Fifteen Mile Stream
Environmental Impact Statement Review

Final Report

CBCL

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CONTENTS

Chapter 1 Introduction 1

1.1 The Proponent 1

1.2 Project Description 2

1.2.1 Construction Phase/Pre-Production Phase 4

1.2.2 Operations Phase 6

1.2.3 Closure Phase 8

1.3 Regulatory Context 9

1.4 Mi'kmaq Engagement 9

1.5 Mi'kmaq Rights and Use of the Area 12

1.5.1 Mi'kmaq Rights 12

1.5.2 Mi'kmaq Use of the Area 13

1.5.3 Known Mi'kmaq Archaeological Sites near the Fifteen Mile Stream Study Area 16

Chapter 2 Environmental Impact Statement Review 17

2.1 Air Quality, Noise, and Light Emissions Review 18

2.1.1 General Comments 18

2.1.2 Summary of Results 19

2.1.3 Identified Gaps 21

2.1.4 Monitoring Programs 21

2.1.5 Recommendations 22

2.2 Groundwater Review 22

2.2.1 General Comments 22

2.2.2 Summary of Results 23

2.2.3 Identified Gaps 24

2.2.4 Monitoring Programs 25

2.2.5 Recommendations 25

2.3 Water Quality and Quantity Review 25

2.3.1 General Comments 25

2.3.2 Summary of Results 26

2.3.3 Identified Gaps 31

2.3.4 Monitoring Programs 33
2.3.5 Recommendations 34
2.4 Wetlands Review 34
2.4.1 General Comments 34
2.4.2 Summary of Results 35
2.4.3 Identified Gaps 36
2.4.4 Monitoring Programs 36
2.4.5 Recommendations 36
2.5 Fish and Fish Habitat Review 36
2.5.1 General Comments 36
2.5.2 Summary of Fish and Fish Habitat Studies 37
2.5.3 Identified Gaps 38
2.5.4 Monitoring Programs 41
2.5.5 Recommendations 42
2.6 Habitat and Flora Review 43
2.6.1 General Comments 43
2.6.2 Summary of Results 44
2.6.3 Identified Gaps 45
2.6.4 Monitoring Programs 45
2.6.5 Recommendations 45
2.7 Terrestrial Fauna Review 45
2.7.1 General Comments 46
2.7.2 Summary of Results 46
2.7.3 Identified Gaps 47
2.7.4 Monitoring Programs 47
2.7.5 Recommendations 47
2.8 Avifauna (Birds) Review 47
2.8.1 General Comments 47
2.8.2 Summary of Results 48
2.8.3 Identified Gaps 48
2.8.4 Monitoring Programs 49

2.8.5 Recommendations 49
2.9 Species of Conservation Interest and Species at Risk Review 49
2.9.1 General Comments 49
2.9.2 Summary of Results 49
2.9.3 Identified Gaps 50
2.9.4 Monitoring Programs 51
2.9.5 Recommendations 51
2.10 Mi'kmaq of Nova Scotia Review 51
2.10.1 General Comments 51
2.10.2 Summary of Results 52
2.10.3 Identified Gaps 55
2.10.4 Monitoring Programs 56
2.10.5 Recommendations 56
2.11 Human Health Risk Review 57
2.11.1 General Comments 57
2.11.2 Summary of Results 58
2.11.3 Identified Gaps 59
2.11.4 Recommendations 60
2.12 Aquatic Effects Review 60
2.12.1 General Comments 61
2.12.2 Summary of Results 61
2.12.3 Identified Gaps 62
2.12.4 Monitoring Programs 63
2.12.5 Recommendations 63
2.13 Cumulative Effects Review 63
2.13.1 General Comments 63
2.13.2 Summary of Results 64
2.13.3 Identified Gaps 65
2.13.4 Monitoring Programs 66
2.13.5 Recommendations 66
2.14 Conclusion 67

2.15 Closure....67
Chapter 3 References.... 68

List of Tables

Table 1: Summary of Key Issues Raised During Mi'kmaq Engagement (adapted from the EIS)....11
Table 2: Reported Contemporary Mi'kmaw Land and Resource Uses within the Study Region....14
Table 3: Number of Identified Plant Species of Special Significance to Mi'kmaw by Type of Use. 16

List of Figures

Figure 1: Atlantic Gold's gold development Projects in Nova Scotia (Source: Atlantic Gold, 2020 [adapted by CBCL]).....2
Figure 2: Fifteen Mile Stream Mine Site and Touquoy Mine Site locations (Source: Atlantic Gold, 2021 [adapted by CBCL]).....3
Figure 3: Fifteen Mile Stream Gold Mine site with Project components and infrastructure outlined (Source: Atlantic Gold, 2020 [adapted by CBCL]). 5
Figure 4: Access roads that will be impacted and constructed as a result of the Fifteen Mile Stream Gold Mine (Source: Atlantic Gold, 2021 [adapted by CBCL]).....6

Appendices

A Technical Background on Open Pit Mines and Impacts to Groundwater

Chapter 1 Introduction

CBCL Limited (CBCL) was retained by the Kwilmu'kw Maw-klusuaqn Negotiation Office (KMKNO) to review the proponent's Environmental Impact Statement (EIS) for the proposed Fifteen Mile Stream Gold Mine Project (the Project). The Project is located near Trafalgar, Nova Scotia, 30 km north of Sheet Harbour. The Project is also 17 km northeast of the Beaver Dam Mine Project.

The aim of the review was to evaluate scientific and technical information for completeness; identify potential environmental monitoring plans; identify information gaps; and when warranted, provide recommendations on how the proponent may address the information gaps in determining the environmental risk of the Project to the Mi'kmaq of Nova Scotia. The information presented herein on the proponent, the Project, and the environmental assessment is based on the information contained within the proponent's EIS.

1.1 The Proponent

The proponent of the Fifteen Mile Stream Gold Mine Project is Atlantic Mining NS Inc. (Atlantic Gold), a wholly-owned subsidiary of St Barbara Limited. Atlantic Gold has been in operation in Nova Scotia since 2017 and currently operates the Touquoy Gold Mine (Touquoy Mine) in Moose River, Nova Scotia.

The proponent is focused on growing gold production in Nova Scotia and currently holds four gold development projects in Nova Scotia (Figure 1).

1. Touquoy Mine (Moose River, Nova Scotia).
2. Beaver Dam Mine Project (Marinette, Nova Scotia).
3. Fifteen Mine Stream Gold Project (near Trafalgar, Nova Scotia).
4. Cochrane Hill Gold Project (Melrose, Nova Scotia).

The Touquoy Mine Site is a fully permitted and approved facility currently operating as part of the Touquoy Gold Project.

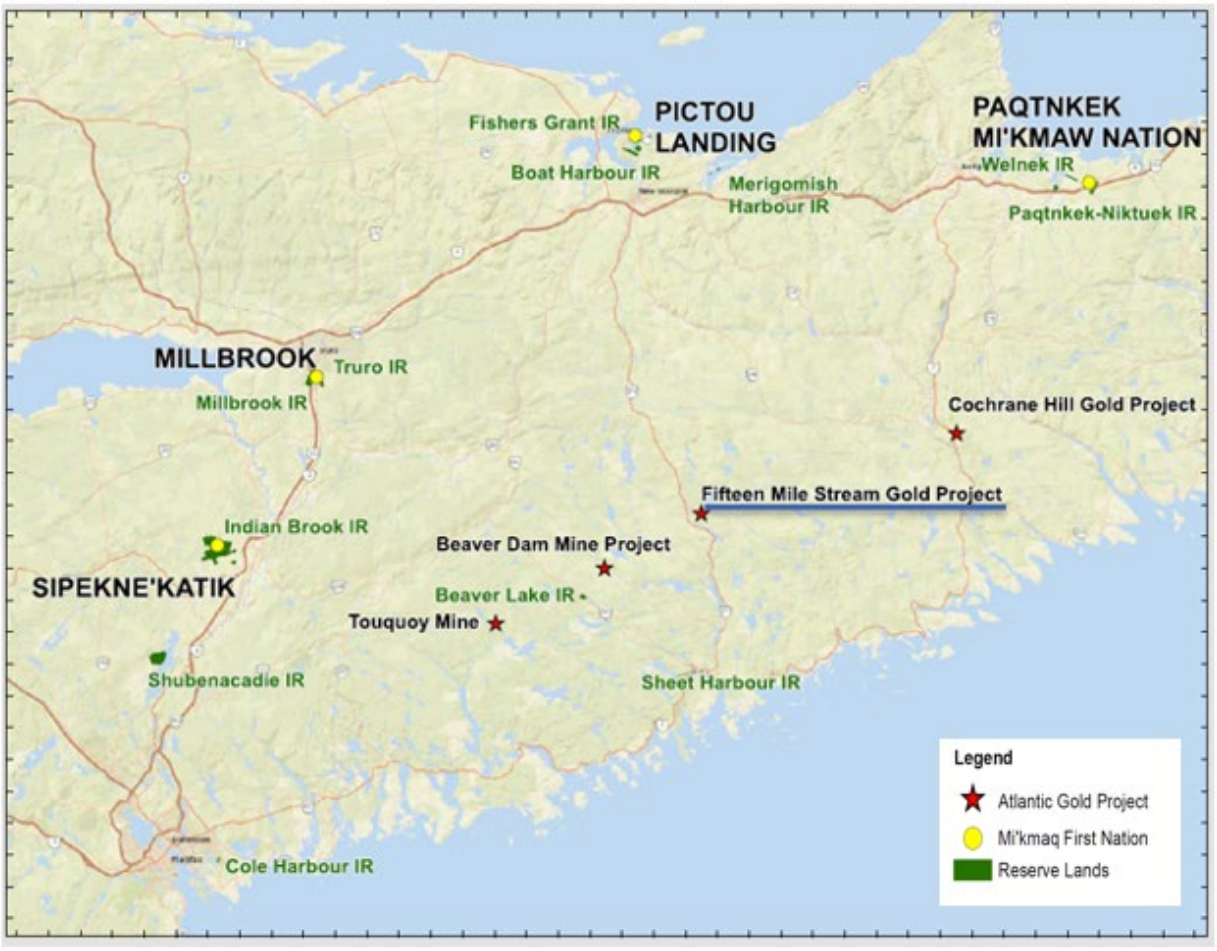

Figure 1: Atlantic Gold's gold development Projects in Nova Scotia (Source: Atlantic Gold, 2020 [adapted by CBCL]).

As presented in the EIS and highlighted in Figure 1, the closest Mi'kmaq communities to the Fifteen Mile Stream Gold Mine site are Sheet Harbour Indian Reserve and Beaver Lake Indian Reserve (Millbrook First Nation). Sheet Harbour Reserve is 25 km south of the Project and Beaver Lake Reserve is 24 km southwest of the Project. Other Mi'kmaq communities that are located in proximity of the Project include Pictou Landing First Nation (59 km north of the Project), Millbrook First Nation communities near Truro (64 km northwest of the Project), Sipekne'katik First Nation (74 km west of the Project), and Paqtnkek First Nation (79 km northeast of the Project).

1.2 Project Description

The proposed Fifteen Mile Stream Project (the Project) has a footprint of approximately 400 hectares. The mine is expected to operate for approximately seven years and produce two million tonnes of gold-bearing ore each year. Ore will be crushed and concentrated at the Fifteen Mile Stream Gold Mine site and gold concentrate will be hauled by highway

transport truck to the Touquoy Mine Site for final processing. Tailings will be generated from mill processing and deposited into the exhausted Touquoy pit.

As outlined in Figure 2, the gold concentrate will be hauled south along Highway 374 (31 km) to Highway 7 (dotted line), through Sheet Harbour (27 km) and onto Mooseland Road to the Touquoy Mine Site (35 km) during the initial phase of mine operation. Once the Beaver Dam Mine Project becomes operational, and the Beaver Dam Haul Road has been upgraded as part of that project, haul trucks from the Project are expected to take Highway 224 from Sheet Harbour to the Beaver Dam Cross Road (21 km) and the Beaver Dam Haul Road will be used for the remainder of the haul to the Touquoy Mine Site (24 km).

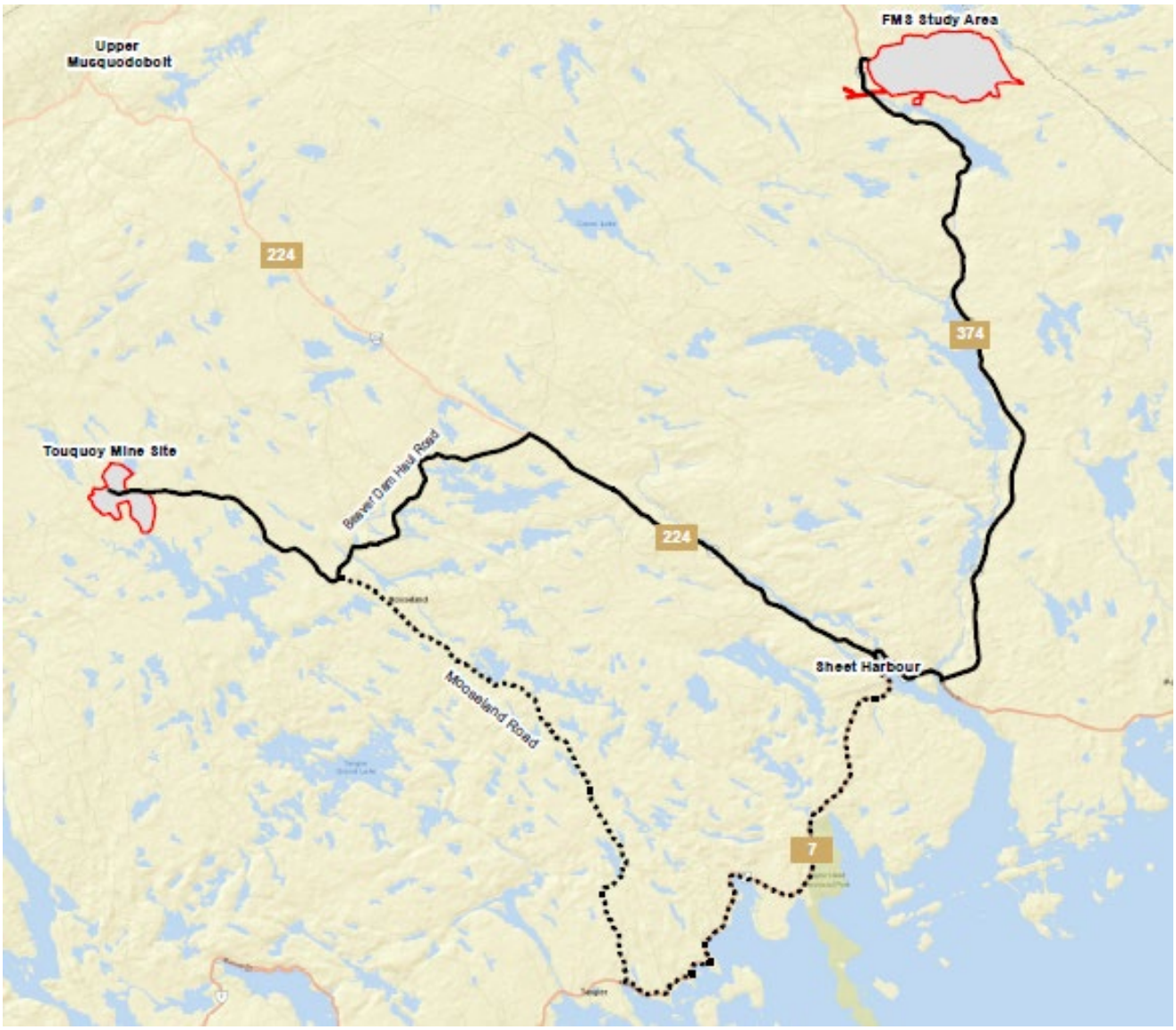

Figure 2: Fifteen Mile Stream Mine Site and Touquoy Mine Site locations (Source: Atlantic Gold, 2021 [adapted by CBCL]).

