous and deciduous trees, shrubs and grasses.





Sampling
- Reference
- Exposure
- Preliminary Property Boundary

- Discharge Point

Infrastructure
- Open Pit
- Other Mine Features

0 390 780 metres

(At original document size of 8.5x11)
1:31,000

N

Stantec

Project Location
Beaver Dam Mine
Nova Scotia, Canada

Client/Project 121619250_002bd
Atlantic Moning NS Corp.
Baseline Aqiatic Study
2020 Baseline Aquatic Environmental Techncial Report

Figure No.
2

Title
Exposure and Referece Stuidy Area

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: Gov. of NS
3. Background: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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4.0 FISH POPULATION STUDY

Habitat characteristics for shoreline and aquatic habitat were documented using Stantec's Electronic Aquatics Utility (EAU) Tool. Details related to substrate, riparian vegetation and cover were noted. Photographs were taken to document the type of habitat found in both the reference and exposures areas.

4.1 METHODS

4.1.1 Sentinel Species Selection

A fish community survey was conducted in the Killag River at the exposure and reference locations described in Section 2.0. Overnight sets of fyke nets and minnow traps baited with a small amount of cat food were the primary methods used to collect fish. Fyke nets and minnow traps were set late in the day and checked early in the morning to reduce soak times and potential for bycatch. The location and effort (i.e., minutes or hours) for all gear were recorded.

Fish captured were identified to species. Fish (i.e., target or non-target species) not retained for the fish study (described below) were measured to the nearest millimeter as time and weather permitted. Following measuring, fish were released.

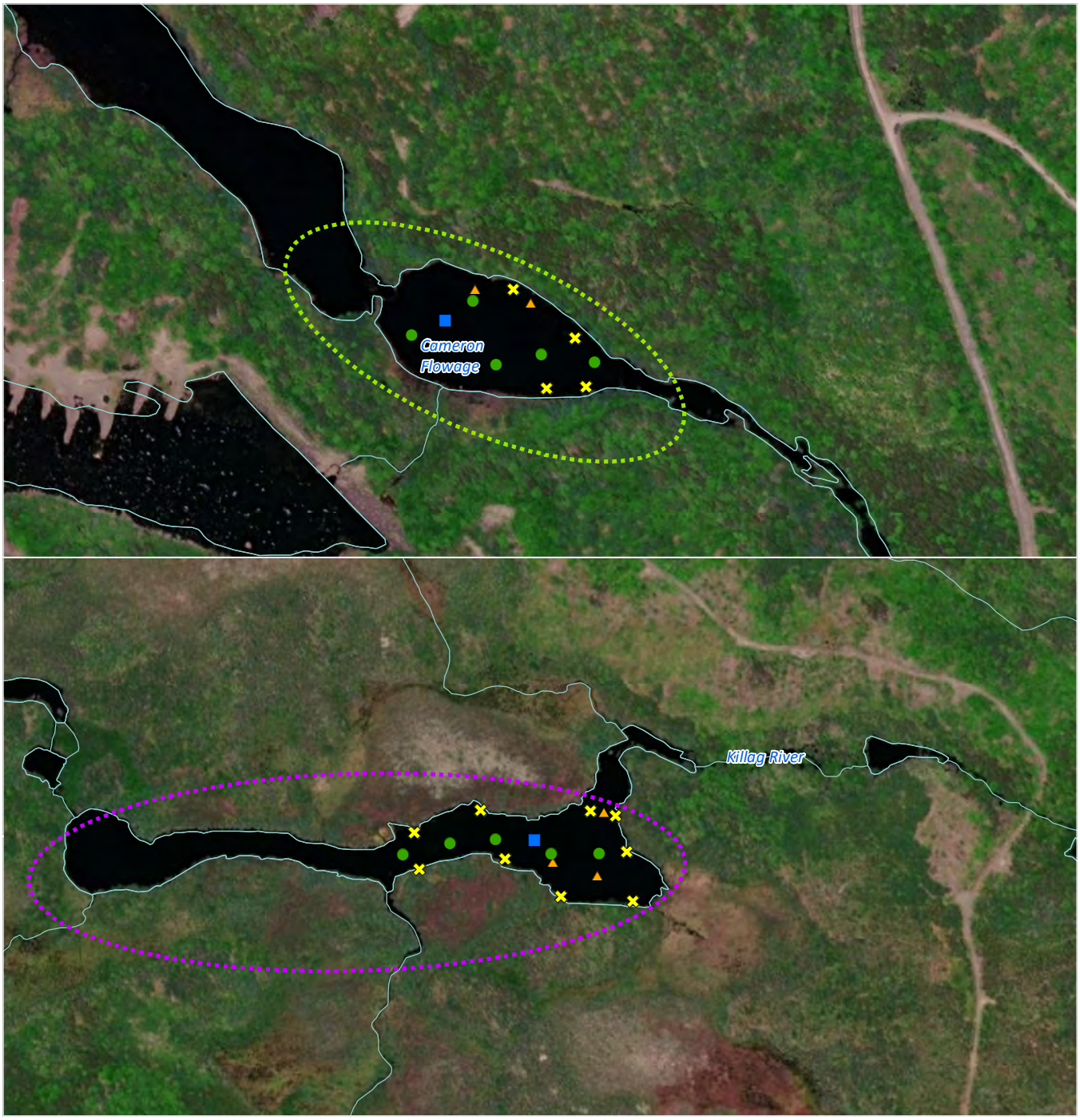
Results of the fish community survey suggested that yellow perch and white sucker would be suitable for use as sentinel species for the baseline sampling based on their abundance in the study area. Both species are routinely used in EEM programs in Canada and fall is the recommended sampling time for these species (EC 2012).

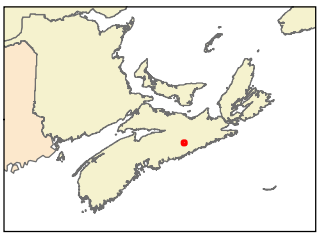
4.1.2 Fish Population Survey

4.1.2.1 Field

Fyke nets and minnow traps baited with small quantities of cat food placed in organza bags were the methods used to target the sentinel species identified in the fish community survey (i.e., yellow perch and white sucker). Location and effort for nets and traps was recorded (Figure 3).

Following the Technical Guidance (EC 2012), a minimum of 20 males and 20 females of each species were targeted from both the exposure and reference areas. Five fish of each species (of varying sizes) were selected from each area for fish tissue analysis. Mature white sucker and yellow perch were euthanized by a blow to the head and stored immediately on ice in labelled bags. Non-target species were identified, counted, and released. Non-target species or immature yellow perch and white sucker were measured for length and weight prior to release, as time permitted, taking care to measure the smallest and largest fish to assess the size range of species.





Sampling Areas
- Reference
- Exposure

Sampling Locations
- Benthic Sampling Site
- Fyke Net
- Minnow Trap
- Water Quality

0 390 780 metres

(At original document size of 8.5x11)
1:7,785

N

Stantec

Project Location
Beaver Dam Mine
Nova Scotia, Canada

Client/Project 121619250_003bd
Atlantic Moning NS Corp.
Baseline Aqiatic Study
2020 Baseline Aquatic Environmental Techncial Report

Figure No.
3

Title
Baseline Sampling Locations for Exposure/Reference Area

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: Gov. of NS
3. Background: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

V:\1216\active\121619\XXX\121619250\geomatics\mapping\mxd\BeaverDam\121619250_003bd_Ref_Exp_rough.mxd Revised: 2021-04-01 By: hward

4.1.2.2 Fish Dissection and Collection of Effect Endpoints

Mature males were considered those with opaque white gonads and mature females were considered as those with opaque gonads where developing eggs were visible. Mature white sucker and yellow perch were processed for length, weight, liver weight, and gonad weight EEM endpoints. Females of both species were also processed for fecundity and egg size. White sucker and yellow perch with a Gonadosomatic Index (GSI) less than 1% were considered immature and were therefore not included in statistical analysis, as recommended in the Technical Guidance (EC 2012).

Fish length was measured to the nearest millimeter. Body weight was measured to the nearest 0.1 g using an A&D® balance (EJ-300). Gonad and liver weights were measured to the nearest 0.001 g using an Ohaus Scout® balance (SJX323N/E).

Fecundity estimates and average egg size (i.e., weight) per female were determined as follows. A subsample consisting of a minimum of 100 eggs were weighed and counted by Stantec. The average egg weight per female was determined by dividing the subsample weight by the number of eggs counted in the subsample. The average egg weight per female was then divided into the total gonad weight to provide an estimate of fecundity.

Age structures were also retained for determination of age. The first pectoral ray and scales were retained for white sucker and the third dorsal spine, otoliths, and scales were retained for yellow perch. The pectoral ray and otoliths were used as the primary aging structures with the dorsal spine and scales used as back up as needed to verify or confirm fish ages. Age analysis was conducted by Jon Tost of North Shore Environmental in Thunder Bay, Ontario.

4.1.2.3 Data Analysis

Descriptive metrics were calculated for sentinel species following the procedures outlined in the Technical Guidance (EC 2012). Condition factor (K), GSI, and Liver Somatic Index (LSI) were completed on mature white sucker and mature yellow perch using the following equations:

- Condition Factor (K) = (fish weight/fork length^3) x 100
- Gonadosomatic Index (GSI) = (gonad weight/fish weight) x 100
- Liver Somatic Index (LSI) = (liver weight/fish weight) x 100

Mean, median, standard deviation, standard error, minimum and maximum values were calculated for each descriptive metric.

4.1.2.4 QA/QC

Livers, gonads and egg sub-sample were weighed using a calibrated digital scale (± 0.001 g), in accordance with precision requirements in the Technical Guidance. Each whole fish was weighed using a calibrated digital scale (± 0.01 g) and measured using a measuring board (± 1 mm). Where possible all efforts were made to increase accuracy; retained fish were weighed in an enclosed room, the balance was tared prior to weighing between fish, and efforts were made to reduce the residual amounts of water on

fish (i.e., blotting excess liquids). A subset of 10% of the fish that were lethally sampled were remeasured and reweighed for quality assurance and quality control as described in the Technical Guidance (EC 2012). For fecundity estimates and average egg size (i.e., weight), 10% of egg samples were recounted.

For statistical analysis of data from the fish survey, Section 4.1.2.3 outlines data QA/QC and identification of outliers. Ten percent of the aging structures collected were sent to Bob Irwin in Maynooth, Ontario for independent confirmation in accordance with the Technical Guidance (EC 2012).

4.2 RESULTS

Photos in Appendix A show representative shoreline habitat and representative sediment for both the exposure and reference areas.

4.2.1 Sentinel Species Selection

Locations of fyke net and minnow trap gear sets used for the survey are shown in Figure 3. Raw data are provided in Tables B.1 and B.2, Appendix B. Results of the fish community survey suggested that yellow perch (*Perca flavescens*) and white sucker (*Catostomus commersonii*) would be suitable for use as sentinel species for the baseline sampling.

Over the course of the survey, more than 2,500 fish were captured from the exposure and reference areas in the Killag River, representing ten different species (Table 4.1; Table B.2, Appendix B). The dominant fish species by relative abundance sampled from the Killag River were yellow perch (53%), brown bullhead (18%), and golden shiner (12%). Minimum and maximum lengths of the sentinel species sampled are shown in Table 4.2. Some fish were unable to be identified, due to decomposition or injury. This was likely due to predation in the nets/traps.

Fyke nets were the primary collection method for most species, and minnow traps were also successful for capturing yellow perch (Table 4.3; Table B.2, Appendix B).

Table 4.1 Total Number of Fish Captured from Killag River, NS for EEM Fish Survey

Species	Reference	Exposure	Grand Total
American eel (*Anguilla rostrata*)	24	22	46
Atlantic salmon (*Salmo salar*)	0	1	1
Banded killifish (*Fundulus diaphanus*)	0	79	79
Brook trout (*Salvelinus fontinalis*)	6	1	7
Brown bullhead (*Ameiurus nebulosus*)	347	140	487
Creek chub (*Semotilus atromaculatus*)	6	106	112
Golden shiner (*Notemigonus crysoleucas*)	188	153	341
Ninespine stickleback (*Pungitius pungitius*)	0	1	1
Unidentifiable*	24	24	48

Table 4.1 Total Number of Fish Captured from Killag River, NS for EEM Fish Survey

Species	Reference	Exposure	Grand Total
White sucker (*Catostomus commersonii*)	58	119	177
Yellow perch (*Perca flavescens*)	1160	290	1450
Grand Total	**1813**	**936**	**2749**
*decomposing or injured beyond recognition			

Table 4.2 Minimum and Maximum Fork Lengths of White Sucker and Yellow Perch Captured from Killag River, NS

Species	Number (n)	Minimum Fork Length (cm)	Maximum Fork Length (cm)
White sucker	177	7.0	35.3
Yellow perch	1,450	3.6	15.6

Table 4.3 Summary of Catch Per Unit Effort (CPUE) by Fishing Method in Killag River

Area	Fyke Nets			Minnow Traps		
	Total Effort (trap hours)	Total Catch	Average CPUE (fish / net / day)	Total Effort (trap hours)	Total Catch	Average CPUE (fish / trap / day)
Reference	105	1705	407	217	108	12
Exposure	151	740	171	591	196	7

4.2.2 Fish Population Survey

Two species, white sucker and yellow perch were targeted as the sentinel species for the lethal baseline program. Both species are routinely used in EEM programs in Canada (EC 2012).

Yellow perch spawn once per year, in spring, typically in late April to early May (Scott and Crossman 1973). Adults migrate to the shallows of the lake or may spawn in river tributaries. Spawning takes place on rooted vegetation, submerged brush, fallen trees, or occasionally over sand or gravel (Scott and Crossman 1973). The best time to sample yellow perch for EEM is in late fall (EC 2012).

White suckers also spawn in the spring, typically from early May to early June (Scott and Crossman 1973). Adults migrate to gravelly streams when temperatures first reach 10°C. This species is also known to spawn in lake margins or quiet areas at the mouth of blocked streams (Scott and Crossman 1973). Spawning typically occurs in shallow waters with a gravel bottom, but they may also spawn in rapids (Scott and Crossman 1973). The best time to sample white sucker for EEM is in late fall (EC 2012).

Raw data for length, weight, condition, GSI, LSI, age, fecundity and egg size are provided in Table B.3 (Appendix B). Other than descriptive statistics (e.g., count, mean, median, minimum, maximum, standard deviation, standard error), no statistical analyses were conducted because this is a baseline program to understand existing conditions.

4.2.2.1 White Sucker

In total, 177 white suckers of all life stages were captured as part of the lethal baseline survey in the Killag River, with fork lengths ranging from 7.0 to 35.3 cm (Table B.2, Appendix B) and descriptive statistics are provided in Table 4.4.

Retained white suckers had fork lengths between 16.0 and 35.3 cm. Of the white sucker with a GSI greater than 1% (which are considered to be mature), 49 females and 21 males were selected for EEM endpoints (Table B.3, Appendix B). Fork lengths for the 70 fish selected for EEM ranged from 18.5 to 35.3 cm.

One of the fish retained was missing its left caudal fin. Some fish had parasites within their body cavity or on internal organs (i.e., encysted nematodes, other unknown parasites). Three of the female white suckers retained from the exposure area were found to have underdeveloped eggs.

Table 4.4 Descriptive Statistics for Weight, Length, Condition, GSI, LSI and Age for White Sucker Captured in Aug/Sept 2020, Proposed Beaver Dam Mine

Statistic	Length (cm)	Weight (g)	Condi-tion	GSI	LSI	Age	Fecundity	Egg Size (mg)
Male White Sucker – Exposure								
Count	7	7	7	7	7	6	N/A	N/A
Mean	23.5	163.74	1.3	1.9	0.8	6.7	N/A	N/A
Median	23.2	158.57	1.3	1.5	0.8	6.5	N/A	N/A
Minimum	22.7	142.86	1.2	1.0	0.4	5.0	N/A	N/A
Maximum	24.7	202.20	1.3	4.9	1.1	8.0	N/A	N/A
Standard Deviation	0.66	20.892	0.06	1.37	0.23	1.21	N/A	N/A
Standard Error	0.25	7.896	0.02	0.52	0.09	0.50	N/A	N/A
Male White Sucker – Reference								
Count	14	14	14	14	14	13	N/A	N/A
Mean	23.4	169.33	1.3	2.2	0.9	5.7	N/A	N/A
Median	23.5	167.70	1.3	1.9	0.9	6.0	N/A	N/A
Minimum	18.5	87.77	1.2	1.2	0.6	3.0	N/A	N/A
Maximum	27.9	266.78	1.4	3.5	1.3	8.0	N/A	N/A
Standard Deviation	2.52	49.963	0.06	0.77	0.20	1.60	N/A	N/A
Standard Error	0.67	13.353	0.02	0.21	0.05	0.44	N/A	N/A

Table 4.4 Descriptive Statistics for Weight, Length, Condition, GSI, LSI and Age for White Sucker Captured in Aug/Sept 2020, Proposed Beaver Dam Mine

Statistic	Length (cm)	Weight (g)	Condi-tion	GSI	LSI	Age	Fecundity	Egg Size (mg)
Female White Sucker – Exposure								
Count	29	29	29	29	29	29	21	21
Mean	25.1	199.91	1.2	1.8	0.8	7.4	5,433.73	0.642
Median	24.5	172.18	1.2	1.6	0.8	7.0	5,036.04	0.580
Minimum	20.3	99.72	1.1	1.1	0.4	4.0	2,421.29	0.366
Maximum	32.2	415.00	1.8	3.6	1.9	12.0	10,442.65	1.378
Standard Deviation	3.62	88.389	0.12	0.66	0.30	2.10	2,205.709	0.2390
Standard Error	0.67	16.413	0.02	0.12	0.06	0.39	481.325	0.0520
Female White Sucker – Reference								
Count	20	20	20	20	20	20	20	20
Mean	26.4	252.23	1.3	2.3	0.9	6.8	8,240.20	0.790
Median	25.6	223.45	1.3	2.4	0.9	7.0	6,424.87	0.661
Minimum	21.0	114.14	1.2	1.5	0.6	3.0	2,026.97	0.485
Maximum	35.3	533.00	1.4	3.1	1.3	11.0	18,560.02	2.408
Standard Deviation	4.44	130.977	0.07	0.47	0.21	2.17	4,740.976	0.4300
Standard Error	0.99	29.287	0.02	0.11	0.05	0.48	1,060.114	0.0960

For white sucker, 49 females and 21 males were targeted for EEM endpoints. This included 29 females and 7 males from the exposure area, and 20 females and 14 males from the reference area. Discussion along with a variety of graphs showing the following relationships are presented below:

- Body weight versus length
- Body weight versus age
- Body weight versus liver weight
- Body weight versus gonad
- Body weight versus fecundity
- Body weight versus egg size

The condition of male and female white sucker appeared to be similar at the exposure and reference area (Figure 4.1). Female white sucker in the exposure and reference locations appeared to be slightly longer and heavier than male white suckers (Figure 4.1). There are no obvious differences in the length or weight of male or female white sucker when comparing the exposure and reference locations.

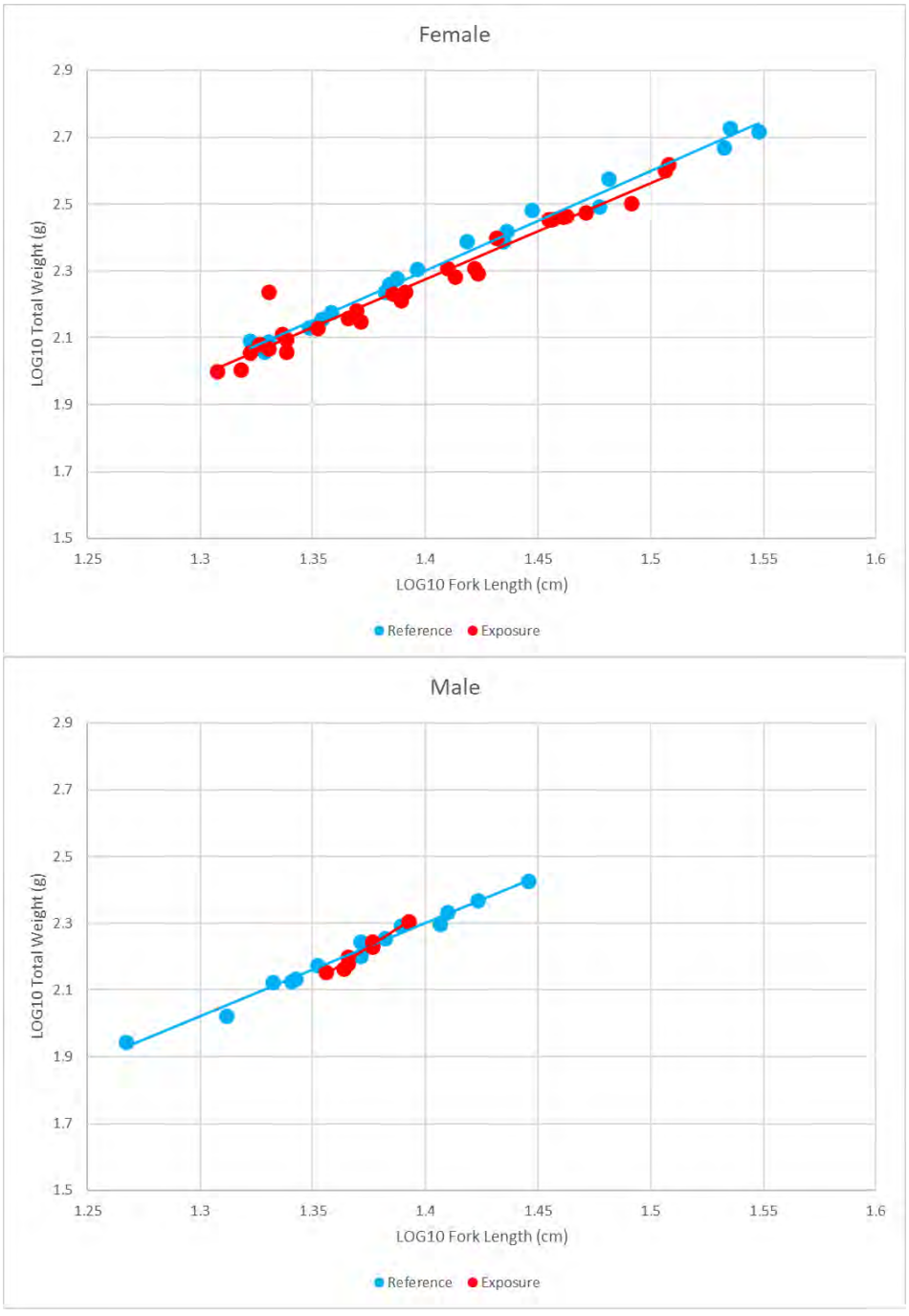


Figure 4.1 Scatterplot of Condition of Adult White Sucker Collected from Reference and Exposure Areas, Aug/Sept 2020, Proposed Beaver Dam Mine

It appeared white sucker from the exposure area tend to be slightly older than those in the reference area. Other than this difference, there are no obvious age differences between female or male white sucker from the exposure or reference areas (Figure 4.2).

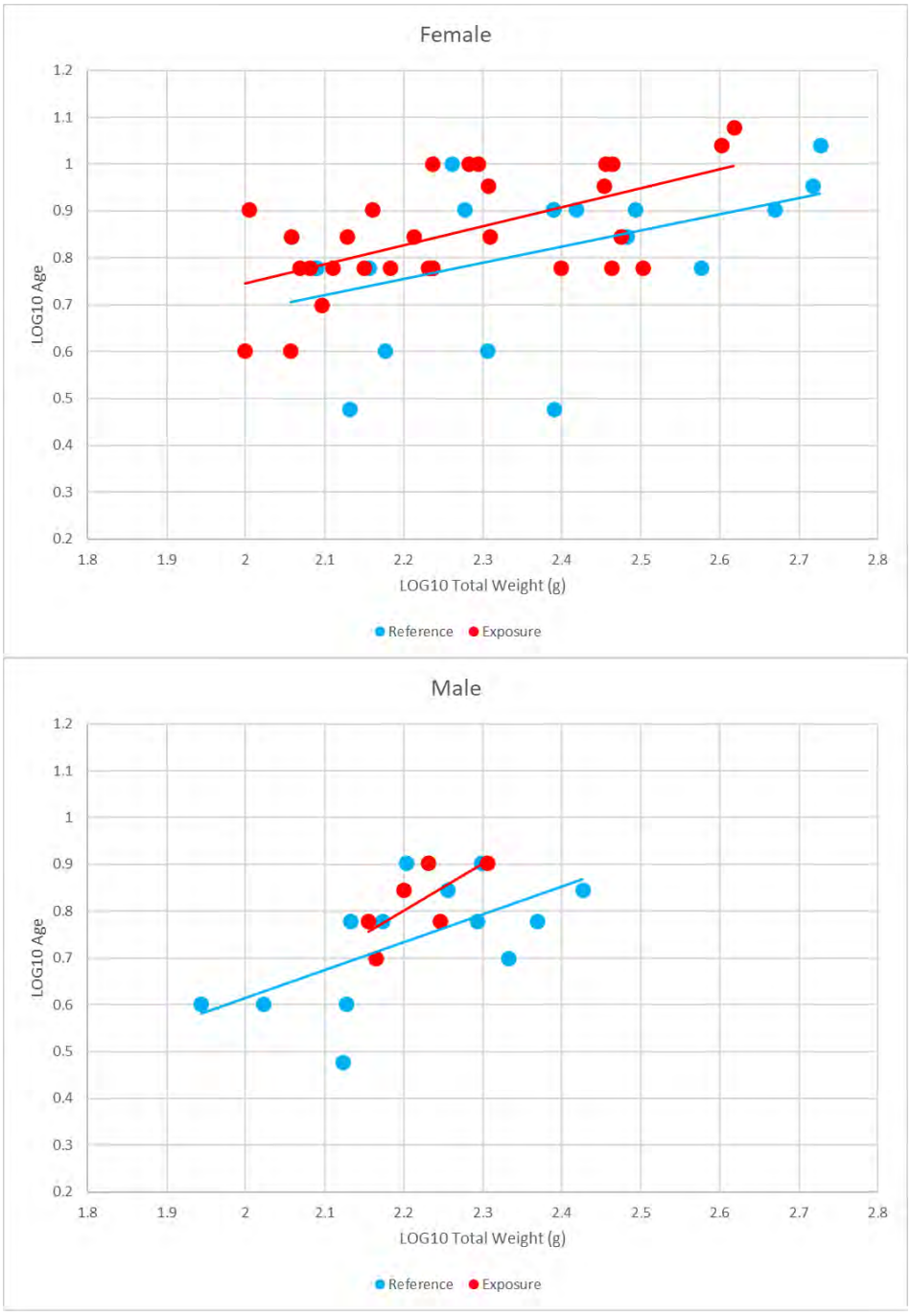


Figure 4.2 Scatterplot of Weight at Age of Adult White Sucker Collected from Reference and Exposure Areas, Aug/Sept 2020, Proposed Beaver Dam Mine

There are no obvious LSI differences between female or male white sucker from the exposure or reference areas (Figure 4.3).

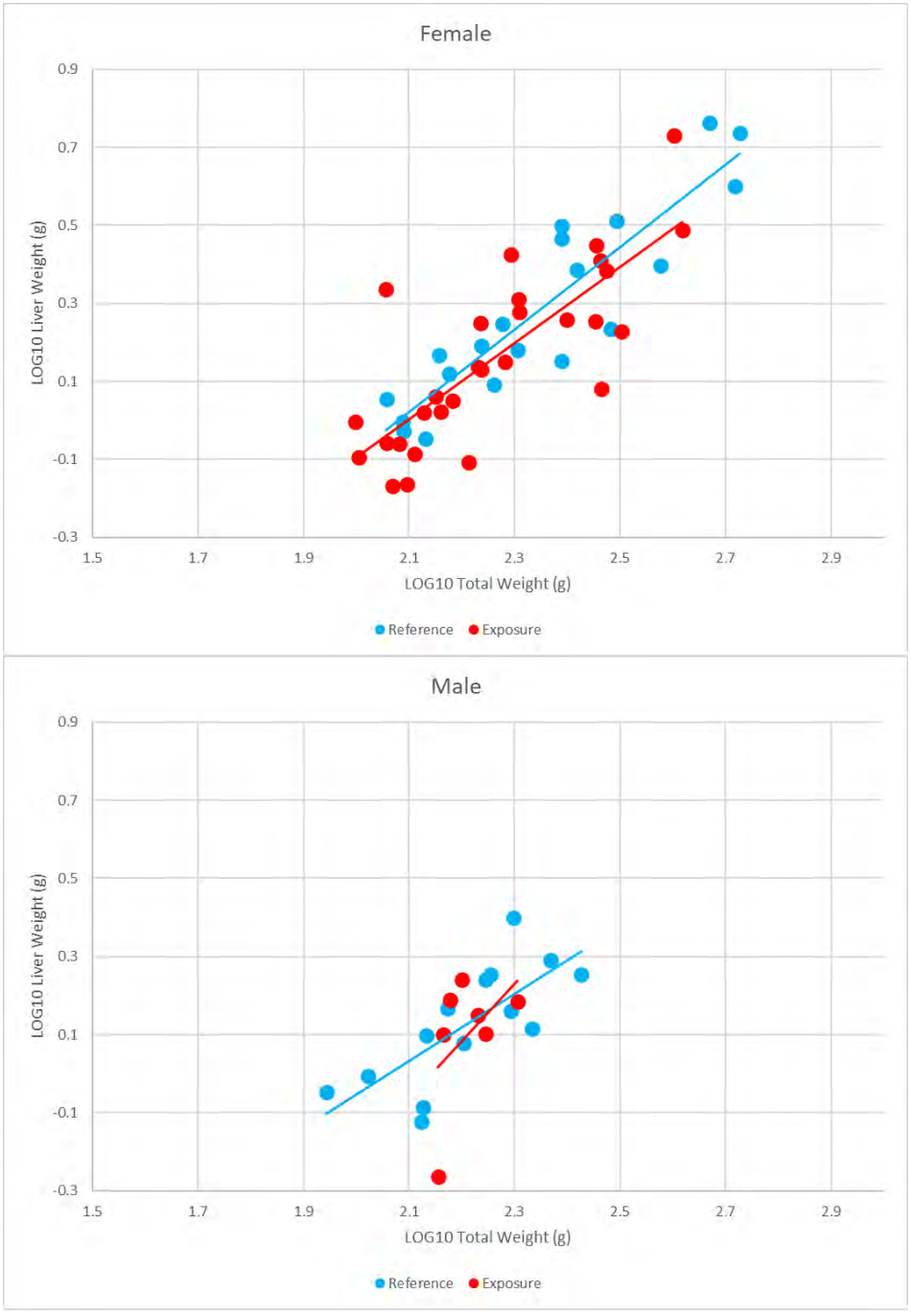


Figure 4.3 Scatterplot of Relative Liver Weight (Liver Weight versus Body Weight) of Adult White Sucker Collected from Reference and Exposure Areas, Aug/Sept 2020, Proposed Beaver Dam Mine

Female white sucker in the reference area appeared to have slightly heavier gonads than females in the exposure area (Figure 4.4) There did not appear to be obvious differences in the gonad weight for males or females when comparing between the reference and exposure locations.

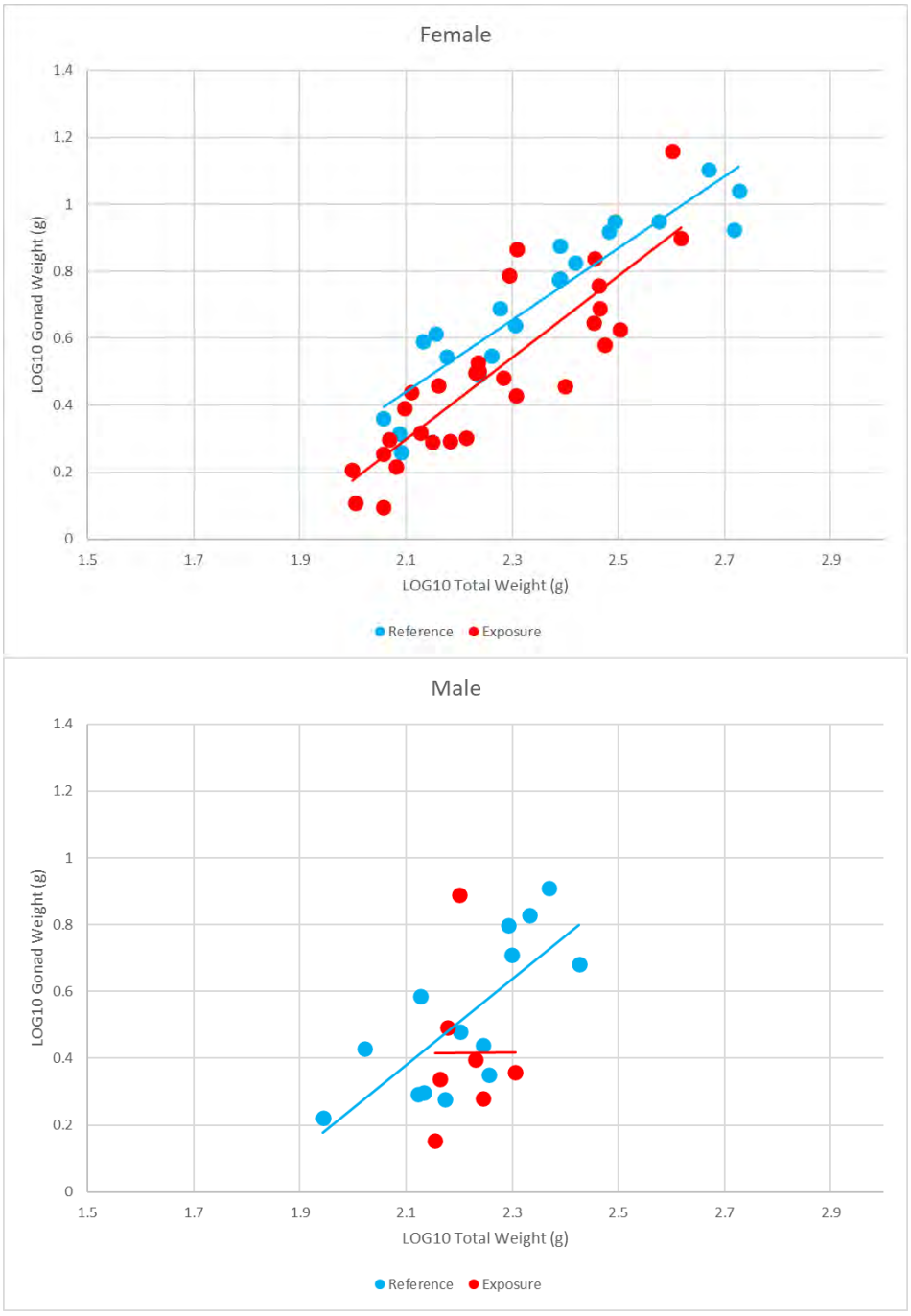


Figure 4.4 Scatterplot of Relative Gonad Weight (Gonad Weight versus Body Weight) of Adult White Sucker Collected from Reference and Exposure Areas, Aug/Sept 2020, Proposed Beaver Dam Mine

Relative fecundity and egg size was found to be similar between female white sucker in reference and exposure locations (Figures 4.5 and 4.6).