The primary Project components and infrastructure at the Fifteen Mile Stream mine site will include:

- An open pit mine to extract ore and waste rock.
- A tailings management facility.
- A processing plant (crusher and concentrator facilities).
- Seloam Brook realignment channel and diversion berm around the open pit.
- Support buildings.
- Waste rock storage areas (non-acid generating and potentially acid generating piles).
- Topsoil, organics, and till stockpiles.
- Run of mine (rock material gathered after blasting that will need to be crushed) stockpile and low-grade ore stockpile.
- Roads (mine site haul roads and local traffic bypass roads).
- Powerline.
- Water management system, including discharge to receiving watercourse.

The primary Project components at the existing Touquoy mine site will include:

- Concentrate storage.
- Gravity concentrate leach reactor.
- Gravity electrowinning cell.
- Exhausted pit for remaining Fifteen Mile Stream concentrate tailings storage.

The Project consists of three main phases (as outlined in Section 2.1 of the EIS). Some of the key activities of each Project phase are briefly outlined below.

1. Construction Phase/Pre-Production Phase (commencing in 2023) is one year.
2. Operations Phase (commencing in 2024) – approximately seven years of production.
3. Closure Phase (commencing in 2030) - Reclamation Stage (approximately two to three years) and Post Closure Stage.

1.2.1 Construction Phase/Pre-Production Phase

As outlined in Section 2.4.1 of the EIS, site preparation activities are anticipated to take one year to complete. The EIS describes activities to prepare the Fifteen Mile Stream Mine Site. These activities include:

- Clearing trees and vegetation, grubbing, and grading
- Drilling and rock blasting
- Stockpiling of topsoil, organic material (saturated topsoil/peat), till, and waste rock
- Seloam Brook Realignment construction and pit site dewatering
- Management of historical mining waste (tailings and waste rock)

Excavated topsoil and till will be stockpiled for use during reclamation.

Seloam Brook will be permanently re-routed because the ore with the highest levels of gold are under the brook – the proposed location of the open pit mine. A raised diversion berm (highlighted in red in Figure 3) will run along the east, north, and west of the open pit. A

new channel will be constructed to divert Seloam Brook, and its main tributary, along the northern portion of the open pit (illustrated by the blue arrow on Figure 3). The proponent states that the new channel will be designed to allow for fish passage and provide suitable fish habitat.

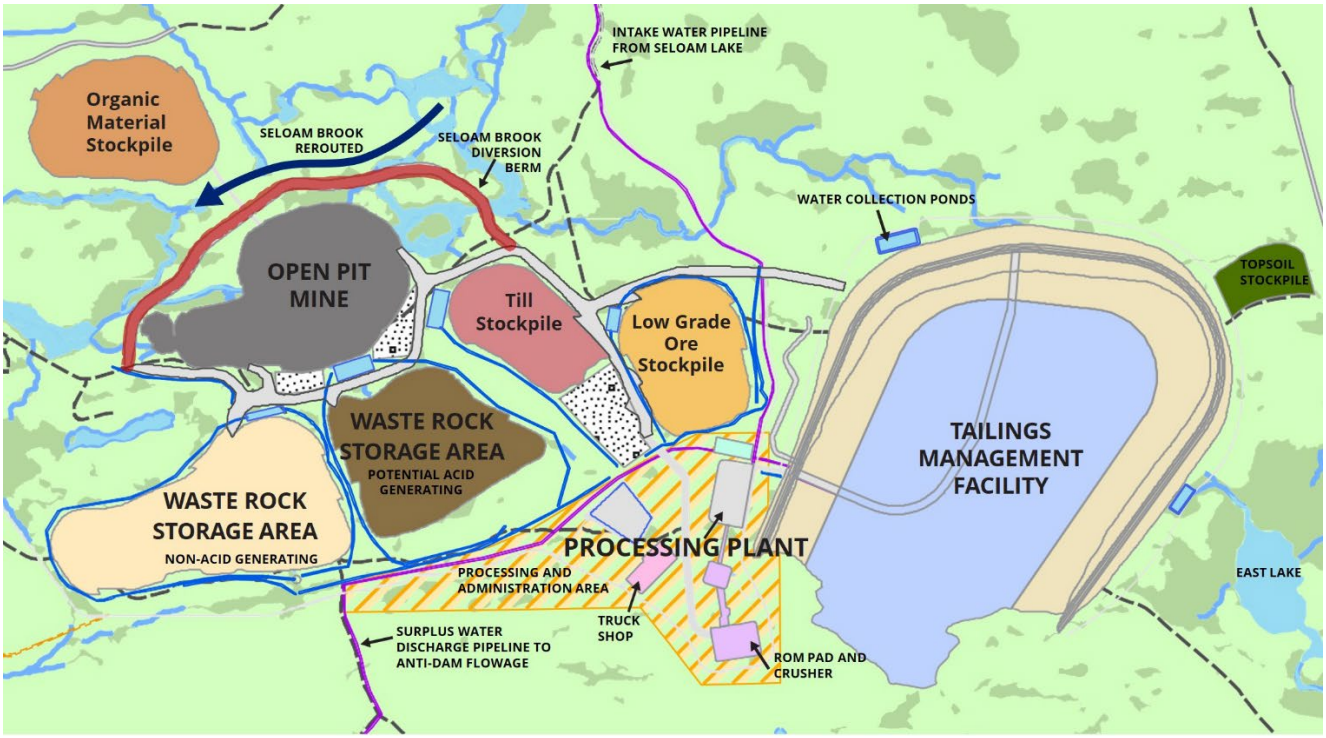

Figure 3: Fifteen Mile Stream Gold Mine site with Project components and infrastructure outlined (Source: Atlantic Gold, 2020 [adapted by CBCL]).

After site preparation activities have been completed, construction will begin, which includes the following activities:

- Watercourse and wetland alteration.
- Mine site road construction.
- Local bypass road construction.
- Surface infrastructure installation and construction.
- Powerline construction.
- Open pit pre-stripping.
- Building the tailing management facility and processing plant.
- collection ditch and water management pond construction.

Mine haul roads will be constructed on site and be approximately 25 m wide (including drainage areas).

The location of the open pit and tailings management facility interferes with local access and ATV trails. The access points that will be restricted are indicated by a red dot on

Figure 4. Two local bypass roads will be constructed to allow continued multiuse public access and these roads are outlined green in Figure 4.

Figure 4: Access roads that will be impacted and constructed as a result of the Fifteen Mile Stream Gold Mine (Source: Atlantic Gold, 2021 [adapted by CBCL]).

Temporary facilities will be constructed to include offices, washrooms, dry room, first aid, and workshop facilities for general maintenance (truck shop) of the mining fleet and ore haulage trucks.

A tailings management facility is being constructed to store tailings produced during processing to extract the gold. The tailings management facility will be developed in stages. The embankment height in the initial stage will be approximately 16 m. A liner system will be installed along the embankment into the basin to control for seepage. The maximum height of the embankment will be approximately 28 m.

1.2.2 Operations Phase

After construction is complete, mining gold at Fifteen Mile Stream will begin and this phase is referred to as the operations phase. The activities that will be undertaken during this phase include:

- Surface mine operation and maintenance:
  - Drilling and rock blasting.
  - Surface mine dewatering.
- Ore management.
- Waste rock management.

- Milling operations:
  - Crushing.
  - Grinding.
  - Gravity concentration.
  - Conventional flotation circuit.
  - Concentrate thickening, filtration and storage.
- Concentrate loading and haulage.
- Tailings management.
- Water management.
- Dust and noise management.
- Petroleum products management.
- Site maintenance and repairs.

During operations, rock is drilled and blasted in the open pit mine area. Blasting will typically occur two to three times per week. Excavators will be used to load the ore and waste rock onto haul trucks. Trucks will haul ore to the processing plant where it will be dumped into a crusher or placed in a stockpile to be crushed later. Waste rock will be hauled to and placed in the waste rock storage areas, shown on Figure 3. If dust is generated on the haul roads during hauling, water and/or chemical dust suppressants will be used.

Waste rock can release acid and dissolved metals. Waste rock will be placed into two different piles based on acid generating characteristics. The two rock piles are non-acid generating waste rock and potentially acid generating waste rock (Figure 3). By separating waste rock into two different stockpiles, Atlantic Gold plans to manage them appropriately. Rock piles will range in height from 20 m to 45 m above the existing ground surface.

Milling operations primarily occur within the Processing Plant area as shown in Figure 3. The main plant building is where the gold concentrate is produced. Ore stockpiling and crushing of ore will occur at the run of mine (ROM) pad and crusher. Crushed ore is then fed into a mill to be ground. The mill discharge is then processed into a gold concentrate. Two processing concentrate streams will be produced at the Project: a gravity concentrate and a float concentrate.

The gold concentrate is then transported to Touquoy Mine for further processing. There will be between eight and eleven round trips between Fifteen Mile Stream and Touquoy each day of operation (350 days per year) between 7am and 11pm.

Surface water collected at the Fifteen Mile Stream site will be directed into the tailings management facility. During operations, the tailings will be sent by pipe into the basin of the tailings management facility. The tailings management facility will contain both tailings and site contact water that is unsuitable for discharge. Water from the tailings management facility will be removed and reused as process water. Atlantic Gold will need to undertake further studies to determine the need for water treatment before discharging

any water from the site. Water that is suitable for discharge will flow through a discharge pipe and into the Anti Dam Flowage and the downstream environment.

The proponent projects that changes at the Touquoy Mine Site as a result of the Project will be minimal. These changes include the addition of concentrate storage, a second gravity concentrate leach reactor, and a gravity electrowinning cell. These changes occur within the existing facility footprint. As a result of the Fifteen Mile Stream Gold Mine project, the Touquoy Mine Site will have to operate for an additional seven years and tailings will be deposited into the mined out Touquoy pit. All other aspects of the Touquoy Mine Site will remain the same as previously assessed including the disturbed footprint, tailings management aspects, and the size and locations of stockpiles.

1.2.3 Closure Phase

The Closure Phase consists of two stages: Reclamation and Decommissioning; and Post-Closure. The objective of the Reclamation and Closure Plan is to return the site to a safe and stable condition, compatible with the surrounding landscape and anticipated final land use.

As outlined in Section 2.5.2 of the EIS, the goals of a successful Final Reclamation and Closure Plan include:

- Remove all equipment and infrastructure not necessary for future use and care of the site.
- Stabilize the terrestrial environment and revegetate the site to encourage regrowth of native species.
- Minimize disruption to the aquatic environment.
- Restore land and surface water use potential.

The reclamation goals are designed to enable eventual abandonment of the site in a safe and stable state.

Atlantic Gold has indicated that all site infrastructure will be removed, site water will be re-directed to the open pit, and the pit will fill with water to create a lake. The potentially acid generating waste rock pile will be covered with a clay cover and then capped and reseeded. Waste rock storage area and tailings dam embankment slopes will be graded so that they are structurally stable. After operations are complete, the tailings management facility will be drained, capped, and revegetated as part of the reclamation process. Water will be treated, as required, prior to discharge.

The Touquoy Mine Site will be reclaimed under a separate approved plan developed for the Touquoy Gold Project.

Reclamation and Closure Plans are required to be submitted to regulators at different stages of the Project. Before the project begins, Conceptual Reclamation and Closure Plans

need to be submitted and the Final Reclamation and Closure Plan must be submitted six months prior to mine closure.

The submission of a Conceptual Reclamation and Closure Plan allows the public, regulators, and the Mi'kmaq of Nova Scotia to provide comments. The Reclamation and Closure Plan will be used as the basis to determine the bond amounts and requirements at the Industrial Approval stage of the Project. Public and Mi'kmaq consultation and engagement will also be sought for the development of the Final Reclamation and Closure Plan through the Community Liaison Committee (CLC) or other technical advisory committee as determined through consultation with the Mi'kmaq and local stakeholders, as concerns raised during the development of the Reclamation and Closure Plan during earlier stages may have changed.

1.3 Regulatory Context

The Project has been subject to both federal and provincial environmental assessment processes. The document prepared by Atlantic Gold is intended to fulfill the Environmental Impact Statement (EIS) and the Environmental Assessment Registration Document (EARD) requirements of the federal and provincial processes, respectively.

The EIS/EARD for the Project was submitted by the proponent to facilitate the approval of the Project in accordance with the *Canadian Environmental Assessment Act, 2012* (CEAA 2012) and Environmental Assessment Regulations made under the Nova Scotia *Environment Act*. The EIS Guidelines (CEAA 2018) prepared by Canadian Environmental Assessment Agency (CEAA / Impact Assessment Agency of Canada [IAAC, agency name change as of August 2019]) have provided a framework for the organization of the EIS.

The environmental assessment process began in July 2018 and IAAC reviewed the Fifteen Mile Stream EIS submitted by Atlantic Gold in October 2019. IAAC determined that the EIS did not meet to the requirements that were outlined in the EIS Guidelines. IAAC identified areas where information and clarifications were required for the EIS to meet the requirements outlined in the guidelines. Atlantic Gold was required to revised and resubmit the EIS. The revised EIS was submitted by the proponent to IAAC in February 2019.

1.4 Mi'kmaq Engagement

As outlined in Chapter 4 of the EIS, the proponent began engaging with the Mi'kmaq of Nova Scotia during the Touquoy Gold Project over a decade ago and has stated a commitment to maintain Mi'kmaq engagement throughout the life of the Fifteen Mile Stream Gold Project.

The proponent engaged with the Mi'kmaq of Nova Scotia to gather views on the environmental effects to Valued Components (VC) including health and socio-economic conditions, physical and cultural heritage, historical/archaeological/paleontological areas of significance, and current and traditional use of land and resources. Engagement was also conducted to understand potential negative impacts of the Project on Aboriginal or Treaty rights, title, and related interests, and to accommodate the Mi'kmaq of Nova Scotia when able to do so.

The following are general engagement tools (outlined by proponent) that can be built upon over time as the Project develops depending on the need:

- Presentations and meetings with local communities.
- Regulatory meetings.
- Open houses and townhall meetings.
- One point of contact for the Mi'kmaq of Nova Scotia.
- Phone calls, emails, website, Dropbox and FTP sites and other digital media.
- Site visits and tours.
- EIS Technical Poster Boards.
- Newsletters and project updates.
- Project Summaries and Potential Impact Summaries.
- Questionnaires.

Atlantic Gold initiated the engagement program for the Project in early 2018 by holding regulatory meetings with all potential regulatory agencies and the Mi'kmaq of Nova Scotia. The regulatory meetings were followed by public open houses to provide general information on the Project. Subsequent to the public open houses, face-to-face meetings were held with Millbrook and Sipekne'katik First Nations and the KMKNO until the end of 2018 to share information on the EIS and environmental assessment process. The proponent also invited the Millbrook and Sipekne'katik First Nations on a tour of the area and participate in the Community Liaison Committee (CLC).

Information continued to be exchanged between the proponent and the Mi'kmaq of Nova Scotia through meetings, open houses and other means during 2019. In 2020, engagement occurred exclusively by digital means. An online/virtual meeting was held with Millbrook First Nation's Chief and Council to provide information on the project to new council members and another meeting was held with the KMKNO to discuss potential mitigation measures and impacts. Additionally, meetings with the Pictou Landing and Paqtnkek First Nations were requested.

The key feedback and issues that were compiled as shared during the engagement program with the Mi'kmaq of Nova Scotia were presented in the EIS as summarized in Table 1.

Table 1: Summary of Key Issues Raised During Mi'kmaq Engagement (adapted from the EIS).

Key Issue	Summary of Proponent Response
Dust from Project infrastructure impacting traditional practices, including ingestion of dust by plants and animals	▸ Minimization of air emissions with mitigation measures and monitoring. ▸ Commitment to dust suppression techniques (water and chemical if needed). ▸ Human health risk assessments to ensure plants and animals are safe to eat and water is safe to swim in.
Impacts to hunting practices near the mines	▸ Obtained community insight on hunting patterns that may be close to the Mine site. ▸ Operational mitigation measures to minimize noise and light impacts. ▸ Identification of tracts of crown land adjacent to site that may be suitable alternatives for traditional practices.
Impacts to quality of water being discharged to streams, rivers, and lakes and potential effect on fish, fish habitat, and other aquatic species	▸ Have only one discharge point on site. ▸ Reduction of impact on fish habitat. ▸ Predictive modelling of impacts to fish habitat. ▸ Water treatment and water quality monitoring. ▸ Indigenous participation in monitoring programs. ▸ Commitment to offsetting plans to reduce impacts to fish and fish habitat.
Concern for timing of renewed access to site after active mining is complete (land reclamation)	▸ Indication of reclamation plan to return the land for forestry and recreational use at end of life cycle. ▸ Traditional land practices will be able to resume after reclamation.
Safety Planning including dam integrity and tailings managements and legacy contamination issues	▸ Hazards based on risk have been assessed. ▸ Total breach of tailings management facility would have a high impact on the regional environment. ▸ Project area has been sited to limit potential impacts to wetlands, streams, and people if dam breached. ▸ Incorporation of dam breach into emergency response plan and safety reviews. ▸ The tailings management facility to be designed by qualified engineers to meet Canadian Dam Association Dam Safety Guidelines. ▸ Independent dam safety reviews to be completed. ▸ Preparation of Operation, Monitoring and Surveillance Manual.

Key Issue	Summary of Proponent Response
Loss of habitat for terrestrial and aquatic flora and fauna	▶ The site has seen historical disturbance and is not entirely untouched. ▶ Reduced mine site footprint. ▶ Bypass roads around important areas. ▶ Wetland and fish habitat restoration. ▶ Land reclamation at end of project life cycle to revegetate stockpiles. ▶ Stated commitment to Mi'kmaq participation in restoration planning and implementation. ▶ Habitat loss for eleven years, followed by revegetation with native plants.
Impacts to Fish Habitat through the rerouting of the Seloam Brook	▶ Seloam Brook previously disturbed by historical mining activities. ▶ Proponent has shared conceptual designs with Mi'kmaq communities and states that no concerns have been received to date. ▶ Commitment to design realignment with natural channel.
Legacy contamination issues Long term storage and safety of tailings and other contamination	▶ On-site management of historical tailings. ▶ Reclamation bonding.
Cumulative loss of area for traditional practices and changing landscape with Eskikewa'kik	▶ Project design involves processing at existing Touquoy Mine to reduce waste and mine footprint. ▶ Reduce mine site footprints through infrastructure placement and planning. ▶ Use of existing transportation routes where possible to protect habitat. ▶ Evaluation of Crown land loss in Esiskewa'kik from known and planned projects.
Ongoing engagement of the Mi'kmaq of Nova Scotia	▶ Proponent stated commitment to ongoing engagement prior to and post environmental assessment.

1.5 Mi'kmaq Rights and Use of the Area

1.5.1 Mi'kmaq Rights

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

Mi'kmaq of Nova Scotia assert both Aboriginal Rights[1] and treaty rights[2]. Aboriginal rights are the inherent rights of the Aboriginal people of Canada that came from prior use and historical occupation of the lands and waters of what is now known as Canada (Denny and Fanning, 2016). Aboriginal and treaty rights are protected under the *Constitution Act, 1982* (Section 35); this has been affirmed in Supreme Court of Canada (SCC) decisions, such as the Sparrow decision (1992) and the Marshall decision (1999).

1.5.2 Mi'kmaq Use of the Area

The Mi'kmaq of Nova Scotia continue to rely on their traditional lands for cultural and economic survival. The Project will impact the Mi'kmaq's ability to access lands during the Project life span and alter the presence or availability of animals or plants that the Mi'kmaq rely on.

The proponent gathered baseline information related to Mi'kmaq of Nova Scotia by:

- Gathering information during on-going engagement with the Mi'kmaq of Nova Scotia.
- Reviewing a Mi'kmaq Ecological Knowledge Study (MEKS) was completed by Mi'kma'ki All Points Services Inc. for the Fifteen Mile Stream Gold Mine Project and provided in Appendix H.1. of the EIS.
- Reviewing publicly available Indigenous knowledge related to the Mi'kmaq of Nova Scotia.
- Completion of archaeological screening and reconnaissance.

The MEKS provides baseline information on both historical and current land and resource use but for the purposes of this review, we have focused our efforts on summarizing current land and resource use within the Project Study area. Mi'kma'ki All Points Services defined the Study Area for current Mi'kmaw land and resource use activities includes the Project Area and a buffer of a 5 km radius surrounding the Project Area. The Study Area also includes corridor of 2 km along the haul road sections extending beyond the core Project Area.

The Study Area and surrounding area has been defined in the EIS as remote, quiet, dark, and undisturbed, with the exception of forestry activities and Nova Scotia Power Inc. (NSPI) operations within the watershed. As a result, it is expected that the use of the land for traditional practices by the Mi'kmaq of Nova Scotia is, and has historically been, completed with limited disturbance or interruption outside of those causes by forestry and NSPI operations.

[1] Aboriginal Rights refer to any activity that has an element of practice, custom, or tradition integral to the distinctive culture of Aboriginal group claiming the right. They generally refer to the right to exercise traditional activities such as harvesting, mapping, and gathering for food, social, and ceremonial purposes (including spiritual and cultural use). R.v. Van der Peet [1966] 2 S.C.R. 507, para 46.
[2] The Peace and Friendship Treaties include the rights to harvest in order to obtain a moderate livelihood. R. v. Donald Marshall (1999).

As defined in Section 6.13.2.2.3.1 of the EIS, the pattern of reported activities shows three major spatial clusters of harvesting activities within, or overlapping, the defined Study Area:

- Located among Lower Rocky Lake, Seloam Lake, and Antidam Flowage—the proposed Project is in the centre of this area.
- An area west of the Project near Como Lake.
- An area east of the Project just south of Hunting Lake.

The proponent notes that details relating to locations, frequency, duration, and timing of harvesting for specific fish, wildlife species, plants or other natural resources were not shared so the list of clusters above is not an exhaustive list. Those listed are a small selection of ongoing activities reported by a sample of the Mi'kmaw land users active in the region.

The proponent states that specific locations for recreational uses, especially swimming, and details relating to the context within which Mi'kmaq rights are being practiced including how subgroups (youth, elders, families, women) are using the land have not been provided to date.

The following table (Table 2) lists the sample of contemporary land and resource use activities reported to occur within the Study Region.

Table 2: Reported Contemporary Mi'kmaw Land and Resource Uses within the Study Region.

Land and Resource Use Category	Reported Resources and Activities
Hunting and Trapping	Whitetail deer (*Odocoileus virgianus*) Eastern moose (*Alces alces americana*) [sighting] Snowshoe hare (*Lepus americanus*) Porcupine (*Erethizon dorsatum*) Groundhog (*Marmota monax*) Black bear (*Ursus americanus*) Red fox (*Vulpes vulpes*) Bobcat (*Felis rufus*) Lynx (*Felis lynx*) Coyote (*Canis latrans*) Beaver (*Castor canadensis*) Muskrat (*Ondatra zibethica*) Otter (*Lutra canadensis*) Fisher (*Martes pennanti*) Mink (*Mustela vison*) Raccoon (*Procyon lotor*) Ruffed grouse (*Bonasa umbellus*) Ducks (*Anas rubripes* et al.) Canada goose (*Branta canadensis*), Barred owl (*Strix varia*)

Land and Resource Use Category	Reported Resources and Activities
Fishing	Speckled trout (*Salvelinus fontialis*) Atlantic salmon (*Salmo salar*) American eel (*Anguilla rostrata*) White sucker (*Catostomus commersoni*) Yellow perch (*Perca flavenscens*) Gaspereau (*Alosa pseudoharengus*) Smallmouth bass (*Micropterus dolomieui*) Freshwater mussels (*Margaritifera margaritifera* et al.)
Food, Medicinal, and Decoration Plants Collection	Blueberries (*Vaccinium angustifolium*) Cranberries (*Vaccinium macrocarpon*) Fiddleheads (*Matteuccia struthiopteris*) Chokecherries (*Prunus virgiana*) Goldenrod (*Solidago canadensis*) Gold thread (*Coptis trifolia*) Sphagnum moss (*Sphagnum* spp.) Labrador tea (*Ledum groenlandicum*) Hazelnuts (*Corylus cornuta*) Mushrooms (*Cantharellus, Agaricus campestris* etc.) Mayflower (*Epigaea repens*) Lion's paw (*Prenanthes trifoliolata*) Bloodroot (*Sanguinaria canadensis*) Golden seal (*Hydrastis canadensis*) Flag root (*Acorus calamus*)
Wood and Wood Products Harvesting	White ash (*Fraxinus americana*), Black ash (*Fraxinus nigra*) Balsam fir (*Abies balsamea*) Hemlock (*Tsuga canadensis*) Juniper (*Juniperus communis*) White cedar (*Thuja occidentalis*) Birch bark (*Betula papyfera*) Red oak (*Quercus rubra*)
Ceremonial / Spiritual Activities and Sites	Sacred site
Burial and Birth Places	Burial
Habitation and Camp Sites	Cabin, travel route

Note: Reproduced from *Mi'kmaw Ecological Knowledge Study - Fifteen Mile Stream Gold Development Project by Atlantic Gold Corporation* (p. 27-28), by Mi'kma'ki All Points Services Inc., 2018, Shubenacadie, NS.

The proponent has also indicated that while the species listed in Table 2 are of economic significance to Mi'kmaw harvesters, some of these—moose, salmon, eel, black ash, and various medicinal plants—are also of special cultural and/or spiritual importance. Several species considered of specific cultural importance to the Mi'kmaw community were identified within the Study Area during plant surveys conducted by Mi'kma'ki All Points Services (Table 3).

Table 3: Number of Identified Plant Species of Special Significance to Mi'kmaw by Type of Use.

Season	Type of Use	Number of Species
Fall (2017)	Food/Beverage	14
	Medicinal	47
	Arts/Crafts	11
Spring (2018)	Food/Beverage	8
	Medicinal	28
	Arts/Crafts	11

Note: Reproduced from *Mi'kmaw Ecological Knowledge Study - Fifteen Mile Stream Gold Development Project by Atlantic Gold Corporation* (p. 27-28), by Mi'kma'ki All Points Services Inc., 2018, Shubenacadie, NS.

The MEKS evaluated the significance of the potential project impacts on Mi'kmaq Land and Resource Use. The potential impact that has been identified as significant includes the potential habitat loss located in and around wetlands and lakes.

1.5.3 Known Mi'kmaq Archaeological Sites near the Fifteen Mile Stream Study Area

Many archaeological discoveries in Nova Scotia have occurred because of development activities. Given the Project area is undeveloped, there are very few records for the area. The archaeological record for most of Eskikewa'kik is very sparse and consists mostly of sporadic surface finds. As indicated in Appendix H.1., the Project area is identified as having high potential to contain Mi'kmaq heritage and resources and form part of a greater Mi'kmaq cultural landscape.

Two known archaeological sites attest to pre-contact Mi'kmaw occupancy of this part of the interior of mainland Nova Scotia, one located just north of the Fifteen Mile Stream Study Area on an island in Seloam Lake (burial site). Just outside the Fifteen Mile Stream Study Area on Liscomb River, 11 km further to the east, is another archaeological site.

An additional cluster of sites is located at the north end of Marshall Flowage, about 8 to 9 km south of the Fifteen Mile Stream Study Area. Some of those sites contain both pre- and post-contact components.

Chapter 2 Environmental Impact Statement Review

Section 5.2 of the EIS outlines the methodology used to conduct the EIS and predict the effects of the Project to meet the requirements of the EIS Guidelines. The EIS Guidelines include requirements under CEAA 2012 and the Nova Scotia *Environmental Assessment Regulations* made under the Nova Scotia *Environment Act*.

The methodology used to conduct the environmental assessment is based on the identification and assessment of potential environmental effects of the Project on Valued Components (VCs). The rationale for the selection of each VC is summarized in Table 5.3-1 of the EIS. The VCs that were identified are outlined below:

- Noise, light, greenhouse gases, and air.
- Geology, soil, and sediment quality.
- Groundwater quality and quantity.
- Surface water quality and quantity.
- Wetlands.
- Fish and fish habitat.
- Habitat and flora.
- Terrestrial fauna.
- Birds.
- Species of Conservation Interest and Species at Risk.
- Mi'kmaq of Nova Scotia.
- Physical and cultural heritage.
- Socio-economic conditions.

Based on consultation with KMKNO, the following VCs were selected for further consideration and analysis:

- Groundwater quality and quantity.
- Surface water quality and quantity.
- Noise, light, and air.
- Wetlands.
- Fish and fish habitat.
- Habitat and flora.
- Terrestrial fauna.
- Birds.

- Species of Conservation Interest and Species at Risk.
- Mi'kmaq of Nova Scotia.

The following subsections include a review of the assessment of each identified VC. Each section provides general comments and a summary of the assessment results, and outlines identified gaps, potential monitoring programs, and recommendations.

The following general comments apply to all of the VC sections reviewed:

- 'Interaction' tables do not actually list any interactions, just activities. Interactions are listed in later tables.
- Authors seem to use the phrase 'VC interactions' instead of activities, which is confusing to the reader and not standard practice.
- Many of the mitigation measures are described very briefly, if at all. Many VCs would benefit from more tailored and specific mitigation measures.
- In the Residual Environmental Effects Tables, under the Project VC Interactions column, this tables just list project phases; there are no activities listed and there is no explanation of interactions.

2.1 Air Quality, Noise, and Light Emissions Review

2.1.1 General Comments

The potential impact of greenhouse gasses, dust, particulates, elevated noise levels, and light emissions from the Fifteen Mile Stream Mine Site on Mi'kmaq traditional usage of the area and in wildlife movement patterns was a key issue raised during the Mi'kmaq engagement process. Our review focussed on emissions as they relate to Mi'kmaq use of the area. As outlined in the MEKS, Mi'kmaq gather and harvest a variety of traditional foods, medicines, and materials from within and adjacent to the proposed Project area. Impacts to these species and the habitat that support them were considered in this review.