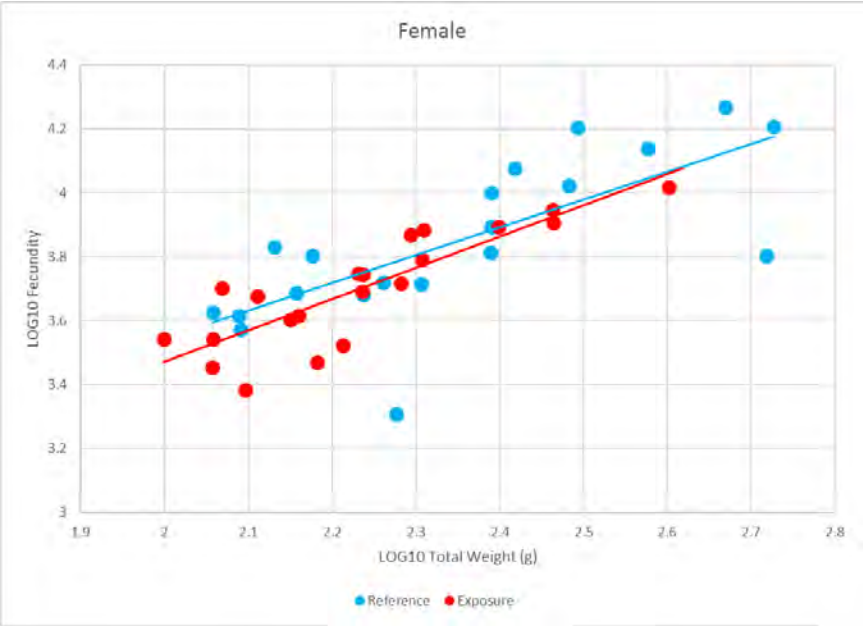


Figure 4.5 Scatterplot of Relative Fecundity (Number of Eggs versus Female Body Weight) of Adult White Sucker Collected from Reference and Exposure Areas, Aug/Sept 2020, Proposed Beaver Dam Mine

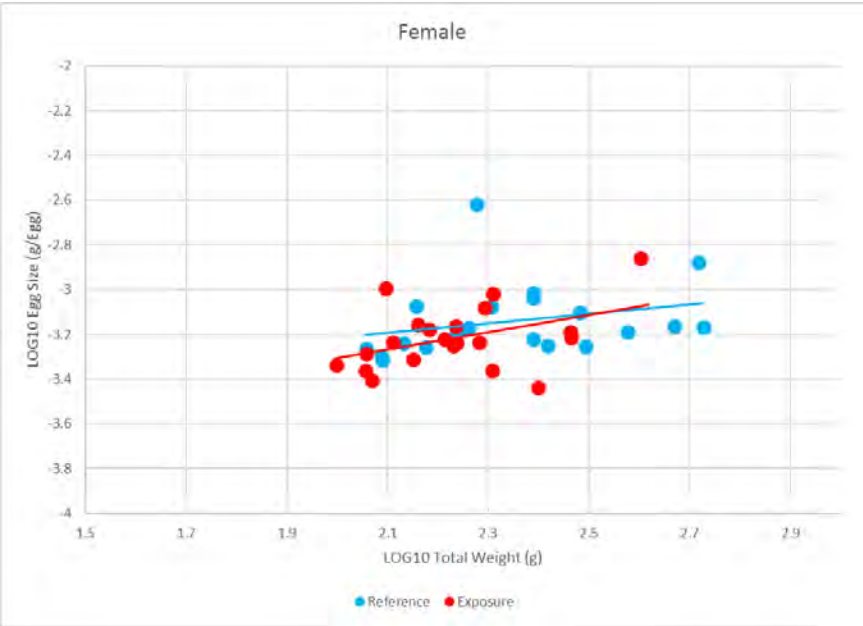


Figure 4.6 Scatterplot of Relative Egg Size (Egg Weight versus Female Body Weight) of Adult White Sucker Collected from Reference and Exposure Areas, Aug/Sept 2020, Proposed Beaver Dam Mine

4.2.2.2 Yellow Perch

Fish sampling captured 1,450 yellow perch in the Killag River, with fork lengths ranging between 3.6 and 15.6 cm (Table B.2, Appendix B).

Retained yellow perch had fork lengths between 5.5 and 15.6 cm. Of these, 3 were identified as immature based on a GSI of less than 1%. Of the yellow perch with a GSI greater than 1%, 77 females and 7 males were selected for analysis of EEM endpoints. Fork lengths for the 84 fish selected for EEM ranged from 9.0 to 15.6 cm. No abnormalities were noted for any of the yellow perch captured. Descriptive statistics for each of the sampling groups are presented in Table 4.5.

Table 4.5 Descriptive Statistics for Weight, Length, Condition, GSI, LSI and Age for Yellow Perch Captured in Aug/Sept 2020, Proposed Beaver Dam Mine

Statistic	Length (cm)	Weight (g)	Condi-tion	GSI	LSI	Age	Fecundity	Egg Size (mg)
Male Yellow Perch – Exposure								
Count	2	2	2	2	2	2	N/A	N/A
Mean	9.2	10.36	1.3	6.9	0.8	3.0	N/A	N/A
Median	9.2	10.36	1.3	6.9	0.8	3.0	N/A	N/A
Minimum	9.0	9.14	1.3	1.4	0.7	3.0	N/A	N/A
Maximum	9.3	11.58	1.4	12.4	0.9	3.0	N/A	N/A
Standard Deviation	0.21	1.725	0.13	7.76	0.15	0.00	N/A	N/A
Standard Error	0.15	1.220	0.09	5.49	0.11	0.00	N/A	N/A
Male Yellow Perch – Reference								
Count	5	5	5	5	5	5	N/A	N/A
Mean	10.3	15.00	1.3	3.2	1.0	5.4	N/A	N/A
Median	9.8	13.34	1.3	3.3	1.0	6.0	N/A	N/A
Minimum	9.7	11.88	1.3	1.9	0.8	3.0	N/A	N/A
Maximum	11.6	20.58	1.4	5.4	1.2	8.0	N/A	N/A
Standard Deviation	0.82	3.800	0.07	1.45	0.15	2.30	N/A	N/A
Standard Error	0.37	1.699	0.03	0.65	0.07	1.03	N/A	N/A
Female Yellow Perch – Exposure								
Count	30	30	30	30	30	30	8	8
Mean	12.5	27.39	1.4	2.4	2.2	3.8	3,716	0.180
Median	12.5	25.77	1.4	1.6	1.0	4.0	2,725	0.132
Minimum	10.5	15.42	1.1	1.1	0.6	3.0	1,801	0.091
Maximum	14.8	44.33	1.7	12.6	12.4	4.0	6,896	0.426
Standard Deviation	1.31	8.563	0.12	2.73	3.03	0.41	2,008	0.1150
Standard Error	0.24	1.563	0.02	0.50	0.55	0.07	710	0.0410

Table 4.5 Descriptive Statistics for Weight, Length, Condition, GSI, LSI and Age for Yellow Perch Captured in Aug/Sept 2020, Proposed Beaver Dam Mine

Statistic	Length (cm)	Weight (g)	Condi-tion	GSI	LSI	Age	Fecundity	Egg Size (mg)
Female Yellow Perch – Reference								
Count	47	47	47	47	47	47	43	43
Mean	12.1	23.89	1.3	1.7	0.9	3.5	4,121	0.129
Median	11.7	20.45	1.3	1.7	0.8	3.0	3,571	0.102
Minimum	10.0	13.08	1.1	1.2	0.1	2.0	382	0.060
Maximum	15.6	54.50	1.6	2.8	1.9	8.0	10,719	0.941
Standard Deviation	1.29	9.593	0.12	0.30	0.28	1.18	2,185	0.1340
Standard Error	0.19	1.399	0.02	0.04	0.04	0.17	333	0.0200

For yellow perch, 77 females and 7 males were targeted for EEM endpoints. This included 30 females and 2 males from the exposure area, and 47 females and 5 males from the reference area.

Discussion along with a variety of graphs showing the following relationships are presented below:

- Body weight versus length
- Body weight versus age
- Body weight versus liver weight
- Body weight versus gonad
- Body weight versus fecundity
- Body weight versus egg size

Female yellow perch in the reference and exposure locations appeared to be slightly longer and heavier than male yellow perch (Figure 4.7). However, very few male yellow perch were captured during the program, so it is difficult to make comparisons between sexes. There are no obvious differences in the length or weight of females when comparing the reference and exposure locations.

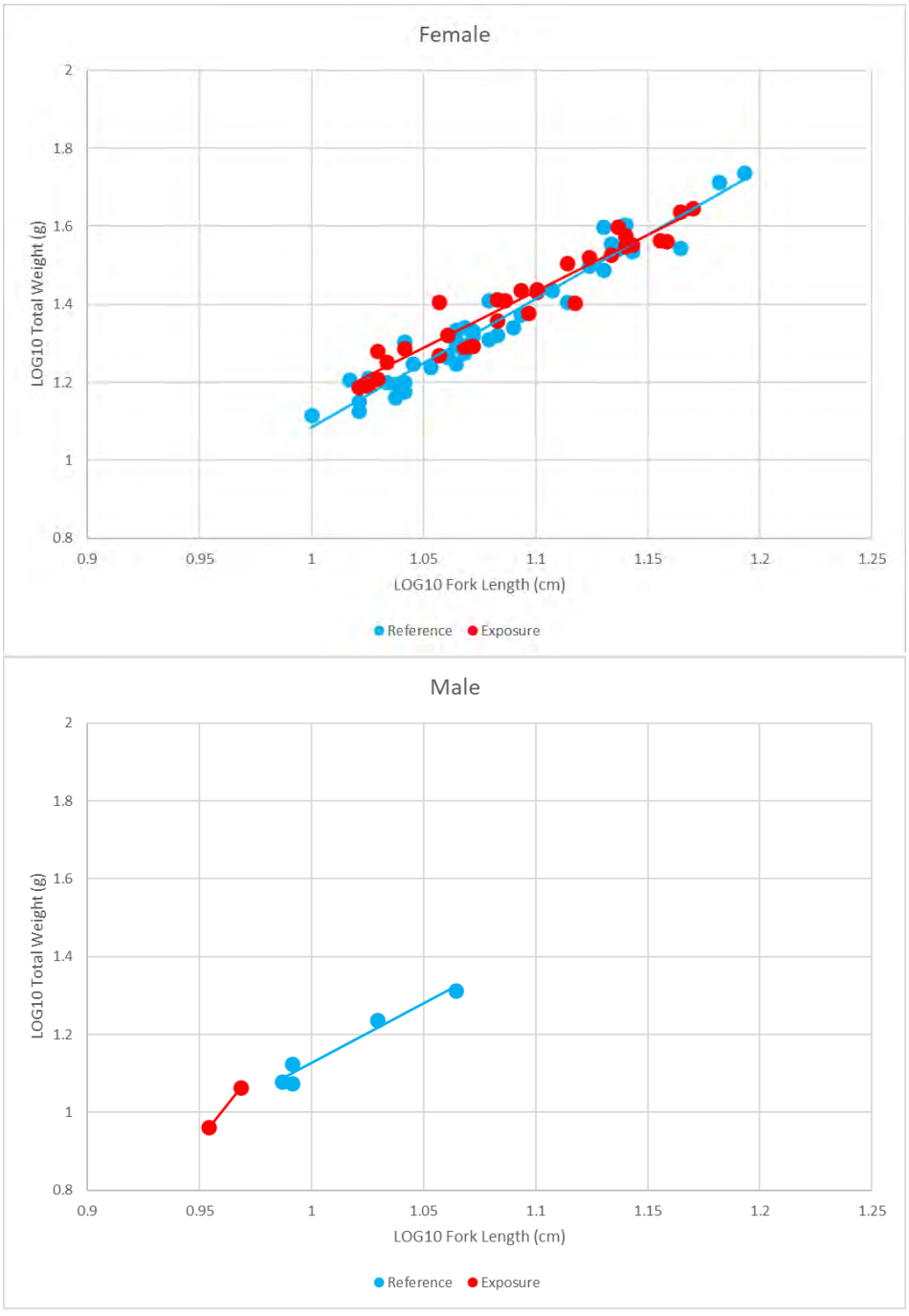


Figure 4.7 Scatterplot of Condition of Adult Yellow Perch Collected from Reference and Exposure Areas, Aug/Sept 2020, Proposed Beaver Dam Mine

In general, there appeared to be greater variation in age (for females and males) in the reference area as opposed to the exposure area (Figure 4.8).

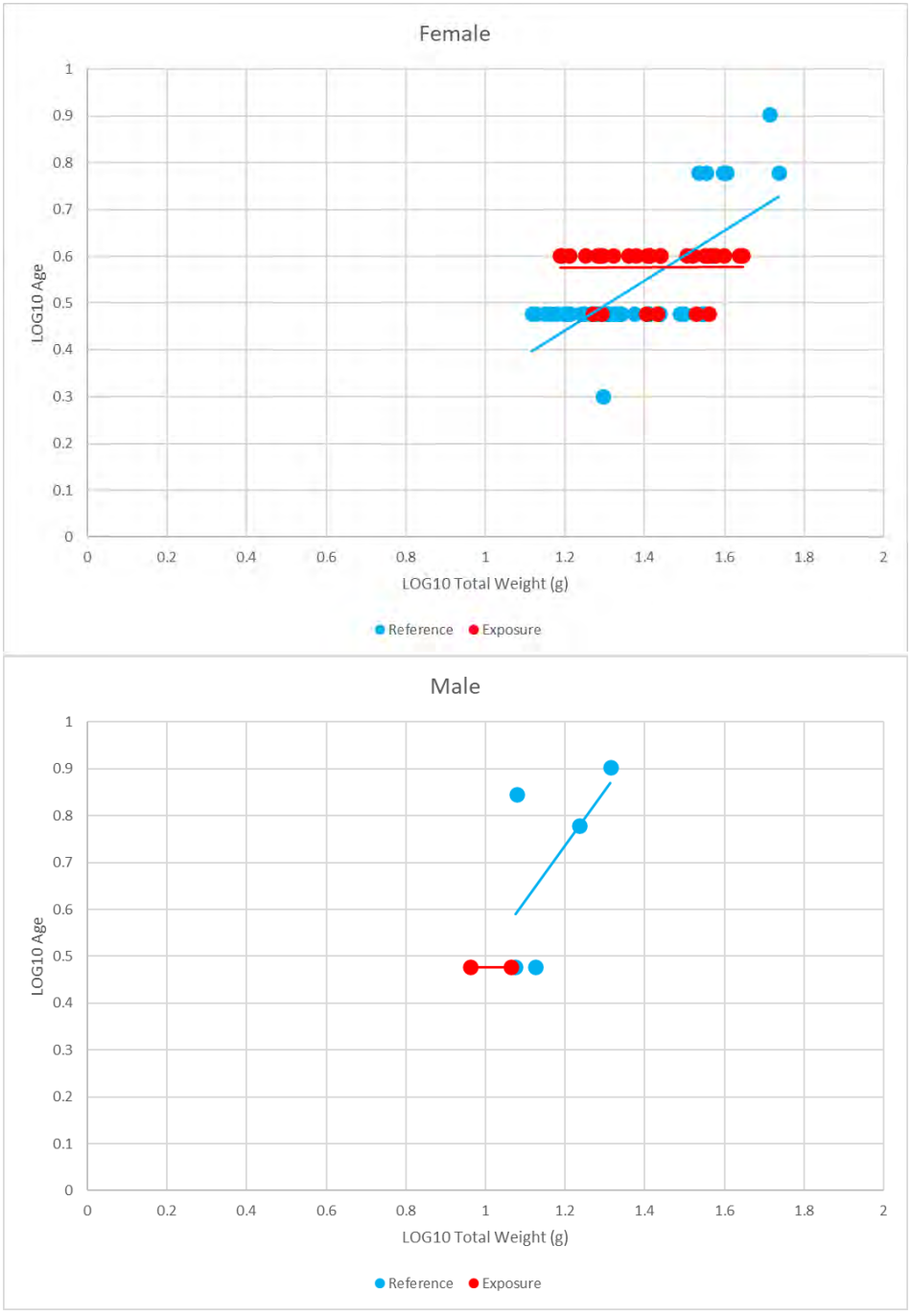


Figure 4.8 Scatterplot of Weight at Age of Adult Yellow Perch Collected from Reference and Exposure Areas, Aug/Sept 2020, Proposed Beaver Dam Mine

Female yellow perch in the exposure area appeared to have higher LSI than females in the reference area. However, outliers may be influencing these results (Figure 4.9).

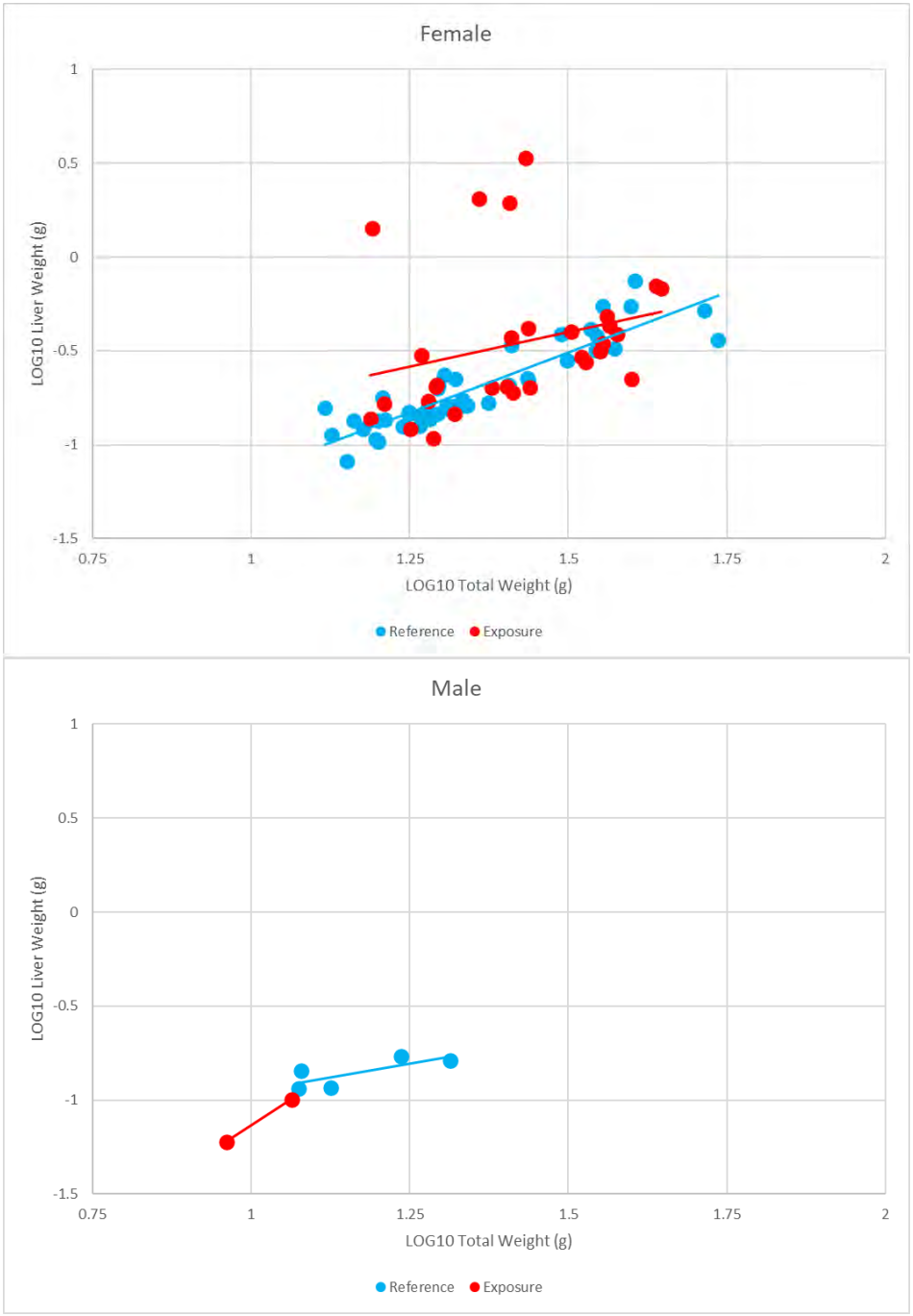


Figure 4.9 Scatterplot of Relative Liver Weight (Liver Weight versus Body Weight) of Adult Yellow Perch Collected from Reference and Exposure Areas, Aug/Sept 2020, Proposed Beaver Dam Mine

Female yellow perch in the reference and exposure areas appeared to have similar GSI (Figure 4.10).

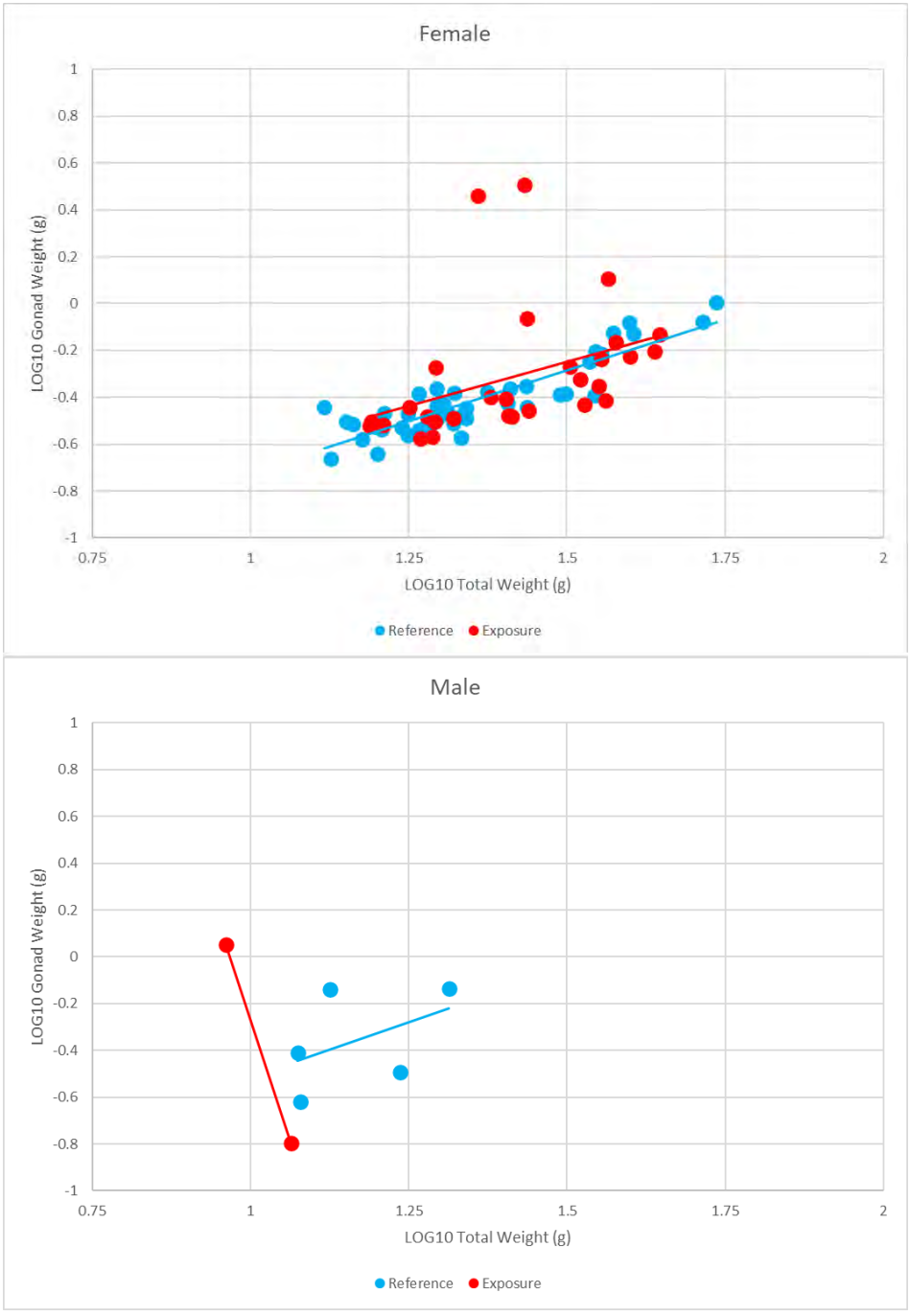


Figure 4.10 Scatterplot of Relative Gonad Weight (Gonad Weight versus Body Weight) of Adult Yellow Perch Collected from Reference and Exposure Areas, Aug/Sept 2020, Proposed Beaver Dam Mine

There were significantly more females caught in the reference area than the exposure area. Based on the results, relative fecundity appeared to be higher for female yellow perch in the reference area compared with the exposure area (Figure 4.11). Egg size, however, tended to be larger for female yellow perch in the reference area (Figure 4.12).

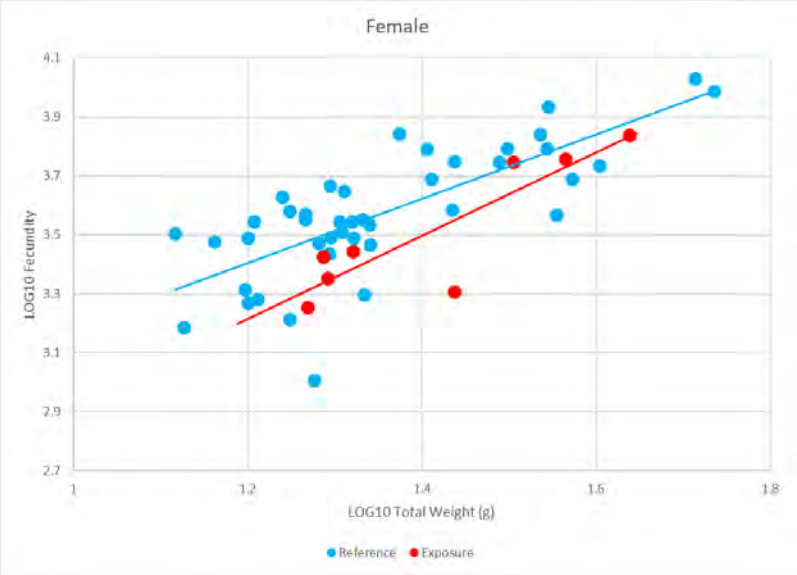


Figure 4.11 Scatterplot of Relative Fecundity (Number of Eggs versus Female Body Weight) of Adult Yellow Perch Collected from Reference and Exposure Areas, Aug/Sept 2020, Proposed Beaver Dam Mine

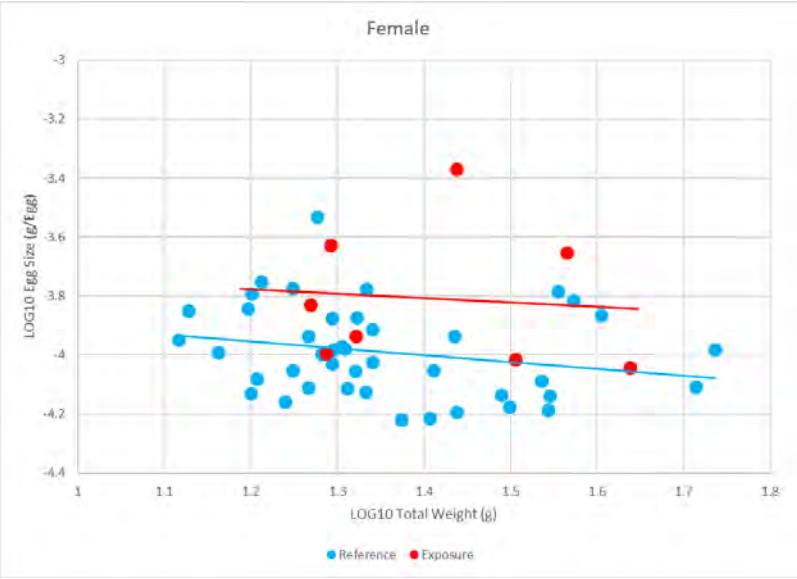


Figure 4.12 Scatterplot of Relative Egg Size (Egg Weight versus Female Body Weight) of Adult Yellow Perch Collected from Reference and Exposure Areas, Aug/Sept 2020, Proposed Beaver Dam Mine

4.2.2.3 QA/QC

Fourteen out of 151 lethally sampled fish were remeasured and reweighed for quality assurance and quality control (Table B.4, Appendix B). RPD values (explained above) were calculated to assess data quality. For length measurements, there was a maximum of 0.84% or less RPD and a maximum of 0.32% or less RPD in the weight of fish, which is well within the 10% maximum RPD recommended in the Technical Guidance (EC 2012).

Ten percent of the aging structures collected were sent to Bob Irwin for independent confirmation in accordance with the Technical Guidance (EC 2012). In total, fifteen samples were submitted, which consisted of eight yellow perch and seven white suckers. There were no differences in the age of the yellow perch otoliths determined by the primary ager and the second independent ager, indicating that the data quality was acceptable (±1 year). For white sucker pectoral fin rays, three out of seven samples met the required precision, three out of seven samples were ±2 years of age and one sample was ±3 years of age. Differences in the precision may be in part based on the subjectivity associated with the preparation and interpretation of the growth increment features in the calcified structures which can vary among readers and laboratories (Campana 2001). Jon Tost noted that there were difficulties aging white sucker from the exposure as there was a lot of false checking and true annuli were difficult to discern (Table B.5, Appendix B).

5.0 FISH TISSUE STUDY

5.1 METHODS

5.1.1 Field and Laboratory

From the fish retained for collection of biological endpoints, five fish of each sentinel species from both the exposure and reference areas were selected for tissue analysis.

To prevent cross-contamination between samples, dissecting tools (e.g., scalpel, forceps, cutting board) were rinsed with tap water, followed by de-ionized water between individual fish samples. Nitrile gloves were worn during dissections and were changed between samples to prevent cross contamination. The carcass of each white sucker was placed in a large plastic bag for whole body analysis. In total, ten white sucker were analyzed as whole body samples, five from the reference area and five from the exposure area.

In total, ten yellow perch were analyzed as whole body (n=10) and muscle fillet samples (n=10); five from the reference area and five from the exposure area. Skinless, boneless muscle fillets were removed using a scalpel, tweezers, and a fillet knife. The skinless, boneless muscle fillets were weighed and placed in individual plastic bags for analysis, with sample IDs ending in “-MUS”. The remaining carcasses were placed in separate plastic bags for analysis, with samples IDs ended in “-CAR”. Samples were labelled with a unique sample ID and placed immediately into a freezer at -20ºC for storage prior to being

submitted in a cooler on ice for trace metals analysis to the Research and Productivity Council (RPC), in Fredericton, NB.

Fish tissue samples were analyzed for several parameters, including a complete scan for metals, lipids (i.e., crude fat), and moisture content. Whole sample homogenates were prepared for each sample. Portions of the homogenates were prepared by Microwave Assisted Digestion in nitric acid and analyzed for trace elements by Inductively Coupled Plasma Mass Spectrometry (ICP-MS). Mercury was analyzed by Cold Vapour Atomic Absorption Spectroscopy (CVAA). Fat was determined by acid hydrolysis (method OAS-FC06) and moisture by method OAS-FC01.

For yellow perch, metal concentrations of both muscle tissue and whole body were determined. The total wet weight body metal concentration (mg/kg) was calculated by adding the metal concentration in the skinless, boneless fillet and carcass. To determine the whole body concentration for yellow perch the following formula was used:

$$WB_c = \frac{\left((P_{cm}\ x\ M_{wt}) + (P_{cc}\ x\ C_{wt})\right)}{(M_{wt} + C_{wt})}$$

Where:

WB_c = Whole-body concentration (mg/kg) wet weight
P_{cm} = Parameter concentration in muscle (mg/kg)
P_{cc} = Parameter concentration in carcass (mg/kg)
M_{wt} = Muscle Weight (kg)
C_{wt} = Carcass Weight (kg)

For white sucker, no calculations for whole body weight were required because the whole body was analyzed. Results are presented on a wet weight basis, with the exception of selenium which is presented on a dry weight basis in mg/kg, which is equivalent to ug/g under MDMER.

5.1.2 Data Analysis

Descriptive statistics including minimum, maximum, median, mean, standard error, and standard deviation were calculated for wet weight arsenic and mercury and dry weight selenium by fish species. Half of the laboratory reportable detection limit (RDL) was used to calculate the descriptive statistics when a parameter was below the RDL. Mercury and selenium were selected for detailed analysis, as a study respecting fish tissue mercury or selenium may be required during EEM under MDMER if these parameters exceed the criteria. Arsenic was selected for detailed analysis as there are federal human health consumption guidelines.

The results of fish tissue analyses were compared to applicable federal consumption guidelines for arsenic and mercury, while selenium was compared to the USEPA 2016 aquatic life ambient criterion (US EPA 2016). The results for metals in fish tissue data collected during baseline will be available for comparison with future data collected during EEM phases.

The Health Canada fish consumption guideline for human consumption for arsenic is 3.5 mg/kg (Health Canada 2020) and for mercury is 0.5 mg/kg (Health Canada 2007). The USEPA 2016 aquatic life ambient criterion for selenium in fish tissue is 11.3 mg/kg and 8.5 mg/kg dry weight for muscle tissue and whole body samples, respectively.

5.2 RESULTS

A total of ten whole body fish samples were collected from white sucker and ten muscle fillet and whole body fish samples were collected from yellow perch, in equal proportions from the reference and exposure locations in the Killag River.

Descriptive statistics for concentrations of arsenic, mercury and selenium in white sucker whole body are provided in Table 5.1, and for yellow perch muscle fillet and whole body in Table 5.2. Laboratory analytical data is provided in Table C.1 to C.4 in Appendix C. Weights are provided in Table C.5, Appendix C.

Table 5.1 Descriptive Statistics for Arsenic, Mercury and Selenium Concentrations for White Sucker Whole Body Samples

Descriptive Statistic	Whole Body	
	Reference Area	Exposure Area
Arsenic (mg/kg)		
Count	5	5
Minimum	0.05	0.16
Maximum	0.08	0.35
Median	0.07	0.19
Mean	0.068	0.226
Standard Error	0.004	0.030
Standard Deviation	0.010	0.067
Mercury (mg/kg)		
Count	5	5
Minimum	0.17	0.21
Maximum	0.31	0.34
Median	0.26	0.30
Mean	0.246	0.282
Standard Error	0.022	0.024
Standard Deviation	0.050	0.053
Selenium - Dry Weight (mg/kg)		
Count	5	5
Minimum	1.74	1.99
Maximum	2.43	3.84
Median	2.08	2.58
Mean	2.12	2.67

Table 5.1 Descriptive Statistics for Arsenic, Mercury and Selenium Concentrations for White Sucker Whole Body Samples

Descriptive Statistic	Whole Body	
	Reference Area	Exposure Area
Arithmetic Mean	0.104	0.280
Standard Deviation	0.233	0.626

Table 5.2 Descriptive Statistics for Arsenic, Mercury and Selenium Concentrations for Yellow Perch Muscle Fillet and Whole Body Samples

Descriptive Statistic	Muscle Fillet		Whole Body	
	Reference Area	Exposure Area	Reference Area	Exposure Area
Arsenic (mg/kg)				
Count	5	5	5	5
Minimum	0.02	0.1	0.03	0.14
Maximum	0.03	0.15	0.05	0.23
Median	0.03	0.12	0.04	0.21
Mean	0.026	0.126	0.04	0.19
Standard Error	0.002	0.008	0.003	0.016
Standard Deviation	0.005	0.017	0.008	0.035
Mercury (mg/kg)				
Count	5	5	5	5
Minimum	0.31	0.34	0.24	0.27
Maximum	0.55	0.61	0.35	0.41
Median	0.36	0.4	0.27	0.28
Mean	0.396	0.438	0.28	0.31
Standard Error	0.038	0.042	0.019	0.025
Standard Deviation	0.085	0.094	0.043	0.055
Selenium - Dry Weight (mg/kg)				
Count	5	5	5	5
Minimum	1.68	2.20	1.51	1.83
Maximum	2.84	4.24	2.07	3.82
Median	2.49	3.05	1.85	2.33
Mean	2.44	2.97	1.82	2.60
Standard Error	0.184	0.337	0.086	0.346
Standard Deviation	0.412	0.753	0.192	0.774

The following points summarize the results for arsenic in fish tissue (Figure 5.1):

- Arsenic concentrations in fish tissue from both yellow perch and white sucker were higher in samples from the exposure area than the reference area.
- Concentrations of arsenic in yellow perch and white sucker were below the Heath Canada guideline of 3.5 mg/kg.

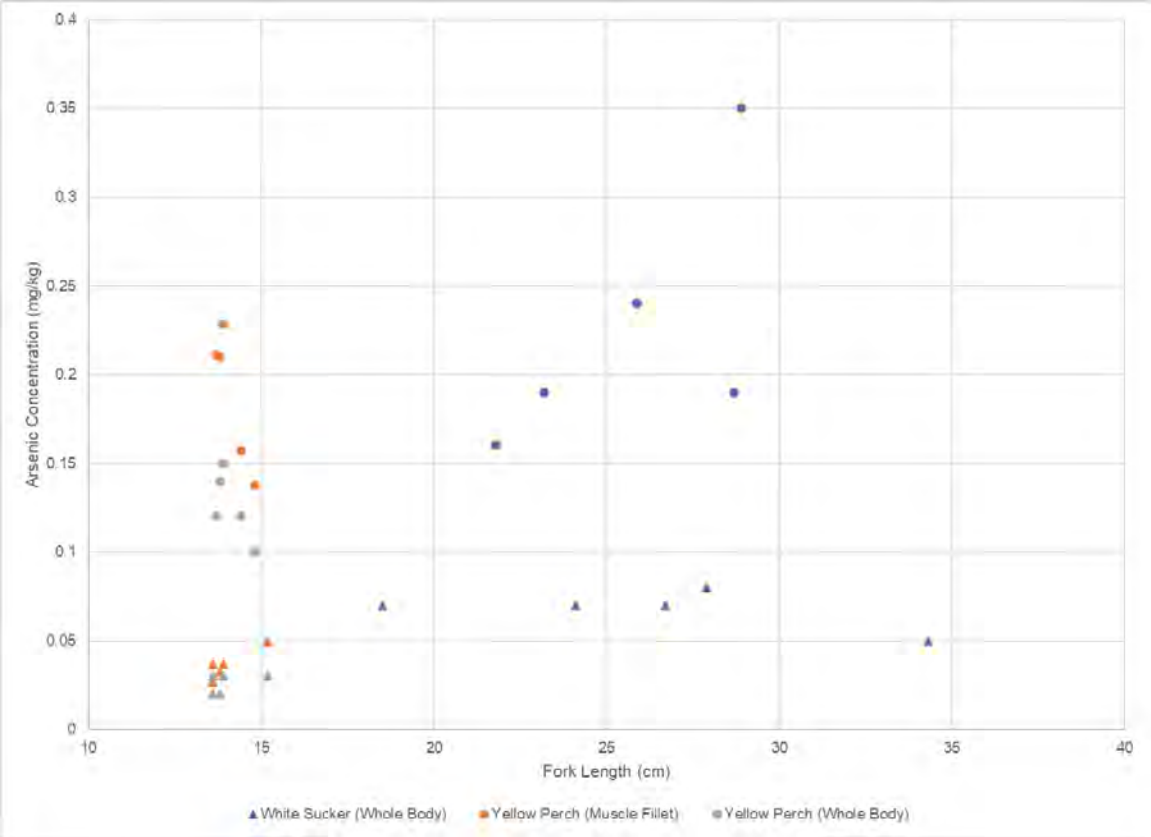


Figure 5.1 White Sucker and Yellow Perch Tissue Arsenic Concentrations in Relation to Fork Length (Circles Represent Exposure, Triangles Represent Reference)

The following points summarize the qualitative results for mercury in fish tissue (Figure 5.2):

- Mercury concentrations were similar in yellow perch and white sucker from the reference and exposure areas.
- Mercury concentrations in yellow perch fillets were generally within the range of whole body samples, with the exception of three samples.
- Concentrations of mercury in yellow perch and white sucker whole bodies were below the Heath Canada guideline of 0.5 mg/kg.
- Concentrations of mercury in yellow perch muscle fillets were above the Heath Canada guideline of 0.5 mg/kg, in two out of ten samples.

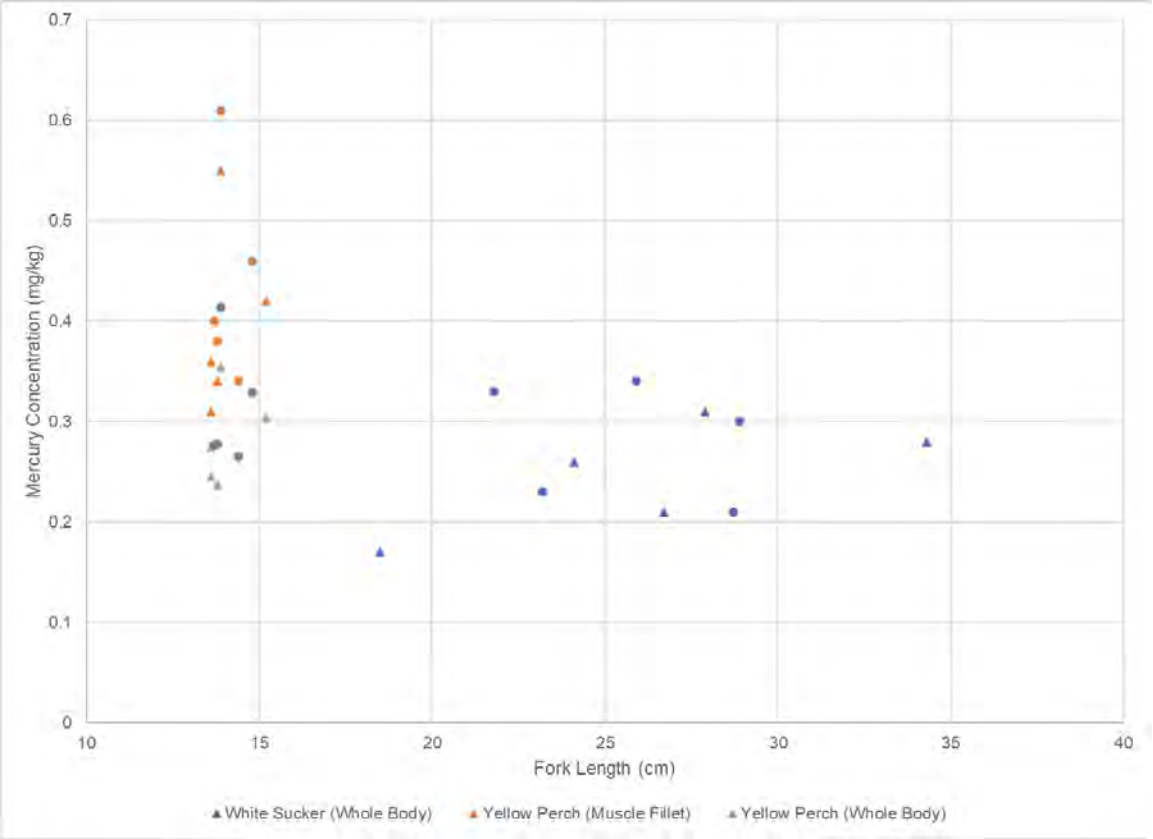


Figure 5.2 White Sucker and Yellow Perch Mercury Concentrations in Relation to Fork Length (Circles Represent Exposure, Triangles Represent Reference)

The following points summarize the results for selenium in fish tissue (Figure 5.3):

- Selenium concentrations were similar in yellow perch and white sucker from the reference and exposure areas.
- Selenium concentrations in yellow perch fillets were generally within the range of whole body samples, with the exception of one sample.
- Concentrations of selenium in yellow perch and white sucker were below the US EPA selenium criteria for protection of aquatic life of 15.1 and 8.5 µg/g, for muscle tissue and whole body samples, as applicable.

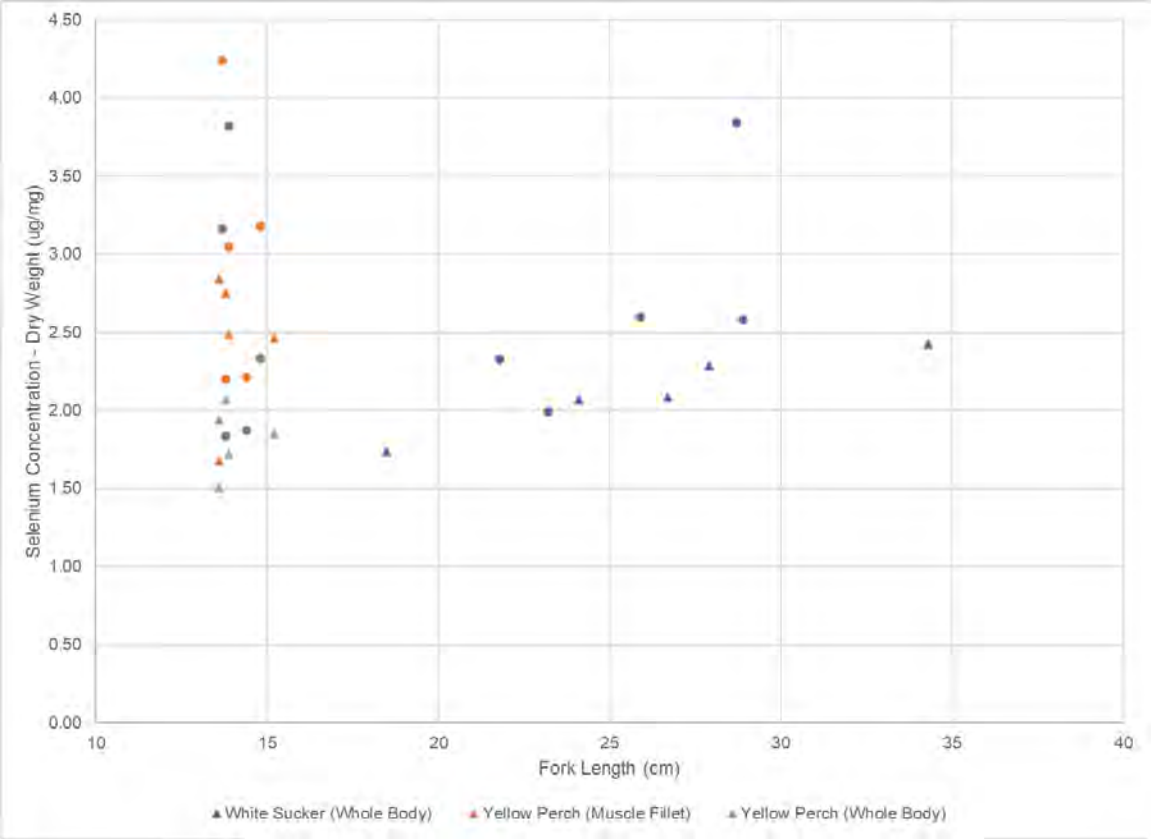


Figure 5.3 White Sucker and Yellow Perch Selenium Concentrations in Relation to Fork Length (Circles Represent Exposure, Triangles Represent Reference)

6.0 BENTHIC INVERTEBRATE COMMUNITY ASSESSMENT

6.1 METHODS

6.1.1 Field and Laboratory

Five samples of the benthic invertebrate community (BIC) were collected at the exposure and reference locations of the Killag River in August 2020. BIC samples were collected using a petit ponar grab and attempts were made to sample within the littoral zone (< 3 m water depth).

BIC samples were collected from the reference and exposure areas at water depths between 1 and 1.6 m using a petit ponar grab with a surface area of 0.0255 m^2. Depth of water for the BIC samples was verified using a digital depth sounder (HawkEye H22PX Handheld Sonar System). Each sample consisted of a composite of three subsamples with each subsample collected at least 5 m away from the nearest subsample. Samples were sieved at site through a 500 µm box sieve prior to preservation. Samples were preserved in the field in 10% buffered formalin solution with unique sample identifiers on labels placed inside and outside each sample container.

The resulting ten benthic invertebrate samples were shipped to Bill Morton in Guelph, ON, to be sorted and identified to family/species level. Bill Morton is an experienced benthic taxonomist that has been providing this service for several decades for mining and pulp and paper EEM programs.

Upon arrival to the laboratory, excess formalin was washed from the samples through a 500 µm sieve. Sediment was flushed and washed through a series of stacked sieves to separate fine particles and coarse debris which were washed into smaller containers for further processing. Benthic invertebrates were sorted by rinsing small amounts of sediment into petri-dishes using a 6x power dissecting scope. Organisms were identified to the lowest practical taxonomic level using current taxonomic keys. Further information, including the raw data, can be found in Appendix D.

A reference collection was retained and archived for potential future taxonomic verification. Calculations of sorting efficiency were provided.

6.1.2 Data Analysis

BIC data were analyzed for the following four endpoints: total invertebrate density, taxa richness, Simpson's Evenness Index and Simpson's Diversity Index. Total invertebrate density, taxa richness, Simpson's Evenness Index and the Similarity Index are required effect endpoints in the Technical Guidance (EC 2012), however the Similarity Index was not calculated as per the Technical Guidance (EC 2012) because of the low overall abundance of benthic invertebrates in the samples.

Data were summarized at the lowest practical level since there were so few taxa overall. The EEM benthic invertebrate community endpoints and descriptors are defined below.

- Mean invertebrate density: # of individuals per m^2
- Mean taxa richness: mean number of taxa (family-level)
- Mean Simpson's Evenness Index (E): a measure of the distribution of individuals among sampled taxa (range: 0 to 1) and calculated at the family level; a more equitable distribution (values approaching 1) indicates how evenly the individual species in the community are distributed. The evenness value for such a community would be 1.
- Mean Simpson's Diversity Index (D): the probability that two organisms, selected at random, are from a different taxonomic group (range: 0 to 1, with larger values indicative of more diverse communities); this index is influenced by the numerically dominant taxa and calculated at the family level.

Simpson's Evenness (E) was calculated using the formula:

$$E = \frac{1}{\frac{\sum_{i=1}^{S}(p_i)^2}{S}}$$

where 'p_i' is the proportion of individuals of the 'i^{th}' taxon in a community of 'S' taxa: ($_i$ = 1 to S).

Simpson's Diversity was calculated using the formula:

$$D = 1 - \sum (p_i)^2$$

where 'p_i' is the proportion of individuals of the 'i^{th}' taxon in a community of 'S' taxa: (i = 1 to S).

The Nematoda observed in sample (Ref-2) was not included in the analyses, as per the Technical Guidance (EC 2012).

6.1.3 QA/QC

The benthic invertebrate samples were sorted and identified by a qualified taxonomist and in accordance with the Technical Guidance (EC 2012). A reference collection of representative benthic invertebrate taxa was retained for future verification (if warranted) and estimates of sorting efficiency were performed as described in the Technical Guidance (EC 2012) and were confirmed to be within the criterion for acceptability.

6.2 RESULTS

6.2.1 Community Structure

Five samples from each of the reference area and exposure area were sampled in the Killag River. 100% of each sample was sorted. In total, twelve different species consisting of eight family taxa were identified. Overall, the samples had relatively low densities. Samples from the reference had an average of 136 individuals per m^2 while samples from the exposure area had an average of 39 individuals per m^2. Relatively few taxa were found in the samples. The predominant class of benthic invertebrates was Diptera and included the Chaoboridae and Chironomidae families (Figure 6.1). Freshwater sponge colonies (i.e., *Spongilla*) were observed, but not included in the analysis.

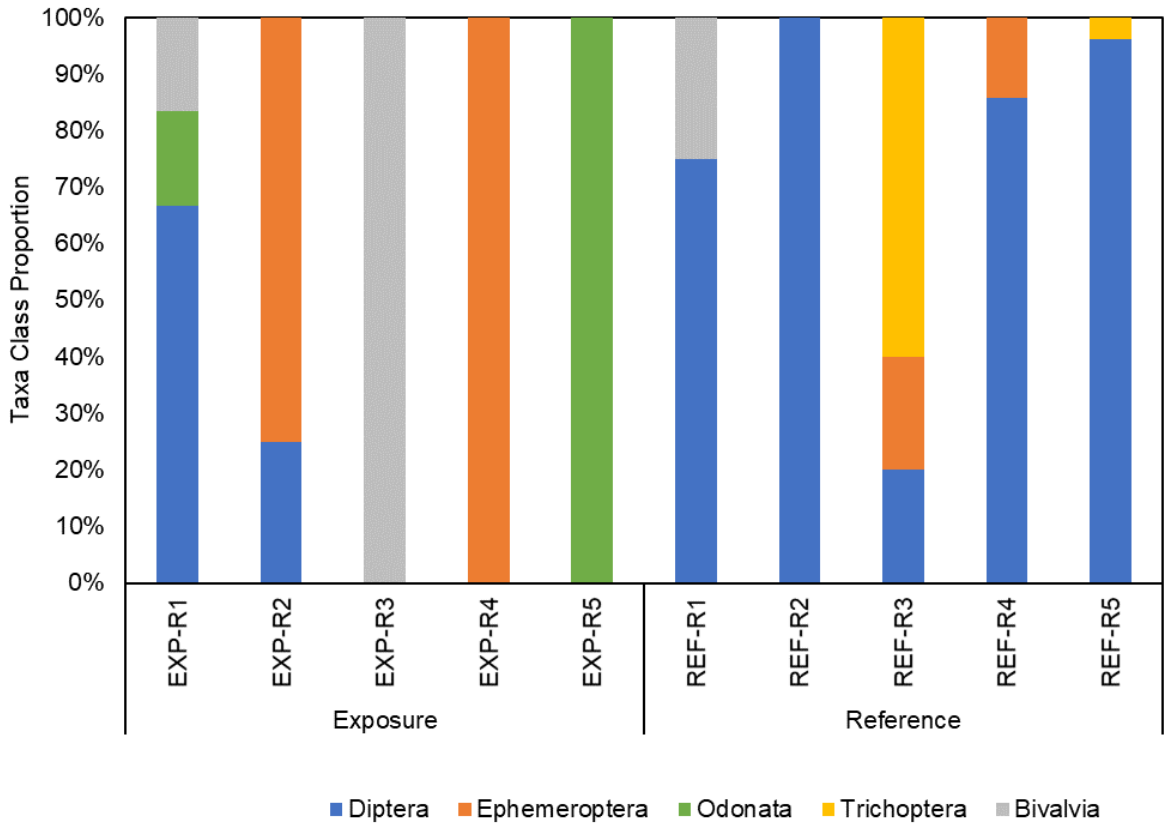


Figure 6.1 Taxonomic Composition of Benthic Invertebrate Community by Location

6.2.2 Benthic Invertebrate Community Endpoints

The summary statistics for the effect endpoints required by the Technical Guidance (EC 2012) are shown in Table 6.1 and include density, taxa richness (at the lowest practical level), Simpson's Evenness Index, as well as Simpson's Diversity Index. The benthic invertebrate community raw and indices values are presented in Appendix D.

Table 6.1 Benthic Invertebrate Community Summary Statistics for Abundance, Taxa Richness, Simpson's Diversity Index and Simpson's Evenness Index

Parameter	Reference	Exposure	Parameter	Reference	Exposure
N of Cases	5	5	N of Cases	5	5
Density (# of individuals per m^2)			Simpson's Evenness Index		
Mean	136	39	Mean	0.51	0.32
Median	92	26	Median	0.56	0.38
Standard Error	53	12	Standard Error	0.07	0.14
Standard Deviation	118	26	Standard Deviation	0.15	0.32
Minimum	52	13	Minimum	0.24	0.00
Maximum	340	78	Maximum	0.63	0.72
Taxa Richness			Simpson's Diversity Index		
Mean	3	2	Mean	0.70	0.94
Median	3	2	Median	0.72	1.00
Standard Error	0.5	0.5	Standard Error	0.07	0.04
Standard Deviation	1.1	1.2	Standard Deviation	0.16	0.09
Minimum	2	1	Minimum	0.46	0.80
Maximum	5	4	Maximum	0.89	1.00

The density of organisms in the benthic invertebrate community was higher in the reference area (mean = 136 individuals per m^2) than the exposure sampling location (mean = 39 individuals per m^2) (Figure 6.2).

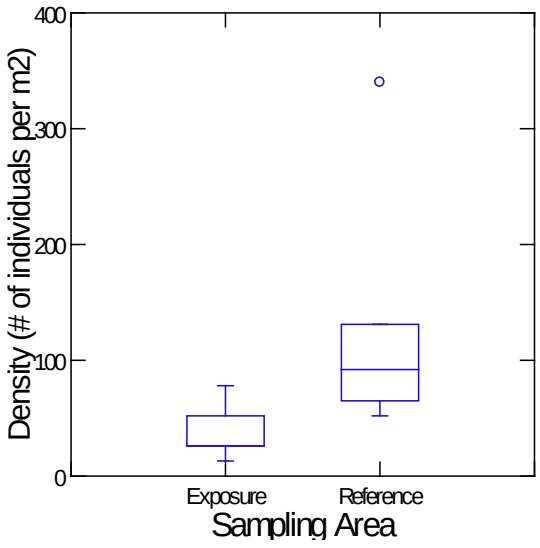


Figure 6.2 Box Plot of Benthic Invertebrate Community: Density (# of individuals per m^2)

Notes: The centre line is the median. Ends of the box indicate the lower and upper quartiles. Ends of the whiskers indicate the quartile ± 1.5 x interquartile spread. Asterisks indicate values falling within the quartile ± 3 x interquartile spread. Open circles indicate values falling outside the quartile ± 3 x interquartile spread.

Taxa richness was similar in the reference (3 taxa) compared to the exposure sampling location (3 taxa) (Figure 6.3).

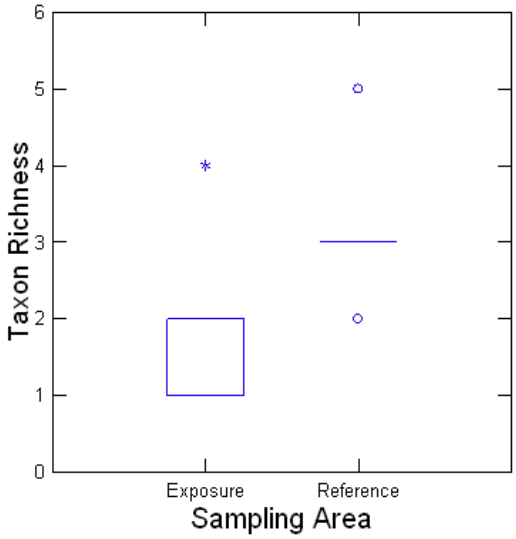


Figure 6.3 Box Plot of Benthic Invertebrate Community: Taxa Richness

Notes: The centre line is the median. Ends of the box indicate the lower and upper quartiles. Ends of the whiskers indicate the quartile ± 1.5 x interquartile spread. Asterisks indicate values falling within the quartile ± 3 x interquartile spread. Open circles indicate values falling outside the quartile ± 3 x interquartile spread.

Simpson's Evenness Index was higher at the reference sampling location (0.51) than the exposure sampling location (0.32) (Figure 6.4).

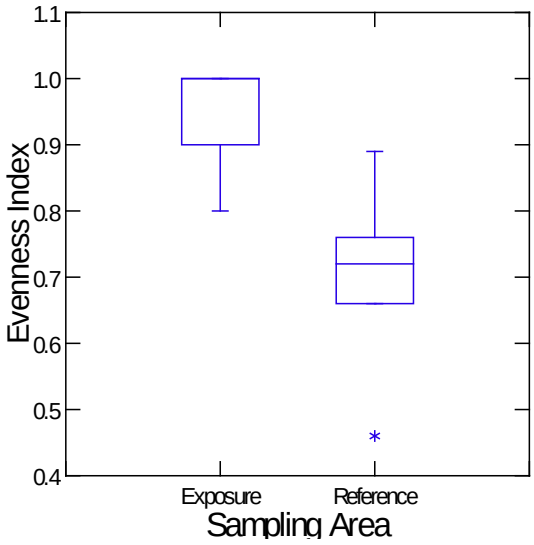


Figure 6.4 Box Plot of Benthic Invertebrate Community: Simpson's Evenness Index

Notes: The centre line is the median. Ends of the box indicate the lower and upper quartiles. Ends of the whiskers indicate the quartile ± 1.5 x interquartile spread. Asterisks indicate values falling within the quartile ± 3 x interquartile spread. Open circles indicate values falling outside the quartile ± 3 x interquartile spread.

Similarly, Simpson's Diversity Index was higher at the exposure sampling location (0.94) than the nearfield sampling location (0.70) (Figure 6.5).

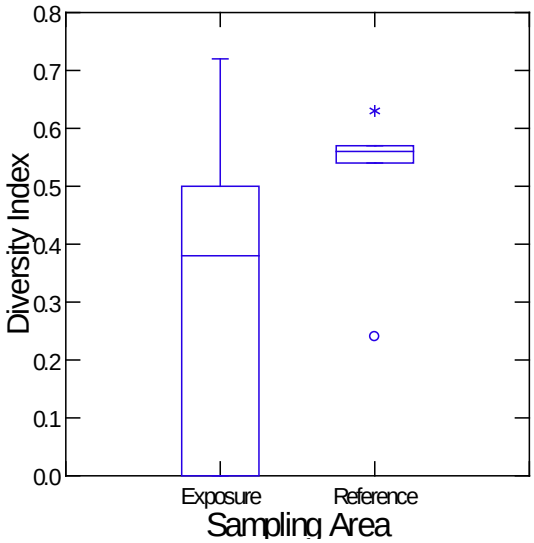


Figure 6.5 Benthic Invertebrate Community: Simpson's Diversity Index

Notes: The centre line is the median. Ends of the box indicate the lower and upper quartiles. Ends of the whiskers indicate the quartile ± 1.5 x interquartile spread. Asterisks indicate values falling within the quartile ± 3 x interquartile spread. Open circles indicate values falling outside the quartile ± 3 x interquartile spread.

Overall, the very low density and species diversity observed in the benthic invertebrate community in the Killag River is likely a reflection of a low-productivity habitat in peat-like sediments in the reference and exposure area. Organisms such as *Hexagenia*, *Phylocentropus* and *Chaoborus*, which are indicators of good water quality were observed. Water quality parameters such as pH (5.5 in the exposure area and 5.4 in the reference area [Section 7.0]) may also inhibit the abundance and diversity of the benthic invertebrate community.

6.2.3 QA/QC

Ten percent (1 of 10) of samples submitted for benthic invertebrate analysis were re-sorted. These re-sorts showed that 100% of the benthic invertebrates were recovered in the original sort (Appendix D). These recovery rates are acceptable.

7.0 SUPPLEMENTAL VARIABLES: WATER & SEDIMENT QUALITY

7.1 METHODS

Surface water and sediment quality information was collected as supporting environmental data to support interpretation of the results of baseline fish and benthic invertebrate community surveys. Samples were submitted to Bureau Veritas Laboratories (BV Labs) for analysis.

7.1.1 Surface Water

In-situ temperature, dissolved oxygen, and conductivity was measured at each sampling location using a YSI Multi-Meter (Model Pro2030, Ohio, USA). In addition, in-situ pH was measured using a Hanna Instruments pH meter (Model HI98127, Quebec, Canada).

Two surface water samples and one field duplicate were collected from the Killag River for laboratory analysis which included the parameters identified in Schedule 5, Part 1 of the MDMER plus supplementary parameters including dissolved metals. Surface water samples were collected as grab samples, using the appropriate containers as indicated by the laboratory. Trace metals samples were field filtered using disposable 45 µm syringe filters. Samples were placed in coolers and stored at 4°C prior to transport to the laboratory.

Surface water quality was compared to the Canadian Water Quality Guidelines for the Protection of Aquatic Life (CWQG PAL) in freshwater (CCME 2021).

7.1.2 Sediment

Four composite sediment samples and one field duplicate were collected at benthic invertebrate sampling stations for laboratory analysis of particle size and total organic carbon (TOC) as identified in Schedule 5, Part 2 of the MDMER, as well as total metals (as recommended in the Technical Guidance). Three sediment samples and the field duplicate were collected from the exposure area and one sample was collected from the reference area.

Sediment quality was compared with the Canadian Sediment Quality Guidelines for the Protection of [Freshwater] Aquatic Life. Guidelines for both the Interim Sediment Quality Guidelines (ISQG) and the Probable Effects Levels (PEL) were applied.

7.1.3 QA/QC

Water and sediment sampling equipment was checked to confirm normal operation prior to use. QA/QC measures included the pre-labelling of sampling bottles, eliminating the need to label samples under field conditions. Pertinent sample identification information was recorded on a data sheet and/or field book. Samples were packaged in coolers on ice, issued chain-of-custody forms, and stored at the appropriate temperature until shipped to the laboratory.

Samples were analyzed by BV Labs, which is accredited by the Standards Council of Canada for the analyses performed and its methodologies conform to Standard CAN-P-4E (ISO/IEG 17025:2005). BV Labs analyzed method blanks, matrix spikes, spiked blanks, laboratory control samples, and laboratory duplicates to demonstrate analytical accuracy and precision.

Blind field duplicates (for surface water and sediment samples) were collected to verify analytical results, equipment reliance, the homogeneity of the site, and the reproducibility of the sampling approach. Results for field duplicates were examined to determine if data quality objectives were met. This included the calculation of the relative percent difference (RPD) between the parent samples and the duplicates collected, when the concentrations detected were at least five times greater than the RDL.

The RPDs were calculated using the following formula:

$$\text{Relative \% Difference} = 100\% \times [(A - B) / ((A + B) / 2)]$$

Where, A = Original concentration (e.g. parent sample)
B = Duplicate concentration

7.2 RESULTS

7.2.1 Surface Water

In situ water quality was measured at both the exposure and reference locations. In situ results for both locations are similar (Table 7.1). Water clarity was brown/yellow at both locations.

Table 7.1 In Situ Water Quality Measurements at Exposure and Reference Locations

Location	Date dd/mm/yy	Depth (m)	Temperature (C)	pH	DO (mg/L)	DO (%)	Specific Conductivity (uS/cm)	Salinity (ppt)
Exposure	26/08/20	0.3	22.1	5.5	7.7	89	21.7	0
Reference	29/08/20	0.3	21.3	5.4	8.3	96	23.9	0

Surface water samples collected from the exposure and reference locations of the Killag River were submitted for laboratory analyses. Coordinates for the sample locations are presented in Table E.1, Appendix E. Analytical results (Table E.2, Appendix E) were compared to the CWQG PAL.

In general, the surface water in the exposure and reference area is soft and contains low concentrations of dissolved minerals (i.e., hardness) and has low pH. The pH values calculated in the lab were slightly higher (5.6-5.78) than those measured in the field (5.4 and 5.5). This is understandable given that the pH of very soft waters is prone to drift during holding time prior to analysis at the laboratory. As a result, field measured pH values are considered to be more reliable than the laboratory measured values.

Alkalinity results were less than the laboratory detection limit, hardness (as $CaCO_3$) was 3.0 mg/L for the reference area and 3.6 mg/L for the exposure area. Conductivity was measured as 21 µS/cm for both samples which is considered low. These values indicate very soft water conditions in the Killag River.

Nutrient concentrations in surface water in the Killag River were generally low, reflecting the relatively undeveloped nature of the surrounding land. Total phosphorus values and orthophosphate results were lower than the laboratory detection limit. Nitrogen (ammonia nitrogen) results were less than the detection limit or just above the detection limit. Nitrate + nitrite results were also less than the laboratory detection limit. Reactive silica concentrations were also low (1.4-2.0 mg/L).

Water quality results for many parameters in the Killag River were found to be below the RDL (Table E.2, Appendix E). Most of the analyzed parameters were below the CWQG PAL, except for the exceedances presented in Table 7.2.

Table 7.2 Exceedances of CWQG PAL for Surface Water Samples Collected from the Killag River

Parameter	Units	CWQG PAL	Exposure Result	Reference Result
Total Aluminum (Al)	ug/L	5-100	200	200
Total Arsenic (As)	ug/L	5	5.5	1.5
Total Iron (Fe)	ug/L	300	670	670
CWQG PAL: Canadian Water Quality Guidelines for the Protection of Aquatic Life in freshwater (CCME 2021)				

7.2.2 Sediment

Sediment quality was compared with the Canadian Sediment Quality Guidelines for the Protection of [Freshwater] Aquatic Life. Guidelines for both the Interim Sediment Quality Guidelines (ISQG) and the Probable Effects Levels (PEL) were applied. The results are presented in Table E.3, Appendix E. Many of the parameters analyzed had concentrations below the RDL. Three samples showed exceedances of the applied guidelines for two parameters: arsenic and mercury (Table 7.3; Table E.3, Appendix E).

Table 7.3 Exceedances of the CSQG for Samples Collected from the Killag River

Parameter	Units	ISQG Guideline	PEL Guideline	Result		
				BD-EXP-R1	BD-EXP-R2	BD-EXP-R3
Acid Extractable Arsenic (As)	mg/kg	5.9	17	21	17	24
Acid Extractable Mercury (Hg)	ug/L	0.17	0.486	0.49	0.33	0.62
CSQG: Canadian Sediment Quality Guidelines for the Protection of [Freshwater] Aquatic Life. ISQG: Interim Sediment Quality Guidelines PEL: Probable Effects Levels						

Grain size distribution for the reference area showed sand as the dominant feature (65%), followed by silt and clay (both 16%), and a small amount of gravel (3.9%; Table 7.4). Grain size distribution for the exposure area showed that sand, silt and clay are the dominant size fractions (depending on location), with minimal gravel. The three samples varied in particle size distribution, as shown in Table 7.4.

Table 7.4 Grain Size Distribution for Reference and Exposure Areas

Grain Size	Reference	Exposure		
	BD-REF	BD-EXP-R1	BD-EXP-R2	BD-EXP-R3
Gravel	3.9	<0.10	0.34	<0.10
Sand	65	19	50	11
Silt	16	40	27	38
Clay	16	41	23	51

7.2.3 QA/QC

Overall, field duplicate results agreed closely with their corresponding samples and confirmed the representativeness of sampling procedures. For surface water, the RPDs for individual parameters were below 14% and for sediment they were below 18%. RPD calculations are included in Tables E.4 and E.5, Appendix E.

As indicated on the laboratory certificates of analysis, average sample temperature upon receipt was greater than 10°C. This is not anticipated to influence the results. Note that samples Beaver Dam (EXP) and BD-EXP-SW-DUP were lab filtered for dissolved mercury.

8.0 SUMMARY

A baseline aquatic monitoring study was implemented in 2020 for the proposed Beaver Dam Mine Project to document existing conditions in the receiving environment in the Killag River and to support design and interpretation of future EEM results when the proposed Project becomes subject to MDMER.

The results of the baseline study establish the existing conditions in the Killag River prior to effluent discharge from the mine for the fish community, benthic invertebrate community, water and sediment quality, and metals and mercury in fish tissues. These results will be used to inform EEM design and to provide context for interpretation of results from the future EEM program.

The following summary points document the main findings of the baseline study:

- Sampling Locations in the Killag River
  - The exposure area is close to the proposed effluent final discharge points (in Cameron Flowage) and is limited by the presence of a lime doser immediately downstream
  - The reference area is approximately 4 km upstream of the exposure area
  - The reference and exposure areas are suitable as they contain similar types of habitat
- Fish population study
  - White sucker and yellow perch were captured in sufficient numbers and are suitable for use as sentinel species
  - Insufficient brook trout were caught for use as a sentinel species (see additional comments below)
  - A sufficient number of females (for both white sucker and yellow perch) in each area were obtained for the EEM fish population effect endpoints
- Fish tissue data were collected for metals and mercury
  - Mercury concentrations in yellow perch and white sucker whole bodies were similar between the exposure and reference areas and were below the Heath Canada guideline of 0.5 mg/kg.
  - Mercury concentrations in yellow perch muscle fillets were above the Heath Canada guideline of 0.5 mg/kg in two out of ten samples
  - Arsenic concentrations in fish tissue from both yellow perch and white sucker were higher in samples from the exposure area than the reference area and below the Heath Canada guideline of 3.5 mg/kg
  - Selenium concentrations in yellow perch and white sucker were below the US EPA selenium criteria for protection of aquatic life of 15.1 and 8.5 µg/g, for muscle tissue and whole body samples, as applicable
- Benthic invertebrate community survey
  - Generally very low density and species diversity observed in the peat-like sediments in the reference and exposure areas
  - Invertebrates that are indicative of good water quality were observed (e.g., *Hexagenia, Phylocentropus* and *Chaoborus)*
  - Water quality parameters such as low pH may inhibit the abundance and diversity of the BIC

- Supporting environmental variables (water and sediment quality) were collected to establish baseline conditions in the Killag River
  - Water quality was indicative of a low nutrient and low productivity environment
  - Water had low hardness and low pH
  - Water clarity was brown/yellow with low nutrient levels
  - Aluminum and iron concentrations in surface water exceeded Canadian Water Quality Guidelines for the Protection of Aquatic Life (freshwater), under baseline conditions.
  - Arsenic and mercury concentrations in sediment samples collected from the exposure area exceeded Sediment Quality Guidelines for the Protection of [Freshwater] Aquatic Life
  - Grain size distribution for the reference area showed sand as the dominant feature (65%), followed by silt and clay (both 16%), and a small amount of gravel (3.9%)
  - Grain size distribution for the exposure area showed that sand, silt and clay are the dominant size fractions (depending on location), with minimal gravel
  - Water and sediment quality are reflective of the natural geological conditions in the area

The results of the 2020 baseline sampling program will be used to support design and interpretation of future EEM programs following approval of the Beaver Dam Mine and triggering of MDMER. Additional field work may be recommended to supplement this baseline information.

9.0 CLOSURE

This document entitled Beaver Dam Mine: 2020 Baseline Environmental Effects Monitoring Report has been prepared by Stantec for the sole benefit of AMNS. Any use that a third party makes of this report, or any reliance on decisions made based on it, is the responsibility of such third parties. Stantec accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made, or actions taken, based on this report.

This report provides an evaluation of selected environmental conditions associated with the identified portion of the property that was assessed at the time the work was conducted and is based on information obtained by and/or provided to Stantec at that time. There are no assurances regarding the accuracy and completeness of this information. All information received from the client or third parties in the preparation of this report has been assumed by Stantec to be correct. Stantec assumes no responsibility for any deficiency or inaccuracy in information received from others.

The opinions in this report can only be relied upon as they relate to the condition of the portion of the identified property that was assessed at the time the work was conducted. Activities at the property subsequent to Stantec's assessment may have significantly altered the property's condition. Stantec cannot comment on other areas of the property that were not assessed.