While the project will emit greenhouse gases, emissions of dust and particulates are predicted to be the greatest source of concern for local air quality. Dust and particulate emissions could impact wildlife and flora in the vicinity. Impacts to these species and the habitat that support them were considered in this review.

In consideration of air quality, baseline dust concentrations in air were collected from two locations in the mine site area in November 2017 by Wood (2019). These were supplemented by data from two locations up to 60 km from the site, with similar characteristics to the mine site. Dust generation during the Project is generally associated with the surface mining as well as ore transport via truck. Future emissions were modelled by Wood (2019) and dust concentrations in air was predicted. The chemical composition of both baseline and future dust was estimated based on the geochemistry of waste rock from Fifteen Mile Stream Mine Site, with the percent composition of metals in the waste rock applied to percent composition of metals in dust.

The EIS states that noise data was collected at two sample locations in the Fifteen Mile Stream Study Area over a 24-hour period between November 20 and 22, 2017. Predicted project noise levels during construction and operation were assessed using the criteria established in the *Pit and Quarry Guidelines* (NSDEL, 1999). A baseline noise study was also conducted at the Touquoy site as part of the 2007 EARD (CRA, 2007).

The EIS assessed the light emissions of the Project as light spill (the extent that light will travel from the source) and sky glow (the brightness of the night sky from light spill). Potential wildlife responses to light emissions vary greatly and may be affected by the following factors: species, age and prior experience of individuals, duration, and frequency of light emissions, surrounding habitat types, timing of light emissions, season, and time of day.

2.1.2 Summary of Results

2.1.2.1 Air Quality

Air dispersion modelling identified elevated levels of particulates (dust) within 500 m of the site, specifically to the south of the Fifteen Mile Stream site boundary. All other air quality parameters modelled were within the Nova Scotia Objectives against which they were compared. With mitigation measures applied, none of the modelled air quality parameters exceed the objectives beyond the site boundaries. The mitigation measures used in the modelling consisted of dust suppression using water and chemicals, applied twice per day (Wood, 2019).

Modelled levels of metals in dust at the Fifteen Mile Stream site boundary were compared to Ontario air quality objectives; predicted levels of metals were below the guidelines and considered in the EIS to not pose a risk to people near the site. A review of the human health risk is provided in Section 2.13 of this report.

2.1.2.2 Noise Emissions

The noise modelling determined that the predicted sound levels at the Fifteen Mile Stream Mine Site property boundary will be at or below the most restrictive noise goals (nighttime hours of 55 dBA) during all construction and operational hours (day, evening, and night) at the property boundary. However, these levels are not below the Environment Code of Practice for Metal Mines ambient sound levels for night time at the property boundary (45 dBA), and so it is possible that wildlife around the Project Area may experience some level of disturbance during the project construction and operations phases due to nighttime noise emissions. This zone may interact with areas potentially used by Mi'kmaq and harvested species within these approximate ranges of noise distribution surrounding the PA have the potential to be affected by noise overnight.

Some species of fauna occurring in the general Project Area that could be affected by noise emissions and which are currently or were historically harvested within or near the Project area include:

- Whitetail Deer
- Eastern Moose
- Snowshoe Hare
- Porcupine
- Groundhog
- Black Bear
- Red Fox
- Bobcat
- Lynx
- Coyote
- Beaver
- Muskrat
- Otter
- Fisher
- Mink
- Raccoon
- Ruffed Grouse
- Ducks
- Canada Goose
- Barred Owl

Among these species, susceptibility to noise impacts may vary greatly depending on species, age of individuals, surrounding habitat type, season (and reproductive status), time of day, and the prior experience of the individual.

There are no established limits for noise levels on wildlife, although the Environment Code of Practice for Metal Mines (Environment Canada, 2012) has established parameters for ambient noise levels for wildlife. These parameters indicate that ambient noise observed above 55 dBA during the day and 45 dBA at night can affect wildlife.

According to the results of the Noise Impact Assessment (Appendix J.1), noise measured at 45 dBA is not predicted to travel farther than 1.5 km from the Fifteen Mile Stream Mine Site property boundary during the operations phase. The predicted sound levels are expected to attenuate to background levels (25.9 dBA) over an approximate distance of 4 to 5 km.

As outlined in the 2018 Noise Impact Study completed in support of the Beaver Dam EIS, the predicted total sound level range at the Touquoy Mine Site property boundary is 39.2 to 53.9 dBA (GHD, 2018), a range which is below the most conservative threshold (nighttime hours of 55 dBA) set in the Pit and Quarry Guidelines (NSDEL 1999). Similar to the Fifteen Mile Stream Mine Site, it is possible that wildlife around the Project Area may experience some level of disturbance during the project construction and operations phases due to nighttime noise emissions. This potential impact zone does not appear to have been mapped, though it will extend considerably less than 5 km from the Touquoy site, as background noise levels at the Touquoy Mine Site were predicted to be reached at approximately 5 km from the PA (GHD 2018).

There are no new or additional effects from noise anticipated to be caused by the processing of concentrate and the management of tailings from the Fifteen Mile Stream Mine Site. The Touquoy site has received no noise complaints to date.

2.1.2.3 Light Emissions

The EIS states that at the Fifteen Mile Stream site, the acceptable thresholds for light are expected to be met within 2 km of the mine site. Light emissions are not predicted to

change at the Touquoy site, with the exception that the duration of light emission will increase, as the processing of Fifteen Mile Stream concentrate will extend the life of the Touquoy site by several years.

2.1.3 Identified Gaps

- The EIS states that the ore-bearing rock will be trucked from the pit to the ROM hopper for crushing or stockpiled on the ROM storage pad for later crushing; there is not indication that this is an indoor facility. The Wood (2019) report states that all material from the open pit will be sent to a warehouse for storage and that all crushing and milling activities will take place indoors; clarification of this assumption is warranted.
- A map showing the predicted extent of the 45 dBa zone around both the Fifteen Mile Stream and Touquoy sites would be beneficial in determining the zone of potential impacts to wildlife due to nighttime noise emissions.
- The discussion of noise impacts on wildlife, particularly harvested species and SAR, have not been described in sufficient detail.
- There is no discussion of potential impacts of increased noise emissions on wildlife due to increased travel between the Fifteen Mile Stream and Touquoy sites.
- It is not clear how many additional years of operation will be added to the Touquoy site.
- It is not clear how many of the activities listed in Table 6.3-5: Potential Interactions with Project Activities and Light in the Fifteen Mile Stream Study Area are predicted to interact with Light levels, as presumably not all of these activities will be occurring at night.
- The only receptors assessed in detail seem to be human residences.
- The discussion of light impacts on fauna, particularly harvested species, is rather short and low on details.

2.1.4 Monitoring Programs

Air monitoring at the Fifteen Mile Stream Mine Site property boundary will be completed as determined through the Industrial Approval process. Frequency and specific details of air monitoring will be determined in consultation with regulatory agencies and will be described in the application for an Industrial Approval for the site development following the environmental assessment process. A Complaints Protocol will be followed to provide a mechanism to register concerns and discuss them with Project representatives.

Air quality monitoring is currently ongoing at the Touquoy Mine Site as required through the Industrial Approval and will continue throughout the operation phase of the Project. The data collected will be used to better understand potential effects and refine mitigation and monitoring requirements prior to the processing of Fifteen Mile Stream concentrate and management of associated tailings.

As the nearest receptor is located at 4.9 km from the Fifteen Mile Stream Mine Site, no noise monitoring is recommended to be implemented to verify the predicted environmental effects and the effectiveness of the mitigation measures outlined in Table

6.1-7. A Complaints Protocol will be followed to provide a mechanism to register concerns and discuss them with Project representatives. Additional noise monitoring would occur if directed by regulators or because of a complaint.

Under the existing Industrial Approval for the Touquoy Gold Project, maximum sound levels are prescribed at property boundaries for days, evenings, and weekends, and monitoring is required only when requested by NSE in response to a complaint or concern. Mitigation measures are to be implemented as necessary where sound levels are a concern, i.e., causing annoyance, and monitoring demonstrates exceedances.

2.1.5 Recommendations

- Monitoring of dust and particulate emissions during the construction and operations phases will presumably be required as part of the Project approval and are recommended.
- Request clarification on the assumptions used in the air dispersion modelling. If crushing and stockpiling activities are not contained in a warehouse, they should be considered in the air dispersion modelling.
- Request clarification on the assessment of noise on wildlife species, particularly those harvested by the Mi'kmaq communities that traditionally harvest in the region.

2.2 Groundwater Review

2.2.1 General Comments

Groundwater work was completed at two sites:

1. The new proposed Fifteen Mile Stream Open Pit Mine.
2. The currently active Touquoy mine.

The Touquoy mine site is connected with the current EIS because some of the waste from Fifteen Mile Stream will be shipped to Touquoy and deposited in the finished, empty open mine pit. This means that the waste generated by the Fifteen Mile Stream mine will affect two separate sites. For additional context to this review, a brief overview of the pathways through which open pit mining can affect groundwater is provided in Appendix A.

These studies were completed by different consultants using different tools, different techniques, and producing different results. Both studies were generally complete and followed standard industry protocols. CBCL has identified issues in both studies that are relevant to KMKNO.

Mining activities tend to reduce the ability of the nearby natural environment to support wildlife. Users of the lands surrounding the mine may notice a difference in the abundance and health of plants, trees, fish, and other wildlife (for example: ducks, grouse, moose). Some of these effects could be related to groundwater.

- The amount of groundwater flowing to streams and wetlands will be reduced.
- The quality of groundwater flowing to streams could change. Worst case examples at other mines have included increased acidity and high concentrations of arsenic.

2.2.2 Summary of Results

2.2.2.1 Fifteen Mile Stream Mine

Work to study the groundwater at Fifteen Mile Stream included:

- Drilling of boreholes and installation of groundwater monitoring wells.
- Measurement of the water table depth and properties affecting flow rates.
- Groundwater quality samples.
- Computer models to predict:
  - The effects of mining on rates of groundwater flow to local streams.
  - Groundwater flow paths between waste storage areas, the closed pit pond, and local streams/wetlands.

Groundwater quantity studies at Fifteen Mile Stream reported the following potential changes.

- During mine operation, dewatering will cause significant drawdown in areas close to the pit.
- Flow rates to East Lake are predicted to decline by 45%.
- The effects of dewatering on local streams are predicted to be generally of low significance.
- When the mine closes, the pit will flood and act as a source zone for flow into the groundwater.
- The tailings management facility will act as a source zone for flow into the groundwater, causing a long-term increase in discharge to surface water in the surrounding areas, taking more than 100 years for the water table to return to pre-mining conditions.

Groundwater quality studies at Fifteen Mile Stream reported the following:

- Existing concentrations of heavy metals are elevated in soil and groundwater.
- Future groundwater quality could be affected by existing contaminated soils, blasting agents (ammonium and nitrate), acidic drainage from rock storage pile, and water seeping from the tailings management facility.
- Groundwater is predicted to discharge to collection drains, the flooded pit, and local surface water bodies during and after pit operation.
- Groundwater and surface water contamination are to be addressed through water collection and treatment “if and as required”.

Reporting on impacts to surface water quality included the potential effects of groundwater contamination. Impacts to surface water at the Fifteen Mile Stream site are predicted to be within acceptable levels. Further commentary on methods used in surface water modelling are provided under our review of Surface Water studies (Section 2.5).

2.2.2.2 Touquoy Mine

The Touquoy pit will receive waste tailings from Fifteen Mile Stream mine site as a part of the gold extraction process. Groundwater studies of the Touquoy site reported the following:

- Dewatering of the pit will reduce baseflow to the Moose River by up to 1.7% in the summer months.
- The existing soil, groundwater, and surface water at Touquoy are contaminated by heavy metals.
- The current computer model predicts that contaminated water stored within tailings pit will not flow to the nearby Moose River, approximately 100 metres away.

2.2.3 Identified Gaps

2.2.3.1 Fifteen Mile Stream Mine

- The computer model predicted lowered water levels within 140 metres of the pit during operation, but it's unclear if or how this effect was incorporated into the surface water model to determine impacts to surface water quantity and ecological health.
- The computer model considered a zone of more permeable rock around the pit walls but did not take advantage of the software's ability to simulate large, individual fractures.
- The computer model relied on a method that considers groundwater flow paths, but does not simulate contaminant concentrations, plume development, or mass loading.
- The computer model provided no estimates of the mass of contaminants that will pass from groundwater into surface water.
- It's unclear if or how groundwater loading of contaminants to surface water was included in the surface water assessment.

2.2.3.2 Touquoy Mine

- The existing computer model predicts that effectively no contaminated water will flow from the tailings pit to the Moose River. This is contrary to conventional conceptual models of groundwater flow, including all other aspects of the conceptual site model as presented in groundwater reporting for the Touquoy site.
- Example calculations suggest that, with a horizontal flow path, groundwater could flow between the closed pit and the river on time scales varying from less than five years in the upper weathered bedrock unit, up to approximately 200 years in the deeper competent bedrock. These calculations do not account for the potential influence of transport through discrete fractures, which would lead to shorter travel times.
- Pending more detailed reporting, there are indications that the computer model of the closed Touquoy pit is not a reasonable representation of the future groundwater flow system. More detailed reporting on the computer model is needed, including cross-sections showing 3D groundwater flow paths from the tailings pit to the river, a detailed description of the boundary conditions in and around the pit, including the Moose River, recharge and/or hydraulic boundary conditions applied to the top and walls of the tailings pit, a local water budget showing the origin and fate of all flow entering and

exiting the pit and surrounding features, a detailed conceptual model and analysis of field data supporting the modelled hydraulic conductivity of the till unit and the tailings unit, and a discussion of advective transport, and how the model treats and represents advective transport between the tailings pit and the Moose River. The need for this data was stated previously by government reviewers, as quoted in the Concordance Table of the report (Appendix A). The existing iteration of the modelling report has not adequately addressed these comments. The concentration contours that have been presented are suggestive of an artefact of numerical dispersion and are not consistent with expected patterns of advective transport/dispersion.

2.2.4 Monitoring Programs

The EIS states that water quality impacts will by managed through collection and treatment if needed. The contingency plan will need to provide clear definitions for the following:

- Confirm and provide mapping of discharge points, where potentially contaminated water may enter the local environment.
- Frequency of sample collection.
- Threshold concentrations for each parameter, including references and regulatory guidance for each threshold concentration, and timing/persistence of threshold concentration that will initiate treatment.
- Supporting environmental effects monitoring of ecological features, as appropriate (including criteria, metrics, schedule).
- A description of the specific treatment technology that will be implemented if the threshold concentration or ecological criteria are exceeded, including discharge criteria.
- A schedule of implementation from the time of detection to the time of deployment of the treatment system.
- Commentary on the ability of the treatment system/plan to manage storm water flow.

A schedule of long-term operation including equipment maintenance and discharge/ compliance monitoring.

2.2.5 Recommendations

Request additional modelling of groundwater impacts and flow paths to respond to information gaps identified.

2.3 Water Quality and Quantity Review

2.3.1 General Comments

The EIS main document reviews the impact of construction, operation, and closure phases of the Fifteen Mile Stream open pit mine (including impact to Touquoy's mine site). In general, the information provided on surface water quality and quantity was focused on weighing the impact of modelled scenarios of the watershed and site's baseline and future

scenarios, the Seloam Brook realignment, and identifying mitigations in operation, maintenance or design to meet environmental objectives.

Using geochemistry, climatic and hydrometric data, climate change projections, process water quality, and groundwater implications, the models predicted water quality in the onsite storage ponds and the resulting impact of releases of water to nearby watercourses (of both Fifteen Mile Stream and Touquoy sites). Water quality data points were then compared to applicable generic and site-specific environmental water quality objectives.

It is important to note that there is historical mining activity at this site which poses a challenge to predicting ground and surface water interactions with natural geology.

At Fifteen Mile Stream, the diversion of Seloam Brook represents a major modification of the local catchment area. Multiple water management ditches and ponds will be constructed to collect contact and non-contact stormwater, separating acid-generating waste rock runoff from other sources. A tailings management facility will be constructed to meet national stability standards and will also include a seepage collection pond. All water holding infrastructure will be constructed to withstand slope stability and will also include liners to prevent groundwater interaction. A single intake for raw water and a single discharge to the Anti-Dam Flowage (from the tailings management facility) will be constructed for controlled water use and discharges.

At Touquoy, modifications to the cyanide gold extraction process will be implemented including increasing production capacity to allow for processing of Fifteen Mile Stream gold concentrate. Haul roads will be constructed and/or modified between the sites.

2.3.2 Summary of Results

2.3.2.1 Construction Phase Implications

Construction phases were discussed qualitatively in the EIS regarding impact to the environment. The focus was primarily on preventing sediment releases to surface water caused by erosion. Prevention modes include following construction best management practices and contingency sediment control in runoff, as needed. Though this is a typical assessment for construction at the EIS level, where this was a concern at the Touquoy site this may warrant additional scrutiny to determine how erosion will be prevented in future developments.

Muddy brook downstream from Atlantic gold clay mining site in December 2020. Photo: Mitchell Glawson

Same brook muddied with sediment again on January 17, 2021 Photo Krista Gillis

Photo 1: Photo excerpts from a Halifax Examiner article (Baxter 2021) discussing 32 environmental charges related to Atlantic Gold operations.

2.3.2.2 Fifteen Mile Stream (Operations and Closure Phases)

The main risk to water quantity and quality highlighted during operations was based on the evaluated surplus of water requiring controlled discharge. Many open pit mines can operate without a discharge, but this is not the case at this project site. During closure, water is expected to flow through the remining open pit, and passively discharge to the environment. Both scenarios may raise the risk of metals contributions to the nearby environment due to onsite mining/mill processes, acid generating waste rock piles, groundwater chemistry, tailings management facility seepage, and surface runoff sediments. The following observations were made of the review:

- The diversion of Seloam Brook is presented as a long-term improvement to fish passage where previous mining activities left the area streams and tributaries in a braided configuration. Water levels are proposed to be controlled within acceptable ranges during low flow and flood conditions for fish passage, and to provide water to mine operations and sufficient mixing regimes for effluent discharges. The supporting data for these conclusions are unclear in the main EIS document, and CBCL is unable to support and further evaluate the validity of this statement without more detailed review of modelling approaches.

- To assess the potential change in stream flow through the Seloam Brook system (i.e., Seloam Brook and tributaries within the SW5 watershed boundaries), because of re-directing flows around the Open Pit, the following was carried out:
  - Analysis of the predicted flooded extent downstream of the realignment and water depth.
  - Optimization of the stream realignment.
  - Analysis of Q200 flood flow scenario.
  - Groundwater - Surface Water interaction.
  - A two-dimensional (2D) flow model was developed for the realignment channel, road crossing, culvert, and surrounding area to support the design.
  - Four flow scenarios were selected to assess channel realignment (1:10, 1:20 Annual Dry, Mean Annual Discharge, and 1:200).
- A channel redesign was undertaken that did not appear to be based on modelling. It is unclear at this time why the redesign was not modelled and how this may impact results.
- A number of existing dams and water structures within the area already exist downstream of the site, providing the infrastructure for hydro power to NSPI. It is unclear what the impact of these structures will be to the site, and if they were considered.
- Sizing of collection ponds and the tailings management facility are based on three major factors stormwater events, construction/materials stability to prevent erosion/leaks, and in considering various acid generating material types to prevent water quality impact.
- Water management ponds and associated water management structures were typically designed to accommodate a 1-in-10 year, 24 hr storm event (approximately 116 mm) plus direct precipitation from a 1-in-200 year, 24-hr storm event (approximately 184 mm) falling directly on the surface of the pond. It is unclear what reference was used to select these design storms. In general, a 1 in 10-year storm does not seem like a very conservative approach, however, there is a plan to divert pond water to the tailings management facility as needed which is a much larger reservoir. 1:10 year size will mean that larger storm events won't have much time for settling solids before diverting to the tailings management facility.
- Water management infrastructure has been sized to pump back collected flows to the tailings management facility supernatant pond over a 10-day drawdown period.
- Storm events and their design factors were adjusted as appropriate to reflect the predicted effects of climate change (15% for structures with a design life longer than 30 years. Both the tailings management facility and Seloam Brook Realignment have been designed with considerations for a 15% increase in peak design flows). It is unclear if or how climate change was considered for the rest of the site design, modelled scenarios, and site phases.
- Overflow weirs will be constructed in water management pond embankments to facilitate safe discharge of flows exceeding the design flows of the pond, up to the IDF for the ponds. The IDF for each pond will be estimated based on dam classification of the retaining embankments for the ponds and will be greater than or equal to a 1-in-

100-year return period storm event. The dam classification for the seepage collection pond dams will be evaluated as part of the Industrial Approval process.

- During the operations phase, non-contact water (i.e., natural runoff from undisturbed catchments) will be diverted directly to the environment; where required this natural runoff will be directed north of the open pit and west through Seloam Brook. Non-contact water is expected to be diverted offsite directly without consideration of treatment.
- To manage contact water (i.e., drainage that has come into contact with disturbed rock or overburden), a series of water management ponds will be used to collect and control the flow across the Site.
- Tailings beach and tailings management facility embankment runoff will collect in the tailings management facility pond.
- The flow of effluent to the environment is based on the Knight Piésold site water management plan. Due to limited time, this document was not reviewed.
- The operations water quality model assumes that the tailings management facility pond effluent flow rate will be actively controlled; in this model, the monthly effluent flow rate from the Knight Piésold site water management plan was applied.
- Separation of acid generating rock piles and ponds allows for potential segregation and treatment of challenging source water.
- Intake raw water (at a single source point) is required for fire water and process water at the mine and mill operations.
- Outfall/discharge pipe (at a single discharge point to the Anti-Dam Flowage) is required to offset storage volumes in tailings management facility.
- Effluent discharge objectives were not developed but are planned to meet best practices and Metal and Diamond Mining Effluent Regulations effluent regulations including toxicity. It is unclear what effluent concentrations were used to assess watercourse concentrations in modelling.
- Impact to nearby watercourses due to potential seepage from the tailings management facility was evaluated though the proponent does not expect this to occur. A selected portion of seepage was diverted to the watercourse to calculate resulting concentrations.
- Residual effects for watercourse surface water quality were predicated based on base case and upper-case scenarios, using an allowed mixing zone of 100 m during variable flow regimes in the water courses.
- Some of the predicated watercourses concentrations are lower than the baseline which is unusual given the presumed addition of dissolved metals loading at outfall.
- Predicted operational water quality in downstream watercourses have shown potential parameters of concern as aluminum, iron, cadmium, and arsenic.
- Predicted closure phase water quality in nearby watercourses list cobalt, cadmium, and iron as tentative parameters of concern.
- Petroleum/fuels, explosives and chemicals/reagents management are mentioned qualitatively as intended to meet best management practices to prevent residuals impact on the site and water. It is unclear if a portion of these materials were

incorporated into modelling scenarios based on anticipated exposure to site surfaces/runoff.

- Monitoring and management plans are cited as proposed to be developed for a number of aspects around the site and operation.
- Accidents and malfunctions regarding water are focused on spills, leaks, breaches of dam/embankments/berms. Between these and the mitigations of surface water quality issues, there is a general low significance placed on the risk of water quality issues from the operations at the Fifteen Mile Stream site or due to Touquoy site changes.

2.3.2.3 Touquoy Site (Operations and Closure Fifteen Mile Stream Phases)

Concentrate will be hauled from Fifteen Mile Stream to Touquoy for processing and gold production including an expanded cyanide leaching process. The tailings will be directed to the Touquoy tailings management facility until mine operations ceases. Then, tailings will be directed to the Touquoy pit. A consolidated review of impacts from various proposed mine sites owned by the proponent are discussed in the EIS but the previous history on Touquoy's environmental approvals and operating permit were not reviewed. Touquoy has an existing integrated water balance model that is used in its operations currently and it was updated for the purpose of this EIS to predict watercourse impacts. The model used was unclear and was not consistent with the model selection and evaluation methodology carried out at the Fifteen Mile Stream site.

The primary potential effect of the continued use of the Touquoy facility on surface water quality is the use of the exhausted Touquoy pit for tailings storage with possible groundwater seepage degrading surface water quality in receiving environments and the potential for Accidents and Malfunctions. Deposition of tailings in the exhausted Touquoy pit for the Project will accelerate the time to naturally fill the pit during reclamation. However, as water in the pit is planned to be treated to meet regulatory discharge limits, this does not change the environmental effects predicted for the reclamation and closure plans for the existing Touquoy Mine Site, it simply changes the total time for the pit to fill.

The following observations were made about Touquoy in reviewing the EIS:

- Aluminum, arsenic, copper, and unionized ammonia are predicted to be potential parameters of concern in the nearby watercourses based on updated modelling results and dispersion/mixing zone assessments. Substantial detail of these assessments and how the results may be impacted by the additional materials from Fifteen Mile Stream was not provided within the EIS.
- Cyanide concentrate leaching is being expanded to take on consolidated mine operations.
- Depositing tailings at Touquoy from residual Fifteen Mile Stream concentrate processing lowers the footprint of transportation and risk of spills during hauling if it were to be returned to Fifteen Mile Stream.

- It is not clear if treatment of effluent at Touquoy will be provided or if it is only planned as needed because proponent concludes that it is not needed based on modelling results.

2.3.3 Identified Gaps

- Temperature effects at the effluent discharge point and within the mixing zone, including downstream watercourse impacts, were not clearly identified in EIS.
- It is not clear why some predicted watercourse concentrations are lower than the background concentrations.
- It is not clear if there will be any water reuse in the mill/concentrator operation from the tailings management facility or if intake water be once-through and discharged.
- It is unclear how the relationship between the NSPI hydroelectric water control network/structures and the operation of the proponent's mine site was incorporated into the design or modelling approaches. There is an inferred potential flood impact at mine site if water levels are high in downstream NSPI dams.
- Flood extents mapping of proposed watershed changes were unclear in the Mapbook.
- It is unclear if flood risks or flood plain assessment was completed on the remaining site, apart from the considerers to the Seloam Brook realignment.
- Explanation is required on how, during construction, erosion and sediment control will be improved versus how it was managed at the comparable Touquoy site,
- The mixing zone/dispersion of effluent analysis was not described in detailed in the EIS. Typically, the proposed location of the discharge pipe, diffuser arrangements, and plume analysis using 2D or 3D modelling (including effects of vary discharge volumes, concentrations and understanding temperature effect) would be clearly state, whereas they are not within the EIS.
- Clarity on the predicted effluent volumes/concentrations at discharge points for selected climate events/ scenarios is required. It is not clear how these results compare to baseline conditions. The selection and characteristics of design storms or climatic conditions simulated within the hydrological model for evaluation purposes of impacts or design were not clear within the EIS.
- Erosion prevention in the diverted channel is not described beyond following best practices, can that be elaborated on? Does the change in velocity impact fish passage?
- It is not clear if dispersion modelling or watercourse concentration modelling is 2D/3D modelling, or if it incorporates a design of the outfall (e.g. diffusers, ports, length/location, or temperature).
- Modelling predictions are being used to conclude that treatment is not needed at the discharge point(s) at the sites, yet it is unclear how accurate the model results are or whether uncertainty or safety factors were considered. Perhaps some comparisons of how Touquoy's original models and assumptions compare to actual operation would support this approach. Regarding Fifteen Mile Stream, there seems be several

assumptions, and pre-existing unknown conditions at the site that could affect model accuracy:
  - Assuming best practices always followed on chemical/explosives/fuel handling could lead to less concentrated base case process water concentrations.
  - The unknown implications of historical mining, waste rock, and till characteristics poses an issue as anomalies may be encountered in the geological/ground conditions.
  - Dust control can impact water use and sediment transport in site water; it is unclear if this was considered.
- It is not clear if dimensions of mixing zones at the discharge watercourses have been finalized.
- The mitigation of adding treatment at both Fifteen Mile Stream and Touquoy, if needed, appears to be a more significant risk than is currently reported in the EIS. It is not clear how quickly or easily treatment can be implemented if it is needed. This is particularly challenging when the tailings management facility embankment stability must be protected from high water volumes to prevent catastrophic failures and releases of tailings.
- If implemented, it is unclear what effluent treatment technologies are planned for the as-needed treatment plant. Suggest having this well scoped in a contingency plan, potentially onsite for use as needed.
- In the selection of generic water quality objectives, it is typical in Nova Scotia to also see some reference to the Atlantic Risk Based Corrective Action guidelines for petroleum hydrocarbons (which may have been considered, but it was not clearly stated in the text reviewed).
- The predicted water quality at Fifteen Mile Stream focuses on metals while there is still a risk of petroleum/fuels, chemicals, and residual explosives (affecting nitrogen compounds). Mitigations assume best practices will prevent these from entering the water system except in accidents/malfunctions where they are listed as a potential spill. It is more common that some low frequency, low volume form of contamination can occur and go unnoticed. The impact of this should be anticipated or monitored at the site in addition to typical Metal and Diamond Mining Effluent Regulations parameters for monitoring.
- Solids management in settling ponds or treatment plant are not identified.
- Details are missing on the changes at Touquoy expected, specifically, in comparison to the original environmental impact assessments or the existing operation. Is there in increase in flow, concentration of tailings expected? Is there an increase in storage of cyanide? Will cyanide degradation be an issue?
- Though the intake is not yet designed, its size and approach poses the risk of entrainment/impingement of fish.
- Details are not provided on water treatment at Fifteen Mile Stream. What happens to the pit lake/water feature on closure if water concentrations do not meet water quality objectives? Will it be treated for the duration of time and owned by the proponent?