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APPENDIX A

Fish Habitat Photos

Stantec

Photographic Log

Client:	**Atlantic Mining NS Inc**	**Project:**	**Beaver Dam Baseline Report**
Site Name:	**Exposure Area**	**Site Location:**	**Killag River**

Photograph ID: 1

Survey Date:
8/25/2020

Comments:
Representative fish habitat along the right bank in the Killag River exposure area facing southwest

Photograph ID: 2

Survey Date:
8/25/2020

Comments:
Representative fish habitat along the right bank in the Killag River exposure area

Client:	**Atlantic Mining NS Inc**	**Project:**	**Beaver Dam Baseline Report**
Site Name:	**Exposure Area**	**Site Location:**	**Killag River**

Photograph ID: 3

Survey Date:
8/25/2020

Comments:
Representative fish habitat along the left bank in the Killag River exposure area facing south

Photograph ID: 4

Survey Date:
8/25/2020

Comments:
Representative fish habitat in the Killag River exposure area facing upstream

Client:	**Atlantic Mining NS Inc**	**Project:**	**Beaver Dam Baseline Report**
Site Name:	**Exposure Area**	**Site Location:**	**Killag River**

Photograph ID: 5

Survey Date:
8/25/2020

Comments:
Representative fish habitat along the left bank in the Killag River exposure area facing northeast

Photograph ID: 6

Survey Date:
8/25/2020

Comments:
Representative fish habitat in the Killag River exposure area facing upstream

Client:	**Atlantic Mining NS Inc**	**Project:**	**Beaver Dam Baseline Report**
Site Name:	**Exposure Area**	**Site Location:**	**Killag River**

Photograph ID: 7

Survey Date:
8/25/2020

Comments:
Representative fish habitat along the left bank in the Killag River exposure area

Photograph ID: 8

Survey Date:
8/25/2020

Comments:
Representative fish habitat along the left bank in the Killag River exposure area facing upstream

Client:	**Atlantic Mining NS Inc**	**Project:**	**Beaver Dam Baseline Report**
Site Name:	**Exposure Area**	**Site Location:**	**Killag River**

Photograph ID: 9

Survey Date:
8/25/2020

Comments:
Representative fish habitat in the Killag River exposure area facing the right bank

Photograph ID: 10

Survey Date:
8/25/2020

Comments:
Representative fish habitat in the Killag River exposure area facing the right bank

Client:	**Atlantic Mining NS Inc**	**Project:**	**Beaver Dam Baseline Report**
Site Name:	**Exposure Area**	**Site Location:**	**Killag River**

Photograph ID: 11

Survey Date:
8/25/2020

Comments:
Representative fish habitat in the Killag River exposure area facing the left bank

Photograph ID: 12

Survey Date:
8/25/2020

Comments:
Representative fish habitat in the Killag River exposure area facing the left bank

Client:	**Atlantic Mining NS Inc**	**Project:**	**Beaver Dam Baseline Report**
Site Name:	**Exposure Area**	**Site Location:**	**Killag River**

Photograph ID: 13

Survey Date:
9/21/2020

Comments:
Representative sediment from the Killag River exposure area

Client:	**Atlantic Mining NS Inc**	**Project:**	**Beaver Dam Baseline Report**
Site Name:	**Reference Area**	**Site Location:**	**Killag River**

Photograph ID: 15

Survey Date:
9/1/2020

Comments:
Representative habitat in the Killag River reference area facing the left bank

Photograph ID: 16

Survey Date:
9/1/2020

Comments:
Representative habitat in the Killag River reference area facing the right bank

Client:	**Atlantic Mining NS Inc**	**Project:**	**Beaver Dam Baseline Report**
Site Name:	**Reference Area**	**Site Location:**	**Killag River**

Photograph ID: 17

Survey Date:
9/1/2020

Comments:
Representative habitat in the Killag River reference area facing the left bank

Photograph ID: 18

Survey Date:
9/1/2020

Comments:
Representative habitat in the Killag River reference area facing downstream

Client:	**Atlantic Mining NS Inc**	**Project:**	**Beaver Dam Baseline Report**
Site Name:	**Reference Area**	**Site Location:**	**Killag River**

Photograph ID: 19

Survey Date:
9/1/2020

Comments: Tannin stained water at the reference area

Photograph ID: 20

Survey Date:
9/1/2020

Comments:
Representative habitat in the Killag River reference area facing the left bank

Client:	**Atlantic Mining NS Inc**	**Project:**	**Beaver Dam Baseline Report**
Site Name:	**Reference Area**	**Site Location:**	**Killag River**

Photograph ID: 21

Survey Date:
9/1/2020

Comments:
Representative habitat in the Killag River reference area facing the right bank downstream

Photograph ID: 22

Survey Date:
8/29/2020

Comments:
Representative habitat in the Killag River reference area facing the right bank looking upstream

Client:	**Atlantic Mining NS Inc**	**Project:**	**Beaver Dam Baseline Report**
Site Name:	**Reference Area**	**Site Location:**	**Killag River**

Photograph ID: 23

Survey Date:
8/31/2020

Comments:
Representative habitat in the Killag River reference area facing the downstream

Photograph ID: 24

Survey Date:
8/31/2020

Comments:
Representative habitat in the Killag River reference area facing the right bank

Client:	**Atlantic Mining NS Inc**	**Project:**	**Beaver Dam Baseline Report**
Site Name:	**Reference Area**	**Site Location:**	**Killag River**

Photograph ID: 25

Survey Date:
8/31/2020

Comments:
Representative sediment in the Killag River reference area

APPENDIX B

Fish Survey Raw Data

Table B.1 Fish Capture Data for the Killag River, NS
Beaver Dam Mine
Baseline Aquatic Environment Technical Report
Atlantic Mining NS Inc.
121619250

Area	Station Number	Lift #	Method	Set Date	Set Time	Lift Date	Lift Time
Exposure	BD-EXP-FN-01	1	Fyke Net	25-Aug-20	13:30	26-Aug-20	13:33
Exposure	BD-EXP-FN-01	2	Fyke Net	26-Aug-20	14:00	26-Aug-20	15:50
Exposure	BD-EXP-FN-02	1	Fyke Net	25-Aug-20	14:00	26-Aug-20	12:40
Exposure	BD-EXP-FN-02	2	Fyke Net	26-Aug-20	13:15	26-Aug-20	14:30
Exposure	BD-EXP-FN-02	3	Fyke Net	26-Aug-20	14:40	27-Aug-20	10:25
Exposure	BD-EXP-MT-01	1	Minnow Trap	25-Aug-20	12:38	26-Aug-20	14:05
Exposure	BD-EXP-MT-02	1	Minnow Trap	25-Aug-20	12:44	26-Aug-20	14:15
Exposure	BD-EXP-MT-03	1	Minnow Trap	25-Aug-20	12:47	26-Aug-20	14:20
Exposure	BD-EXP-MT-04	1	Minnow Trap	25-Aug-20	12:50	26-Aug-20	14:25
Exposure	BD-EXP-MT-05	1	Minnow Trap	25-Aug-20	12:53	26-Aug-20	12:24
Exposure	BD-EXP-MT-05	2	Minnow Trap	26-Aug-20	12:26	26-Aug-20	14:45
Exposure	BD-EXP-MT-06	1	Minnow Trap	25-Aug-20	12:56	26-Aug-20	12:11
Exposure	BD-EXP-MT-06	2	Minnow Trap	26-Aug-20	12:19	26-Aug-20	14:45
Exposure	BD-EXP-MT-07	1	Minnow Trap	25-Aug-20	12:59	26-Aug-20	12:05
Exposure	BD-EXP-MT-07	2	Minnow Trap	26-Aug-20	12:08	27-Aug-20	10:44
Exposure	BD-EXP-MT-08	1	Minnow Trap	25-Aug-20	13:02	26-Aug-20	11:30
Exposure	BD-EXP-MT-08	2	Minnow Trap	26-Aug-20	11:40	27-Aug-20	10:48
Exposure	BD-EXP-MT-09	1	Minnow Trap	25-Aug-20	13:03	26-Aug-20	11:46
Exposure	BD-EXP-MT-09	2	Minnow Trap	26-Aug-20	11:54	27-Aug-20	10:55
Exposure	BD-EXP-MT-10	1	Minnow Trap	26-Aug-20	17:36	27-Aug-20	11:00
Exposure	BD-EXP-MT-11	1	Minnow Trap	26-Aug-20	17:27	27-Aug-20	11:11
Exposure	BD-EXP-MT-12	1	Minnow Trap	26-Aug-20	17:38	27-Aug-20	11:02
Exposure	BD-EXP-MT-13	1	Minnow Trap	26-Aug-20	17:23	27-Aug-20	11:08
Exposure	BD-EXP-FN-03	1	Fyke Net	27-Aug-20	12:50	28-Aug-20	10:05
Exposure	BD-EXP-FN-04	1	Fyke Net	27-Aug-20	13:50	28-Aug-20	10:15
Exposure	BD-EXP-MT-14	1	Minnow Trap	27-Aug-20	14:33	28-Aug-20	10:47
Exposure	BD-EXP-MT-15	1	Minnow Trap	27-Aug-20	14:31	28-Aug-20	10:45
Exposure	BD-EXP-MT-16	1	Minnow Trap	27-Aug-20	14:55	28-Aug-20	10:35
Exposure	BD-EXP-MT-17	1	Minnow Trap	27-Aug-20	14:52	28-Aug-20	10:31
Exposure	BD-EXP-MT-18	1	Minnow Trap	28-Aug-20	16:21	29-Aug-20	10:12
Exposure	BD-EXP-MT-19	1	Minnow Trap	28-Aug-20	16:23	29-Aug-20	10:10
Exposure	BD-EXP-MT-20	1	Minnow Trap	28-Aug-20	16:25	29-Aug-20	10:08
Exposure	BD-EXP-MT-21	1	Minnow Trap	28-Aug-20	16:15	29-Aug-20	10:06
Exposure	BD-EXP-FN-01A	1	Fyke Net	20-Sep-20	14:15	21-Sep-20	10:14
Exposure	BD-EXP-FN-02B	1	Fyke Net	20-Sep-20	14:46	21-Sep-20	10:35
Exposure	BD-EXP-MT-1	1	Minnow Trap	20-Sep-20	15:06	21-Sep-20	10:55
Exposure	BD-EXP-MT-2	1	Minnow Trap	20-Sep-20	15:08	21-Sep-20	10:57
Exposure	BD-EXP-MT-3	1	Minnow Trap	20-Sep-20	15:11	21-Sep-20	10:59
Exposure	BD-EXP-MT-4	1	Minnow Trap	20-Sep-20	15:15	21-Sep-20	10:51
Reference	BD-REF-FN-05	1	Fyke Net	29-Aug-20	16:00	30-Aug-20	13:10
Reference	BD-REF-FN-05	2	Fyke Net	30-Aug-20	15:20	31-Aug-20	11:20
Reference	BD-REF-FN-05	3	Fyke Net	31-Aug-20	12:00	01-Sep-20	11:15
Reference	BD-REF-FN-06	1	Fyke Net	29-Aug-20	16:20	30-Aug-20	13:52
Reference	BD-REF-FN-07	1	Fyke Net	30-Aug-20	15:48	31-Aug-20	10:25
Reference	BD-REF-MT-22	1	Minnow Trap	29-Aug-20	14:29	30-Aug-20	14:37
Reference	BD-REF-MT-23	1	Minnow Trap	29-Aug-20	14:33	30-Aug-20	14:39
Reference	BD-REF-MT-24	1	Minnow Trap	29-Aug-20	14:40	30-Aug-20	14:59
Reference	BD-REF-MT-25	1	Minnow Trap	29-Aug-20	14:42	30-Aug-20	14:57
Reference	BD-REF-MT-26	1	Minnow Trap	29-Aug-20	14:46	30-Aug-20	14:54
Reference	BD-REF-MT-27	1	Minnow Trap	29-Aug-20	14:27	30-Aug-20	14:31
Reference	BD-REF-MT-28	1	Minnow Trap	29-Aug-20	14:36	30-Aug-20	14:41
Reference	BD-REF-MT-29	1	Minnow Trap	29-Aug-20	14:49	30-Aug-20	14:52
Reference	BD-REF-MT-30	1	Minnow Trap	29-Aug-20	14:51	30-Aug-20	14:47

Notes:
nr = not recorded

Table B.2 Raw Fish Data from the Killag River, NS
Beaver Dam Mine
Baseline Aquatic Environment Technical Report
Atlantic Mining NS Inc.
121619250

Area	Specimen ID	Date	Species	Station Number	Fork length (cm)	Sex M/F/I	Count
Exposure	BD-EXP-YEPR-13	26-Aug-20	Yellow Perch	BD-EXP-FN-01	10.8	F	1
Exposure	BD-EXP-YEPR-14	26-Aug-20	Yellow Perch	BD-EXP-FN-01	10.7	F	1
Exposure	BD-EXP-YEPR-15	26-Aug-20	Yellow Perch	BD-EXP-FN-01	10.7	F	1
Exposure	BD-EXP-YEPR-16	26-Aug-20	Yellow Perch	BD-EXP-FN-01	9.9	F	1
Exposure	BD-EXP-YEPR-17	26-Aug-20	Yellow Perch	BD-EXP-FN-01	10.2	I	1
Exposure	BD-EXP-YEPR-18	26-Aug-20	Yellow Perch	BD-EXP-FN-01	10.0	I	1
Exposure	BD-EXP-YEPR-19	26-Aug-20	Yellow Perch	BD-EXP-FN-01	9.6	I	1
Exposure	BD-EXP-YEPR-20	26-Aug-20	Yellow Perch	BD-EXP-FN-01	9.4	I	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	5.1	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	4.5	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	4.6	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	5.6	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	3.9	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	4.0	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	5.9	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	4.0	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	4.2	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	5.0	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	4.3	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	4.4	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	5.3	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	5.3	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	4.3	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	4.2	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	5.3	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	4.5	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	4.3	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	4.2	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	4.3	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	4.8	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	5.0	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	4.3	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	4.6	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	4.0	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	4.4	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	-	-	4
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	-	-	15
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	3.8	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	3.9	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	4.0	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	4.6	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	3.8	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	4.2	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	4.2	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	4.5	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	4.3	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	4.9	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	4.7	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	4.1	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	4.0	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-01	4.3	-	1
Exposure	BD-EXP-YEPR-03	26-Aug-20	Yellow Perch	BD-EXP-FN-02	13.8	F	1
Exposure	BD-EXP-YEPR-04	26-Aug-20	Yellow Perch	BD-EXP-FN-02	13.3	F	1
Exposure	BD-EXP-YEPR-05	26-Aug-20	Yellow Perch	BD-EXP-FN-02	12.6	F	1
Exposure	BD-EXP-YEPR-06	26-Aug-20	Yellow Perch	BD-EXP-FN-02	12.2	F	1
Exposure	BD-EXP-YEPR-21	26-Aug-20	Yellow Perch	BD-EXP-FN-02	13.7	F	1
Exposure	BD-EXP-YEPR-22	26-Aug-20	Yellow Perch	BD-EXP-FN-02	12.1	F	1
Exposure	BD-EXP-YEPR-23	26-Aug-20	Yellow Perch	BD-EXP-FN-02	9.7	I	1
Exposure	BD-EXP-YEPR-24	26-Aug-20	Yellow Perch	BD-EXP-FN-02	9.6	I	1
Exposure	BD-EXP-YEPR-25	26-Aug-20	Yellow Perch	BD-EXP-FN-02	11.7	F	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.5	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	5.3	-	1

Note: - no data available

Table B.2 Raw Fish Data from the Killag River, NS
Beaver Dam Mine
Baseline Aquatic Environment Technical Report
Atlantic Mining NS Inc.
121619250

Area	Specimen ID	Date	Species	Station Number	Fork length (cm)	Sex M/F/I	Count
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.8	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.0	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.5	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	5.0	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.4	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.4	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.4	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	5.7	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.4	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	6.0	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	5.3	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.3	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	5.3	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	5.2	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.5	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.5	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.5	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.1	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.9	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	5.5	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.1	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	7.1	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	5.4	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	3.9	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.6	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	5.0	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.3	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.9	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	5.2	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	6.2	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.6	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	3.7	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.0	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.0	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.0	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.7	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.2	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.8	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	5.0	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.9	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.6	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.8	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.9	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.0	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.3	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	3.6	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.3	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	3.9	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	5.2	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.5	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	3.9	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.5	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	5.4	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.0	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	5.1	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.9	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.0	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.6	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	3.9	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.4	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.3	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	4.5	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-FN-02	-	-	11
Exposure	-	27-Aug-20	Yellow Perch	BD-EXP-FN-02	-	-	8

Note: - no data available

Table B.2 Raw Fish Data from the Killag River, NS
Beaver Dam Mine
Baseline Aquatic Environment Technical Report
Atlantic Mining NS Inc.
121619250

Area	Specimen ID	Date	Species	Station Number	Fork length (cm)	Sex M/F/I	Count
Exposure	-	28-Aug-20	Yellow Perch	BD-EXP-FN-03	5.2	-	1
Exposure	BD-EXP-YEPR-41	28-Aug-20	Yellow Perch	BD-EXP-FN-04	14.6	F	1
Exposure	BD-EXP-YEPR-42	28-Aug-20	Yellow Perch	BD-EXP-FN-04	13.8	F	1
Exposure	BD-EXP-YEPR-43	28-Aug-20	Yellow Perch	BD-EXP-FN-04	13.0	F	1
Exposure	BD-EXP-YEPR-44	28-Aug-20	Yellow Perch	BD-EXP-FN-04	11.5	F	1
Exposure	BD-EXP-YEPR-45	28-Aug-20	Yellow Perch	BD-EXP-FN-04	11.0	F	1
Exposure	BD-EXP-YEPR-46	28-Aug-20	Yellow Perch	BD-EXP-FN-04	9.3	M	1
Exposure	-	28-Aug-20	Yellow Perch	BD-EXP-FN-04	-	-	16
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-MT-01	5.5	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-MT-01	4.7	-	1
Exposure	BD-EXP-YEPR-01	26-Aug-20	Yellow Perch	BD-EXP-MT-02	13.9	F	1
Exposure	BD-EXP-YEPR-02	26-Aug-20	Yellow Perch	BD-EXP-MT-02	14.4	F	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-MT-02	6.2	-	1
Exposure	BD-EXP-YEPR-29	26-Aug-20	Yellow Perch	BD-EXP-MT-03	12.6	F	1
Exposure	BD-EXP-YEPR-30	26-Aug-20	Yellow Perch	BD-EXP-MT-03	11.1	I	1
Exposure	BD-EXP-YEPR-31	26-Aug-20	Yellow Perch	BD-EXP-MT-03	10.6	I	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-MT-03	9.6	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-MT-03	5.3	-	1
Exposure	BD-EXP-YEPR-26	26-Aug-20	Yellow Perch	BD-EXP-MT-04	12.1	F	1
Exposure	BD-EXP-YEPR-27	26-Aug-20	Yellow Perch	BD-EXP-MT-04	11.4	F	1
Exposure	BD-EXP-YEPR-28	26-Aug-20	Yellow Perch	BD-EXP-MT-04	10.1	I	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-MT-04	9.6	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-MT-04	5.7	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-MT-04	5.5	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-MT-04	9.4	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-MT-04	5.2	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-MT-04	5.7	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-MT-04	4.7	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-MT-04	5.0	-	1
Exposure	BD-EXP-YEPR-07	26-Aug-20	Yellow Perch	BD-EXP-MT-05	14.8	F	1
Exposure	BD-EXP-YEPR-08	26-Aug-20	Yellow Perch	BD-EXP-MT-05	13.6	F	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-MT-05	-	-	2
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-MT-06	-	-	16
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-MT-06	4.0	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-MT-06	5.8	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-MT-06	4.2	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-MT-06	5.0	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-MT-06	6.1	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-MT-06	5.0	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-MT-06	5.9	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-MT-06	4.2	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-MT-06	5.8	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-MT-06	3.9	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-MT-06	6.0	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-MT-06	4.5	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-MT-06	4.7	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-MT-06	5.5	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-MT-06	4.1	-	1
Exposure	BD-EXP-YEPR-09	26-Aug-20	Yellow Perch	BD-EXP-MT-07	13.4	I	1
Exposure	BD-EXP-YEPR-10	26-Aug-20	Yellow Perch	BD-EXP-MT-07	9.8	I	1
Exposure	BD-EXP-YEPR-11	26-Aug-20	Yellow Perch	BD-EXP-MT-07	9.0	I	1
Exposure	BD-EXP-YEPR-12	26-Aug-20	Yellow Perch	BD-EXP-MT-07	8.9	I	1
Exposure	BD-EXP-YEPR-32	26-Aug-20	Yellow Perch	BD-EXP-MT-08	10.6	F	1
Exposure	BD-EXP-YEPR-33	26-Aug-20	Yellow Perch	BD-EXP-MT-08	9.7	I	1
Exposure	BD-EXP-YEPR-34	26-Aug-20	Yellow Perch	BD-EXP-MT-08	9.7	I	1
Exposure	BD-EXP-YEPR-35	26-Aug-20	Yellow Perch	BD-EXP-MT-08	9.2	I	1
Exposure	BD-EXP-YEPR-36	26-Aug-20	Yellow Perch	BD-EXP-MT-08	8.7	I	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-MT-08	4.5	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-MT-08	4.2	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-MT-08	4.1	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-MT-08	4.3	-	1
Exposure	-	27-Aug-20	Yellow Perch	BD-EXP-MT-08	4.7	-	1
Exposure	-	27-Aug-20	Yellow Perch	BD-EXP-MT-08	4.6	-	1
Exposure	-	27-Aug-20	Yellow Perch	BD-EXP-MT-08	5.8	-	1

Note: - no data available

Table B.2 Raw Fish Data from the Killag River, NS
Beaver Dam Mine
Baseline Aquatic Environment Technical Report
Atlantic Mining NS Inc.
121619250

Area	Specimen ID	Date	Species	Station Number	Fork length (cm)	Sex M/F/I	Count
Exposure	-	27-Aug-20	Yellow Perch	BD-EXP-MT-08	4.3	-	1
Exposure	-	27-Aug-20	Yellow Perch	BD-EXP-MT-08	-	-	5
Exposure	BD-EXP-YEPR-37	26-Aug-20	Yellow Perch	BD-EXP-MT-09	9.9	I	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-MT-09	4.7	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-MT-09	4.5	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-MT-09	4.6	-	1
Exposure	-	26-Aug-20	Yellow Perch	BD-EXP-MT-09	-	-	1
Exposure	-	27-Aug-20	Yellow Perch	BD-EXP-MT-11	5.5	-	1
Exposure	BD-EXP-YEPR-38	27-Aug-20	Yellow Perch	BD-EXP-MT-12	13.1	F	1
Exposure	BD-EXP-YEPR-39	27-Aug-20	Yellow Perch	BD-EXP-MT-12	12.9	I	1
Exposure	BD-EXP-YEPR-40	27-Aug-20	Yellow Perch	BD-EXP-MT-12	12.5	F	1
Exposure	-	28-Aug-20	Yellow Perch	BD-EXP-MT-14	-	-	4
Exposure	-	28-Aug-20	Yellow Perch	BD-EXP-MT-16	-	-	2
Exposure	BD-EXP-YEPR-47	28-Aug-20	Yellow Perch	BD-EXP-MT-17	10.5	F	1
Exposure	BD-EXP-YEPR-48	29-Aug-20	Yellow Perch	BD-EXP-MT-18	11.4	F	1
Exposure	-	29-Aug-20	Yellow Perch	BD-EXP-MT-21	-	-	1
Exposure	BD-EXP-YEPR-49	21-Sep-20	Yellow Perch	BD-EXP-FN-01A	12.4	F	1
Exposure	BD-EXP-YEPR-50	21-Sep-20	Yellow Perch	BD-EXP-FN-01A	11.8	F	1
Exposure	BD-EXP-YEPR-51	21-Sep-20	Yellow Perch	BD-EXP-FN-01A	9	M	1
Exposure	BD-EXP-YEPR-52	21-Sep-20	Yellow Perch	BD-EXP-FN-02A	14.3	F	1
Exposure	BD-EXP-YEPR-53	21-Sep-20	Yellow Perch	BD-EXP-FN-02A	13.3	F	1
Exposure	BD-EXP-YEPR-54	21-Sep-20	Yellow Perch	BD-EXP-FN-02A	6.7	I	1
Exposure	-	21-Sep-20	Yellow Perch	BD-EXP-MT	5.5	I	3
Exposure	BD-EXP-YEPR-56	21-Sep-20	Yellow Perch	BD-EXP-MT	6.3	I	2
Reference	BD-REF-YEPR-10	30-Aug-20	Yellow Perch	BD-REF-FN-05	11.0	F	1
Reference	BD-REF-YEPR-11	30-Aug-20	Yellow Perch	BD-REF-FN-05	11.3	F	1
Reference	BD-REF-YEPR-12	30-Aug-20	Yellow Perch	BD-REF-FN-05	10.5	F	1
Reference	BD-REF-YEPR-13	30-Aug-20	Yellow Perch	BD-REF-FN-05	14.6	F	1
Reference	BD-REF-YEPR-14	30-Aug-20	Yellow Perch	BD-REF-FN-05	11.7	F	1
Reference	BD-REF-YEPR-15	30-Aug-20	Yellow Perch	BD-REF-FN-05	10.9	F	1
Reference	BD-REF-YEPR-16	30-Aug-20	Yellow Perch	BD-REF-FN-05	11.8	F	1
Reference	BD-REF-YEPR-17	30-Aug-20	Yellow Perch	BD-REF-FN-05	10.8	F	1
Reference	BD-REF-YEPR-18	30-Aug-20	Yellow Perch	BD-REF-FN-05	12.1	F	1
Reference	BD-REF-YEPR-19	30-Aug-20	Yellow Perch	BD-REF-FN-05	10.5	F	1
Reference	BD-REF-YEPR-20	30-Aug-20	Yellow Perch	BD-REF-FN-05	11.0	F	1
Reference	BD-REF-YEPR-21	30-Aug-20	Yellow Perch	BD-REF-FN-05	15.2	F	1
Reference	BD-REF-YEPR-22	30-Aug-20	Yellow Perch	BD-REF-FN-05	13.9	F	1
Reference	BD-REF-YEPR-23	30-Aug-20	Yellow Perch	BD-REF-FN-05	13.6	F	1
Reference	BD-REF-YEPR-24	30-Aug-20	Yellow Perch	BD-REF-FN-05	11.6	F	1
Reference	BD-REF-YEPR-25	30-Aug-20	Yellow Perch	BD-REF-FN-05	10.6	F	1
Reference	BD-REF-YEPR-26	30-Aug-20	Yellow Perch	BD-REF-FN-05	13.6	I	1
Reference	BD-REF-YEPR-27	30-Aug-20	Yellow Perch	BD-REF-FN-05	13.1	F	1
Reference	BD-REF-YEPR-28	30-Aug-20	Yellow Perch	BD-REF-FN-05	10.9	F	1
Reference	BD-REF-YEPR-29	30-Aug-20	Yellow Perch	BD-REF-FN-05	11.6	F	1
Reference	BD-REF-YEPR-30	30-Aug-20	Yellow Perch	BD-REF-FN-05	10.9	F	1
Reference	BD-REF-YEPR-31	30-Aug-20	Yellow Perch	BD-REF-FN-05	11.2	F	1
Reference	BD-REF-YEPR-32	30-Aug-20	Yellow Perch	BD-REF-FN-05	11.2	F	1
Reference	BD-REF-YEPR-33	30-Aug-20	Yellow Perch	BD-REF-FN-05	11.0	F	1
Reference	BD-REF-YEPR-34	30-Aug-20	Yellow Perch	BD-REF-FN-05	11.1	F	1
Reference	BD-REF-YEPR-35	30-Aug-20	Yellow Perch	BD-REF-FN-05	12.4	F	1
Reference	BD-REF-YEPR-36	30-Aug-20	Yellow Perch	BD-REF-FN-05	11.2	F	1
Reference	BD-REF-YEPR-37	30-Aug-20	Yellow Perch	BD-REF-FN-05	10.2	F	1
Reference	BD-REF-YEPR-38	30-Aug-20	Yellow Perch	BD-REF-FN-05	10.6	F	1
Reference	BD-REF-YEPR-39	30-Aug-20	Yellow Perch	BD-REF-FN-05	9.7	M	1
Reference	BD-REF-YEPR-40	30-Aug-20	Yellow Perch	BD-REF-FN-05	10.9	F	1
Reference	BD-REF-YEPR-41	30-Aug-20	Yellow Perch	BD-REF-FN-05	10.3	F	1
Reference	BD-REF-YEPR-42	30-Aug-20	Yellow Perch	BD-REF-FN-05	10.1	F	1
Reference	BD-REF-YEPR-43	30-Aug-20	Yellow Perch	BD-REF-FN-05	10.6	F	1
Reference	BD-REF-YEPR-44	30-Aug-20	Yellow Perch	BD-REF-FN-05	10.9	F	1
Reference	BD-REF-YEPR-45	30-Aug-20	Yellow Perch	BD-REF-FN-05	11.3	F	1
Reference	BD-REF-YEPR-46	30-Aug-20	Yellow Perch	BD-REF-FN-05	11.1	F	1
Reference	BD-REF-YEPR-47	30-Aug-20	Yellow Perch	BD-REF-FN-05	10.7	M	1
Reference	BD-REF-YEPR-48	30-Aug-20	Yellow Perch	BD-REF-FN-05	10.8	F	1
Reference	BD-REF-YEPR-49	30-Aug-20	Yellow Perch	BD-REF-FN-05	11.1	F	1

Note: - no data available

Table B.2 Raw Fish Data from the Killag River, NS
Beaver Dam Mine
Baseline Aquatic Environment Technical Report
Atlantic Mining NS Inc.
121619250

Area	Specimen ID	Date	Species	Station Number	Fork length (cm)	Sex M/F/I	Count
Reference	BD-REF-YEPR-50	30-Aug-20	Yellow Perch	BD-REF-FN-05	12.5	F	1
Reference	BD-REF-YEPR-51	30-Aug-20	Yellow Perch	BD-REF-FN-05	11.6	F	1
Reference	BD-REF-YEPR-52	30-Aug-20	Yellow Perch	BD-REF-FN-05	10.4	F	1
Reference	BD-REF-YEPR-53	30-Aug-20	Yellow Perch	BD-REF-FN-05	11.9	F	1
Reference	BD-REF-YEPR-54	30-Aug-20	Yellow Perch	BD-REF-FN-05	11.6	F	1
Reference	BD-REF-YEPR-55	30-Aug-20	Yellow Perch	BD-REF-FN-05	10.4	F	1
Reference	BD-REF-YEPR-56	30-Aug-20	Yellow Perch	BD-REF-FN-05	11.2	F	1
Reference	BD-REF-YEPR-57	30-Aug-20	Yellow Perch	BD-REF-FN-05	11.0	F	1
Reference	BD-REF-YEPR-58	30-Aug-20	Yellow Perch	BD-REF-FN-05	10.8	F	1
Reference	BD-REF-YEPR-59	30-Aug-20	Yellow Perch	BD-REF-FN-05	11.6	F	1
Reference	BD-REF-YEPR-60	30-Aug-20	Yellow Perch	BD-REF-FN-05	12.1	F	1
Reference	BD-REF-YEPR-61	30-Aug-20	Yellow Perch	BD-REF-FN-05	11.4	F	1
Reference	BD-REF-YEPR-62	30-Aug-20	Yellow Perch	BD-REF-FN-05	10.7	F	1
Reference	BD-REF-YEPR-63	30-Aug-20	Yellow Perch	BD-REF-FN-05	13.0	F	1
Reference	BD-REF-YEPR-64	30-Aug-20	Yellow Perch	BD-REF-FN-05	12.9	F	1
Reference	BD-REF-YEPR-65	30-Aug-20	Yellow Perch	BD-REF-FN-05	13.4	F	1
Reference	BD-REF-YEPR-66	30-Aug-20	Yellow Perch	BD-REF-FN-05	13.8	F	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-05	10.1	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-05	8.5	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-05	9.0	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-05	10.0	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-05	9.6	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-05	9.1	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-05	9.8	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-05	8.1	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-05	9.0	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-05	9.7	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-05	9.4	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-05	10.1	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-05	7.6	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-05	10.6	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-05	9.8	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-05	8.5	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-05	4.3	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-05	10.6	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-05	5.7	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-05	9.9	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-05	8.4	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-05	10.1	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-05	8.9	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-05	9.9	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-05	9.5	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-05	5.0	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-05	5.1	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-05	9.0	-	1
Reference	BD-REF-YEPR-73	31-Aug-20	Yellow Perch	BD-REF-FN-05	12.8	F	1
Reference	BD-REF-YEPR-74	31-Aug-20	Yellow Perch	BD-REF-FN-05	11.7	F	1
Reference	BD-REF-YEPR-75	31-Aug-20	Yellow Perch	BD-REF-FN-05	15.6	F	1
Reference	-	31-Aug-20	Yellow Perch	BD-REF-FN-05	-	-	233
Reference	BD-REF-YEPR-85	1-Sep-20	Yellow Perch	BD-REF-FN-05	13.8	F	1
Reference	BD-REF-YEPR-86	1-Sep-20	Yellow Perch	BD-REF-FN-05	12.6	F	1
Reference	BD-REF-YEPR-87	1-Sep-20	Yellow Perch	BD-REF-FN-05	10.0	F	1
Reference	BD-REF-YEPR-88	1-Sep-20	Yellow Perch	BD-REF-FN-05	11.5	F	1
Reference	BD-REF-YEPR-89	1-Sep-20	Yellow Perch	BD-REF-FN-05	11.8	F	1
Reference	BD-REF-YEPR-90	1-Sep-20	Yellow Perch	BD-REF-FN-05	11.3	F	1
Reference	BD-REF-YEPR-91	1-Sep-20	Yellow Perch	BD-REF-FN-05	10.5	F	1
Reference	BD-REF-YEPR-92	1-Sep-20	Yellow Perch	BD-REF-FN-05	9.8	M	1
Reference	BD-REF-YEPR-93	1-Sep-20	Yellow Perch	BD-REF-FN-05	8.0	F	1
Reference	BD-REF-YEPR-94	1-Sep-20	Yellow Perch	BD-REF-FN-05	7.5	IM	1
Reference	BD-REF-YEPR-95	1-Sep-20	Yellow Perch	BD-REF-FN-05	8.5	IM	1
Reference	BD-REF-YEPR-96	1-Sep-20	Yellow Perch	BD-REF-FN-05	11.0	F	1
Reference	BD-REF-YEPR-97	1-Sep-20	Yellow Perch	BD-REF-FN-05	11.4	F	1
Reference	BD-REF-YEPR-98	1-Sep-20	Yellow Perch	BD-REF-FN-05	11.5	F	1
Reference	BD-REF-YEPR-99	1-Sep-20	Yellow Perch	BD-REF-FN-05	11.9	F	1

Note: - no data available

Table B.2 Raw Fish Data from the Killag River, NS
Beaver Dam Mine
Baseline Aquatic Environment Technical Report
Atlantic Mining NS Inc.
121619250

Area	Specimen ID	Date	Species	Station Number	Fork length (cm)	Sex M/F/I	Count
Reference	-	1-Sep-20	Yellow Perch	BD-REF-FN-05	-	-	58
Reference	BD-REF-YEPR-67	30-Aug-20	Yellow Perch	BD-REF-FN-06	12.0	F	1
Reference	BD-REF-YEPR-68	30-Aug-20	Yellow Perch	BD-REF-FN-06	11.9	F	1
Reference	BD-REF-YEPR-69	30-Aug-20	Yellow Perch	BD-REF-FN-06	11.6	M	1
Reference	BD-REF-YEPR-70	30-Aug-20	Yellow Perch	BD-REF-FN-06	11.8	F	1
Reference	BD-REF-YEPR-71	30-Aug-20	Yellow Perch	BD-REF-FN-06	11.6	F	1
Reference	BD-REF-YEPR-72	30-Aug-20	Yellow Perch	BD-REF-FN-06	13.3	F	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	4.3	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	5.4	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	5.4	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	5.0	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	5.5	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	4.6	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	4.4	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	5.4	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	9.6	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	10.6	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	9.9	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	5.7	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	4.4	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	5.0	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	10.7	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	9.4	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	4.8	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	4.4	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	4.6	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	4.4	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	5.6	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	5.4	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	4.9	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	5.3	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	9.0	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	4.4	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	4.8	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	4.5	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	5.7	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	5.7	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	5.3	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	5.4	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	5.2	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	5.1	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	4.8	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	4.4	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	4.6	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	5.6	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	4.9	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	5.2	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	5.3	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	4.5	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	5.3	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	5.4	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	10.6	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	6.0	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	5.7	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	4.9	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	4.7	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	5.0	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	4.6	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	5.3	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	5.4	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	4.7	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	9.8	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	5.4	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	4.7	-	1

Note: - no data available

Table B.2 Raw Fish Data from the Killag River, NS
Beaver Dam Mine
Baseline Aquatic Environment Technical Report
Atlantic Mining NS Inc.
121619250