- Specific data source references for drainage basin and topography/geography descriptions are not clearly provided within the EIS.
- Climate data from Halifax Airport was used to statistically determine probabilities of a storm events occurring at the site, this is a different approach than what is undertaken in the Fifteen Mile Stream hydrometric model (GoldSim) – it is unclear how approaches compare and how they are applied for final design decisions.
- Clarification should be provided on Fifteen Mile Stream GoldSim model selection vs that of Touquoy vs alternative modelling methods.
- Explanation of climate change factors added to storm events for predicted hydrology, when and to which site components these were applied and for what scenarios is not clear.
- The methodology for determination of why potential effects do not extend "greatly" beyond the Local Assessment Area is not clear.
- The realignment design was not modelled, rather, the range of stream velocity estimated through the revised design (Wood 2020) was compared with those modelled using the Knight Piésold (2020) design for applicability to this downstream hydraulic assessment. Modelling of the design is missing. It is not clear how the velocities were estimated. CBCL is unable to review the validity of this approach at this time based on time constraint.
- Baseline and operations scenarios on watercourses surrounding the site do not indicate volumes, velocity changes, or targets for intake or discharge. Seasonal comparisons of stream flows are not provided.
- Climate change predictions for the life of the pit/final water feature is lacking. If it does not meet water quality objectives, a controlled and treated effluent discharge point will be required. Climate change assessments in the EIS are focused on the life of the mine operation but do not mention the life of the pit which is much longer/infinite.

2.3.4 Monitoring Programs

Monitoring plans are not prepared yet, but the following should be considered for surface water quality and quantity:

- Monitoring of water entering fish bearing water should include all parameters of concern based on predicted modelling and identified sensitivities to the receiving watercourse.
- Water levels and predicted overflow conditions should align with climate change predictions on precipitation/evaporation.
- Non-contact runoff designated areas should have regular soils sampling to assess the impact of dust settling in the area as this will disperse as sediment into the environment during rainfall events or contribute to groundwater contamination.
- In the case of a storm event water management ponds are to be monitored regularly.

2.3.5 Recommendations

- Request clarifications and additional information/analysis identified in information gaps.
- Request piloting or bench scale lab work to confirm water characteristics for inputs into the model instead of assumptions and chemical calculations.
- Request comparisons of how Touquoy's original models and assumptions compare to actual operation to support the predictions.
- Request dimensions of mixing zones at the discharge watercourses be tied back to a risk-based selection in the water courses, vs arbitrary assignment of 100 m.
- Request elaboration on discharge treatment mitigation plan at both Fifteen Mile Stream and Touquoy, including how it will be delivered and contingency plans to prevent uncontrolled releases, particularly during high storm events.

2.4 Wetlands Review

The Wetland Section was reviewed in terms of wildlife habitat as it relates to Mi'kmaq interests, particularly harvesting of fauna and flora.

2.4.1 General Comments

As outlined in the EIS, mapped wetland areas were identified from the NSE Wetland Inventory Database and the Nova Scotia wet areas mapping database was reviewed to identify potential un-mapped wetlands. NSE's wetlands of special significance mapping was also consulted to assess the presence of expected and potential wetlands of special significance within the Fifteen Mile Stream Study Area.

Following the initial desktop review, field surveys were completed within the Fifteen Mile Stream Study Area between November 2016 and August 2019, generally within the growing season (June 1 to September 30). Wetlands that were assessed outside of this period were revisited within the following growing season to confirm functional assessment conclusions and species assemblages.

Standard accepted methods were used to delineate, classify, and assess the functioning of the wetlands. Further baseline field surveys were conducted throughout the entire Fifteen Mile Stream Study Area to assess the suitability of wetland habitat for wetland specific species, especially those considered to be species at risk and/or species of conservation interest.

Wetlands were identified within Touquoy Mine Site as part of the EARD process via the NSDNR Wetlands Database and air photo interpretation. These wetlands were assessed in September 2006 and in the spring of 2007 (CRA, 2007). Further wetland surveys were conducted from 2015 to 2018, including delineation and functional assessments as part of the wetland permitting process.

2.4.2 Summary of Results

As stated in the EIS, a total of 274 freshwater wetlands were present within the Fifteen Mile Stream Study Area, accounting for 210 hectares and representing a land cover of 16.6% of the Fifteen Mile Stream Study Area. Tree and shrub swamps were the most abundant wetland types in the Fifteen Mile Stream Study Area, accounting for 70% of all wetlands. Bogs accounted for 18% of all wetlands within the Fifteen Mile Stream Study Area, and 15% of the total wetland area. Fens and marshes combined account for 3% of wetlands within the Fifteen Mile Stream Study Area, and 4% of the total wetland area.

In general, hydrological flow within wetlands present within the Fifteen Mile Stream Study Area follow Seloam Brook from Seloam Lake in the northeast, through the proposed open pit, and continue west towards Fifteen Mile Stream. Wetland 2 is the predominant wetland complex that exists along Seloam Brook. This system is fed by tributaries from the east (WC12, which originates in Wetland 27), and from the south (WC 2, from WLs 3 and 1). This system has many side channels and other associated wetlands, including Wetlands 219, 13, 240, 133, 175 and 173. Two main branches of Seloam Brook converge in WL 64 before flowing into Fifteen Mile Stream.

The proposed tailings management facility lies on a watershed divide, where wetlands to the north drain into Seloam Brook, while wetlands present in the southeast portion of the proposed tailings management facility flow east into East Lake (which eventually flows into Anti-Dam Flowage). Toward the southern extent of the Fifteen Mile Stream Study Area, one drainage basin collects water from Wetlands 47 and 52, converges in Wetland 249, 250 and 251, and continues to drain outside of the Fifteen Mile Stream Study Area directly into Anti-Dam Flowage. While many wetlands are associated with those main watercourse systems, the vast majority of wetlands within the Fifteen Mile Stream Study Area are isolated or are only hydrologically connected to others by drainage instead of watercourses.

Direct and potentially indirect losses of wetlands will occur as the result of Project development. The maximum potential indirect impact of the project on wetlands is 10.78 hectares. This represents 5.1% of delineated wetlands within the Fifteen Mile Stream Study Area, and 0.8% of wetlands within the LAA. Impacts will occur to two wetlands of special significance, both of which support blue felt lichen.

A total of 52 wetlands were identified within the Touquoy Mine Site (including the western bypass road) during additional field studies from 2015 to 2017. Evaluation for the purposes of this Project was limited to riparian wetlands along Moose River, downstream of the proposed discharge location from the exhausted Touquoy pit, once tailings deposition is complete, to identify any potential indirect impacts to riparian wetlands from the Project due to a potential change in flow regime in the River. There are no new direct or indirect wetland impacts predicted at the Touquoy Mine Site.

2.4.3 Identified Gaps

- Some discussion of which wetlands are more likely to support harvested species of fauna would be beneficial.
- Removal of wetlands and watercourses for the tailings management facility without re-directing flow could impact wetlands around East Lake, however this potential impact does not appear to be discussed in the EIS.

2.4.4 Monitoring Programs

A Preliminary Wetland Compensation Plan was provided as Appendix G.4 of the EIS. Specific post-construction wetland monitoring requirements will presumably be provided to the proponent by NSE as part of the wetland alteration approval process. As these detailed plans have not yet been prepared, no comments can be made.

2.4.5 Recommendations

- CBCL recommends post-construction monitoring for wetlands to be impacted by the Project, particularly those which may support flora or fauna species traditionally used by Mi'kmaq.
- Mi'kmaq FN communities and groups should be consulted on the final wetland compensation plan, particularly in terms of how it contributes to relevant fauna habitat.

2.5 Fish and Fish Habitat Review

2.5.1 General Comments

Brook Trout, American Eel, Gaspereau, and Atlantic Salmon are all species of conservation concern, are important fish species to the Mi'kmaq, and are considered to be Indigenous fish species. Habitat and impacts to fish that support these species were considered in this review, as these species provide valuable food sources. Considering this, this review focussed on the impacts to the identified important Indigenous fish species and their support fish species. The following fish species have been confirmed or expected in the Study Area based on the Atlantic Canada Conservation Data Centre report, the MEKS, and the result of fish sampling presented in the EIS:

Fish Species Confirmed in Study Area	Fish Species Expected in Study Area
White Sucker	Atlantic Salmon
Lake Chub	American Eel
Brook Trout	Brook Stickleback
Ninespine Stickleback	Gaspereau (Alewife)
Cyprinid sp.	Smallmouth Bass
Golden Shiner	Freshwater mussels
Brown Bullhead	White Perch
Banded Killifish	Yellow Perch

Pearl Dace	

There appears to be a misunderstanding of fish barriers throughout the EIS. In one instance, a fish barrier was declared, and fish were caught upstream of the barrier. For example, the EIS states, "Upstream of the potential barrier (WC12R2), one fyke net, two eel pots, and three minnow traps were deployed, and one electrofishing reach was sampled. This survey yielded one brook trout and ten ninespine stickleback, confirming that the boulder-bed channel section is passable to fish during high flow conditions, or a resident population of fish exists above the barrier" (EIS p. 506).

2.5.2 Summary of Fish and Fish Habitat Studies

The following baseline studies were identified in the EIS related to Indigenous fish species, their habitat, and their support fish species, within the proposed Project site:

- Fish Habitat Assessments for 42 watercourses and two waterbodies.
- Fish sampling results using methods such as electrofishing eel pots, fyke nets and minnow traps.
- eDNA study.
- Water quality at each site assessed for fish habitat and fish sampling.
- Benthic Invertebrate and Secondary Productivity.
- Sediment quality.
- Periphyton and Primary Productivity.

2.5.2.1 Loss of Fish and Fish Habitat for Indigenous Fish Species and Support Fish

Direct loss of fish and fish habitat, including habitat for the identified Indigenous fish species and support fish have been identified within a number of watercourses within the Project footprint. Direct loss of fish and fish habitat has been identified in the form of fish habitat removal and in the reduction of annual runoff into many of the lakes and within the Study Area. It appears over 25 watercourses in the Project footprint will be completely or partially lost or re-directed by the proposed works. In addition, it appears that approximately a dozen of these watercourses including a section of Seloam Brook will be eliminated due to the proposed Open Pit footprint and berm. Due to this, these watercourses and Seloam Brook are proposed to be diverted around these developments.

2.5.2.2 Migration of Indigenous Fish Species and Support Fish

Watercourse crossings are proposed at five unnamed watercourses and the new Diversion Channel for Seloam Brook. In addition, several watercourses are being eliminated or re-directed. Indigenous fish species were found or expected in these watercourses that are proposed to be impacted by the proposed development, but little information is provided on the migration times of these species and the impacts of the proposed development on these species and their migrations.

Furthermore, the EIS states that, "Where appropriate, the Proponent will work to install open bottom box culverts or bridges to reduce potential impact on the watercourses and

associated fish habitat during road construction." (EIS Reference: p.543). The EIS states, "As a result, work associated with development of the mine will not affect migration patterns or local movements of fish species, and there is no expectation of change to the composition of populations of fish from direct loss and alteration of fish habitat, given the limited numbers of fish observed within the Fifteen Mile Stream Mine Site and its position downstream of Seloam Lake dam, which acts as a barrier to upstream fish passage" (EIS Reference: p.544).

2.5.3 Identified Gaps

CBCL has identified several data gaps in relation to Indigenous fish species, their habitat, and their support fish species. The identified gaps have been separated into three categories and are discussed in detail in the following sections:

- Loss of Fish and Fish Habitat for Indigenous Fish Species and Support Fish.
- Fish Migration for Indigenous Fish Species and Support Fish.
- Indigenous Fish Species Health.

2.5.3.1 Loss of Fish and Fish Habitat for Indigenous Fish Species and Support Fish

- Fish and Fish Habitat: The EIS does not clearly confirm the fish and fish habitat in the Study Area being impacted by the proposed development. For example, a ninespine stickleback was captured in WC43; however, Table 6.8-8 states no fish presence, Page 535 of the EIS stated that there were no fish present and other sections state that there is an uncertainty. If fish were found in WC43, the presence of fish in the watercourse is confirmed. In addition, fish sampling results were not presented in the EIS for WC19 and WC39. To determine the impacts of fish habitat loss within the Project footprint to Indigenous fish species and support fish and their habitat, these areas and fish presence in these areas need to be clarified.
- Unclear Extent of Fish Habitat Survey Investigations: Large sections of the proposed Study Area and Infrastructure Layout do not clearly specify watercourse presence or absence. These areas include the waste rock stockpile areas, low grade ore stockpile, plant facilities, truck stop, ROM pad, till stockpile, and topsoil pile.
- Fish and Fish Habitat Supporting Documentation: Lacking biophysical report or raw data for fish and fish habitat in appendices. A number of inconsistencies or gaps were identified in the EIS.
- Atlantic Salmon Confirmed Presence or Absence: No definitive confirmation on Atlantic salmon in the Study Area other than the AC CDC report and the MEK study. Land locked Atlantic salmon are possible in the Study Area. The EIS states that, "Atlantic salmon smolts were recorded during creel census in 1979. Fingerling landlocked Atlantic salmon and brook trout were stocked in Scraggy Lake between 1998-2000 and 1994-1996, respectively" (EIS Reference p. 924). There is no mention if individuals conducting fish surveys were qualified to positively identify all age stages of Atlantic salmon.
- Inconclusive or Misinterpreted eDNA results: A few discrepancies were identified with eDNA results and actual field findings. For example, eDNA results were interpreted as negative for WC12 and WC43; however, ninespine stickleback and/ brook trout were

captured at these locations during the fish sampling program in the Study Area. The eDNA analysis in Appendix G.12 indicate a positive detection in these watercourses which is consistent with field findings. These findings question either the validity of the eDNA results or the interpretation of the results. Furthermore, every watercourse assessed in the eDNA analysis had at least one positive detection of the target species, which questions any conclusions in the EIS that these watercourses are fish habitat or not.

- Downstream Fish Habitat Instream Flow Needs: With the elimination of some watercourses there is the potential for a change in flow to the downstream watercourses and lakes and the potential impacts to fish and fish habitat. There appeared to be a lack of discussion or clarification on the effects of a change in flow on downstream habitats for all watercourses, especially during migration and spawning seasons for Indigenous fish species. The EIS states that, "Indirect effects related to flow reduction are predicted in WC2 and East Brook (SW15) due to construction of the WRSA and tailings management facility, respectively. These habitat losses will be included in the application for HADD authorization under the Fisheries Act and have been included in the Fish Habitat Offset Plan" (EIS Reference p. 992). However, WC19, WC 39 and sections of WC43 will be eliminated for the tailings management facility. There is suspicion that there is downstream flow and connection from WC19 and WC39 to WC43 via the mapped wetlands. There appears to be limited discussion or investigation of the connectivity of these watercourses to the remaining section of WC43, WC30, WC38, East Lake in the EIS and the potential impacts of eliminating these sections of watercourses on the downstream tributaries of East Lake, East Lake and East Brook. Impacts to downstream habitat during the migration windows and spawning times for Indigenous fish species appears to be lacking such as April to June for juvenile eel traveling upstream and September to November for salmon and brook trout. The predicted impact to the downstream fish habitat due to changes or elimination in flow did not appear to be quantified or qualified.
- Cumulative Effects on Fish Habitat: The EIS stated that, "The proposed Project could potentially result in an additive cumulative effect to fish and fish habitat, however a few key considerations must be made" (EIS Reference p. 920). In addition, Section 6.8.2.10 of the EIS stated "Fish habitat within the FMS Study Area has been substantially degraded by historic mine workings and deposition of tailings". (EIS Reference p. 526). There appeared to be a lack of information or assessment in the EIS on the cumulative effects of the Project on fish and fish habitat. This is identified as a data gap as the proposed activities are adding more mining development and activities to an otherwise very impacted and stressed environment.
- Priority Species: Gaspereau (alewife) are missing as a considered priority species from Table 6.12-2 of the EIS. This species is ranked as S3 according to the AC CDC.

2.5.3.2 Fish Migration for Indigenous Fish Species and Support Fish

- With so many watercourses being eliminated or diverted there was a lack of information in the EIS on the baseline movements and migration of Indigenous fish species in the Study Area.

Appendix D.4 provides culvert design details for two culverts, but not all of the proposed culverts required for stream crossings. Fish migration will only occur if fish baffles are correctly installed or culverts are installed at the appropriate slope and if the flow rates are predicted to be adequate for the swimming abilities of fish species in the system such as elver American eel. Elver eels (60 mm) are possible in the Study Area and are considered weak swimmers and travel from the sea to upstream habitats in the spring (COSEWIC, 2012). The following additional data gaps have been identified with respect to fish migration:

- Velocity in Culvert Structures: The EIS mentioned that box culverts may be used for stream crossings, the EIS did not clearly state what the flow velocity will be in these culverts. Appendix D.4 does indicate that culverts will be designed according to Watercourse Alteration Standards for Nova Scotia. However, there appears to be a lack of information in the EIS if open bottom culverts on other watercourse crossings will follow these standards. According to the guidance documents from Fisheries and Oceans Canada (DFO) and Nova Scotia Environment (NSE), a stream flow velocity is required to not exceed 1.8 m/s during a 1 in 100 year discharge event and is a requirement for the sizing of open bottom structures (DFO, 2015; NSE, 2015).
- Indigenous Fish Species Swimming Abilities through New Structures and Diversion Channel: There appears to be a lack of information on the swimming abilities of Indigenous fish species that are confirmed or expected in the Study Area and if these species and the different life stages can swim through the predicted velocities for the culverts and the proposed Diversion Channel under normal flows.

2.5.3.3 Indigenous Fish Species Health

Exceedances of metals and contaminants in baseline sediment and in future water quality could impact Indigenous fish species as further mining activities from the proposed Project could have an additive or synergistic cumulative effect on fish health. The EIS states that these baselines, predicted, and cumulative exceedances will not have significant impacts to fish. Based on these findings and statements, the following data gaps were identified for Indigenous fish health:

- *Sublethal Impacts on Future Populations*: There is a lack of information or literature support in the EIS on the sublethal and long-term impacts of these predicted exceedances on larval stages of fish or studies on sublethal impacts overtime of long-term exposure to those levels.
- *Fish Tissue Analysis.* No baseline fish tissue analysis was conducted to determine impacts of metals and contaminants over time on Indigenous fish health. Metals can bind to soils and can be transferred into aquatic environments through rainfall events or via dust. Atmospheric deposition is another method in which metals can be transported from a source into the surrounding environment. Project related accidents and malfunctions is yet another potential source of metals and contaminants into nearby waterbodies. Trace amounts of many metals in fish can cause sub-lethal impacts to fish such as reduced growth (Rowe, 2003), disruption of gills and the

olfactory system (Price, 2013). In addition, elevations of these metals and contaminates in Indigenous fish tissue could have an impact on human health if ingested.

- *Effluent Treatment*: There appears to be a lack of information of when metals and other contaminates stabilize in the Study Area. The EIS states for the Touquoy mine site that "the average concentrations in the discharge to the river stabilize after about 150 years". There is a lack of information on the number of years the water will be treated to ensure that there are not significant effects on future fish health. Although the EIS states that the surface water will be treated and the water management ponds will be lined with clay or geosynthetic liner, these contaminants may enter the surrounding environments through other methods such as flooding events, atmospheric deposition, and dust (EIS Reference: p.26 and 79-81).
- *Climate Change Predictions*: Appendix C.2 states that "The 95th percentile results represent an upper bound scenario, which would only result in the instance that low flow events occur in conjunction with upper case source term conditions, which is unlikely." Although with climate change predictions of periods of drought and low flow conditions, low flow events may become more common in the future (see McCurdy and Stewart, 2003; Nova Scotia Environment, 2011; Yusa et al., 2015). The EIS was not clear if climate change predictions were included in the predictive modeling results for these results.
- *Cumulative Impacts on Fish Health*: There appears to be a lack of information or understanding of the potential cumulative effects of predicted metal and contaminant exceedances on fish health. Appendix C.2 of the EIS stated "Based on the predicted future concentrations, relative to available water quality guidelines, total cyanide and cobalt merit further evaluation" (Appendix C.2 p. 40).

2.5.4 Monitoring Programs

Based on the gap analysis, the following monitoring programs are suggested for the protection of Indigenous fish species and support fish:

- For the construction phase, specific monitoring for turbidity or TSS during instream works such as culvert replacements and watercourse diversions was not identified. An increase in turbidity and TSS can have negative impacts on Indigenous fish species and support fish such as altering fish social hierarchies, change in feeding and swimming behaviours, relocation and in some cases mortality (Wilber and Clarke, 2001).
- Due to the number of watercourses being eliminated or diverted, pre and post construction monitoring of migration and habitat usage is suggested for Indigenous fish through any sections of watercourses being eliminated, diverted, or having a culvert installed. Acoustic tagging, radio tagging or sonar are methods of determining fish migration and habitat use in these areas.
- Post construction and riparian monitoring was suggested for the activities associated with the Seloam Brook diversion, but not other culvert installations or other watercourses proposed to be impacted. It is suggested to monitor all areas post construction to verify that all watercourses and riparian areas are returned to normal or better condition following impacts.

- No fish tissue monitoring was identified to determine if metals and contaminants associated from the mine are increasing, stabilizing, or decreasing in Indigenous fish tissue. Therefore, pre and post construction monitoring of metal and other contaminate in fish tissue is suggested. Transfer of metals into the aquatic environment can occur through soil runoff, dust, and atmospheric deposition.

2.5.5 Recommendations

Based on the gap analysis, several recommendations were made for the protection of Indigenous and other fish within the proposed Project area. The recommendations are provided below:

- Fish habitat mapping is recommended in the watercourses that will be removed or diverted in order to better understand the habitats that are being eliminated and to better assess cumulative effects on fish and fish habitat in the Study Area. Fish habitat mapping can also quantify and qualify the habitats in these areas to better understand the impacts on fish populations.
- Tagging Indigenous fish species and support fish with radio transmitters, acoustic tags or using sonar and monitoring movements is suggested for the watercourses that will be removed or diverted from the proposed Project. This is recommended to better understand fish migration patterns and fish habitat use within the area of the proposed footprint.
- Baseline fish tissue analysis is recommended for brook trout and eel, as well as tissue monitoring during the operations and decommissioning phases of the Project. Analysis should include metals and other containments of concern such as cyanide, cobalt, arsenic, cadmium, and zinc.
- If the EIS indicates that predicted exceedances of metals and other contaminants are not significant to fish, it is recommended to ask for literature to support this statement There should be literature to support that these exceedances should not have sublethal impacts on fish and that these effects are considered to not be significant. If the literature does not exit, then a toxicity study such as sediment bioassays is recommended according to ECCC protocols.
- Turbidity or TSS monitoring is recommended during all instream works where flowing water is present.
- Fish habitat and riparian post construction monitoring is recommended to determine if impacted watercourses and riparian areas have returned to pre-construction conditions or better.
- A master summary table is recommended of every watercourse impacted by the proposed development, the fish habitat results and fish survey results including the time of year the fish were sampled.
- It is recommended to request the original data sheets from field surveys for fish and fish habitat.
- Conduct eDNA sampling in watercourses specific to Atlantic salmon in watercourses proposed to be eliminated or diverted. It is recommended to have the primers made specific for Atlantic salmon.

- It is recommended to request the extent of investigation for watercourse presence or absence in the Study Area. This can be provided via tracks from a GPS unit.
- There is suspicion that some watercourses or connections to waterbodies may have gone undetected in the Study Area. Therefore, it is recommended to request results of provincial wet areas mapping or lidar terrain modeling throughout the entire Study Area.
- Regarding fish barriers, it is recommended to request clarification of statements in the EIS of fish barriers or potential barriers for watercourse where fish were caught above the 'potential barrier', as these statements are unclear. In addition, other sections of the EIS that state fish barriers are recommended to be revisited. For instance, beaver dams, dry sections of channel, boulder fields, and even sections of ephemeral watercourse between channelized sections are not true barriers to fish, especially during normal or high flows and especially for species such as American eel who can travel across land (Gillis, 2000).
- It is recommended to request credentials and experience of individuals that identified fish captured in the Study Area.
- Regarding swimming performances of Indigenous fish species, it is recommended to request a summary table of predicted flows in the proposed culverts and the Diversion Channel during the key migration windows for Indigenous fish such as spring and fall.

2.6 Habitat and Flora Review

The potential effects of the Project on habitats, flora, and Mi'kmaq traditional practices was a key issue raised during the Mi'kmaq engagement process. Our review therefore focussed on potential impacts to habitat and flora as they relate to Mi'kmaq use of the area. As outlined in the MEKS, Mi'kmaq harvest a variety of traditional foods, medicines, and materials from within and adjacent to the proposed Project area. Impacts to these species and the habitats that support them were considered in this review.

2.6.1 General Comments

Several types of survey of the habitat and flora on the Fifteen Mile Stream site were conducted. The vascular plant and lichen assessments included desktop review prior to field surveys, which included desktop review of species data from AC CDC. The lichen review also included a review of the boreal felt lichen mapping layer provided by NSE and a review of proposed critical habitat layers for Boreal Felt Lichen and Vole Ears, provided by ECCC-CWS.

Vascular plant assessments occurred early and late in the growing season to capture plant species with different blooming periods. Lichen surveys throughout the Fifteen Mile Stream Study Area were focused on mature stands, particularly those located within mapped wetlands and predicted boreal felt lichen habitat. The Fifteen Mile Stream habitat assessments consisted of visiting 34 pre-determined locations to assess species and habitats present and categorize them according to ecosite type as outlined in (Neily et al.,

2017), and by vegetation type (VT) as outlined in the nova scotia forest ecosystem classification guide (Neily, 2010).

As stated in the 2007 EARD (CRA, 2007), vascular flora, lichen and habitat surveys were completed at the Touquoy Mine Site from 2004 to 2006 as part of the environmental assessment process. Lichen surveys focuses on areas mapped as potentially suitable for boreal felt lichen.

2.6.2 Summary of Results

As stated in the EIS, upland forests in the Fifteen Mile Stream Study Area have experienced relatively high levels of disturbance from timber harvesting and historical mining activities. Mature, undisturbed habitats are present in the Fifteen Mile Stream Study Area particularly in large wetland complexes. Canopies typically closer to logging roads and historic mining sites have been disturbed. In areas affected by natural or anthropogenic disturbance (e.g., wind throw, tree harvesting, and historical mining activities), the habitat types consisted of the spruce-pine, mixed-wood, tolerant hardwood and spruce-hemlock vegetation types (VT) that were often dominated by regenerative canopies.

A total of 277 species of vascular plants were identified within the Fifteen Mile Stream Study Area. The diversity of species is moderate to high, especially considering the low fertility of soils within the Fifteen Mile Stream Study Area. This is attributed to the range of habitat types encountered, from natural aquatic systems, a variety of wetland types, and both intact and disturbed upland habitats. Of the 277 species identified, three are considered Priority Species and are discussed in more detail in Section 2.11.

A total of 59 lichen species were observed. Most were common and widespread species typical of the habitat types present, though one Species at Risk, blue felt lichen (*Pectenia* (formerly *Degelia) plumbea*) and eight SOCI were detected. SAR and OSCI are discussed in more detail in Section 2.11.

In the Touquoy Gold Project EARD, habitat was documented to contain coniferous forest, deciduous forest, mixed forest, cutover forest, wetlands, rural residential areas, and areas to be cleared (CRA, 2007a). Prior to the construction of site infrastructure, coniferous forest was the most common forest habitat type within the Touquoy Mine Site.

No vascular plant SOCI were observed during vascular plant surveys conducted in August 2004, May and June 2005, and September 2006 as part of the EARD process (CRA, 2007). One black ash was discovered within the Touquoy Mine Site incidentally during wetland surveys in September 2015 and was subsequently removed under permit in the Spring of 2016, after the Mi'kmaq of Nova Scotia were consulted. SAR and OSCI are discussed in more detail in Section 2.11.

Lichen surveys conducted in the Touquoy Mine Site in 2004, 2005, and 2007 as part of the EARD process documented the presence of 21 lichen species, of which eight were Priority species, including one SAR. SAR and SOCI are discussed in more detail in Section 2.11. No Boreal Felt Lichen was identified on the Touquoy site.

Some general comments on the EIS include:

- Table 6.9-2: Habitat Survey Results within the Fifteen Mile Stream Study Area - this table could be made more straightforward and less technical.
- Vegetation types could be explained better. Some discussion on how these may relate to terrestrial fauna habitats would be useful to Mi'kmaq.

2.6.3 Identified Gaps

- As stated in the EIS, habitat surveys were completed at discrete points and no effort was made to delineate the extent of that habitat type around those points. The ability to extrapolate habitat survey results across the entire Fifteen Mile Stream Study Area is limited. It is not clear why a desktop GIS mapping exercise was not completed since the field ground-truthing data was available. Clarification of the total area of each major habitat type present within the area, and the proportion to be removed would be beneficial.

2.6.4 Monitoring Programs

It is understood that that vegetation monitoring is planned for partially altered and selected additional representative wetlands, where baseline monitoring and post-construction comparative monitoring will occur.

Monitoring of SAR lichens would aid in preserving biodiversity in the Project Area.

The EIS states that Proposed follow-up and monitoring programs have been reviewed with the Mi'kmaq of Nova Scotia during engagement, and that on-going engagement with the Mi'kmaq will continue through the environmental assessment process and associated permitting relating to follow-up programs and monitoring.

2.6.5 Recommendations

It is recommended that a monitoring plan for SAR lichens be implemented.

It should be clarified that hydroseeding will be done using seed mixes of suitable local native species.

2.7 Terrestrial Fauna Review

Terrestrial fauna, and the habitat upon which they rely, may be altered either directly or indirectly by proposed Project activities. This has the potential to impact traditional Mi'kmaq

harvesting practices in the Project Area. The potential effects of the Project on terrestrial fauna and Mi'kmaq traditional practices was a key issue raised during the Mi'kmaq engagement process. Our review therefore focussed on potential impacts to terrestrial fauna as they relate to Mi'kmaq use of the area. As outlined in the MEKS, Mi'kmaq harvest many species from within and adjacent to the proposed Project area. Impacts to these species and the habitats that support them were considered in this review.

Note that birds are discussed separately in Section 2.10.

2.7.1 General Comments

The desktop evaluation completed for the EIS confirmed that the Fifteen Mile Stream Study Area is located within a mainland moose concentration area, within the Liscomb Game Sanctuary, and identified the presence of abandoned mine openings which could provide bat hibernating habitat. Targeted surveys were completed for the EIS for bat hibernacula, mainland moose, and wood turtles. Due to their large home ranges, moose surveys were completed within and outside of the Fifteen Mile Stream Study Area to provide additional regional survey effort. Abandoned mine openings in the vicinity were visited to assess their potential to support bat hibernating habitat.

The abandoned mine openings identified within and outside the Fifteen Mile Stream Study Area were evaluated for their potential to provide bat hibernacula on August 2 to 3, 2017 and July 4, 2018.