Area	Specimen ID	Date	Species	Station Number	Fork length (cm)	Sex M/F/I	Count
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	5.6	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	5.2	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	5.4	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	5.5	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	5.3	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	4.7	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	5.0	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	5.3	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	4.7	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	4.9	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	5.5	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	5.4	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	5.1	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-FN-06	-	-	20
Reference	BD-REF-YEPR-76	31-Aug-20	Yellow Perch	BD-REF-FN-07	12.3	F	1
Reference	BD-REF-YEPR-77	31-Aug-20	Yellow Perch	BD-REF-FN-07	12.0	F	1
Reference	BD-REF-YEPR-78	31-Aug-20	Yellow Perch	BD-REF-FN-07	13.5	F	1
Reference	BD-REF-YEPR-79	31-Aug-20	Yellow Perch	BD-REF-FN-07	13.0	F	1
Reference	BD-REF-YEPR-80	31-Aug-20	Yellow Perch	BD-REF-FN-07	11.6	F	1
Reference	BD-REF-YEPR-81	31-Aug-20	Yellow Perch	BD-REF-FN-07	13.7	F	1
Reference	BD-REF-YEPR-82	31-Aug-20	Yellow Perch	BD-REF-FN-07	13.5	F	1
Reference	BD-REF-YEPR-83	31-Aug-20	Yellow Perch	BD-REF-FN-07	12.4	F	1
Reference	BD-REF-YEPR-84	31-Aug-20	Yellow Perch	BD-REF-FN-07	11.2	F	1
Reference	-	31-Aug-20	Yellow Perch	BD-REF-FN-07	-	-	555
Reference	-	30-Aug-20	Yellow Perch	BD-REF-MT-23	-	-	3
Reference	-	30-Aug-20	Yellow Perch	BD-REF-MT-24	-	-	13
Reference	BD-REF-YEPR-04	30-Aug-20	Yellow Perch	BD-REF-MT-26	11.6	F	1
Reference	BD-REF-YEPR-05	30-Aug-20	Yellow Perch	BD-REF-MT-26	11.5	F	1
Reference	BD-REF-YEPR-06	30-Aug-20	Yellow Perch	BD-REF-MT-26	10.9	F	1
Reference	BD-REF-YEPR-07	30-Aug-20	Yellow Perch	BD-REF-MT-26	11.0	F	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-MT-26	-	-	6
Reference	BD-REF-YEPR-01	30-Aug-20	Yellow Perch	BD-REF-MT-27	11.1	F	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-MT-27	-	-	12
Reference	-	30-Aug-20	Yellow Perch	BD-REF-MT-27	8.5	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-MT-27	10.4	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-MT-27	9.8	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-MT-27	10.6	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-MT-27	10.0	-	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-MT-27	9.3	-	1
Reference	BD-REF-YEPR-02	30-Aug-20	Yellow Perch	BD-REF-MT-28	11.7	F	1
Reference	BD-REF-YEPR-03	30-Aug-20	Yellow Perch	BD-REF-MT-28	11.7	F	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-MT-28	-	-	24
Reference	-	30-Aug-20	Yellow Perch	BD-REF-MT-29	-	-	5
Reference	BD-REF-YEPR-08	30-Aug-20	Yellow Perch	BD-REF-MT-30	10.4	F	1
Reference	BD-REF-YEPR-09	30-Aug-20	Yellow Perch	BD-REF-MT-30	9.8	M	1
Reference	-	30-Aug-20	Yellow Perch	BD-REF-MT-30	-	-	28

Note: - no data available

Table B.3 Raw EEM Data for the Beaver Dam Baseline Study
Beaver Dam Mine
Baseline Aquatic Environment Technical Report
Atlantic Mining NS Inc.
121619250

ID	Area	Date Dissected	Date Pulled	Species	Method	Station Number	Fork length (cm)	Total length (cm)	Total Weight (g)	Sex M/F/I	Liver Wt (g)	Gonad Wt (g)	Aging Structure SC/FR/OT/DS	Fecundity (~100 eggs)	Condition	Gonadosomatic Index (GSI)	Liver Somatic Index (LSI)	Age
BD-EXP-YEPR-01	EXP	27-Aug-20	26-Aug-20	YEPR	Minnow Trap	BD-EXP-MT-02	13.9	14.6	35.82	F	0.348	0.578	DS + SC	-	1	1.61	0.97	4
BD-EXP-YEPR-02	EXP	27-Aug-20	26-Aug-20	YEPR	Minnow Trap	BD-EXP-MT-02	14.4	15.1	36.42	F	0.481	0.385	DS + SC	-	1	1.06	1.32	3
BD-EXP-YEPR-03	EXP	27-Aug-20	26-Aug-20	YEPR	Fyke Net	BD-EXP-FN-02	13.8	14.0	35.45	F	0.317	0.446	DS + SC	-	1	1.26	0.89	4
BD-EXP-YEPR-04	EXP	27-Aug-20	26-Aug-20	YEPR	Fyke Net	BD-EXP-FN-02	13.3	14.0	33.22	F	0.295	0.474	DS + SC	-	1	1.43	0.89	4
BD-EXP-YEPR-05	EXP	27-Aug-20	26-Aug-20	YEPR	Fyke Net	BD-EXP-FN-02	12.6	13.3	27.48	F	0.201	0.350	DS + SC	-	1	1.27	0.73	4
BD-EXP-YEPR-06	EXP	27-Aug-20	26-Aug-20	YEPR	Fyke Net	BD-EXP-FN-02	12.2	12.9	25.71	F	0.373	0.332	DS + SC	-	1	1.29	1.45	4
BD-EXP-YEPR-07	EXP	27-Aug-20	26-Aug-20	YEPR	Minnow Trap	BD-EXP-MT-05	14.8	15.4	44.33	F	0.684	0.739	DS + SC	-	1	1.67	1.54	4
BD-EXP-YEPR-08	EXP	27-Aug-20	26-Aug-20	YEPR	Minnow Trap	BD-EXP-MT-05	13.6	14.3	33.74	F	0.277	0.369	DS + SC	-	1	1.09	0.82	3
BD-EXP-YEPR-13	EXP	27-Aug-20	26-Aug-20	YEPR	Fyke Net	BD-EXP-FN-01	10.8	11.4	17.85	F	0.121	0.360	DS + SC	-	1	2.02	0.68	4
BD-EXP-YEPR-14	EXP	27-Aug-20	26-Aug-20	YEPR	Fyke Net	BD-EXP-FN-01	10.7	11.4	19.03	F	0.171	0.330	DS + SC	-	2	1.73	0.90	4
BD-EXP-YEPR-15	EXP	27-Aug-20	26-Aug-20	YEPR	Fyke Net	BD-EXP-FN-01	10.7	11.4	16.20	F	0.165	0.303	DS + SC	-	1	1.87	1.02	4
BD-EXP-YEPR-21	EXP	27-Aug-20	26-Aug-20	YEPR	Fyke Net	BD-EXP-FN-02	13.7	14.3	39.76	F	0.224	0.594	DS + SC	-	2	1.49	0.56	4
BD-EXP-YEPR-22	EXP	27-Aug-20	26-Aug-20	YEPR	Fyke Net	BD-EXP-FN-02	12.1	12.7	25.83	F	0.189	0.330	DS + SC	-	1	1.28	0.73	4
BD-EXP-YEPR-25	EXP	27-Aug-20	26-Aug-20	YEPR	Fyke Net	BD-EXP-FN-02	11.7	12.4	19.58	F	0.205	0.313	DS + SC		1	1.60	1.05	3
BD-EXP-YEPR-38	EXP	27-Aug-20	27-Aug-20	YEPR	Minnow Trap	BD-EXP-MT-12	13.1	13.8	25.35	F	0.205	0.393	DS + SC	-	1	1.55	0.81	3
BD-EXP-YEPR-40	EXP	27-Aug-20	27-Aug-20	YEPR	Minnow Trap	BD-EXP-MT-12	12.5	13.1	23.92	F	0.202	0.398	DS + SC	-	1	1.66	0.84	4
BD-EXP-YEPR-41	EXP	28-Aug-20	28-Aug-20	YEPR	Fyke Net	BD-EXP-FN-04	14.6	15.4	43.46	F	0.706	0.626	DS + SC + OT	0.062	1	1.44	1.62	4
BD-EXP-YEPR-42	EXP	28-Aug-20	28-Aug-20	YEPR	Fyke Net	BD-EXP-FN-04	13.8	14.5	37.73	F	0.387	0.682	DS + SC + OT	-	1	1.81	1.03	4
BD-EXP-YEPR-43	EXP	28-Aug-20	28-Aug-20	YEPR	Fyke Net	BD-EXP-FN-04	13.0	13.7	32.01	F	0.402	0.540	DS + SC + OT	0.067	1	1.69	1.26	4
BD-EXP-YEPR-44	EXP	28-Aug-20	28-Aug-20	YEPR	Fyke Net	BD-EXP-FN-04	11.5	12.0	20.95	F	0.146	0.323	DS + SC + OT	0.032	1	1.54	0.70	4
BD-EXP-YEPR-45	EXP	28-Aug-20	28-Aug-20	YEPR	Fyke Net	BD-EXP-FN-04	11.0	11.8	19.35	F	0.108	0.270	DS + SC + OT	0.069	1	1.40	0.56	4
BD-EXP-YEPR-46	EXP	28-Aug-20	28-Aug-20	YEPR	Fyke Net	BD-EXP-FN-04	9.3	10.0	11.58	M	0.101	0.160	DS + SC + OT	-	1	1.38	0.87	3
BD-EXP-YEPR-47	EXP	28-Aug-20	28-Aug-20	YEPR	Minnow Trap	BD-EXP-MT-17	10.5	11.0	15.42	F	0.138	0.300	DS + SC + OT	0.059	1	1.95	0.89	4
BD-EXP-YEPR-48	EXP	30-Aug-20	29-Aug-20	YEPR	Minnow Trap	BD-EXP-MT-18	11.4	12.0	18.57	F	0.299	0.266	DS + SC + OT	0.079	1	1.43	1.61	3
BD-EXP-YEPR-50	EXP	21-Sep-20	21-Sep-20	YEPR	Fyke Net	BD-EXP-FN-01A	11.8	12.4	19.60	F	0.208	0.532	DS + SC + OT	0.047	1	2.71	1.06	4
BD-EXP-YEPR-51	EXP	21-Sep-20	21-Sep-20	YEPR	Fyke Net	BD-EXP-FN-01A	9.0	9.6	9.14	M	0.060	1.129	DS + SC + OT	-	1	12.35	0.66	3
BD-EXP-YEPR-26	EXP	27-Aug-20	26-Aug-20	YEPR	Minnow Trap	BD-EXP-MT-04	12.1	12.7	22.86	F	2.050	2.880	DS + SC	-	1	12.60	8.97	4
BD-EXP-YEPR-29	EXP	27-Aug-20	26-Aug-20	YEPR	Minnow Trap	BD-EXP-MT-03	12.6	13.3	27.05	F	3.360	3.210	DS + SC	-	1	11.87	12.42	3
BD-EXP-YEPR-27	EXP	27-Aug-20	26-Aug-20	YEPR	Minnow Trap	BD-EXP-MT-04	11.4	12.2	25.51	F	1.950	0.333	DS + SC	-	2	1.31	7.64	4
BD-EXP-YEPR-32	EXP	27-Aug-20	26-Aug-20	YEPR	Minnow Trap	BD-EXP-MT-08	10.6	11.1	15.52	F	1.420	0.314	DS + SC	-	1	2.02	9.15	4
BD-EXP-YEPR-52	EXP	21-Sep-20	21-Sep-20	YEPR	Fyke Net	BD-EXP-FN-02A	14.3	15.1	36.69	F	0.432	1.272	DS + SC + OT	0.074	1	3.47	1.18	4
BD-EXP-YEPR-49	EXP	21-Sep-20	21-Sep-20	YEPR	Fyke Net	BD-EXP-FN-01A	12.4	13.2	27.37	F	0.420	0.865	DS + SC + OT	0.058	1	3.16	1.53	4
BD-REF-YEPR-01	REF	30-Aug-20	30-Aug-20	YEPR	Minnow Trap	BD-REF-MT	11.1	11.8	17.70	F	0.146	0.339	DS + SC	0.035	1	1.92	0.82	3
BD-REF-YEPR-02	REF	30-Aug-20	30-Aug-20	YEPR	Minnow Trap	BD-REF-MT	11.7	12.5	19.11	F	0.138	0.299	DS + SC	0.019	1	1.56	0.72	3
BD-REF-YEPR-03	REF	30-Aug-20	30-Aug-20	YEPR	Minnow Trap	BD-REF-MT	11.7	12.4	18.90	F	0.152	0.298	DS + SC	0.022	1	1.58	0.80	3
BD-REF-YEPR-04	REF	31-Aug-20	30-Aug-20	YEPR	Minnow Trap	BD-REF-MT	11.6	12.3	17.71	F	0.149	0.275	DS + SC	0.035	1	1.55	0.84	3
BD-REF-YEPR-05	REF	31-Aug-20	30-Aug-20	YEPR	Minnow Trap	BD-REF-MT	11.5	12.1	18.46	F	0.144	0.289	DS + SC + OT	0.031	1	1.57	0.78	3
BD-REF-YEPR-06	REF	31-Aug-20	30-Aug-20	YEPR	Minnow Trap	BD-REF-MT	10.9	11.1	15.73	F	0.107	0.297	DS + SC	0.035	1	1.89	0.68	3
BD-REF-YEPR-07	REF	31-Aug-20	30-Aug-20	YEPR	Minnow Trap	BD-REF-MT	11.0	11.6	20.19	F	0.237	0.374	DS + SC	0.048	2	1.85	1.17	3
BD-REF-YEPR-08	REF	31-Aug-20	30-Aug-20	YEPR	Minnow Trap	BD-REF-MT	10.4	11.0	16.11	F	0.178	0.292	DS + SC	0.019	1	1.81	1.10	3
BD-REF-YEPR-09	REF	31-Aug-20	30-Aug-20	YEPR	Minnow Trap	BD-REF-MT	9.8	10.4	13.34	M	0.117	0.726	DS + SC	-	1	5.44	0.88	3
BD-REF-YEPR-10	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	11.0	11.7	15.87	F	0.135	0.300	DS + SC	0.027	1	1.89	0.85	3
BD-REF-YEPR-11	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	11.3	12.0	17.35	F	0.125	0.295	DS + SC	0.024	1	1.70	0.72	3
BD-REF-YEPR-12	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	10.5	11.2	13.40	F	0.113	0.217	DS + SC	0.023	1	1.62	0.84	3
BD-REF-YEPR-13	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	14.6	15.3	35.10	F	0.382	0.626	DS + SC	0.028	1	1.78	1.09	3
BD-REF-YEPR-14	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	11.7	12.5	19.67	F	0.146	0.364	DS + SC + OT	0.033	1	1.85	0.74	4
BD-REF-YEPR-15	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	10.9	11.4	14.52	F	0.135	0.307	DS + SC + OT	0.024	1	2.11	0.93	3
BD-REF-YEPR-16	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	11.8	12.5	20.89	F	0.161	0.309	DS + SC + OT	0.023	1	1.48	0.77	3
BD-REF-YEPR-17	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	10.8	11.4	15.85	F	0.104	0.229	DS + SC + OT	0.010	1	1.44	0.66	3
BD-REF-YEPR-18	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	12.1	12.7	20.99	F	0.224	0.415	DS + SC + OT	0.029	1	1.98	1.07	3
BD-REF-YEPR-19	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	10.5	11.1	14.17	F	0.082	0.313	DS + SC + OT	-	1	2.21	0.58	3
BD-REF-YEPR-20	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	11.0	11.7	15.02	F	0.121	0.264	DS + SC + OT	-	1	1.76	0.81	3
BD-REF-YEPR-21	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	15.2	16.0	51.75	F	0.520	0.835	DS + SC + OT	0.049	1	1.61	1.00	8
BD-REF-YEPR-22	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	13.9	14.6	34.35	F	0.415	0.565	DS + SC + OT	0.040	1	1.64	1.21	6
BD-REF-YEPR-23	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	13.6	14.2	35.88	F	0.545	0.609	DS + SC + OT	0.035	1	1.70	1.52	6
BD-REF-YEPR-24	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	11.6	12.2	19.74	F	0.208	0.324	DS + SC + OT	0.024	1	1.64	1.05	2
BD-REF-YEPR-25	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	10.6	11.2	16.28	F	0.136	0.340	DS + SC + OT	0.051	1	2.09	0.84	3
BD-REF-YEPR-39	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	9.7	10.3	11.98	M	0.143	0.240	DS + SC + OT	-	1	2.00	1.19	7
BD-REF-YEPR-47	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	10.7	11.4	17.24	M	0.171	0.322	DS + SC + OT	-	1	1.87	0.99	6
BD-REF-YEPR-66	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	13.8	14.4	37.38	F	0.325	0.750	DS + SC + OT	0.037	1	2.01	0.87	4
BD-REF-YEPR-67	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-06	12.0	12.7	20.45	F	0.155	0.343	DS + SC + OT	0.019	1	1.68	0.76	3
BD-REF-YEPR-68	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-06	11.9	12.5	22.37	F	0.270	0.359	DS + SC + OT	0.350	1	1.60	0.12	3
BD-REF-YEPR-69	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-06	11.6	12.2	20.58	M	0.163	0.730	DS + SC + OT	-	1	3.55	0.79	8
BD-REF-YEPR-70	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-06	11.8	12.4	21.49	F	0.175	0.267	DS + SC + OT	0.016	1	1.24	0.81	3
BD-REF-YEPR-71	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-06	11.6	12.4	20.34	F	0.162	0.340	DS + SC + OT	0.033	1	1.67	0.80	3
BD-REF-YEPR-72	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-06	13.3	14.0	31.49	F	0.281	0.414	DS + SC + OT	0.037	1	1.31	0.89	3
BD-REF-YEPR-73	REF	1-Sep-20	31-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	12.8	13.4	27.37	F	0.221	0.360	DS + SC + OT	0.020	1	1.32	0.81	3
BD-REF-YEPR-74	REF	1-Sep-20	31-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	11.7	12.4	21.89	F	0.163	0.357	DS + SC + OT	0.016	1	1.63	0.74	3
BD-REF-YEPR-75	REF	1-Sep-20	31-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	15.6	16.4	54.50	F	0.362	1.015	DS + SC + OT	0.042	1	1.86	0.66	6
BD-REF-YEPR-76	REF	1-Sep-20	31-Aug-20	YEPR	Fyke Net	BD-REF-FN-07	12.3	12.9	21.88	F	0.162	0.324	DS + SC + OT	0.033	1	1.48	0.74	3
BD-REF-YEPR-77	REF	1-Sep-20	31-Aug-20	YEPR	Fyke Net	BD-REF-FN-07	12.0	12.7	25.73	F	0.339	0.434	DS + SC + OT	0.051	1	1.69	1.32	3
BD-REF-YEPR-78	REF	1-Sep-20	31-Aug-20	YEPR	Fyke Net	BD-REF-FN-07	13.5	14.2	39.61	F	0.546	0.832	DS + SC + OT	0.062	2	2.10	1.38	6
BD-REF-YEPR-79	REF	1-Sep-20	31-Aug-20	YEPR	Fyke Net	BD-REF-FN-07	13.0	13.7	25.47	F	0.208	0.377	DS + SC + OT	0.039	1	1.48	0.82	3
BD-REF-YEPR-80	REF	1-Sep-20	31-Aug-20	YEPR	Fyke Net	BD-REF-FN-07	11.6	12.3	21.55	F	0.163	0.332	DS + SC + OT	0.037	1	1.54	0.76	3
BD-REF-YEPR-81	REF	1-Sep-20	31-Aug-20	YEPR	Fyke Net	BD-REF-FN-07	13.7	14.4	34.94	F	0.318	0.404	DS + SC + OT	0.047	1	1.16	0.91	3
BD-REF-YEPR-82	REF	1-Sep-20	31-Aug-20	YEPR	Fyke Net	BD-REF-FN-07	13.5	14.2	30.84	F	0.387	0.410	DS + SC + OT	0.034	1	1.33	1.25	3
BD-REF-YEPR-83	REF	1-Sep-20	31-Aug-20	YEPR	Fyke Net	BD-REF-FN-07	12.4	13.1	23.65	F	0.167	0.421	DS + SC + OT	0.013	1	1.78	0.71	3
BD-REF-YEPR-85	REF	1-Sep-20	1-Sep-20	YEPR	Fyke Net	BD-REF-FN-05	13.8	14.6	40.21	F	0.750	0.741	DS + SC + OT	0.029	2	1.84	1.87	6
BD-REF-YEPR-86	REF	1-Sep-20	1-Sep-20	YEPR	Fyke Net	BD-REF-FN-05	12.6	13.4	27.23	F	0.227	0.446	DS + SC + OT	0.017	1	1.64	0.83	3
BD-REF-YEPR-87	REF	1-Sep-20	1-Sep-20	YEPR	Fyke Net	BD-REF-FN-05	10.0	10.6	13.08	F	0.157	0.361	DS + SC + OT	0.025	1	2.76	1.20	3
BD-REF-YEPR-88	REF	1-Sep-20	1-Sep-20	YEPR	Fyke Net	BD-REF-FN-05	11.5	12.2	18.45	F	0.127	0.414	DS + SC + OT	0.024	1	2.24	0.69	3
BD-REF-YEPR-89	REF	1-Sep-20	1-Sep-20	YEPR	Fyke Net	BD-REF-FN-05	11.8	12.4	19.68	F	0.199	0.435	DS + SC + OT	0.025	1	2.21	1.01	3
BD-REF-YEPR-90	REF	1-Sep-20	1-Sep-20	YEPR	Fyke Net	BD-REF-FN-05	11.3	12.0	18.36	F	0.184	0.327	DS + SC + OT	-	1	1.78	1.00	3
BD-REF-YEPR-92	REF	1-Sep-20	1-Sep-20	YEPR	Fyke Net	BD-REF-FN-05	9.8	10.4	11.88	M	0.115	0.389	DS + SC + OT	-	1	3.27	0.97	3

Highlighted cells indicate potential outliers

Table B.3 Raw EEM Data for the Beaver Dam Baseline Study
Beaver Dam Mine
Baseline Aquatic Environment Technical Report
Atlantic Mining NS Inc.
121619250

ID	Area	Date Dissected	Date Pulled	Species	Method	Station Number	Egg Sample Count	Fecundity (Total # eggs)	Egg Size (Weight per egg)	GSI (%)	GSI >1%	LOG10 Total Weight (g)	LOG10 Fork Length (cm)	LOG10 Liver Weight (g)	LOG10 Gonad Weight (g)	LOG10 Fecundity	LOG10 Egg Size (g/Egg)	LOG10 Age
BD-EXP-YEPR-01	EXP	27-Aug-20	26-Aug-20	YEPR	Minnow Trap	BD-EXP-MT-02	-	-	-	1.6	MATURE	1.554	1.143	-0.458	-0.238	-	-	0.602
BD-EXP-YEPR-02	EXP	27-Aug-20	26-Aug-20	YEPR	Minnow Trap	BD-EXP-MT-02	-	-	-	1.1	MATURE	1.561	1.158	-0.318	-0.415	-	-	0.477
BD-EXP-YEPR-03	EXP	27-Aug-20	26-Aug-20	YEPR	Fyke Net	BD-EXP-FN-02	-	-	-	1.3	MATURE	1.550	1.140	-0.499	-0.351	-	-	0.602
BD-EXP-YEPR-04	EXP	27-Aug-20	26-Aug-20	YEPR	Fyke Net	BD-EXP-FN-02	-	-	-	1.4	MATURE	1.521	1.124	-0.530	-0.324	-	-	0.602
BD-EXP-YEPR-05	EXP	27-Aug-20	26-Aug-20	YEPR	Fyke Net	BD-EXP-FN-02	-	-	-	1.3	MATURE	1.439	1.100	-0.697	-0.456	-	-	0.602
BD-EXP-YEPR-06	EXP	27-Aug-20	26-Aug-20	YEPR	Fyke Net	BD-EXP-FN-02	-	-	-	1.3	MATURE	1.410	1.086	-0.428	-0.479	-	-	0.602
BD-EXP-YEPR-07	EXP	27-Aug-20	26-Aug-20	YEPR	Minnow Trap	BD-EXP-MT-05	-	-	-	1.7	MATURE	1.647	1.170	-0.165	-0.131	-	-	0.602
BD-EXP-YEPR-08	EXP	27-Aug-20	26-Aug-20	YEPR	Minnow Trap	BD-EXP-MT-05	-	-	-	1.1	MATURE	1.528	1.134	-0.558	-0.433	-	-	0.477
BD-EXP-YEPR-13	EXP	27-Aug-20	26-Aug-20	YEPR	Fyke Net	BD-EXP-FN-01	-	-	-	2.0	MATURE	1.252	1.033	-0.917	-0.444	-	-	0.602
BD-EXP-YEPR-14	EXP	27-Aug-20	26-Aug-20	YEPR	Fyke Net	BD-EXP-FN-01	-	-	-	1.7	MATURE	1.279	1.029	-0.767	-0.481	-	-	0.602
BD-EXP-YEPR-15	EXP	27-Aug-20	26-Aug-20	YEPR	Fyke Net	BD-EXP-FN-01	-	-	-	1.9	MATURE	1.210	1.029	-0.783	-0.519	-	-	0.602
BD-EXP-YEPR-21	EXP	27-Aug-20	26-Aug-20	YEPR	Fyke Net	BD-EXP-FN-02	-	-	-	1.5	MATURE	1.599	1.137	-0.650	-0.226	-	-	0.602
BD-EXP-YEPR-22	EXP	27-Aug-20	26-Aug-20	YEPR	Fyke Net	BD-EXP-FN-02	-	-	-	1.3	MATURE	1.412	1.083	-0.724	-0.481	-	-	0.602
BD-EXP-YEPR-25	EXP	27-Aug-20	26-Aug-20	YEPR	Fyke Net	BD-EXP-FN-02	-	-	-	1.6	MATURE	1.292	1.068	-0.688	-0.504	-	-	0.477
BD-EXP-YEPR-38	EXP	27-Aug-20	27-Aug-20	YEPR	Minnow Trap	BD-EXP-MT-12	-	-	-	1.6	MATURE	1.404	1.117	-0.688	-0.406	-	-	0.477
BD-EXP-YEPR-40	EXP	27-Aug-20	27-Aug-20	YEPR	Minnow Trap	BD-EXP-MT-12	-	-	-	1.7	MATURE	1.379	1.097	-0.695	-0.400	-	-	0.602
BD-EXP-YEPR-41	EXP	28-Aug-20	28-Aug-20	YEPR	Fyke Net	BD-EXP-FN-04	683	6896	0.0001	1.4	MATURE	1.638	1.164	-0.151	-0.203	3.839	-4.042	0.602
BD-EXP-YEPR-42	EXP	28-Aug-20	28-Aug-20	YEPR	Fyke Net	BD-EXP-FN-04	-	-	-	1.8	MATURE	1.577	1.140	-0.412	-0.166	-	-	0.602
BD-EXP-YEPR-43	EXP	28-Aug-20	28-Aug-20	YEPR	Fyke Net	BD-EXP-FN-04	692	5577	0.0001	1.7	MATURE	1.505	1.114	-0.396	-0.268	3.746	-4.014	0.602
BD-EXP-YEPR-44	EXP	28-Aug-20	28-Aug-20	YEPR	Fyke Net	BD-EXP-FN-04	276	2786	0.0001	1.5	MATURE	1.321	1.061	-0.836	-0.491	3.445	-3.936	0.602
BD-EXP-YEPR-45	EXP	28-Aug-20	28-Aug-20	YEPR	Fyke Net	BD-EXP-FN-04	681	2665	0.0001	1.4	MATURE	1.287	1.041	-0.967	-0.569	3.426	-3.994	0.602
BD-EXP-YEPR-46	EXP	28-Aug-20	28-Aug-20	YEPR	Fyke Net	BD-EXP-FN-04	-	-	-	1.4	MATURE	1.064	0.968	-0.996	-0.796	-	-	0.477
BD-EXP-YEPR-47	EXP	28-Aug-20	28-Aug-20	YEPR	Minnow Trap	BD-EXP-MT-17	Underdeveloped	-	-	1.9	MATURE	1.188	1.021	-0.860	-0.523	-	-	0.602
BD-EXP-YEPR-48	EXP	30-Aug-20	29-Aug-20	YEPR	Minnow Trap	BD-EXP-MT-18	535	1801	0.0001	1.4	MATURE	1.269	1.057	-0.524	-0.575	3.256	-3.831	0.477
BD-EXP-YEPR-50	EXP	21-Sep-20	21-Sep-20	YEPR	Fyke Net	BD-EXP-FN-01A	199	2253	0.0002	2.7	MATURE	1.292	1.072	-0.682	-0.274	3.353	-3.627	0.602
BD-EXP-YEPR-51	EXP	21-Sep-20	21-Sep-20	YEPR	Fyke Net	BD-EXP-FN-01A	-	-	-	12.4	MATURE	0.961	0.954	-1.222	0.053	-	-	0.477
BD-EXP-YEPR-26	EXP	27-Aug-20	26-Aug-20	YEPR	Minnow Trap	BD-EXP-MT-04	-	-	-	12.6	MATURE	1.359	1.083	0.312	0.459	-	-	0.602
BD-EXP-YEPR-29	EXP	27-Aug-20	26-Aug-20	YEPR	Minnow Trap	BD-EXP-MT-03	-	-	-	11.9	MATURE	1.432	1.100	0.526	0.507	-	-	0.477
BD-EXP-YEPR-27	EXP	27-Aug-20	26-Aug-20	YEPR	Minnow Trap	BD-EXP-MT-04	-	-	-	1.3	MATURE	1.407	1.057	0.290	-0.478	-	-	0.602
BD-EXP-YEPR-32	EXP	27-Aug-20	26-Aug-20	YEPR	Minnow Trap	BD-EXP-MT-08	-	-	-	2.0	MATURE	1.191	1.025	0.152	-0.503	-	-	0.602
BD-EXP-YEPR-52	EXP	21-Sep-20	21-Sep-20	YEPR	Fyke Net	BD-EXP-FN-02A	333	5724	0.0002	3.5	MATURE	1.565	1.155	-0.365	0.104	3.758	-3.653	0.602
BD-EXP-YEPR-49	EXP	21-Sep-20	21-Sep-20	YEPR	Fyke Net	BD-EXP-FN-01A	136	2028	0.0004	3.2	MATURE	1.437	1.093	-0.377	-0.063	3.307	-3.370	0.602
BD-REF-YEPR-01	REF	30-Aug-20	30-Aug-20	YEPR	Minnow Trap	BD-REF-MT	394	3816	0.0001	1.9	MATURE	1.248	1.045	-0.836	-0.470	3.582	-4.051	0.477
BD-REF-YEPR-02	REF	30-Aug-20	30-Aug-20	YEPR	Minnow Trap	BD-REF-MT	188	2959	0.0001	1.6	MATURE	1.281	1.068	-0.860	-0.524	3.471	-3.995	0.477
BD-REF-YEPR-03	REF	30-Aug-20	30-Aug-20	YEPR	Minnow Trap	BD-REF-MT	75	1016	0.0003	1.6	MATURE	1.276	1.068	-0.818	-0.526	3.007	-3.533	0.477
BD-REF-YEPR-04	REF	31-Aug-20	30-Aug-20	YEPR	Minnow Trap	BD-REF-MT	208	1634	0.0002	1.6	MATURE	1.248	1.064	-0.827	-0.561	3.213	-3.774	0.477
BD-REF-YEPR-05	REF	31-Aug-20	30-Aug-20	YEPR	Minnow Trap	BD-REF-MT	400	3729	0.0001	1.6	MATURE	1.266	1.061	-0.842	-0.539	3.572	-4.111	0.477
BD-REF-YEPR-06	REF	31-Aug-20	30-Aug-20	YEPR	Minnow Trap	BD-REF-MT	243	2062	0.0001	1.9	MATURE	1.197	1.037	-0.971	-0.527	3.314	-3.842	0.477
BD-REF-YEPR-07	REF	31-Aug-20	30-Aug-20	YEPR	Minnow Trap	BD-REF-MT	449	3498	0.0001	1.9	MATURE	1.305	1.041	-0.625	-0.427	3.544	-3.971	0.477
BD-REF-YEPR-08	REF	31-Aug-20	30-Aug-20	YEPR	Minnow Trap	BD-REF-MT	228	3504	0.0001	1.8	MATURE	1.207	1.017	-0.750	-0.535	3.545	-4.079	0.477
BD-REF-YEPR-09	REF	31-Aug-20	30-Aug-20	YEPR	Minnow Trap	BD-REF-MT	-	-	-	5.4	MATURE	1.125	0.991	-0.932	-0.139	-	-	0.477
BD-REF-YEPR-10	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	167	1856	0.0002	1.9	MATURE	1.201	1.041	-0.870	-0.523	3.268	-3.791	0.477
BD-REF-YEPR-11	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	346	4253	0.0001	1.7	MATURE	1.239	1.053	-0.903	-0.530	3.629	-4.159	0.477
BD-REF-YEPR-12	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	163	1538	0.0001	1.6	MATURE	1.127	1.021	-0.947	-0.664	3.187	-3.850	0.477
BD-REF-YEPR-13	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	385	8608	0.0001	1.8	MATURE	1.545	1.164	-0.418	-0.203	3.935	-4.138	0.477
BD-REF-YEPR-14	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	247	2724	0.0001	1.9	MATURE	1.294	1.068	-0.836	-0.439	3.435	-3.874	0.602
BD-REF-YEPR-15	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	235	3006	0.0001	2.1	MATURE	1.162	1.037	-0.870	-0.513	3.478	-3.991	0.477
BD-REF-YEPR-16	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	261	3506	0.0001	1.5	MATURE	1.320	1.072	-0.793	-0.510	3.545	-4.055	0.477
BD-REF-YEPR-17	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	135	3092	0.0001	1.4	MATURE	1.200	1.033	-0.983	-0.640	3.490	-4.130	0.477
BD-REF-YEPR-18	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	216	3091	0.0001	2.0	MATURE	1.322	1.083	-0.650	-0.382	3.490	-3.872	0.477
BD-REF-YEPR-19	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	352	-	-	2.2	MATURE	1.151	1.021	-1.086	-0.504	-	-	0.477
BD-REF-YEPR-20	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	-	-	-	1.8	MATURE	1.177	1.041	-0.917	-0.578	-	-	0.477
BD-REF-YEPR-21	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	629	10719	0.0001	1.6	MATURE	1.714	1.182	-0.284	-0.078	4.030	-4.108	0.903
BD-REF-YEPR-22	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	490	6921	0.0001	1.6	MATURE	1.536	1.143	-0.382	-0.248	3.840	-4.088	0.778
BD-REF-YEPR-23	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	213	3706	0.0002	1.7	MATURE	1.555	1.134	-0.264	-0.215	3.569	-3.784	0.778
BD-REF-YEPR-24	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	230	3105	0.0001	1.6	MATURE	1.295	1.064	-0.682	-0.489	3.492	-3.982	0.301
BD-REF-YEPR-25	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	287	1913	0.0002	2.1	MATURE	1.212	1.025	-0.866	-0.469	3.282	-3.750	0.477
BD-REF-YEPR-39	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	-	-	-	2.0	MATURE	1.078	0.987	-0.845	-0.620	-	-	0.845
BD-REF-YEPR-47	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	-	-	-	1.9	MATURE	1.237	1.029	-0.767	-0.492	-	-	0.778
BD-REF-YEPR-66	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	241	4885	0.0002	2.0	MATURE	1.573	1.140	-0.488	-0.125	3.689	-3.814	0.602
BD-REF-YEPR-67	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-06	246	4441	0.0001	1.7	MATURE	1.311	1.079	-0.810	-0.465	3.647	-4.112	0.477
BD-REF-YEPR-68	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-06	372	382	0.0009	1.6	MATURE	1.350	1.076	-0.569	-0.445	2.582	-3.026	0.477
BD-REF-YEPR-69	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-06	-	-	-	3.5	MATURE	1.313	1.064	-0.788	-0.137	-	-	0.903
BD-REF-YEPR-70	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-06	214	3571	0.0001	1.2	MATURE	1.332	1.072	-0.757	-0.573	3.553	-4.126	0.477
BD-REF-YEPR-71	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-06	314	3235	0.0001	1.7	MATURE	1.308	1.064	-0.790	-0.469	3.510	-3.978	0.477
BD-REF-YEPR-72	REF	31-Aug-20	30-Aug-20	YEPR	Fyke Net	BD-REF-FN-06	554	6199	0.0001	1.3	MATURE	1.498	1.124	-0.551	-0.383	3.792	-4.175	0.477
BD-REF-YEPR-73	REF	1-Sep-20	31-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	313	5634	0.0001	1.3	MATURE	1.437	1.107	-0.656	-0.444	3.751	-4.195	0.477
BD-REF-YEPR-74	REF	1-Sep-20	31-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	131	2923	0.0001	1.6	MATURE	1.340	1.068	-0.788	-0.447	3.466	-3.913	0.477
BD-REF-YEPR-75	REF	1-Sep-20	31-Aug-20	YEPR	Fyke Net	BD-REF-FN-05	403	9739	0.0001	1.9	MATURE	1.736	1.193	-0.441	0.006	3.989	-3.982	0.778
BD-REF-YEPR-76	REF	1-Sep-20	31-Aug-20	YEPR	Fyke Net	BD-REF-FN-07	349	3427	0.0001	1.5	MATURE	1.340	1.090	-0.790	-0.489	3.535	-4.024	0.477
BD-REF-YEPR-77	REF	1-Sep-20	31-Aug-20	YEPR	Fyke Net	BD-REF-FN-07	576	4902	0.0001	1.7	MATURE	1.410	1.079	-0.470	-0.363	3.690	-4.053	0.477
BD-REF-YEPR-78	REF	1-Sep-20	31-Aug-20	YEPR	Fyke Net	BD-REF-FN-07	-	-	-	2.1	MATURE	1.598	1.130	-0.263	-0.080	-	-	0.778
BD-REF-YEPR-79	REF	1-Sep-20	31-Aug-20	YEPR	Fyke Net	BD-REF-FN-07	639	6177	0.0001	1.5	MATURE	1.406	1.114	-0.682	-0.424	3.791	-4.214	0.477
BD-REF-YEPR-80	REF	1-Sep-20	31-Aug-20	YEPR	Fyke Net	BD-REF-FN-07	221	1983	0.0002	1.5	MATURE	1.333	1.064	-0.788	-0.479	3.297	-3.776	0.477
BD-REF-YEPR-81	REF	1-Sep-20	31-Aug-20	YEPR	Fyke Net	BD-REF-FN-07	723	6215	0.0001	1.2	MATURE	1.543	1.137	-0.498	-0.394	3.793	-4.187	0.477
BD-REF-YEPR-82	REF	1-Sep-20	31-Aug-20	YEPR	Fyke Net	BD-REF-FN-07	464	5595	0.0001	1.3	MATURE	1.489	1.130	-0.412	-0.387	3.748	-4.135	0.477
BD-REF-YEPR-83	REF	1-Sep-20	31-Aug-20	YEPR	Fyke Net	BD-REF-FN-07	215	6963	0.0001	1.8	MATURE	1.374	1.093	-0.777	-0.376	3.843	-4.218	0.477
BD-REF-YEPR-85	REF	1-Sep-20	1-Sep-20	YEPR	Fyke Net	BD-REF-FN-05	212	5417	0.0001	1.8	MATURE	1.604	1.140	-0.125	-0.130	3.734	-3.864	0.778
BD-REF-YEPR-86	REF	1-Sep-20	1-Sep-20	YEPR	Fyke Net	BD-REF-FN-05	147	3857	0.0001	1.6	MATURE	1.435	1.100	-0.644	-0.351	3.586	-3.937	0.477
BD-REF-YEPR-87	REF	1-Sep-20	1-Sep-20	YEPR	Fyke Net	BD-REF-FN-05	222	3206	0.0001	2.8	MATURE	1.117	1.000	-0.804	-0.442	3.506	-3.948	0.477
BD-REF-YEPR-88	REF	1-Sep-20	1-Sep-20	YEPR	Fyke Net	BD-REF-FN-05	207	3571	0.0001	2.2	MATURE	1.266	1.061	-0.896	-0.383	3.553	-3.936	0.477
BD-REF-YEPR-89	REF	1-Sep-20	1-Sep-20	YEPR	Fyke Net	BD-REF-FN-05	267	4646	0.0001	2.2	MATURE	1.294	1.072	-0.701	-0.362	3.667	-4.029	0.477
BD-REF-YEPR-90	REF	1-Sep-20	1-Sep-20	YEPR	Fyke Net	BD-REF-FN-05	-	-	-	1.8	MATURE	1.264	1.053	-0.735	-0.485	-	-	0.477
BD-REF-YEPR-92	REF	1-Sep-20	1-Sep-20	YEPR	Fyke Net	BD-REF-FN-05	-	-	-	3.3	MATURE	1.075	0.991	-0.939	-0.410	-	-	0.477

Highlighted cells indicate potential outliers

Table B.4 QA/QC Measurements for Fork Length, Total Length, and Total Weight
Beaver Dam Mine
Baseline Aquatic Environment Technical Report
Atlantic Mining NS Inc.
121619250

ID	Area	Date Dissected	Date Pulled	Species	Fork length (cm)	QC - Fork length (cm)	Relative Percent Difference	Total length (cm)	QC - Total length (cm)	Relative Percent Difference	Total Weight (g)	QC - Total Weight (g)	Relative Percent Difference	Sex M/F/I
BD-EXP-WHSC-09	EXP	26-Aug-20	26-Aug-20	WHSC	31.0	31.1	0.32%	33.5	33.4	0.30%	318.00	319.00	0.31%	F
BD-EXP-WHSC-23	EXP	26-Aug-20	26-Aug-20	WHSC	23.8	23.9	0.42%	25.8	25.9	0.39%	175.99	175.64	0.20%	M
BD-EXP-WHSC-34	EXP	27-Aug-20	26-Aug-20	WHSC	21.2	21.3	0.47%	23.0	23.0	0.00%	120.57	120.49	0.07%	F
BD-EXP-WHSC-51	EXP	27-Aug-20	27-Aug-20	WHSC	20.3	20.3	0.00%	21.8	21.8	0.00%	99.72	99.60	0.12%	F
BD-EXP-WHSC-67	EXP	28-Aug-20	28-Aug-20	WHSC	22.5	22.5	0.00%	24.2	24.2	0.00%	134.18	134.16	0.01%	F
BD-REF-WHSC-18	REF	30-Aug-20	30-Aug-20	WHSC	30.3	30.3	0.00%	33.1	33.1	0.00%	377.00	378.00	0.26%	F
BD-REF-WHSC-86	REF	31-Aug-20	31-Aug-20	WHSC	22.8	22.7	0.44%	24.6	24.5	0.41%	150.04	149.98	0.04%	F
BD-REF-WHSC-101	REF	1-Sep-20	1-Sep-20	WHSC	25.5	25.4	0.39%	27.4	27.3	0.37%	198.87	198.79	0.04%	M
BD-EXP-YEPR-13	EXP	27-Aug-20	26-Aug-20	YEPR	10.8	10.8	0.00%	11.4	11.4	0.00%	17.85	17.84	0.06%	F
BD-EXP-YEPR-43	EXP	28-Aug-20	28-Aug-20	YEPR	13.0	13.0	0.00%	13.7	13.8	0.73%	32.01	31.99	0.06%	F
BD-REF-YEPR-01	REF	30-Aug-20	30-Aug-20	YEPR	11.1	11.1	0.00%	11.8	11.9	0.84%	17.70	17.69	0.06%	F
BD-REF-YEPR-10	REF	31-Aug-20	30-Aug-20	YEPR	11.0	11.0	0.00%	11.7	11.7	0.00%	15.87	15.82	0.32%	F
BD-REF-YEPR-21	REF	31-Aug-20	30-Aug-20	YEPR	15.2	15.2	0.00%	16.0	16.0	0.00%	51.75	51.75	0.00%	F
BD-REF-YEPR-73	REF	1-Sep-20	31-Aug-20	YEPR	12.8	12.7	0.78%	13.4	13.4	0.00%	27.37	27.35	0.07%	F

Table B.5 QA/QC for Age
Beaver Dam Mine
Baseline Aquatic Environment Technical Report
Atlantic Mining NS Inc.
121619250

Fish ID	Sample Age	Quality Control Age	Age Difference
BD-REF-YEPR-16	3	3	0
BD-EXP-YEPR-50	4	4	0
BD-REF-YEPR-80	3	3	0
BD-REF-YEPR-25	3	3	0
BD-EXP-YEPR-49	4	4	0
BD-REF-YEPR-76	3	3	0
BD-EXP-YEPR-51	3	3	0
BD-EXP-YEPR-52	4	4	0
BD-EXP-WHSC-32	6	6	0
BD-EXP-WHSC-29	6	4	2
BD-EXP-WHSC-18	6	5	1
BD-EXP-WHSC-08	10	8	2
BD-REF-WHSC-104	6	4	2
BD-REF-WHSC-77	7	7	0
BD-REF-WHSC-16	8	5	3

APPENDIX C

Fish Tissue Data

Table C.1 Trace Metal, Moisture and Fat Concentrations of Whole Body White Sucker
Beaver Dam Mine
Baseline Aquatic Environment Technical Report
Atlantic Mining NS Inc.
121619250

		RPC Sample ID	372863-01	372863-02	372863-03	372863-04	372863-05	372863-06	372863-07	372863-08	372863-09	372863-10
		Stantec Sample ID	BD-REF-WHSC-06	BD-REF-WHSC-03	BD-REF-WHSC-02	BD-REF-WHSC-04	BD-REF-WHSC-07	BD-EXP-WHSC-06	BD-EXP-WHSC-04	BD-EXP-WHSC-07	BD-EXP-WHSC-02	BD-EXP-WHSC-03
		Date Sampled	30-Aug-20	30-Aug-20	30-Aug-20	30-Aug-20	30-Aug-20	26-Aug-20	26-Aug-20	26-Aug-20	26-Aug-20	26-Aug-20
Analytes	**Units**	**RL**										
Aluminum	mg/kg	0.05	1.25	0.73	0.74	0.7	0.4	2.54	3.17	1.43	4.5	5.12
Antimony	mg/kg	0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Arsenic	mg/kg	0.05	0.05	0.07	0.08	0.07	0.07	0.19	0.24	0.16	0.35	0.19
Barium	mg/kg	0.05	6.31	5.95	7.92	7.5	6.16	3.69	5.79	4.31	4.41	12.2
Beryllium	mg/kg	0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Bismuth	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Boron	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Cadmium	mg/kg	0.0005	0.0288	0.0347	0.0269	0.0229	0.0262	0.0186	0.028	0.028	0.0347	0.0672
Calcium	mg/kg	2	12400	10200	12200	10800	10000	11200	14200	13000	15600	13100
Chromium	mg/kg	0.05	0.11	0.12	< 0.05	0.06	0.07	0.07	0.08	< 0.05	0.07	0.08
Cobalt	mg/kg	0.005	0.018	0.036	0.018	0.017	0.019	0.026	0.031	0.031	0.087	0.048
Copper	mg/kg	0.05	0.62	0.65	0.58	0.48	0.59	0.62	0.6	0.86	0.58	0.66
Iron	mg/kg	1	22	21	21	19	18	24	32	24	39	41
Lead	mg/kg	0.005	0.521	0.433	0.503	0.351	0.45	0.205	0.196	0.239	0.403	0.743
Lithium	mg/kg	0.005	0.009	0.01	0.01	0.012	0.009	0.008	0.012	0.008	0.009	0.018
Magnesium	mg/kg	0.5	396	339	401	380	373	378	420	415	423	418
Manganese	mg/kg	0.05	25.1	38	32.8	33.9	36.7	28	30.4	37.3	74.5	99.3
Mercury	mg/kg	0.01	0.28	0.17	0.31	0.26	0.21	0.23	0.34	0.33	0.3	0.21
Molybdenum	mg/kg	0.005	0.049	0.038	0.022	0.024	0.026	0.027	0.032	0.033	0.067	0.045
Nickel	mg/kg	0.05	0.09	0.11	0.08	0.07	0.09	0.08	0.12	0.12	0.12	0.11
Potassium	mg/kg	2	3050	2740	3100	3230	3200	3140	3180	3130	3070	2910
Rubidium	mg/kg	0.005	5.72	9.69	6.71	5.9	9.25	7.92	7.67	8.13	11.3	9.04
Selenium	mg/kg	0.05	0.65	0.44	0.54	0.49	0.55	0.45	0.61	0.51	0.62	0.81
Silver	mg/kg	0.005	0.01	0.009	0.006	0.008	0.006	0.005	0.006	0.011	0.007	0.008
Sodium	mg/kg	2	968	1060	964	950	825	928	974	996	1020	1120
Strontium	mg/kg	0.05	40.6	41.9	51.6	44.3	43.9	33.7	44.7	35.6	50.9	62.7
Tellurium	mg/kg	0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Thallium	mg/kg	0.005	< 0.005	< 0.005	0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.005	< 0.005	0.005
Tin	mg/kg	0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Uranium	mg/kg	0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.009
Vanadium	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.06	0.07
Zinc	mg/kg	0.05	22	21.1	20.5	22.4	18.9	24	22.2	28.5	24.9	24.5
Moisture	g/100g	0.3	73.2	74.7	76.4	76.3	73.6	77.4	76.5	78.1	76	78.9
Fat (Acid Hydrolysis)	g/100g	0.5	6.08	4.17	3.97	3.26	5.3	1.65	2.66	1.28	2.62	0.71
Selenium (dry weight)	mg/kg	0.05	2.43	1.74	2.29	2.07	2.08	1.99	2.60	2.33	2.58	3.84

Table C.2 Trace Metal, Moisture and Fat Concentrations of Yellow Perch Muscle Fillets
Beaver Dam Mine
Baseline Aquatic Environment Technical Report
Atlantic Mining NS Inc.
121619250

		RPC Sample ID	372863-16	372863-17	372863-18	372863-19	372863-20	381506-01	381506-02	381506-03	381506-04	381506-05
		Stantec Sample ID	BD-EXP-YEPR-01	BD-EXP-YEPR-02	BD-EXP-YEPR-03	BD-EXP-YEPR-07	BD-EXP-YEPR-21	BD-REF-YELR-21	BD-REF-YELR-22	BD-REF-YELR-23	BD-REF-YELR-26	BD-REF-YELR-66
		Sample Type	-MUS	-MUS	-MUS	-MUS	-MUS	-MUS	-MUS	-MUS	-MUS	-MUS
		Date Sampled	27-Aug-20	27-Aug-20	27-Aug-20	27-Aug-20	27-Aug-20	31-Aug-20	31-Aug-20	31-Aug-20	31-Aug-20	31-Aug-20
Analytes	**Units**	**RL**										
Aluminum	mg/kg	0.05	0.75	0.13	0.09	0.18	0.13	0.3	0.4	0.3	0.2	< 0.2
Antimony	mg/kg	0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Arsenic	mg/kg	0.05	0.15	0.12	0.14	0.1	0.12	0.03	0.03	0.02	0.03	0.02
Barium	mg/kg	0.05	< 0.05	0.07	< 0.05	0.11	< 0.05	0.03	0.06	0.09	0.06	0.05
Beryllium	mg/kg	0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Bismuth	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Boron	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Cadmium	mg/kg	0.0005	0.0006	0.0007	0.0007	0.0005	0.0032	0.0023	0.0014	0.001	< 0.0005	< 0.0005
Calcium	mg/kg	2	276	830	361	833	429	137	327	499	384	301
Chromium	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Cobalt	mg/kg	0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.007	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Copper	mg/kg	0.05	0.37	0.36	2.4	0.52	0.3	0.15	0.43	0.36	1.07	0.21
Iron	mg/kg	1	3	3	10	2	4	2	2	2	2	1
Lead	mg/kg	0.005	0.007	0.006	0.045	0.01	< 0.005	0.004	0.008	0.014	0.018	0.006
Lithium	mg/kg	0.005	0.008	0.008	< 0.005	0.005	< 0.005	0.009	0.007	0.008	< 0.005	0.013
Magnesium	mg/kg	0.5	274	265	279	304	288	295	272	258	284	238
Manganese	mg/kg	0.05	0.35	0.73	0.49	1.04	0.49	0.18	0.38	0.55	0.55	0.27
Mercury	mg/kg	0.01	0.61	0.34	0.38	0.46	0.4	0.42	0.55	0.31	0.36	0.34
Molybdenum	mg/kg	0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Nickel	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Potassium	mg/kg	2	4250	3900	4270	3920	4140	3830	4020	3410	3850	3130
Rubidium	mg/kg	0.005	15.4	17.7	16.3	15.8	16.8	10.3	12.6	8.3	20.9	9.68
Selenium	mg/kg	0.05	0.57	0.46	0.47	0.69	0.89	0.51	0.51	0.56	0.33	0.54
Silver	mg/kg	0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Sodium	mg/kg	2	349	330	329	328	478	458	503	510	415	339
Strontium	mg/kg	0.05	0.71	2.49	1.28	2.81	1.21	0.43	1.18	1.98	1.37	1.2
Tellurium	mg/kg	0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Thallium	mg/kg	0.005	0.006	0.007	0.008	0.007	0.006	0.0089	0.0045	0.0036	0.0092	0.0032
Tin	mg/kg	0.005	< 0.005	< 0.005	0.011	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.021	0.01
Uranium	mg/kg	0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Vanadium	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Zinc	mg/kg	0.05	3.7	4.07	4.32	4.57	4.09	3.09	2.91	2.8	3.27	2.66
Moisture	g/100g	0.3	81.3	79.2	78.6	78.3	79	79.3	79.5	80.3	80.3	80.4
Fat (Acid Hydrolysis)	g/100g	0.5	0.72	0.78	0.82	0.83	0.77	0.61	0.66	0.71	0.62	0.71

Table C.3 Trace Metal, Moisture and Fat Concentrations of Yellow Perch Carcass
Beaver Dam Mine
Baseline Aquatic Environment Technical Report
Atlantic Mining NS Inc.
121619250

		RPC Sample ID	372863-11	372863-12	372863-13	372863-14	372863-15	381506-06	381506-07	381506-08	381506-09	381506-10
		Stantec Sample ID	BD-EXP-YEPR-01	BD-EXP-YEPR-02	BD-EXP-YEPR-03	BD-EXP-YEPR-07	BD-EXP-YEPR-21	BD-REF-YELR-21	BD-REF-YELR-22	BD-REF-YELR-23	BD-REF-YELR-26	BD-REF-YELR-66
		Sample Type	-CAR	-CAR	-CAR	-CAR	-CAR	-CAR	-CAR	-CAR	-CAR	-CAR
		Date Sampled	27-Aug-20	27-Aug-20	27-Aug-20	27-Aug-20	27-Aug-20	31-Aug-20	31-Aug-20	31-Aug-20	31-Aug-20	31-Aug-20
Analytes	**Units**	**RL**										
Aluminum	mg/kg	0.05	8.21	1.84	2.69	2.12	0.82	8.2	4.2	5.4	2.1	3.7
Antimony	mg/kg	0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Arsenic	mg/kg	0.05	0.27	0.18	0.25	0.16	0.26	0.06	0.04	0.03	0.04	0.04
Barium	mg/kg	0.05	20.4	1.51	2	2	1.86	5.88	6.22	5.07	2.38	4.4
Beryllium	mg/kg	0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Bismuth	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Boron	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Cadmium	mg/kg	0.0005	0.103	0.0141	0.0153	0.0128	0.0174	0.019	0.0302	0.028	0.0095	0.0115
Calcium	mg/kg	2	23600	19800	21800	18300	23700	31100	33600	24600	19400	25400
Chromium	mg/kg	0.05	0.15	0.05	0.21	0.07	< 0.05	0.04	0.04	< 0.02	0.02	0.02
Cobalt	mg/kg	0.005	0.075	0.024	0.031	0.024	0.029	< 0.005	0.007	0.005	0.006	0.006
Copper	mg/kg	0.05	1	2.79	4.79	1.08	0.47	0.75	0.49	0.72	0.43	0.7
Iron	mg/kg	1	67	22	50	20	20	16	26	26	18	24
Lead	mg/kg	0.005	1.15	0.202	0.649	0.14	0.112	0.544	0.498	0.486	0.226	0.36
Lithium	mg/kg	0.005	0.03	0.057	0.048	0.05	0.052	0.111	0.119	0.076	0.048	0.101
Magnesium	mg/kg	0.5	687	480	509	427	514	829	831	614	544	593
Manganese	mg/kg	0.05	166	16.5	24	20.6	26.1	28	33.1	31.9	18.6	24.1
Mercury	mg/kg	0.01	0.31	0.22	0.22	0.25	0.21	0.24	0.25	0.21	0.23	0.17
Molybdenum	mg/kg	0.005	0.073	0.016	0.014	0.013	0.018	0.012	0.008	0.009	0.007	0.01
Nickel	mg/kg	0.05	0.21	0.16	0.2	0.14	0.13	0.02	0.01	< 0.01	< 0.01	< 0.01
Potassium	mg/kg	2	4540	2260	2480	2390	2440	2740	2480	2320	2520	2300
Rubidium	mg/kg	0.005	13.9	12	10.7	11.5	11.2	7.38	8	6.16	14.5	7.1
Selenium	mg/kg	0.05	1.18	0.51	0.51	0.65	0.83	0.52	0.44	0.53	0.41	0.6
Silver	mg/kg	0.005	0.011	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Sodium	mg/kg	2	1740	1060	1160	952	1120	1440	1490	1260	1180	1120
Strontium	mg/kg	0.05	112	68.2	81.9	71.8	84.3	138	142	115	82.2	115
Tellurium	mg/kg	0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Thallium	mg/kg	0.005	0.008	0.008	0.008	0.008	0.006	0.0097	0.0065	0.0066	0.0096	0.0053
Tin	mg/kg	0.005	< 0.005	0.025	0.202	< 0.005	< 0.005	0.008	< 0.005	< 0.005	< 0.005	0.014
Uranium	mg/kg	0.005	0.014	< 0.005	< 0.005	< 0.005	< 0.005	0.005	0.0018	0.0032	0.0008	0.0014
Vanadium	mg/kg	0.05	0.11	0.08	0.15	0.14	0.2	0.28	0.43	0.29	0.06	0.18
Zinc	mg/kg	0.05	37.2	28.5	30.5	21.8	26.1	31.9	26.2	34.4	33.9	28.5
Moisture	g/100g	0.3	71.1	70.4	69.8	67.4	69.9	68.2	69.6	67.7	71.7	66.8
Fat (Acid Hydrolysis)	g/100g	0.5	5.62	4.75	6.38	9.11	5.6	4.13	5	7.09	5.91	11.1

Table C.4 Calculated Trace Metal, Moisture and Fat Concentrations of Whole Body Yellow Perch
Beaver Dam Mine
Baseline Aquatic Environment Technical Report
Atlantic Mining NS Inc.
121619250

		RPC Sample ID	372863-11	372863-12	372863-13	372863-14	372863-15	381506-06	381506-07	381506-08	381506-09	381506-10
		Stantec Sample ID	BD-EXP-YEPR-01	BD-EXP-YEPR-02	BD-EXP-YEPR-03	BD-EXP-YEPR-07	BD-EXP-YEPR-21	BD-REF-YELR-21	BD-REF-YELR-22	BD-REF-YELR-23	BD-REF-YELR-26	BD-REF-YELR-66
		Date Sampled	27-Aug-20	27-Aug-20	27-Aug-20	27-Aug-20	27-Aug-20	31-Aug-20	31-Aug-20	31-Aug-20	31-Aug-20	31-Aug-20
Analytes	**Units**	**RL**										
Aluminum	mg/kg	0.05	5.63	1.19	1.75	1.39	0.58	5.41	2.88	3.62	1.44	2.28
Antimony	mg/kg	0.005	0.003	0.003	0.003	0.003	0.003	0.001	0.001	0.001	0.001	0.001
Arsenic	mg/kg	0.05	0.23	0.16	0.21	0.14	0.21	0.05	0.04	0.03	0.04	0.03
Barium	mg/kg	0.05	13.36	0.96	1.29	1.29	1.22	3.81	4.08	3.33	1.58	2.68
Beryllium	mg/kg	0.005	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
Bismuth	mg/kg	0.05	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Boron	mg/kg	0.05	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Cadmium	mg/kg	0.0005	0.0676	0.0090	0.0100	0.0082	0.0124	0.0131	0.0202	0.0186	0.0063	0.0071
Calcium	mg/kg	2	15547	12603	14058	11726	15561	20159	22029	16182	12843	15490
Chromium	mg/kg	0.05	0.11	0.04	0.14	0.05	0.03	0.03	0.03	0.01	0.02	0.02
Cobalt	mg/kg	0.005	0.050	0.016	0.021	0.016	0.021	0.003	0.005	0.004	0.005	0.005
Copper	mg/kg	0.05	0.78	1.87	3.93	0.87	0.41	0.54	0.47	0.59	0.65	0.51
Iron	mg/kg	1	45	15	36	13	14	11	18	18	12	15
Lead	mg/kg	0.005	0.755	0.128	0.431	0.091	0.074	0.353	0.328	0.321	0.154	0.220
Lithium	mg/kg	0.005	0.022	0.038	0.032	0.033	0.035	0.075	0.080	0.052	0.032	0.066
Magnesium	mg/kg	0.5	544.4	398.4	425.9	380.7	435.0	640.3	636.6	489.7	454.3	452.8
Manganese	mg/kg	0.05	108.80	10.52	15.51	13.24	17.14	18.17	21.72	20.95	12.38	14.69
Mercury	mg/kg	0.01	0.41	0.27	0.28	0.33	0.28	0.30	0.35	0.24	0.27	0.24
Molybdenum	mg/kg	0.005	0.049	0.011	0.010	0.009	0.013	0.009	0.006	0.007	0.005	0.007
Nickel	mg/kg	0.05	0.15	0.11	0.14	0.10	0.09	0.01	0.01	0.01	0.01	0.01
Potassium	mg/kg	2	4440	2882	3126	2966	3035	3125	3016	2701	2979	2628
Rubidium	mg/kg	0.005	14.418	14.163	12.722	13.118	13.159	8.412	9.600	6.907	16.707	8.119
Selenium	mg/kg	0.05	0.97	0.49	0.50	0.67	0.85	0.52	0.46	0.54	0.38	0.58
Silver	mg/kg	0.005	0.008	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
Sodium	mg/kg	2	1260	783	860	717	895	1093	1147	998	916	812
Strontium	mg/kg	0.05	73.57	43.27	52.79	45.83	55.24	89.39	93.03	75.52	54.33	70.07
Tellurium	mg/kg	0.005	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
Thallium	mg/kg	0.005	0.007	0.008	0.008	0.008	0.006	0.009	0.006	0.006	0.009	0.004
Tin	mg/kg	0.005	0.003	0.016	0.133	0.003	0.003	0.006	0.003	0.003	0.009	0.012
Uranium	mg/kg	0.005	0.010	0.003	0.003	0.003	0.003	0.003	0.001	0.002	0.001	0.001
Vanadium	mg/kg	0.05	0.08	0.06	0.10	0.10	0.14	0.18	0.28	0.19	0.04	0.11
Zinc	mg/kg	0.05	25.63	19.23	21.05	15.31	18.40	21.72	18.10	23.36	23.34	18.30
Moisture	g/100g	0.3	74.62	73.74	72.98	71.50	73.08	72.12	73.04	72.10	74.67	72.17
Fat (Acid Hydrolysis)	g/100g	0.5	3.93	3.24	4.37	5.99	3.91	2.89	3.49	4.86	4.09	7.00
Selenium (dry wt)	mg/kg	0.05	3.82	1.87	1.83	2.33	3.16	1.85	1.72	1.94	1.51	2.07

Table C.5 Summary of Fish Samples Submitted for Tissue Analysis
Beaver Dam Mine
Baseline Aquatic Environment Technical Report
Atlantic Mining NS Inc.
121619250

Sample Number	Sample Weight (g)	Metals	Moisture	Lipids
BD-EXP-WHSC-02	280.09	X	X	X
BD-EXP-WHSC-03	250.03	X	X	X
BD-EXP-WHSC-04	191.61	X	X	X
BD-EXP-WHSC-06	144.47	X	X	X
BD-EXP-WHSC-07	114.16	X	X	X
BD-REF-WHSC-02	266.78	X	X	X
BD-REF-WHSC-03	87.77	X	X	X
BD-REF-WHSC-04	180.06	X	X	X
BD-REF-WHSC-06	533	X	X	X
BD-REF-WHSC-07	223.18	X	X	X
BD-EXP-YEPR-01-CAR	22.28	X	X	X
BD-EXP-YEPR-02-CAR	21.64	X	X	X
BD-EXP-YEPR-03-CAR	21.37	X	X	X
BD-EXP-YEPR-07-CAR	26.41	X	X	X
BD-EXP-YEPR-21-CAR	25.08	X	X	X
BD-REF-YEPR-21-CAR	27.23	X	X	X
BD-REF-YEPR-22-CAR	21.38	X	X	X
BD-REF-YEPR-23-CAR	22.3	X	X	X
BD-REF-YEPR-26-CAR	20.33	X	X	X
BD-REF-YEPR-66-CAR	21.95	X	X	X
BD-EXP-YEPR-01-MUS	11.75	X	X	X
BD-EXP-YEPR-02-MUS	13.23	X	X	X
BD-EXP-YEPR-03-MUS	12.08	X	X	X
BD-EXP-YEPR-07-MUS	15.94	X	X	X
BD-EXP-YEPR-21-MUS	13.49	X	X	X
BD-REF-YEPR-21-MUS	14.88	X	X	X
BD-REF-YEPR-22-MUS	11.4	X	X	X
BD-REF-YEPR-23-MUS	11.97	X	X	X
BD-REF-YEPR-26-MUS	10.7	X	X	X
BD-REF-YEPR-66-MUS	14.32	X	X	X

APPENDIX D

Benthic Invertebrate Community

Jenny Reid
Stantec Consulting Ltd.
845 Prospect Street
Fredericton, N.B.
E3B 2T7

(506) 452-7000

March 12, 2021

Dear Jenny,

Re: Atlantic Gold, Cameron Flowage EEM, Aquatic Invertebrate Identifications 2020, (Project: 121619250.2000.950.1201)

We have finished the analysis of the 10 aquatic invertebrate samples for the 2020 Atlantic Gold, Cameron flowage, Beaver Dam, EEM, study (Stantec project 121619250.2000.950.1201). Copies of the results, a list of taxonomic references used and our invoice accompany this letter. You may already have received copies of these files by email.

The processing of the 10 Cameron Flowage, Beaver Dam, EEM study aquatic invertebrate samples followed a simple routine we have found acceptable for other Stantec studies. This involved placing each sample into a geological sieve with a 500 um mesh and collecting the field preservative. This preservative was set aside and used to re-preserve the sediments once processing was completed. The samples were then rinsed with tap water to remove any excess preservative. The material retained on the sieve was washed into a clean 2 litre container for processing. This sediment was again flushed with tap water and washed through a stacked series of sieves with a 4 mm mesh placed over a 1 mm mesh and a 500 um mesh. This helped separate the fine particles from the coarse debris and allowed us to sort through each sample quicker. Sediments from each sieve were then washed into smaller 500-1000 ml containers for further processing. The sorting process required the rinsing of small amounts of the sediment into petri-dishes and searching through the sediments for any invertebrates with the assistance of a dissecting microscope at 6 x power. Once sorted the sediments were collected into a 2 litre container. This step was repeated until all the sediments were searched. The sorted sediments were returned to the original containers and preserved with the field preservative. All containers, dishes and sieves were completely scrubbed after each sample was processed to help prevent specimen contamination between samples. We managed to sort 100% of the sediments from this year's study.

As part of the sampling procedures we routinely check our sorting efficiency. For small studies with low density invertebrate communities, such as this study, this may not be warranted but we took the opportunity to resort one sample (Ref R4) and found no additional specimens or 100% sorting efficiency (see attached letter). This result fell within the Federal Government EEM guidelines which indicated the results should be acceptable.

After removal from the sediments the specimens were sorted into like groups and identified to the lowest practical level, species if possible. Chironomidae had representatives slide mounted in glycerine to confirm their identity. Once identified all material was placed into labelled shell vials with neoprene stoppers and re-preserved with 75% ethanol. A voucher collection containing representatives of each taxa identified was compiled for future referral. The resulting data was compiled into EXCEL spreadsheet, AtlanticCameronFlowageRAW2020.xls. A list of taxonomic references used to assist with our identifications was compiled and a copy is attached (CamFlowREF2020).

The ten 2020 Cameron Flowage, Beaver Dam, samples proved to have very dense and somewhat peat-like sediments but very low density and diversity. Only 13 taxa were recorded and density ranging from 1 specimen in EXP R5 up to 26 specimens in REF R5. The samples were well preserved so that is not an issue here. Good water quality organisms such as *Hexagenia*, *Phylocentropus* and *Chaoborus*, were evident in the samples but just in low numbers. It is possible that the fine organic sediment was a poor habitat for organisms but other factors may also be responsible for the low density recorded. Discussions with Jenny Reid pointed to a low pH of 5.7 as possibly inhibiting the invertebrate community. Perhaps seasonal factors, such as many specimens having already emerged before the time-of-capture, could also be at work here. Field notes and observations should be helpful in sorting out these issues.

We hope this short outline will be sufficient for your needs. Feel free to give me a call should you have any questions. Thank you for this opportunity to work with you on this project and we look forward to working with you on other projects again soon.

Regards,

William B. Morton (Bill)

3 Woodridge Drive
Guelph, Ontario N1H 7E3
(519) 763-4396

SITE	EXP					REF				
REP	R1	R2	R3	R4	R5	R1	R2	R3	R4	R5
DATE	20.08.28	20.08.28	20.08.28	20.08.28	20.08.28	20.08.31	20.08.31	20.08.31	20.08.31	20.08.31
% Subsampled	100	100	100	100	100	100	100	100	100	100
TAXA LIST										
INSECTA :										
DIPTERA										
CHAOBORIDAE:										
Chaoborus punctipennis						1	6		6	16
CHIRONOMIDAE: CHIRONOMINAE:										
Chironomus	2									3
Tanytarsus							1			1
CHIRONOMIDAE:TANYPODINAE										
Ablabesmyia annulaya		1								
Procladius	2					2	3	1		5
EPHEMEROPTERA										
CAENIDAE:										
Caenis								1	1	
EPHEMERIDAE										
Hexagenia		3		2						
MEGALOPTERA:										
SIALIDAE:										
Sialis			1							
ODONATA:										
GOMPHIDAE:										
Gomphus (Gomphus) exilis	1									
LIBELLULIDAE:										
Ladona julia					1					
TRICHOPTERA										
DIPSEUDOPSIDAE:										
Phylocentropus								3		1
MOLLUSCA:BIVALVIA										
SPHAERIIDAE										
Pisidium	1		1			1				
NEMATODA		1								
TOTAL NUMBERS	6	5	2	2	1	4	10	5	7	26
TOTAL TAXA	4	3	2	1	1	3	3	3	2	5
Colonial animals not usually included in analysis										
PORIFERA:										
SPONGILLIDAE:										
Spongilla (colonies)					1		1			

Taxonomic References Used for the Identification of
Atlantic Gold, Cameron Flowage, Beaver Dam, EEM aquatic Invertebrates 2020

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WBM, 2021.03.12

APPENDIX E

Water and Sediment Quality Data

Table E.1 Location of Sediment and Water Samples Collected from the Killag River, NS

Beaver Dam Mine

Baseline Aquatic Environment Technical Report

Atlantic Mining NS Inc.

121619250

Matrix	Sample	Coordinates
Sediment	BD-EXP-R1	45.065877 -62.709074
	BD-EXP-R2	45.065980 -62.709613
	BD-EXP-R3	45.065904 -62.710111
	DUPLICATE 1	45.065904 -62.710111
	BD-REF	45.076919 -62.741844
Water	BD-REF	45.076066 -62.743415
	BD-EXP	45.066229 -62.710636
	BD-EXP-SW-DUP	45.066229 -62.710636

Table E.2 2020 Water Chemistry Data From the Killag River, NS
Beaver Dam Mine
Baseline Aquatic Environment Technical Report
Atlantic Mining NS Inc.
121619250

Sampling Date	UNITS	Reportable Detection Limit	CWQG PAL	29-Aug-20	26-Aug-20	26-Aug-20
				BD-REF	BD-EXP	BD-EXP-SW-DUP
Calculated Parameters						
Anion Sum	me/L	N/A	-	0.11	0.1	0.1
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	1.0	-	<1.0	<1.0	<1.0
Calculated TDS	mg/L	1	-	10	10	9
Carb. Alkalinity (calc. as CaCO3)	mg/L	1.0	-	<1.0	<1.0	<1.0
Cation Sum	me/L	N/A	-	0.21	0.23	0.21
Hardness (CaCO3)	mg/L	1.0	-	3	3.6	3.5
Ion Balance (% Difference)	%	N/A	-	31.3	39.4	35.5
Langelier Index (@ 20C)	N/A	N/A	-	NC	NC	NC
Langelier Index (@ 4C)	N/A	N/A	-	NC	NC	NC
Nitrate (N)	mg/L	0.050	-	<0.050	<0.050	<0.050
Saturation pH (@ 20C)	N/A	N/A	-	NC	NC	NC
Saturation pH (@ 4C)	N/A	N/A	-	NC	NC	NC
Inorganics						
Total Alkalinity (Total as CaCO3)	mg/L	5.0	-	<5.0	<5.0	<5.0
Dissolved Chloride (Cl-)	mg/L	1.0	-	3.8	3.4	3.4
Colour	TCU	25	-	130	110	110
Nitrate + Nitrite (N)	mg/L	0.050	-	<0.050	<0.050	<0.050
Nitrite (N)	mg/L	0.010	0.06	<0.010	<0.010	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	0.050	4	0.051	<0.050	<0.050
Total Organic Carbon (C)	mg/L	0.5	-	13	12	13[a]
Orthophosphate (P)	mg/L	0.010	-	<0.010	<0.010	<0.010
pH	pH	N/A	6.5-9.0	5.6	5.78	5.72
Reactive Silica (SiO2)	mg/L	0.5	-	2	1.4	1.5
Dissolved Sulphate (SO4)	mg/L	2.0	-	<2.0	<2.0	<2.0
Turbidity	NTU	0.1	-	2.7	2.3	2
Conductivity	uS/cm	1	-	21	21	21
Total Suspended Solids	mg/L	2.0	-	3.2	4.0	3.2
Total Cyanide (CN)	mg/L	0.0050	0.005	***<0.0050***	***<0.0050***	***<0.0050***
Radium-226	Bq/L	0.010	-	<0.010	<0.010	<0.010
Metals						
Total Aluminum (Al)	ug/L	5	5-100	**200**	**200**	**190**
Total Antimony (Sb)	ug/L	1.0	-	<1.0	<1.0	<1.0
Total Arsenic (As)	ug/L	1.0	5	1.5	**5.5**	**5.3**
Total Barium (Ba)	ug/L	1.0	-	2.9	2.9	2.7
Total Beryllium (Be)	ug/L	1.0	-	<1.0	<1.0	<1.0
Total Bismuth (Bi)	ug/L	2.0	-	<2.0	<2.0	<2.0
Total Boron (B)	ug/L	50	1500	<50	<50	<50
Total Cadmium (Cd)	ug/L	0.010	0.09	<0.010	<0.010	<0.010
Total Calcium (Ca)	ug/L	100	-	620	790	740
Total Chromium (Cr)	ug/L	1.0	-	<1.0	<1.0	<1.0
Total Cobalt (Co)	ug/L	0.40	-	<0.40	<0.40	<0.40
Total Copper (Cu)	ug/L	0.50	2	<0.50	<0.50	<0.50
Total Iron (Fe)	ug/L	50	300	**670**	**670**	**660**
Total Lead (Pb)	ug/L	0.50	1	<0.50	<0.50	<0.50
Total Magnesium (Mg)	ug/L	100	-	320	360	360
Total Manganese (Mn)	ug/L	2	-	33	37	36
Total Mercury (Hg)	ug/L	0.013	0.026	<0.013	<0.013	<0.013
Total Molybdenum (Mo)	ug/L	2.0	73	<2.0	<2.0	<2.0
Total Nickel (Ni)	ug/L	2.0	25	<2.0	<2.0	<2.0
Total Phosphorus (P)	ug/L	100	-	<100	<100	<100
Total Potassium (K)	ug/L	100	-	160	170	160
Total Selenium (Se)	ug/L	0.50	1	<0.50	<0.50	<0.50
Total Silver (Ag)	ug/L	0.10	0.25	<0.10	<0.10	<0.10
Total Sodium (Na)	ug/L	100	-	2500	2600	2600
Total Strontium (Sr)	ug/L	2.0	-	5.3	6.6	6.9
Total Thallium (Tl)	ug/L	0.10	-	<0.10	<0.10	<0.10
Total Tin (Sn)	ug/L	2.0	-	<2.0	<2.0	<2.0
Total Titanium (Ti)	ug/L	2.0	-	3.1	3.8	4.3
Total Uranium (U)	ug/L	0.10	15	<0.10	<0.10	<0.10
Total Vanadium (V)	ug/L	2.0	-	<2.0	<2.0	<2.0
Total Zinc (Zn)	ug/L	5.0	7	<5.0	<5.0	<5.0
Dissolved Aluminum (Al)	ug/L	5	-	190	180	180
Dissolved Antimony (Sb)	ug/L	1.0	-	<1.0	<1.0	<1.0
Dissolved Arsenic (As)	ug/L	1.0	-	1.3	4.8	4.7
Dissolved Barium (Ba)	ug/L	1.0	-	3.1	3.0	2.8
Dissolved Beryllium (Be)	ug/L	1.0	-	<1.0	<1.0	<1.0
Dissolved Bismuth (Bi)	ug/L	2.0	-	<2.0	<2.0	<2.0
Dissolved Boron (B)	ug/L	50	-	<50	<50	<50
Dissolved Cadmium (Cd)	ug/L	0.01	-	0.011	<0.010	0.011
Dissolved Calcium (Ca)	ug/L	100	-	650	800	780
Dissolved Chromium (Cr)	ug/L	1.0	-	<1.0	<1.0	<1.0
Dissolved Cobalt (Co)	ug/L	0.40	-	<0.40	<0.40	<0.40
Dissolved Copper (Cu)	ug/L	0.50	-	<0.50	<0.50	<0.50
Dissolved Iron (Fe)	ug/L	50	-	580	540	510
Dissolved Lead (Pb)	ug/L	0.50	-	<0.50	<0.50	<0.50
Dissolved Magnesium (Mg)	ug/L	100	-	340	400	380
Dissolved Manganese (Mn)	ug/L	2	-	36	38	37

Table E.2 2020 Water Chemistry Data From the Killag River, NS
Beaver Dam Mine
Baseline Aquatic Environment Technical Report
Atlantic Mining NS Inc.
121619250

Sampling Date	UNITS	Reportable Detection Limit	CWQG PAL	29-Aug-20	26-Aug-20	26-Aug-20
				BD-REF	BD-EXP	BD-EXP-SW-DUP
Dissolved Mercury (Hg)	ug/L	0.013	0.026	<0.013	<0.013	<0.013
Dissolved Molybdenum (Mo)	ug/L	2.0	-	<2.0	<2.0	<2.0
Dissolved Nickel (Ni)	ug/L	2.0	-	<2.0	<2.0	<2.0
Dissolved Phosphorus (P)	ug/L	100	-	<100	<100	<100
Dissolved Potassium (K)	ug/L	100	-	160	180	160
Dissolved Selenium (Se)	ug/L	0.50	-	<0.50	<0.50	<0.50
Dissolved Silver (Ag)	ug/L	0.10	-	<0.10	<0.10	<0.10
Dissolved Sodium (Na)	ug/L	100	-	2700	3000	2700
Dissolved Strontium (Sr)	ug/L	2.0	-	5.6	7.1	7.3
Dissolved Thallium (Tl)	ug/L	0.10	-	<0.10	<0.10	<0.10
Dissolved Tin (Sn)	ug/L	2.0	-	<2.0	<2.0	<2.0
Dissolved Titanium (Ti)	ug/L	2.0	-	2.6	2.9	2.4
Dissolved Uranium (U)	ug/L	0.10	-	<0.10	<0.10	<0.10
Dissolved Vanadium (V)	ug/L	2.0	-	<2.0	<2.0	<2.0
Dissolved Zinc (Zn)	ug/L	5.0	-	<5.0	5.5	<5.0

Notes:
[a] Reporting limit is 5 mg/L due to sample matrix
N/C = not calculated
N/A = not applicable
Exceedance of the applied guidelines
RDL is equal to or > guideline value ***<0.010***

Table E.3 2020 Sediment Chemistry Data From the Killag River, NS
Beaver Dam Mine
Baseline Aquatic Environment Technical Report
Atlantic Mining NS Inc.
121619250

				Sampling Date	30-Aug-20	21-Sep-20	21-Sep-20	21-Sep-20	21-Sep-20
	UNITS	RDL	ISQG	CSQG PEL	BD-REF	BD-EXP-R1	BD-EXP-R2	BD-EXP-R3	DUPLICATE 1
Metals									
Acid Extractable Aluminum (Al)	mg/kg	10	-	-	9700	8900	8400	9500	9500
Acid Extractable Antimony (Sb)	mg/kg	2	-	-	<2.0	<2.0	<2.0	<2.0	<2.0
Acid Extractable Arsenic (As)	mg/kg	2	5.9	17	3.9	**21**	**17**	**24**	**23**
Acid Extractable Barium (Ba)	mg/kg	5	-	-	26	42	28	46	44
Acid Extractable Beryllium (Be)	mg/kg	2	-	-	<2.0	<2.0	<2.0	<2.0	<2.0
Acid Extractable Bismuth (Bi)	mg/kg	2	-	-	<2.0	<2.0	<2.0	<2.0	<2.0
Acid Extractable Boron (B)	mg/kg	50	-	-	<50	<50	<50	<50	<50
Acid Extractable Cadmium (Cd)	mg/kg	0.3	0.6	3.5	0.41	0.37	<0.30	0.41	0.46
Acid Extractable Chromium (Cr)	mg/kg	2	37.3	90	16	9.7	10	9.9	10
Acid Extractable Cobalt (Co)	mg/kg	1	-	-	4	2.9	3.3	2.9	3
Acid Extractable Copper (Cu)	mg/kg	2	35.7	197	8.3	9.9	6.9	11	11
Acid Extractable Iron (Fe)	mg/kg	50	-	-	11000	8200	9800	7900	7600
Acid Extractable Lead (Pb)	mg/kg	0.5	35	91.3	9.1	19	15	19	20
Acid Extractable Lithium (Li)	mg/kg	2	-	-	19	7.9	10	7.6	7.7
Acid Extractable Manganese (Mn)	mg/kg	2	-	-	150	150	170	160	160
Acid Extractable Mercury (Hg)	mg/kg	0.1	0.17	0.486	0.11	**0.49**	**0.33**	**0.62**	**0.61**
Acid Extractable Molybdenum (Mo)	mg/kg	2	-	-	<2.0	<2.0	<2.0	<2.0	<2.0
Acid Extractable Nickel (Ni)	mg/kg	2	-	-	8.9	10	10	10	10
Acid Extractable Rubidium (Rb)	mg/kg	2	-	-	5.9	4.5	4.4	5.3	4.9
Acid Extractable Selenium (Se)	mg/kg	0.5	-	-	0.93	2.1	1.3	2.3	2.4
Acid Extractable Silver (Ag)	mg/kg	0.5	-	-	<0.50	<0.50	<0.50	<0.50	<0.50
Acid Extractable Strontium (Sr)	mg/kg	5	-	-	8.5	21	12	23	20
Acid Extractable Thallium (Tl)	mg/kg	0.1	-	-	<0.10	<0.10	<0.10	<0.10	<0.10
Acid Extractable Tin (Sn)	mg/kg	1		-	<1.0	1.3	<1.0	1.1	1.3
Acid Extractable Uranium (U)	mg/kg	0.1	-	-	0.52	0.88	0.68	1	1
Acid Extractable Vanadium (V)	mg/kg	2	-	-	18	9.4	9.9	9.7	10
Acid Extractable Zinc (Zn)	mg/kg	5	123	315	47	38	43	41	49
Organic Carbon (TOC)	g/kg	0.5	-	-	100	250	170	260	260
Particle Size									
< -1 Phi (2 mm)	%	0.5		-	96[a]	100	100[b]	100	100[a]
< 0 Phi (1 mm)	%	0.1		-	91[a]	100[a]	99[a]	100	99[a]
< +1 Phi (0.5 mm)	%	0.1		-	83[a]	98[a]	96[a]	100	99
< +2 Phi (0.25 mm)	%	0.1		-	64[a]	94[a]	84[a]	97	96
< +3 Phi (0.12 mm)	%	0.1		-	43	88	62	92	91
< +4 Phi (0.062 mm)	%	0.1		-	31	81	50	89	87
< +5 Phi (0.031 mm)	%	0.1		-	27	75	42	85	84
< +6 Phi (0.016 mm)	%	0.1		-	22	65	36	79	77
< +7 Phi (0.0078 mm)	%	0.1		-	17	48	26	57	60
< +8 Phi (0.0039 mm)	%	0.1		-	16	41	23	51	50
< +9 Phi (0.0020 mm)	%	0.1		-	15	28	18	39	40
Gravel	%	0.1		-	3.9	<0.10	0.34	<0.10	0.44
Sand	%	0.1		-	65	19	50	11	12
Silt	%	0.1		-	16	40	27	38	37
Clay	%	0.1		-	16	41	23	51	50

Notes:

[a] Fraction contained organic matter

[b] Fraction contained organic matter and one small rock

RDL = Reportable Detection Limit

ISQG = CCME Sediment Quality Guidelines for the Protection of Aquatic Life, Interim Sediment Quality Guidelines [Freshwater]

CSQG PEL = CCME Sediment Quality Guidelines for the Protection of Aquatic Life, Probable Effects Levels [Freshwater]

#	Exceedance of the ISQG
	Exceedance of the ISQC and the PEL

Table E.4 QA/QC Calculations for Water Chemistry Data
Beaver Dam Mine
Baseline Aquatic Environment Technical Report
Atlantic Mining NS Inc.
121619250

Sampling Date	UNITS	RDL	26-Aug-20	26-Aug-20	RPD
			BD-EXP	BD-EXP-SW-DUP	
Calculated Parameters					
Anion Sum	me/L	N/A	0.1	0.1	0%
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	1.0	<1.0	<1.0	nc
Calculated TDS	mg/L	1	10	9	11%
Carb. Alkalinity (calc. as CaCO3)	mg/L	1.0	<1.0	<1.0	nc
Cation Sum	me/L	N/A	0.23	0.21	9%
Hardness (CaCO3)	mg/L	1.0	3.6	3.5	nc
Ion Balance (% Difference)	%	N/A	39.4	35.5	10%
Langelier Index (@ 20C)	N/A	N/A	NC	NC	nc
Langelier Index (@ 4C)	N/A	N/A	NC	NC	nc
Nitrate (N)	mg/L	0.050	<0.050	<0.050	nc
Saturation pH (@ 20C)	N/A	N/A	NC	NC	nc
Saturation pH (@ 4C)	N/A	N/A	NC	NC	nc
Inorganics					
Total Alkalinity (Total as CaCO3)	mg/L	5.0	<5.0	<5.0	nc
Dissolved Chloride (Cl-)	mg/L	1.0	3.4	3.4	nc
Colour	TCU	25	110	110	nc
Nitrate + Nitrite (N)	mg/L	0.050	<0.050	<0.050	nc
Nitrite (N)	mg/L	0.010	<0.010	<0.010	nc
Nitrogen (Ammonia Nitrogen)	mg/L	0.050	<0.050	<0.050	nc
Total Organic Carbon (C)	mg/L	0.5	12	13	8%
Orthophosphate (P)	mg/L	0.010	<0.010	<0.010	nc
pH	pH	N/A	5.78	5.72	1%
Reactive Silica (SiO2)	mg/L	0.5	1.4	1.5	nc
Dissolved Sulphate (SO4)	mg/L	2.0	<2.0	<2.0	nc
Turbidity	NTU	0.1	2.3	2	14%
Conductivity	uS/cm	1	21	21	0%
Total Suspended Solids	mg/L	2.0	4.0	3.2	nc
Total Cyanide (CN)	mg/L	0.0050	<0.0050	<0.0050	nc
Radium-226	Bq/L	0.010	<0.010	<0.010	nc
Metals					
Total Aluminum (Al)	ug/L	5	200	190	5%
Total Antimony (Sb)	ug/L	1.0	<1.0	<1.0	nc
Total Arsenic (As)	ug/L	1.0	5.5	5.3	4%
Total Barium (Ba)	ug/L	1.0	2.9	2.7	nc
Total Beryllium (Be)	ug/L	1.0	<1.0	<1.0	nc
Total Bismuth (Bi)	ug/L	2.0	<2.0	<2.0	nc
Total Boron (B)	ug/L	50	<50	<50	nc
Total Cadmium (Cd)	ug/L	0.010	<0.010	<0.010	nc
Total Calcium (Ca)	ug/L	100	790	740	7%
Total Chromium (Cr)	ug/L	1.0	<1.0	<1.0	nc
Total Cobalt (Co)	ug/L	0.40	<0.40	<0.40	nc
Total Copper (Cu)	ug/L	0.50	<0.50	<0.50	nc
Total Iron (Fe)	ug/L	50	670	660	2%
Total Lead (Pb)	ug/L	0.50	<0.50	<0.50	nc
Total Magnesium (Mg)	ug/L	100	360	360	nc
Total Manganese (Mn)	ug/L	2	37	36	3%
Total Mercury (Hg)	ug/L	0.013	<0.013	<0.013	nc
Total Molybdenum (Mo)	ug/L	2.0	<2.0	<2.0	nc
Total Nickel (Ni)	ug/L	2.0	<2.0	<2.0	nc
Total Phosphorus (P)	ug/L	100	<100	<100	nc
Total Potassium (K)	ug/L	100	170	160	nc
Total Selenium (Se)	ug/L	0.50	<0.50	<0.50	nc
Total Silver (Ag)	ug/L	0.10	<0.10	<0.10	nc
Total Sodium (Na)	ug/L	100	2600	2600	0%
Total Strontium (Sr)	ug/L	2.0	6.6	6.9	nc
Total Thallium (Tl)	ug/L	0.10	<0.10	<0.10	nc
Total Tin (Sn)	ug/L	2.0	<2.0	<2.0	nc
Total Titanium (Ti)	ug/L	2.0	3.8	4.3	nc
Total Uranium (U)	ug/L	0.10	<0.10	<0.10	nc
Total Vanadium (V)	ug/L	2.0	<2.0	<2.0	nc
Total Zinc (Zn)	ug/L	5.0	<5.0	<5.0	nc
Dissolved Aluminum (Al)	ug/L	5	180	180	0%
Dissolved Antimony (Sb)	ug/L	1.0	<1.0	<1.0	nc
Dissolved Arsenic (As)	ug/L	1.0	4.8	4.7	nc
Dissolved Barium (Ba)	ug/L	1.0	3.0	2.8	nc
Dissolved Beryllium (Be)	ug/L	1.0	<1.0	<1.0	nc
Dissolved Bismuth (Bi)	ug/L	2.0	<2.0	<2.0	nc
Dissolved Boron (B)	ug/L	50	<50	<50	nc
Dissolved Cadmium (Cd)	ug/L	0.01	0.005	0.011	nc

Table E.4 QA/QC Calculations for Water Chemistry Data
Beaver Dam Mine
Baseline Aquatic Environment Technical Report
Atlantic Mining NS Inc.
121619250

Sampling Date	UNITS	RDL	26-Aug-20	26-Aug-20	RPD
			BD-EXP	BD-EXP-SW-DUP	
Dissolved Calcium (Ca)	ug/L	100	800	780	3%
Dissolved Chromium (Cr)	ug/L	1.0	<1.0	<1.0	nc
Dissolved Cobalt (Co)	ug/L	0.40	<0.40	<0.40	nc
Dissolved Copper (Cu)	ug/L	0.50	<0.50	<0.50	nc
Dissolved Iron (Fe)	ug/L	50	540	510	6%
Dissolved Lead (Pb)	ug/L	0.50	<0.50	<0.50	nc
Dissolved Magnesium (Mg)	ug/L	100	400	380	nc
Dissolved Manganese (Mn)	ug/L	2	38	37	3%
Dissolved Mercury (Hg)	ug/L	0.013	<0.013	<0.013	nc
Dissolved Molybdenum (Mo)	ug/L	2.0	<2.0	<2.0	nc
Dissolved Nickel (Ni)	ug/L	2.0	<2.0	<2.0	nc
Dissolved Phosphorus (P)	ug/L	100	<100	<100	nc
Dissolved Potassium (K)	ug/L	100	180	160	nc
Dissolved Selenium (Se)	ug/L	0.50	<0.50	<0.50	nc
Dissolved Silver (Ag)	ug/L	0.10	<0.10	<0.10	nc
Dissolved Sodium (Na)	ug/L	100	3000	2700	11%
Dissolved Strontium (Sr)	ug/L	2.0	7.1	7.3	nc
Dissolved Thallium (Tl)	ug/L	0.10	<0.10	<0.10	nc
Dissolved Tin (Sn)	ug/L	2.0	<2.0	<2.0	nc
Dissolved Titanium (Ti)	ug/L	2.0	2.9	2.4	nc
Dissolved Uranium (U)	ug/L	0.10	<0.10	<0.10	nc
Dissolved Vanadium (V)	ug/L	2.0	<2.0	<2.0	nc
Dissolved Zinc (Zn)	ug/L	5.0	5.5	2.5	nc

Note: nc = not calculated

Table E.5 QA/QC Calculations for Sediment Chemistry Data
Beaver Dam Mine
Baseline Aquatic Environment Technical Report
Atlantic Mining NS Inc.
121619250

Sampling Date			21-Sep-20	21-Sep-20	Relative Percent Difference
	UNITS	RDL	BD-EXP-R3	DUPLICATE 1	
Metals					
Acid Extractable Aluminum (Al)	mg/kg	10	9500	9500	0%
Acid Extractable Antimony (Sb)	mg/kg	2	<2.0	<2.0	nc
Acid Extractable Arsenic (As)	mg/kg	2	24	23	4%
Acid Extractable Barium (Ba)	mg/kg	5	46	44	4%
Acid Extractable Beryllium (Be)	mg/kg	2	<2.0	<2.0	nc
Acid Extractable Bismuth (Bi)	mg/kg	2	<2.0	<2.0	nc
Acid Extractable Boron (B)	mg/kg	50	<50	<50	nc
Acid Extractable Cadmium (Cd)	mg/kg	0.3	0.41	0.46	nc
Acid Extractable Chromium (Cr)	mg/kg	2	9.9	10	nc
Acid Extractable Cobalt (Co)	mg/kg	1	2.9	3	nc
Acid Extractable Copper (Cu)	mg/kg	2	11	11	0%
Acid Extractable Iron (Fe)	mg/kg	50	7900	7600	4%
Acid Extractable Lead (Pb)	mg/kg	0.5	19	20	5%
Acid Extractable Lithium (Li)	mg/kg	2	7.6	7.7	nc
Acid Extractable Manganese (Mn)	mg/kg	2	160	160	0%
Acid Extractable Mercury (Hg)	mg/kg	0.1	0.62	0.61	2%
Acid Extractable Molybdenum (Mo)	mg/kg	2	<2.0	<2.0	nc
Acid Extractable Nickel (Ni)	mg/kg	2	10	10	0%
Acid Extractable Rubidium (Rb)	mg/kg	2	5.3	4.9	nc
Acid Extractable Selenium (Se)	mg/kg	0.5	2.3	2.4	nc
Acid Extractable Silver (Ag)	mg/kg	0.5	<0.50	<0.50	nc
Acid Extractable Strontium (Sr)	mg/kg	5	23	20	nc
Acid Extractable Thallium (Tl)	mg/kg	0.1	<0.10	<0.10	nc
Acid Extractable Tin (Sn)	mg/kg	1	1.1	1.3	nc
Acid Extractable Uranium (U)	mg/kg	0.1	1	1	0%
Acid Extractable Vanadium (V)	mg/kg	2	9.7	10	nc
Acid Extractable Zinc (Zn)	mg/kg	5	41	49	18%
Organic Carbon (TOC)	g/kg	0.5	260	260	0%
Particle Size					
< -1 Phi (2 mm)	%	0.5	100	100	0%
< 0 Phi (1 mm)	%	0.1	100	99	1%
< +1 Phi (0.5 mm)	%	0.1	100	99	1%
< +2 Phi (0.25 mm)	%	0.1	97	96	1%
< +3 Phi (0.12 mm)	%	0.1	92	91	1%
< +4 Phi (0.062 mm)	%	0.1	89	87	2%
< +5 Phi (0.031 mm)	%	0.1	85	84	1%
< +6 Phi (0.016 mm)	%	0.1	79	77	3%
< +7 Phi (0.0078 mm)	%	0.1	57	60	5%
< +8 Phi (0.0039 mm)	%	0.1	51	50	2%
< +9 Phi (0.0020 mm)	%	0.1	39	40	3%
Gravel	%	0.1	0.05	0.44	nc
Sand	%	0.1	11	12	9%
Silt	%	0.1	38	37	3%
Clay	%	0.1	51	50	2%

Note: nc = not calculated

APPENDIX B
SUMMARY OF EFFECTS ASSESSMENT MITIGATIONS

Table B-1: Summary of Key Mitigation Measures by Valued Component

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
• **Noise**		
• C, O	• Operations, infrastructure, and property boundaries for the Beaver Dam Mine have been updated to mitigate predicted noise levels at the property line. The following noise mitigation measures are incorporated into the current design of the Beaver Dam Mine: • The pit entrance/exit has been relocated to the west side of the pit, farther from the northeast property boundary. • No more than four drills will operate concurrently during any day, evening or nighttime hour. • Increase the height of the safety berm along the north boundary of the pit.	• 6.1.7.3.2
• C, O	• Restrict blasting to a specific and regular daytime schedule during weekdays. Specifically, blasting will not be undertaken on Sundays, or statutory holidays (NSEL 1999)	• 6.1.8
• C	• Haul road construction will be restricted to the day and evening periods	• 6.1.8
• O	• Implement safety berm along the north boundary of the pit, with maximum height in accordance with the constraints of topography and mine infrastructure requirements, and respecting wetlands and watercourse buffers.	• 6.1.8
• O	• Operating hours for trucking on the Haul Road will be restricted to the day and evening periods only (7:00 AM to 11:00 PM)	• 6.1.8
• O	• Maximum 4 drills will operate at the Beaver Dam Mine Site pit at any time during the Operation Phase of the Project.	• 6.1.8
• C, O, CL	• Implement preventative maintenance plans for all mobile and stationary equipment.	• 6.1.8
• C, O, CL	• Noise-reduction as criteria in equipment selection.	• 6.1.8
• C, O	• Communicate general blasting schedule to the local community.	• 6.1.8
• C	• Consider the use of natural landforms when available as noise barriers when designing final site details and when placing fixed equipment.	• 6.1.8
• O	• Regular check by site manager for excessive noise on site and in relation to sensitive receptors so that resolution can be timely.	• 6.1.8
• C, O	• Speed reduction.	• 6.1.8
• C, O	• Use equipment that meets appropriate noise emission standards for off-road diesel equipment.	• 6.1.8
• C, O	• Subcontractor agreements will include an obligation to comply with environmental protection including noise reduction.	• 6.1.8
• C, O	• Site design to reduce need for reversing and vehicle reversing alarms.	• 6.1.8
• C, O	• A procedure, including a response plan, will be available for public to be able to register complaints regarding noise concerns.	• 6.1.8

Table B-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
• **Air**		
• C, O	• Use wet suppression controls on unpaved surfaces.	• 6.2.8
• C, O	• Utilize paved surfaces where available.	• 6.2.8
• C, O	• Speed reduction.	• 6.2.8
• O	• Apply stabilized covers on inactive stockpiles.	• 6.2.8
• O	• Apply dust suppressants, when and where practicable, to target 80 to 90% percent effectiveness.	• 6.2.8
• O	• Size haul vehicles appropriately to minimize trip frequency.	• 6.2.8
• O	• Cover haul trucks to minimize dust during transportation between the mine site and the Touquoy facility.	• 6.2.8
• O	• Implement Dust Suppression Plan as part of the Fugitive Dust Control Plan (Appendix C.3).	• 6.2.8
• O	• A procedure, including a response plan, will be available for public to be able to register complaints regarding dust concerns.	• 6.2.8
• CL	• Stabilize slopes on inactive stockpiles to a safe and long-term angle of repose.	• 6.2.8
• CL	• Use soil and organics stockpiles for final capping and stabilization. Hydroseed as required.	• 6.2.8
• **Light**		
• C	• Temporary lighting will be directly focused on work areas and shielded where practicable to avoid light trespass	• 6.3.8
• C, O, CL	• Use of only downward-facing lights on site infrastructure and Mine Site roads	• 6.3.8
	• Install motion-sensing lights, where practicable	• 6.3.8
	• Only use direct and focused light when needed for worker safety	• 6.3.8
	• All floodlights will employ full horizontal cutoff, as appropriate	• 6.3.8
	• Lighting not in use will be turned off, whenever practicable	• 6.3.8
	• Site perimeter lighting will be directed to minimize light offsite light trespass	• 6.3.8
	• Utilize efficient sources of light to reduce overall magnitude of light, wherever practicable	• 6.3.8
	• A procedure, including a response plan, will be available for public to be able to register complaints regarding light concerns	• 6.3.8
• **Greenhouse Gases**		
• C, O, CL	• Limit engine idling where practicable.	• 6.4.8
• C, O, CL	• Implement fuel efficiencies where practicable.	• 6.4.8
• C, O, CL	• Implement preventative maintenance plans for all mobile and stationary equipment.	• 6.4.8
• C, O, CL	• Use renewable energy where reasonable (e.g., solar-powered lights).	• 6.4.8

Table B-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
• **Geology, Soils and Sediment**		
• C, O, CL	• Use of the following routine controls, as needed: • Silt fences • Silt curtains • Riprap • Check dams • Settling ponds	• 6.5.8
• C, O, CL	• Segregate and manage waste rock with the potential for acid generation	• 6.5.8
• C, O	• Implement Erosion and Sediment Control Plan	• 6.5.8, Appendix C of Appendix P.4 (Mine Water Management Plan)
• C, O	• Secure overburden stockpiles using a combination of mulching, hydroseeding, and slope stabilization	• 6.5.8
• C, O, CL	• Limit exposed soil	• 6.5.8
• CL	• Use soil and organics stockpiles for final capping and stabilization. Hydroseed as required	• 6.5.8
• **Groundwater**		
• C	• Conduct pre-construction well survey at Beaver Lake IR 17.	• 6.6.8
• C, O	• Use above ground fuel storage tanks that meet applicable regulatory standards.	• 6.6.8
• C, O	• Select appropriate type of explosive that will minimize nitrogen release to surface water and groundwater. An explosive management plan will be developed prior to construction and a Nitrogen Management Plan will be developed with site specific adaptive management measures in the event that Nitrogen levels exceed predictions.	• 6.6.8
• C, O, CL	• Sub-aqueous deposition of mine tailings to reduce/prevent oxides and leaching.	• 6.6.8
• CL	• 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 an engineered cover to reduce infiltration and oxidation thereby limiting potential acid drainage.	• 6.6.8
• C, O, CL	• 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 2 pathway specific guidelines or groundwater baseline/background prior to seepage discharging into surface waterbodies.	• 6.6.8
• C, O	• Use blasting and pit construction techniques that minimize the potential for negatively interacting the adjacent groundwater table and nearby surface water	• 6.6.8
• C, O	• Implement water conservation program for onsite facilities.	• 6.6.8
• C, O	• Recycle site water for reuse wherever practical to reduce water withdrawal from lakes or streams.	• 6.6.8
• C, O	• Recycled water must meet acceptable water quality criteria for its intended use.	• 6.6.8
• **Surface Water**		

Table B-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
• C, O, CL	• Use of the following structures, as needed: • Silt fences • Silt curtains • Riprap • Check dams	• 6.7.9, Appendix P.4 (Mine Water Management Plan)
• C, O, CL	• Limit exposed soil	• 6.7.9
• C, O	• Implement Erosion and Sediment Control Plan	• 6.7.9
• O, CL	• Segregate and manage waste rock with the potential for acid generation	• 6.7.9
• O	• Use adequately sized settling and containment ponds as required	• 6.7.9
• O	• Use flocculants and coagulants as required	• 6.7.9
• C, O	• Install perimeter ditches around site infrastructure	• 6.7.9
• O	• Provide appropriate settling time for suspended solids prior to discharge	• 6.7.9
• O	• Ensure pit water meets applicable regulatory quality criteria for discharge – otherwise treat water prior to discharge	• 6.7.9
• O	• Direct drainage ditches to designated settling ponds or other locations	• 6.7.9
• C, O	• Use above ground fuel storage tanks that meet applicable regulatory standards	• 6.7.9
• C, O	• Select appropriate type of explosive that will minimize nitrogen release to surface water and groundwater	• 6.7.9
• C, O	• Implement Surface Water Management Plan	• 6.7.9, Appendix P.4 (Mine Water Management Plan)
• C, O	• Develop and implement an Emergency Response Spill Contingency Plan	• 6.7.9
• C, O	• Use clean, non-ore-bearing, non-watercourse derived and non-toxic materials for erosion control methods	• 6.7.9
• C, O, CL	• Sub-aqueous deposition of mine tailings to reduce/prevent oxides and leaching	• 6.7.9
• CL	• 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	• 6.7.9
• C, O, CL, PC	• Minimize snow deposition into watercourses during snow removal activities	• 6.7.9
• C	• Construct drainage ditches and ponds to maintain natural flow directions when practical	• 6.7.9
• O	• Control release of settling ponds to mimic natural hydrograph, where practicable	• 6.7.9
• O	• Recycle site water for reuse wherever practical to reduce water withdrawal from lakes or streams	• 6.7.9
• O	• Recycled water must meet acceptable water quality criteria for its intended use	• 6.7.9

Table B-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
• C	• Mine infrastructure will be designed to minimize erosion during construction and operations, so as to preserve the stability of the ground surface surrounding mine infrastructure, SWM ditches, settling ponds and conveyance pathways, dykes, berms and any other Mine installations. The potential for scouring downstream of structures and the potential impacts of sudden changes in flow volume will also be considered. Short courses on erosion and sediment control design and inspection will be given to all managers and supervisors prior to mining or construction activities that may cause erosion or sediment movement and deposition. Environmental monitors will participate in a short course or seminar on inspection activities associated with erosion and sediment control. An 'Erosion Awareness and Identification' module will be a component of Mine specific training provided to all workers associated with earthwork mining activities. Principles for the ESCP for the Site include: • 1. Fit the activity to the existing topography, soils, waterways, and natural vegetation of the site • 2. Expose the smallest practical area of land for the shortest possible time • 3. Apply erosion control practices as the primary method to prevent on-site damage • 4. Apply sediment control practices as perimeter protection to prevent off-site damage • 5. Implement a thorough maintenance plan during construction and operations	• Appendix C draft Erosion and Sediment Control Plan of Appendix P.4 (Mine Water Management Plan)
• C	• To prevent discharge of sediment laden water from the Site during construction the first piece of site infrastructure to be constructed is to be the north settling pond. All site water will be directed towards the north settling pond (via an expanding network of surface water ditches or via pumping) prior to discharge until the east settling pond and south settling pond have been constructed. The north settling pond is to be constructed prior to any clearing or grubbing for other components of the Mine Site.	• Appendix C draft Erosion and Sediment Control Plan of Appendix P.4 (Mine Water Management Plan)
• C	• Following the development of the north settling pond, other aspects of the mine will be developed including the open pit, administrative areas, and haul road. Prior to the development of other aspects of the mine the associated mine water infrastructure components are to be developed as well. For example, prior to clearing, grubbing and development of the till and organics stockpile areas the east and south settling ponds must be developed first. The contact water ditch network is to be developed in conjunction with the stockpile and haul road development, starting at the downstream end and working upstream.	• Appendix C draft Erosion and Sediment Control Plan of Appendix P.4 (Mine Water Management Plan)
• O	• Climate change impacts were accounted for in the design of mine water management infrastructure using Nova Scotia Environment climate change projections for the province.	• Section 2.2 Mine Water Management Plan (Appendix P.4)
• O	• All site contact water will be collected into the north settling pond during construction and operations. The north pond will be connected to a robust water treatment system to ensure discharge water quality meets regulatory guidelines. An emergency spillway has been designed to direct excess runoff water into the open pit should an event larger than a 1:100 year storm event occur, to mitigate against the potential release of non-treated contact water from an extreme flood event.	• Mine Water Management Plan (Appendix P.4, Appendix B Hydrologic Modelling Section 4)
• O	• All settling ponds include a filter berm to further improve the removal of TSS prior to discharge into the natural environment	• Section 3.3 Mine Water Management Plan (Appendix P.4)
• O	• The settling ponds have been designed to control discharge for all storm events up to and including the 100-year design storm event over a minimum of duration of 24 hours. All ponds also include an emergency overflow spillway that has been designed to control the largest hurricane on record, Hurricane Beth	• Section 3.3 Mine Water Management Plan (Appendix P.4)

Table B-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
• O	• Contact water ditches are proposed to be lined with impermeable membranes to mitigate against infiltration into the groundwater system	• Section 6.1 Mine Water Management Plan (Appendix P.4)
• O	• Water treatment system used during dewatering of historical tailings (construction period) will remain on-site and connected to the north pond system to be used if it is identified, through on-going monitoring, that discharge water exceeds regulatory discharge requirements	• Section 7.2 Mine Water Management Plan (Appendix P.4)
• O	• The proposed mine development is anticipated to increase streamflow volumes in the Killag River. AMNS will ensure post-development peak discharge does not exceed baseline peak discharge in the Killag River by providing peak flow attenuation through the settling ponds	• Mine Water Management Plan Appendix A Water Balance Analysis Section 6 (Appendix P.4)
• O	• To further mitigate impacts to fish and fish habitat downstream of the settling ponds during more frequent events, all pond outlet structures (including the aeration lagoon) will be equipped with emergency shut-off valves that will be closed if any water quality parameter exceedances are triggered. The east, south and west settling ponds can contain the 10-year 24-hour rain event with no outflow, while the north settling pond can contain up to the 5-year 24-hour event with no outflow.	• Mine Water Management Plan Appendix B Hydrologic Modelling Section 3 (Appendix P.4)
• O	• If the nitrite or metal concentration objectives are exceeded in the east or south settling ponds, the impacted water will be pumped, or collected in a vacuum truck, and transported to the north settling pond for further treatment.	• Mine Water Management Plan Appendix B Hydrologic Modelling Section 3 (Appendix P.4)
• O	• Each settling pond will maintain a permanent pool to the level of the first low flow orifice and will control the three design storms with a minimum detention time of 24 hours. There will be a minimum of 0.3 m of freeboard between the 100-year design event and the emergency spillway invert. • Above the 100-year event, the emergency spillway is designed to pass Hurricane Beth	• Mine Water Management Plan Appendix B Hydrologic Modelling Section 4 (Appendix P.4)
• CL	• The WBM predicts a decrease in streamflow at the Killag River DS assessment point while the pit is being filled with water in PC conditions. AMNS will implement a circular pumping system that uses water collected in the open pit, (including groundwater that is drawn from the Killag River), to mitigate against baseflow reduction in the Killag River caused by the open pit during low flow periods as described in the Baseflow Mitigation Assessment	• Mine Water Management Plan Appendix H Baseflow Mitigation Assessment (Appendix P.4)
• CL	• The north settling pond will remain active during post closure and pit lake filling. The purpose will be to allow for the diversion of flow directly to the Killag River during low flow periods to augment flow volume to maintain environmental flows	• Section 3.3 Mine Water Management Plan (Appendix P.4)
• CL	• The PAG waste rock pile will be capped with an impermeable liner and vegetated to reduce infiltration and seepage of contact water.	• Section 3.3 Mine Water Management Plan (Appendix P.4)

Table B-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
• CL	• As part of the reclamation plan, the LGO stockpile will be removed and surface runoff from this area will be directed back toward Mud Lake to reduce the environmental impact to the lake	• Section 3.3 Mine Water Management Plan (Appendix P.4)
• CL	• Based on the results from the Baseflow Mitigation Study, the discharge point of the Pit Lake has been set to re-establish ~99% of baseflow through this section of Cameron Flowage	• Mine Water Management Plan Appendix H Baseflow Mitigation Assessment (Appendix P.4)
• **Wetlands**		
• C, O, CL	• Complete pre-construction site meetings for all relevant staff/contractors related to working around wetlands and watercourses to minimize unauthorized disturbance, such as the introduction of invasive species	• 6.8.8.2
• C, O, CL	• Implement Erosion and Sediment Control Plan and measures to ensure site runoff is not directed towards wetlands to ensure habitat integrity and existing drainage patterns are maintained.	• 6.8.8.2, Appendix C draft Erosion and Sediment Control Plan of Appendix P.4 (Mine Water Management Plan)
• C, O, CL	• Maintain pre-construction hydrological flows through wetland habitats and partially altered wetlands, wherever practicable	• 6.8.8.2
• C, O, CL	• Topsoil will be salvaged and stored for use in site restoration where practicable.	• 6.8.8.2
• C, O, CL	• Re-vegetate slopes adjacent to wetlands, using native seed mixes, to limit erosion and sediment release	• 6.8.8.2
• C, O, CL	• Implement the Preliminary Wetland Monitoring Plan, as refined through the permitting process.	• 6.8.8.2, Preliminary Wetland Compensation Plan (Appendix H.3)
• C	• Ensure all wetlands are visually delineated (e.g., flagged)	• 6.8.8.2
• C	• Complete detailed design of Haul Road and micro-siting of Beaver Dam Mine Site infrastructure to avoid or minimize impacts to wetlands	• 6.8.8.2
• C	• Implement construction methods that reduce the potential to drain or flood surrounding wetlands	• 6.8.8.2
• C	• Acquire and adhere to wetland alteration permits	• 6.8.8.2
• C	• Detailed culvert design of upgraded/replaced culverts to maintain current hydrology and necessary fish passage.	• 6.8.8.2, 6.9.8.2.3
• C	• Translocation of blue felt lichen and monitoring of lichen SAR where direct and indirect impacts are expected to occur as per the Preliminary Lichen Mitigation and Monitoring Plan.	• 6.8.8.2, 6.10.8, 6.13.8.2, draft Lichen Mitigation and Monitoring Plan (Appendix P.6)
• C	• Complete work within Wetland 64 outside of the breeding season in consideration of greater yellowlegs observations and probable breeding habitat.	• 6.8.8.2, 6.13.8
• C, O	• Direct runoff through natural vegetation, wherever practicable	• 6.8.8.2

Table B-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
• C, O	• Minimize erosion of wetland soils by limiting flow velocities by means of hydraulic dissipation techniques	• 6.8.8.2
• C, O	• Minimize the rutting of wetland habitat by limiting the use of machinery within wetland habitat and use of swamp mats/corduroy bridges as required	• 6.8.8.2
• C, O	• Conduct vegetation management (cutting and clearing) in or near wetlands and watercourses in accordance with applicable guidelines	• 6.8.8.2
• C, O	• Employ measures to reduce the spread of invasive species (particularly by vehicles) into wetlands and retain habitat integrity • Inspect vehicles regularly, particularly vehicles arriving from outside the PA. If necessary, cleaning will be undertaken at a designated cleaning station, away from wetlands and watercourses.	• 6.8.8.2
• CL	• Compensate for permanent loss of wetland function through implementation of the Preliminary Wetland Compensation Plan, subject to NSE approval. The preliminary plan includes: • On-the-ground restoration opportunities to meet a minimum 2:1 ratio and to be completed in a watershed near the Project area to the extent practicable; • Wetland restoration opportunities within the Beaver Dam Mine Site will be considered where practicable; • Other secondary forms of compensation that ECCC and NSE consider valuable to support the wetland conservation program in Nova Scotia; • Collaboration with local community groups and the Mi'kmaq of Nova Scotia to the extent possible; and • Inclusion of a conservation allowance in the Preliminary Wetland Compensation Plan to address restoration of equivalent habitat for wildlife SAR.	• 6.8.8.2, Preliminary Wetland Compensation Plan (Appendix H.3), draft Lichen Mitigation and Monitoring Plan (Appendix P.6)
• CL	• Review and consider alternatives to traditional hydroseeding methods to advance vegetation re-establishment and reclamation methods	• 6.8.8.2
• Post-Closure	• Follow monitoring requirements in wetland alteration permits and final Wetland Monitoring Plan (to be completed at permitting stage).	• 6.8.8.2, Preliminary Wetland Compensation Plan (Appendix H.3)
• **Fish and Fish Habitat**		
• C, O, CL	• 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	• 6.9.8.2.3
• C, O, CL	• Implement a groundwater interceptor trench on the west side of the PAG stockpile, if necessary.	• 6.9.8.2.3
• C, O, CL	• Collect and treat all contact water, as required.	• 6.9.8.2.3
• C, O, CL	• Implement Erosion and Sediment Control Plan	• 6.9.8.2.3, Appendix C draft Erosion and Sediment Control Plan of Appendix P.4 (Mine Water Management Plan)
• C, O, CL	• 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	• 6.9.8.2.3

Table B-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
• C, O, CL	• Complete offsetting for HADD including for permanent loss of fish habitat through fish habitat restoration activities, subject to DFO approval, as required under the *Fisheries Act*	• 6.9.8.2.3, 6.13.8
• C, O, CL	• Develop and implement the Aquatic Effects Monitoring Program (to be completed prior to the permitting stage) to identify and further mitigate any additional adverse impacts to fish and fish habitat	• 6.9.8.2.3
• C, O, CL	• Provide signage on fish habitat streams	• 6.9.8.2.3
• C, O, CL	• Complete micro siting of mine infrastructure to avoid or minimize fish habitat impact as necessary	• 6.9.8.2.3
• C, O, CL	• Complete fish rescue within all fish bearing streams to be impacted by the Project, prior to commencement of mine development, with DFO approval if required	• 6.9.8.2.3
• C, O, CL	• Implement construction methods that reduce potential interaction with fish habitat and limit vegetation clearing around watercourses	• 6.9.8.2.3
• C, O, CL	• Complete culvert installations and upgrades in accordance with the NSE Watercourse Standard (2015) or as updated at time of construction. Limit vegetation clearing	• 6.9.8.2.3, 6.8.9.2
• C, O, CL	• Minimize the removal of vegetation upgradient of watercourses and stabilize shorelines or banks disturbed by any activity associated with Project activities	• 6.9.8.2.3
• C, O, CL	• Minimize the temporal extent of in-stream works as much as practicable	• 6.9.8.2.3
• C, O, CL	• Monitoring of standard mitigations will be supported by the Mine Water Management Plan and Aquatic Effects Monitoring Program (to be submitted as part of the Industrial Approval), both of which will be in place prior to construction activities to minimize possible disturbances of fish and fish habitat.	• 6.9.8.2.3, Appendix P.4 (Mine Water Management Plan)
• C, O	• Maintain 30 m riparian wetland and watercourse buffers, where practicable.	• 6.9.8.2.3
• C, O	• Use vegetated buffers and aquatic vegetation wherever practicable to provide shade to on-site ponds.	• 6.9.8.2.3
• C, O	• Install groundwater pumps to supplement baseflow in Cameron Flowage, if necessary	• 6.9.8.2.3
• C, O	• Follow DFO-advised Measures to avoid causing harm to fish and fish habitat pertaining to blasting (DFO 2019)	• 6.9.8.2.3
• C, O	• A detailed explosive management plan will be developed as part of the permitting process.	• 6.9.8.2.3
• C, O	• Use an emulsion-type explosive that will minimize nitrogen release to surface water and groundwater	• 6.9.8.2.3
• C, O	• Use clean, non-ore-bearing, non-watercourse derived and non-toxic materials for erosion control methods	• 6.9.8.2.3
• C, O	• Incorporate drainage structures, where necessary, to dissipate hydraulic energy and maintain flow velocities sufficiently low to prevent erosion of native soil material	• 6.9.8.2.3
• C, O	• Limit clearing within confirmed fish habitat outside of approved alteration areas to within approved areas.	• 6.9.8.2.3
• C, O	• Acquire and follow watercourse alteration permits	• 6.9.8.2.3, 6.7.9
• C, O	• 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	• 6.9.8.2.3
• C, O	• Locate fueling areas are a minimum of 30 m from waterbodies	• 6.9.8.2.3
• C, O	• Use and maintain properly sized screens on any water intakes or outlet pipes to prevent entrainment or impingement of fish (DFO, 2020)	• 6.9.8.2.3
• C, O	• Ensure that machinery arrives on site in a clean condition and is maintained and free of fluid leaks	• 6.9.8.2.3, 6.18

Table B-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
• C, O	• Develop and implement Mine Water Management Plan	• 6.9.8.2.3, Appendix P.4 (Mine Water Management Plan)
• **Habitat and Flora**		
• C, O	• Intact forest stands and wetlands will be avoided wherever practicable during detailed Project planning and design in favor of previously disturbed areas (e.g., stands disturbed by timber harvesting, roads, or other development).	• 6.10.8
• C, O	• Where natural, intact habitat cannot be avoided, maintain existing vegetation cover whenever practicable and minimize overall areas of disturbance.	• 6.10.8
• C, O	• A wetland alteration application will be submitted during Project planning and design to request an authorization to alter wetland habitat and to address loss of wetland function.	• 6.10.8
• C, O	• 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.	• 6.10.8, Preliminary Wetland Compensation Plan (Appendix H.3)
• C, O	• Topsoil will be salvaged and stored for use in site restoration where possible. Upland and wetland soils should be stockpiled separately.	• 6.10.8
• C, O	• Conduct vegetation management by cutting (e.g., no use of herbicides)	• 6.10.8
• C, O	• Implement Erosion and Sediment Control Plan and measures to ensure site runoff is not directed towards unaltered habitat where possible to ensure existing drainage patterns are maintained.	• 6.10.8, Appendix C of Appendix P.4 (Mine Water Management Plan)
• C, O	• Avoid frequent or unnecessary travel over erosion prone areas through communication with personnel and project planning	• 6.10.8
• C, O	• Monitor dust conditions and implement dust suppression mitigation (refer to air mitigation) when normal precipitation levels are not enough to suppress fugitive dust. In addition to water suppression, provincially approvable chemical dust suppressants will be used along the Haul Road. • Implement Dust Control Plan.	• 6.10.8, Appendix C.3 (draft Fugitive Dust Control Plan)
• C, O	• 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.	• 6.10.8
• C, O	• Winter road maintenance will include conventional snow clearing and deposition of sand for traction control where necessary.	• 6.10.8
• C, O	• Employ measures to reduce the spread of invasive species (particularly by vehicles) and retain habitat integrity. • Inspect vehicles regularly, particularly vehicles arriving from outside the PA. If necessary, cleaning will be undertaken at a designated cleaning station, away from wetlands and watercourses.	• 6.10.8
• C, O	• Confirm Potential Old Growth areas with NSLF and asses possible avoidance through the alternative Haul Road route, dependant on NSLF findings.	• 6.10.8
• C, O	• Consider on-site opportunities for progressive reclamation during construction and operations to avoid viability issues with long-term stockpiling of organic material.	• 6.10.8

Table B-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
• C, O	• Translocation of blue felt lichen and monitoring of lichen SAR where direct and indirect impacts are expected to occur as per the draft Lichen Mitigation and Monitoring Plan.	• 6.8.8.2, 6.10.8, 6.13.8.2, draft Lichen Mitigation Monitoring Plan (Appendix P.6)
• CL	• Hydroseed areas that have erosion potential to return the area to pre-disturbance conditions in a timely fashion upon final reclamation	• 6.10.8
• CL	• Alternatives to traditional hydroseeding methods will be reviewed to advance vegetation re-establishment and reclamation methods. Consideration will be given to native species with Indigenous significance.	• 6.10.8
• CL	• Implement reclamation program within the Beaver Dam Mine Site to re-establish native vegetation communities	• 6.10.8
• CL	• Consider on-site opportunities for progressive reclamation during construction and operations to avoid viability issues with long-term stockpiling of organic material.	• 6.10.8
• **Terrestrial Fauna**		
• C, O	• Provide wildlife awareness training to site personnel to reduce interactions between site personnel and wildlife.	• 6.11.8
• C, O	• Intact forest stands and wetlands will be avoided wherever practicable during detailed Project planning and design in favor of previously disturbed areas (e.g., stands disturbed by timber harvesting, roads, or other development). • Micro-site Haul Road and mine infrastructure to avoid major fauna habitat.	• 6.11.8
• C, O	• Where natural, intact habitat cannot be avoided, maintain existing vegetation cover whenever practicable and minimize overall areas of disturbance.	• 6.11.8
• C, O	• Minimization of impact to old forest.	• 6.11.8, 6.10.8
• C, O	• For those species reliant on wetland habitat, a wetland alteration application will be submitted during Project planning and design to request an authorization to alter wetland habitat and to address loss of wetland function.	• 6.11.8, Preliminary Wetland Compensation Plan (Appendix H.3)
• C, O	• 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.	• 6.11.8, Preliminary Wetland Compensation Plan (Appendix H.3)
• C, O	• Habitat fragmentation will be reduced by limiting the area of new roads, favoring upgrading of existing roads where possible instead.	• 6.11.8
• C, O	• Site infrastructure will be fenced in, where practical, to reduce interactions between Project infrastructure and wildlife.	• 6.11.8
• C, O	• A speed limit of 40 km/hr within the Beaver Dam Mine Site and 70 km/hr along the Haul Road (or not exceeding posted speed limits) will be implemented to reduce likelihood of collisions with fauna.	• 6.11.8
• C, O	• Install signage where specific wildlife concerns have been identified. Vehicles will yield to wildlife on roads.	• 6.11.8
• C, O	• Monitor and manage road conditions through dust suppression and traction control (sand on icy roads) to reduce potential for collisions with wildlife. • Implement Dust Control Plan.	• 6.11.8, Appendix C.3 (draft Fugitive Dust Control Plan)
• C, O	• An un-vegetated buffer of 10 m along roadsides will be maintained, where possible, to improve visibility along roadsides and reduce the potential for collisions with wildlife.	• 6.11.8

Table B-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
• C, O	• Clearing and construction will be limited within wetlands that could support snapping turtles during winter hibernation period	• 6.11.8
• C, O	• Erosion and sediment control planning will be completed to ensure site runoff is not directed towards unaltered habitat. • Implement Erosion and Sediment Control Plan.	• 6.11.8, Appendix C of Appendix P.4 (Mine Water Management Plan)
• C, O	• 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. • Upgrade culverts along the new and upgraded Haul Road sections to improve habitat connectivity.	• 6.11.8, 6.8.8.2
• C, O	• Implement Emergency Response and Spill Contingency Plans to protect fauna and their habitat from accidental spills	• 6.11.8, 6.18
• C, O	• 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).	• 6.11.8, 6.18
• C, O	• Follow the Pit and Quarry Guidelines to reduce impact of noise and vibration on wildlife	• 6.11.8
• C, O	• 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. • Install lights facing downward and wherever practicable using motion-sensing lights.	• 6.11.8, 6.3.8
• C, O	• Consider limiting use of lights that emit more blue shortwave light (e.g., LEDs, metal halides) which have greater impacts to wildlife at night, where practicable and considering operational safety.	• 6.11.8, 6.3.8
• C, O	• Restrict blasting to a specific and regular daytime schedule during weekdays to allow time for wildlife to recover from potential noise disturbance.	• 6.11.8
• C, O	• Implement draft Wildlife Management Plan	• 6.11.8, draft Wildlife Management Plan (Appendix P.7)
• C, O	• Site-specific measures to protect wildlife will be addressed in the EPP.	• 6.11.8
• CL	• Implement remediation plans to restore natural habitat and food source re-establishment to support fauna	• 6.11.8
• CL	• Install signage where specific wildlife concerns have been identified. Vehicles will yield to wildlife on roads.	• 6.11.8
• Post-Closure	• A deterrent system will be considered at the Touquoy Mine Site when the pit fills as tailing deposition will be present. This will deter wildlife from using the pit during and after filling which may have deleterious effects resulting from long-term exposure.	• 6.11.8
• **Avifauna**		
• C, O, CL	• 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 active closure activities to identify and remove any trapped or injured avifauna	• 6.12.9, 6.13.8.4, SAR Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7)
• C	• Avoid construction on native vegetation during the regional breeding season for migratory avifauna where practicable (beginning of April to end of August for migratory avifauna; ECCC 2015). Where this is not practicable, an avifauna nest mitigation plan will be developed	• 6.12.9
• C	• 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	• 6.12.9

Table B-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
• C, O	• Limit the amount of exposed soil during nesting season	• 6.12.9
• C, O	• 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	• 6.12.9, 6.13.8.4, SAR Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7)
• C, O	• Should any ground- or burrow-nesting species initiate breeding activities on stockpiles or exposed areas, AMNS will work with ECCC and NSE to develop buffer zones that incorporate adaptive management	• 6.12.9
• C, O	• 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 avifauna	• 6.12.9
• C, O	• Implement Dust Control Plan	• 6.12.9, Appendix C.3 (draft Fugitive Dust Control Plan)
• C, O	• Install downward-facing lights on site infrastructure and mine site haul roads. Wherever practicable, install motion-sensing lights to ensure lights are not turned on when they are not necessary	• 6.12.9, 6.3.8
• C, O	• Consider limiting use of lights that emit more blue shortwave light (e.g., LEDs, metal halides) which have greater impacts to wildlife at night, where practicable and considering operational safety.	• 6.12.9, 6.3.8
• C, O	• Conduct mobile refueling at least 30 m from any identified breeding locations	• 6.12.9
• C, O	• 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	• 6.12.9
• C, O	• Conduct routine inspections of the open pit area to remove any trapped or injured avifauna. If identified, determine a plan for removal in consultation with an avian expert	• 6.12.9
• C, O	• Notify ECCC within 24 hours in the event of the mortality or injury of ten or more migratory avifauna in a single event or in the event of the mortality or injury of a migratory avifauna SAR	• 6.12.9, 6.13.8.4, SAR Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7)
• C, O	• Mitigation measures will be applied to reduce the potential environmental impacts of the Project on migratory avifauna at the Touquoy Mine Site as per existing operational approvals. Audio and visual deterrents are currently being utilized at Touquoy Mine Site to dissuade avifauna from landing in the TMF.	• 6.12.9
• CL	• Continued monitoring	• 6.12.9

Table B-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
• **Species of Conservation Interest and Species at Risk**		
• C, O, CL	• Blue Felt Lichen • 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 and setback areas • Implement dust suppression plan • Provide map of all priority vascular and non-vascular flora, and their setbacks, to site personnel during site orientation • Implement the SAR Lichen Mitigation and Monitoring Plan, developed in consultation with lichen specialists and regulators, for observations within and in close proximity to the PA • Wherever avoidance of SAR lichen species is not possible, the Project Team will implement the SAR Lichen Mitigation and Monitoring Plan, developed in consultation with lichen specialists and regulators. The two directly impacted blue felt lichen occurrences are proposed for translocation. • Where avoidance and translocation 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)	• 6.8.8.2, 6.10.8, 6.13.8.2 Lichen Mitigation and Monitoring Plan (Appendix P.6)
• C, O, CL	• Frosted Glass-whiskers • Complete further detailed design of Haul Road and micro siting of mine infrastructure to avoid priority lichen species • 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 and setback areas • Implement dust suppression plan • Provide map of all priority vascular and non-vascular flora, and their setbacks, to site personnel during site orientation • Implement the SAR Lichen Mitigation and Monitoring Plan, developed in consultation with lichen specialists and regulators, for observations within and in close proximity to the PA • Wherever avoidance of SAR lichen species is not possible, the Project Team will implement the SAR Lichen Mitigation and Monitoring Plan, developed in consultation with lichen specialists and regulators. 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)	• 6.8.8.2, 6.10.8, 6.13.8.2 Lichen Mitigation and Monitoring Plan (Appendix P.6)

Table B-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
• C, O, CL	• Boreal Felt Lichen • Micro-siting of Project infrastructure has been completed to avoid observations and Boreal Felt Lichen Critical Habitat Areas • Continued detailed Project design to ensure no development occurs within the Boreal Felt Lichen Critical Habitat Areas • Implement air quality monitoring and dust suppression plans • Flag host tree and setback areas • Implement dust suppression plan • Provide map of all priority vascular and non-vascular flora, and their setbacks, to site personnel during site orientation • Implement the SAR Lichen Mitigation and Monitoring Plan, developed in consultation with lichen specialists and regulators.	• 6.8.9.2, 6.10.9, 6.13.9.2, Lichen Mitigation and Monitoring Plan (Appendix P.6)
• C, O, CL	• Atlantic Salmon • 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 • Implement downstream water quality and quantity monitoring program • Replace crushed, hung, or improperly installed culverts along the Haul Road that are impeding fish passage	• 6.13.8.1, 6.9.8.2.3

Table B-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
• C, O, CL	• American Eel • 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 • 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	• 6.13.8.1, 6.9.8.2.3

Table B-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
• C, O, CL	• <u>Snapping Turtle</u> • Include in the development and implementation of the draft Wildlife Management Plan • Implement wildlife observation reporting to appropriate site personnel during construction, operation, and decommissioning of Project • Safety and Environment orientation and training will include information on turtles and nesting season awareness training, particularly along the Haul Road. • If snapping turtle activity is occurring within and/or adjacent to the Beaver Dam Mine Site or Haul Road, additional turtle awareness and management program will be implemented to ensure all staff are well informed regarding the increased turtle activity, especially during breeding season • 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 (while maintaining existing hydrological conditions) • 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 • 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 • 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	• 6.11.8, 6.13.8.3, draft Wildlife Monitoring and Management Plan (Appendix P.7), Appendix C.3 (draft Fugitive Dust Control Plan)

Table B-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
• C, O, CL	• Mainland Moose • Include in the development and implementation of the Wildlife Management Plan. 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. • 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 • AMNS encourages the public to report mainland moose sightings to the province at https://novascotia.ca/natr/wildlife/sustainable/msform.asp.	• 6.11.8, 6.13.8.3, draft Wildlife Monitoring and Management Plan (Appendix P.7)
• C, O, CL	• Common nighthawk • 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 • Discourage ground- or burrow-nesting species by limiting the amount of exposed soil • 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 dust suppression plan • Implement the Landbird SAR Mitigation and Monitoring Plan and Wildlife Management Plan • 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	• 6.3.8, 6.10.8, 6.12.9, 6.13.8.4, SAR Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7), draft Wildlife Monitoring and Management Plan (Appendix P.7), Appendix C.3 (draft Fugitive Dust Control Plan)

Table B-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
• C, O, CL	• Canada Warbler • 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 dust suppression plan • Implement the Landbird SAR Mitigation and Monitoring Plan and Wildlife Management Plan • 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	• 6.3.8, 6.12.9, 6.13.8.4, SAR Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7), draft Wildlife Monitoring and Management Plan (Appendix P.7), Appendix C.3 (draft Fugitive Dust Control Plan)
• C, O, CL	• Olive-sided Flycatcher • 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 dust suppression plan • Implement surface water quality monitoring program • Implement the Landbird SAR Mitigation and Monitoring Plan and Wildlife Management Plan • 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	• 6.3.8, 6.12.9, 6.13.8.4, SAR Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7), draft Wildlife Monitoring and Management Plan (Appendix P.7), Appendix C.3 (draft Fugitive Dust Control Plan)

Table B-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
• C, O, CL	• Eastern Wood-Pewee • 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 dust suppression plan • Implement the Landbird SAR Mitigation and Monitoring Plan and Wildlife Management Plan • 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	• 6.3.8, 6.12.9, 6.13.8.4, SAR Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7), draft Wildlife Monitoring and Management Plan (Appendix P.7), Appendix C.3 (draft Fugitive Dust Control Plan)
• C, O, CL	• Chimney Swift • 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 dust suppression plan • Implement noise management including use of mufflers on equipment and regular maintenance • Implement the Landbird SAR Mitigation and Monitoring Plan and Wildlife Management Plan • 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	• 6.3.8, 6.12.9, 6.13.8.4, SAR Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7), draft Wildlife Monitoring and Management Plan (Appendix P.7), Appendix C.3 (draft Fugitive Dust Control Plan)

Table B-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
• C, O, CL	• <u>Rusty Blackbird</u> • 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 dust suppression plans • Implement noise management including use of mufflers on equipment and regular maintenance • Implement the Landbird SAR Mitigation and Monitoring Plan and Wildlife Management Plan • 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	• 6.3.8, 6.8.8, 6.12.9, 6.13.8.4, SAR Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7), draft Wildlife Monitoring and Management Plan (Appendix P.7), Appendix C.3 (draft Fugitive Dust Control Plan)
• C, O, CL	• <u>Barn Swallow</u> • 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 dust suppression plans • Implement noise management including use of mufflers on equipment and regular maintenance • Implement the Landbird SAR Mitigation and Monitoring Plan and Wildlife Management Plan • 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	• 6.3.8, 6.12.9, 6.13.8.4, SAR Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7), draft Wildlife Monitoring and Management Plan (Appendix P.7), Appendix C.3 (draft Fugitive Dust Control Plan)

Table B-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
• C, O, CL	• Evening Grosbeak • 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 dust suppression plans • Implement noise management including use of mufflers on equipment and regular maintenance • Implement the Landbird SAR Mitigation and Monitoring Plan and Wildlife Management Plan • 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	• 6.3.8, 6.12.9, 6.13.8.4, SAR Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7), draft Wildlife Monitoring and Management Plan (Appendix P.7), Appendix C.3 (draft Fugitive Dust Control Plan)
• C, O, CL	• Peregrine Falcon • 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 dust suppression plan • Implement noise management including use of mufflers on equipment and regular maintenance • Implement the Landbird SAR Mitigation and Monitoring Plan and Wildlife Management Plan • 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	• 6.3.8, 6.12.9, 6.13.8.4, SAR Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7), draft Wildlife Monitoring and Management Plan (Appendix P.7), Appendix C.3 (draft Fugitive Dust Control Plan)

Table B-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
• C, O, CL	• Greater Yellowlegs • Avoid clearing/grubbing activities during nesting season • Complete construction and upgrades of 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, AMNS 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. • If new breeding evidence or nests are observed within 300 m of Project activities, a site mitigation plan will be developed in consultation with regulators. Nests will be monitored from a distance using binoculars or a spotting scope to avoid further human disturbance from monitoring. An acceptable setback (to be established in consultation with regulatory authorities) will be established. • New bypass roads have been micro-sited to avoid Wetland 64 and, as a result of PA and infrastructure modifications, a waterline has been rerouted and will no longer discharge into Wetland 64, avoiding resultant changes in hydrology • To avoid nesting activity, bird deterrents will be implemented within Wetland 64, as this is the only location where probably breading was observed, following best-management-practices used in the mining industry. • Implement dust suppression plans • 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 the Landbird SAR Mitigation and Monitoring Plan and Wildlife Management Plan • 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	• 6.3.8, 6.8.8, 6.12.9, 6.13.8.4, SAR Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7), draft Wildlife Monitoring and Management Plan (Appendix P.7), Appendix C.3 (draft Fugitive Dust Control Plan)
• **Mi'kmaq of Nova Scotia**		
• EIS Review	• Support Mi'kmaq third party review of AMNS's EIS, including mitigation and monitoring programs.	• 6.14.8, 6.14.10
• EIS Review	• Continuing to provide the opportunity for Mi'kmaq to delineate the specificity of Mi'kmaq traditional use, and meet with the Mi'kmaq to receive feedback on EIS conclusions and impacts.	• 6.14.8
• EIS Review	• AMNS will establish a schedule of proposed technical workshops with Millbrook First Nation with the goal to: • review water quality predictions and surface water monitoring plans and Millbrook involvement in these monitoring programs • review human health risk assessment process and conclusions relating to risk to food consumption within indirect impact zones from dust/other contaminants • review dust predictions and proposed mitigation measures and monitoring program with Millbrook involvement • review wildlife patterns with Millbrook, incorporate this traditional knowledge into effects assessment, mitigation measures, and AMNS commitments	• 6.14.8

Table B-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
• Pre-construction	• Provide Mi'kmaq land users the opportunity to walk the Beaver Dam Mine Site and Haul Road with Proponent representatives to identify and document sensitive sites prior to construction	• 6.14.8
• Pre-construction	• Provide a tour of the Beaver Dam Mine Site and Haul Road and information on Project operations to interested Mi'kmaq peoples.	• 6.14.8
• Pre-construction	• Develop a Mi'kmaq Communication Plan with the Mi'kmaq of Nova Scotia that outlines an on-going two-way communication process throughout the lifecycle of the Project.	• 6.14.8
• Pre-construction	• As part of the existing communications process, AMNS will build upon and strengthen a Complaints Management and Action Program for Mi'kmaq input in advance of Project commencement, as an opportunity for having grievances heard and addressed, and development of a communication protocol.	• 6.14.8
• Pre-construction	• Possible establishment of Community Working Group with Millbrook First Nation to review proposed and develop additional environmental mitigation protocols, oversee monitoring procedures and review/evaluate results. This committee will be led by AMNS and Proponent environmental experts, and Millbrook First Nation, with additional representation from Unama'ki Institute of Natural Resources, the Mi'kmaq Conservation Group, and Nova Scotia Environment.	• 6.14.8
• Pre-construction	• In conjunction with Millbrook First Nation, complete a baseline country foods program. This baseline program can be community led and/or with active participation by Millbrook First Nation.	• 6.14.8
• Construction	• Design and construct bypass roads allow for travel routes to bypass the Beaver Dam Mine Site and Haul Road and allow access to areas surrounding the Project.	• 6.14.8, 6.15.8
• Construction	• If 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, AMNS will ensure mitigation measures are undertaken to prevent irreversible damage to Mi'kmaq archaeological resources and known burial site(s), including ensuring all Project activities are within the defined Project property boundaries only.	• 6.14.8, 6.14.10, Appendix N.1 to N.7
• On-going	• In conjunction with Millbrook First Nation, complete a country foods monitoring program to validate HHRA conclusions. This monitoring program can be community led and/or with active participation by Millbrook First Nation.	• 6.14.8
• On-going	• AMNS will provide various opportunities for Mi'kmaq participation in the Project, including opportunities to participate in environmental monitoring and implementation of Mi'kmaq projects such as fish habitat offsetting, wetland compensation, and others. AMNS will continue to engage with the Mi'kmaq on various Project benefits.	• 6.14.8
• On-going	• Engage in open dialogue with affected communities relating to issues of limited Mi'kmaq access to the Beaver Dam Mine Site and Haul Road for the eight year project window and continue to review and discuss mitigation options including suitable alternative crown land access in close proximity to the Beaver Dam Mine Site and Haul Road.	• 6.14.8
• On-going	• Continue to engage with the Mi'kmaq of Nova Scotia to determine how they would like to participate and integrate traditional knowledge into the Reclamation and Closure Plan for the Project. AMNS will also provide the opportunity for the Mi'kmaq to provide input on species end land uses, revegetation, reclamation techniques, and for Mi'kmaq members to join the reclamation team to execute this Project phase.	• 6.14.8
• On-going	• Commitment to developing and conducting a Mi'kmaq Cultural Awareness Program for staff and contractors. Scope to be determined based on further discussions.	• 6.14.8

Table B-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
• **Physical and Cultural Heritage**		
• C	• A program of archaeological shovel testing was conducted in fall 2020, in advance of any disturbance to Site 6, Areas 2 and 3. CRM Group cleared these areas of any requirement for further archaeological investigation	• 6.15.8, Appendix N.1 to N.7
• C	• If any development is to occur within 100 metres of Crusher Lake, intensified reconnaissance (i.e., shovel testing) should be conducted to identify any additional features.	• 6.15.8, Appendix N.1 to N.7
• C	• If any development is to occur specifically around the historic features identified during the 2014, 2015, 2016, 2018 and 2019 reconnaissance, intensified historical research and archaeological shovel testing should be conducted in advance of disturbance.	• 6.15.8, Appendix N.1 to N.7
• C	• Any further changes in the layout of the mine and associated facilities be evaluated as to potential impacts to archaeological resources.	• 6.15.8, Appendix N.1 to N.7
• O	• In the event that archaeological resources or human remains are encountered during ground disturbance activities, it is required that all activity stop, and the Coordinator of Special Places, Nova Scotia Communities, Culture, & Heritage Department be contacted.	• 6.15.8, Appendix N.1 to N.7
• **Socio-economic Conditions**		
• C	• Restriction of recreational activities within the spatial boundaries of the Project. Notification will be provided by signage. • Communication Plan to communication access information to key stakeholders (Sections 3 and 4 [Public Engagement and Indigenous Peoples Engagement, respectively]). • Liaison with any local recreation groups, such as ATV associations through an Ad Hoc group. • Equipment maintenance. • Reduction of mobile equipment accident risk through discussions with NSTIR, appropriate signage, and operator training.	• 6.16.11
• O	• Restriction of recreational activities within the spatial boundaries of the Project. Notification will be provided by signage. • Liaison with local recreation groups, such as ATV associations. • Equipment maintenance. • Limiting haul truck operational hours to approximately 16 hours per day. • Reduction of mobile equipment accident risk through discussions with NSTIR, appropriate signage, and operator training. • Ongoing engagement with community associations, CLC and residents to assess and adaptively manage the site. • Potential housing and employment studies to monitor impacts on population growth and housing market.	• 6.16.11
• CL	• Ongoing engagement with community associations, CLC and residents to assess and adaptively manage the site.	• 6.16.11
• **Accidents and Malfunctions**		
• Open Pit Mine Slope Failure	• The pit slope design, construction and monitoring follow applicable regulations and recommendations provided by a qualified geotechnical professional.	• 6.18.6.1, Appendix A.2a and Golder (2021 In Progress)
• Stockpile Slope Failure	• The stockpile design, construction and monitoring follow applicable regulations and recommendations provided by a qualified geotechnical professional.	• 16.8.6.2
• Settling Pond Failure	• The water management ponds are designed by a qualified professional and lined with suitable materials, such as clay or a geosynthetic liner.	• 6.18.6.3
• Infrastructure Failure	• The infrastructure is designed following applicable regulations and recommendations provided by a qualified professional.	• 6.18.6.4

Table B-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
• Fuel and/or other spills	• Fuel delivery suppliers and their personnel will have certification and training in fuel transport and delivery in compliance with applicable regulatory requirements. • Onsite storage and dispensing of fuel products will be conducted in accordance with applicable regulatory requirements and adhere to the Petroleum Operation Procedure and related site-specific procedures. • Staff will be trained in spill response measures. Spill response kits will be accessible and dedicated in areas of fuel storage and transfer.	• 6.18.7.1, Appendix A draft Spill Contingency Plan of Appendix P.1 draft Emergency Response Plan
• Mobile Equipment Accident	• The Beaver Dam Mine Site will have restricted traffic patterns, speed limits, right-of-way signage and training that will minimize the risk of mobile equipment accidents. • Highway haul trucks will be remotely tracked and monitored. • Communications will be maintained between vehicles using radios to minimize adverse interactions and ensure prompt response to any incident.	• 6.18.7.3
• Tailings and Reclaim Water Pipelines Spills	• Touquoy Mine tailings and reclaim pipelines between the plant site, TMF and open pit will be designed and constructed to minimize the potential for release. Not applicable at the Beaver Dam Mine Site. • Measures at the Touquoy Mine may include double walled tailings pipes, lined service trenches and adequately sized, lined, collection pond capable of containing the volume of the pipeline. Not applicable at the Beaver Dam Mine Site. • At the Touquoy Mine the catchment pond would be lined with suitable materials, such as clay or a geosynthetic liner. Not applicable at the Beaver Dam Mine Site.	• 6.18.7.5
• Cyanide Release (Touquoy Mine Site)	• For the Touquoy Mine cyanide is transported stored and handled in accordance with applicable regulatory requirements and the International Cyanide Management Code. Not applicable at the Beaver Dam Mine Site. • At the Touquoy Mine cyanide is stored and handled inside the plant footprint within a restricted containment area. Not applicable at the Beaver Dam Mine Site.	• 6.18.7.6
• Forest and/or Site Fires	• 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 buildings and key areas of the Beaver Dam Mine Site.	• 6.18.8

Table B-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
• **Effects of the Environment on the Project**		
• C	• 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	• 7.3
• C	• 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	• 7.3
• O	• 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	• 7.3
• O	• Stockpile design will be re-assessed following material placement to ensure slopes are geotechnical stable and within acceptable safety factors • An Emergency Action Plan will be implemented during the operation phase	• 7.3
• CL	• 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