Comments on the EIS document include:

- Section 6.10.3.1.3 Invertebrates refers to consulting the Maritime Breeding Bird Atlas (MBBA), when they presumably mean the Maritime Butterfly Atlas (MBA).
- Overuse of abbreviations in tables makes them hard to follow.

2.7.2 Summary of Results

A wide range of terrestrial fauna species were documented on the Fifteen Mile Stream site, many of which are relevant to Mi'kmaq interests. Moose evidence was documented at many locations within the Fifteen Mile Stream Project Area. None of the 77 abandoned mine openings assessed were determined to have potential to serve as bat hibernacula, as all were reportedly in-filled, capped, or flooded.

A similar suite of species was reported from the Touquoy Mine site (CRA, 2007). Mainland Moose are known to occur in the area, and a Post-Construction Moose Monitoring Program for Mainland Moose was conducted in lands surrounding the Touquoy Mine Site during winter and spring in 2017 and 2018, with moose evidence reported each year. No updated information appears to be available.

None of the abandoned mine openings assessed near Touquoy were considered suitable for bat hibernacula.

No turtles were detected during baseline surveys on the Touquoy site, but several reports of Snapping Turtles have been reported near the site since the site became operational.

2.7.3 Identified Gaps

Some identified data gaps include:

- There is no mention of the potential for improved access throughout the Project area to increase hunting activity of both licensed hunters and illegal poachers.
- There was no field assessment of potential bat use of the study area, other than a discussion of potential hibernacula in the area.
- There was no mention of Four-toed Salamander in this section, though it likely occurs.

2.7.4 Monitoring Programs

It is understood that a Mainland Moose monitoring program has been implemented at the Touquoy Mine Site, along with a wildlife management and monitoring plan for the Touquoy Gold Project. As stated in the EIS, the Mainland Moose program includes post-construction surveys for Mainland Moose, and both plans require any observations of wildlife species (particularly priority species and those which pose a safety concern) to be reported to the site Environmental Technician.

It is understood that similar programs are intended for the Fifteen Mile Stream site.

2.7.5 Recommendations

It is strongly recommended that a Mainland Moose monitoring program and a wildlife management and monitoring plan be developed for the Fifteen Mile Stream site, similar to what has been implemented at the Touquoy site.

2.8 Avifauna (Birds) Review

Bird habitat may be altered or lost as a result of direct or indirect disturbances from the Project. Key issues raised during public and Mi'kmaq engagement relating to birds include potential for direct mortality associated with the operations and indirect effects of changes to other VCs, such as dust, noise and light, as well as potential effects on birds associated with permanent loss of habitat from construction of the Project. Potential effects on traditional uses of land and resources by the Mi'kmaq were noted. Our review therefore focussed on potential impacts to birds as they relate to Mi'kmaq use of the area. As outlined in the MEKS, Mi'kmaq may harvest bird species from within and adjacent to the proposed Project area. Impacts to these species and the habitats that support them were considered in this review.

2.8.1 General Comments

Bird species using the Project area appear to have been well-surveyed, with a detailed desktop review of available species and habitat data. Bird surveys followed industry

standard methods. These surveys appear to be sufficient in documenting the presence of bird species potentially occurring on the Fifteen Mile Stream site.

As part of the EARD process, bird habitat usage within the Touquoy Mine Site was characterized between 2006 and 2007. The following surveys were conducted:

- Fall migration monitoring.
- Winter wildlife (including birds).
- Spring diurnal migrating raptor.
- Spring nocturnal owl surveys.
- Spring migration monitoring.
- Breeding bird survey.
- Common Nighthawk surveys.

2.8.2 Summary of Results

Targeted bird surveys at the Fifteen Mile Stream site documented 6,644 individuals, representing 89 species within the Fifteen Mile Stream Study Area (not including incidentals). Across all survey seasons, a total of 22 priority species were identified on the Fifteen Mile Stream site. These species may be affected by various project activities throughout the lifetime of the Fifteen Mile Stream project.

The 2005 breeding bird surveys of the Touquoy Mine Site found 398 birds representing 52 species over 11 point count stations. Ten were (and still are) considered priority species. The Project will have no new effects on birds at the Touquoy Mine, except that the mine lifetime will be extended by several years by the processing of ore from Fifteen Mile Stream.

General Comments on this section are as follows:

- Table 6.11-5: Seasonal and total abundances of avian species identified during the baseline assessments for dedicated fall, spring, and breeding bird surveys utilizes odd choices of symbols to represent SAR, SOCI, and migratory birds.
- Section 6.11.3.2.7 Summary of Field Surveys states that Accipitridae (e.g., harriers and hawks), Alcedinidae (e.g., kingfisher), Corvidae (e.g., jays, crows and ravens), Phasianidae (e.g., grouse and pheasants), and Strigidae (e.g., owls) families are not protected under the MBCA. However, these species are protected under the NS *Wildlife Act*, and this should be acknowledged.
- Tables could be formatted better to show results more clearly.

2.8.3 Identified Gaps

- A master table for birds including incidental observations was not included in the document (Table 6.11-5 presents all species observed during seasonal surveys but excludes incidental observations).
- Missing an estimate of the area of suitable habitat for bird SAR that will be removed.
- There are few specific mitigation measures provided.

2.8.4 Monitoring Programs

Wetland monitoring should be sufficient to monitor impacts to wetland habits which some SAR/SOCI birds require.

2.8.5 Recommendations

It is recommended that post-construction SAR bird surveys be conducted to assess the continued existence of these species near the Fifteen Mile Stream site.

It is also recommended that a wildlife deterrent program be implemented for the Fifteen Mile Stream tailings management facility, as is currently done at the Touquoy Mine Site.

2.9 Species of Conservation Interest and Species at Risk Review

2.9.1 General Comments

Methods and results for birds, mammals, fish, lichens, and vascular plants surveys are outlined within the relevant sections of this document, and so are not repeated here.

Table 6.12-3. Vascular flora species with elevated potential to occur within the Fifteen Mile Stream Study is difficult to decipher; use of bold/ underlining is not apparent.

2.9.2 Summary of Results

A total of eight species at risk has been confirmed to occur on the Fifteen Mile Stream Site. This includes six birds (Canada Warbler, Common Nighthawk, Eastern-wood Pewee, Evening Grosbeak, Olive-sided Flycatcher, and Rusty Blackbird), one mammal (Mainland Moose), and one lichen (Blue Felt Lichen).

A total of 30 species of conservation interest have been confirmed to occur on the Fifteen Mile Stream Site, including two fish, sixteen birds, three vascular plants, and nine lichens.

The potential presence of two additional species of particular Mi'kmaq significance—Atlantic Salmon and American Eel—are also discussed in the document. Both have historically occurred and should assumed to be present on site, at least occasionally.

Each of these species may experience some habitat alteration of loss due to the Project. However, as specific habitats for most of these species were not mapped in sufficient detail, an estimate of the amount of habitat lost is not possible. An exception is for SAR species with distinct habitat requirements which require wetland habitat, as wetlands have been mapped within the Project Area. Comparison of the loss of wetland habitat within the Project Area against the amount of suitable habitat known to occur in the Local

Assessment Area result in the following predicted cumulative direct losses of wetland habitat for the following SAR:

- Mainland Moose – 2.5%
- Olive-sided Flycatcher – 5.5%
- Rusty Blackbird – 0.3%

Impacts are also identified to two wetlands of special significance, which are designated as wetlands of special significance due to the presence of one SAR, the blue felt lichen. Relocation of the blue felt lichen is proposed. No direct or indirect alteration is proposed within two additional wetlands of special significance containing this species.

No plant species at risk or species of conservation interest were reported in the 2007 EARD (CRA, 2007). Moose River is considered to provide habitat for Atlantic Salmon and Brook Trout. Salmon were seen in 2006 but are thought to have been from a landlocked population occurring in Scraggy Lake (CRA, 2007a). Brook Trout were present in the historic Mini-Pit, which no longer exists due to site development.

Two SAR species were reported from the Touquoy site (CRA 2007a): one mammal (Mainland Moose) and one lichen (Blue Felt Lichen). Nine lichen species of conservation interest were reported (CRA, 2007a).

While not detected prior to the Touquoy site development, nine observations of Snapping Turtles were recorded by the proponent staff members and contractors at various locations throughout the Touquoy Mine Site, typically in close proximity to the Moose River. The EIS did not mention any incidences of project interactions with Snapping Turtles.

2.9.3 Identified Gaps

- The EIS report feels somewhat dismissive of potential Atlantic salmon and American Eel presence in the Fifteen Mile Stream area. These important species require additional assessment, particularly in Watercourses 19 and 39, which most likely connect to Watercourse 43 which is known to be a fish bearing watercourse.
- A dace species was reported from the Mini-Pit and said to be an S5, however no detail on how this specimen was determined to not be pearl dace (an S3 species) was provided.
- Table 6.12-7: Terrestrial mammal species with an elevated potential to be within the Fifteen Mile Stream Study Area lists (among others) the following species: Tri-colored Bat, Rock Vole, Silver-haired Bat, Eastern Red Bat, Hoary Bat, Maritime Shrew. It should be clarified why these species are considered to have elevated potential to occur within the Study Area. Tricoloured bats in particular are thought to be restricted to the southern end of the province (Broders et al., 2003).
- The following statement in Section 6.12.3.3.1.2 Bats (page 674) is highly questionable: “Bats are generally difficult to detect but could be detectable during all avian surveys completed within the Fifteen Mile Stream Study Area.” Bats are nocturnal and generally

inaudible to humans except at extremely close range, it is extremely unlikely that any bats would be detected during early morning auditory or visual bird surveys.

- The following statement in Section 6.12.3.3.1.2 Bats (page 674) is somewhat problematic. “MEL biologists did not record any incidental observations of roosts, maternity roosts or foraging bats during any biophysical surveys.” Targeted surveys by qualified bat surveyors are generally required to identify these specific habitats, and so this statement is of little value.
- Acoustic bat surveys would have helped assess the seasonal use of the site by resident bat species such as Little Brown Myotis and Northern Myotis, both of which are SAR and likely to utilize habitats on the site for foraging and roosting.
- The following statement “No observations of odonates were recorded within the vicinity of the FMS Study Area by Odonata Central” is overstating the significance of the lack of records on an online database, as the Fifteen Mile Stream site is very rural and its coverage by Odonata Central is presumably extremely limited.
- There is no discussion of the differing overwintering strategies of migratory and resident bat species, as written the EIS implies that three migratory bat species (Silver-haired Bat, Eastern Red Bat, and Hoary Bat) could potentially overwinter in the province, which is extremely unlikely, as they species are all migratory and do not overwinter in NS.
- Four-toed salamander is discussed only very briefly. This cryptic species likely occurs within the Project Area.
- Now that turtles have been confirmed on the Touquoy site, measures to exclude them from any contaminated water bodies on the Touquoy site could be implemented; however, no information was provided. Information on measures taken to protect this sensitive and long-lived species would be beneficial.

2.9.4 Monitoring Programs

It is assumed that the Touquoy wildlife management and monitoring plan will continue, and that a similar monitoring project will be enacted at the Fifteen Mile Stream site.

2.9.5 Recommendations

It is recommended that a wildlife management and monitoring plan like the one at Touquoy be established at the Fifteen Mile Stream site.

2.10 Mi’kmaq of Nova Scotia Review

2.10.1 General Comments

Four main components went into defining baseline information for the Mi’kmaq of Nova Scotia as part of the EIS to determine impacts to the VCs:

- Information obtained during on-going engagement with the Mi’kmaq of Nova Scotia.
- Completion of a Mi’kmaq Ecological Knowledge Study (MEKS) for the Study Area by Mi’kma’ki All Point Services (MAPS).

- Publicly available Indigenous knowledge related to the Mi'kmaq of Nova Scotia.
- Completion of archaeological screening and reconnaissance.

Engagement efforts are summarized in Section 1.4 of this review. The MEKS was undertaken to incorporate Mi'kmaq traditional ecological knowledge into the assessment process and development decisions. The MEKs included a study of historic and current Mi'kmaq land and resource use within a 5-km radius of the site (discussed in more detail in Section 1.5.2 of this review); a cursory evaluation of the potential impacts of the Project on Mi'kmaq use, occupation, and legally protected rights; an evaluation of the significance of the potential impacts of the Project on Mi'kmaq use and occupation; and recommendations for additional study or consultation.

The study area and surrounding area have a long-standing history of Mi'kmaq occupancy, harvesting and gathering and guiding based on known archaeological sites in this part of interior mainland Nova Scotia. Patterns of current use indicated in the MEKS suggest that the area is being used for traditional purposes by the Mi'kmaq of Nova Scotia in three separate clusters that occur within the centre of the study area, and east and west of the study area (see Section 1.5.2).

The land and resource use described in the MEKS was included in the EIS. The EIS describes the methodology developed to assess the significance of potential interactions and effects of Project activities on the Mi'kmaq of Nova Scotia. The EIS defines the following thresholds to determine significant adverse effects of the Project on the Mi'kmaq of Nova Scotia:

- Long-term (greater than 20 years) or permanent loss of availability of, or access to, land and resources.
- Potential adverse effect to human health identified through the human health risk assessment.
- Unmitigated loss of a physical or culture structure, site, or thing of historical, archaeological, paleontological, or architectural significance to the Mi'kmaq of Nova Scotia.

A human health risk assessment was conducted, which was reviewed and summarized in Section 2.1.2 of this report.

2.10.2 Summary of Results

Project activities were broken down by phase (construction, operations, closure and reclamation, and post-closure and outlined in Section 1.2) and were assessed for interactions on the VCs and significance of effects as they relate to the Mi'kmaq of Nova Scotia. It is important to note that analysis of Project effects on the Mi'kmaq of Nova Scotia is limited; however, a more general analysis of Project impacts was completed. Further information on risk to physical human health, water, vegetation, and other VCs is provided in previous sections of this report.

A high-level summary of the environmental effects on VCs that may apply to the Mi'kmaq of Nova Scotia, as identified in the EIS, are as follows:

- Wildlife patterns, including SAR patterns, may be impacted by the occurrence of elevated noise and light levels and other human disturbances during construction, operation, and reclamation phases, which may influence traditional gathering, harvesting, and food consumption practices.
- Dust suppression is to occur to prevent the accumulation of dust in the atmosphere, but particulate matter above background concentrations outside of the Mine Site property boundaries could accumulate on vegetation and berries which may influence traditional gathering and food consumption practices by dust generated blasting, crushing and transportation activities.
- Tests were completed (e.g., 62 static tests and 5 humidity cell tests) on the mine rock materials. Results indicate that there is very low potential for acidic conditions to occur during operations, though there is potential for it to occur following closure of the mine. After closure, surface water could become more acidic, thereby reducing quality which could affect fishing practices and human health. Release of sediments and contaminants from tailings could also affect downstream water quality.
- Groundwater seepage was assessed through predictive monitoring, groundwater changes and seepage were not expected to affect traditional practices or residences of the Mi'kmaq of Nova Scotia.
- Wetland restoration opportunities will be identified during consultation with the Mi'kmaq of Nova Scotia, with the goal to identify projects that would benefit the Mi'kmaq and local watersheds.
- Areas where Mi'kmaq fishing activities are known or expected to take place will not be affected by the Project. Impacts to human health through the consumption of fish are discussed in Section 2.12 of this review report.
- The loss of 15 occurrences of vascular plants that would occur within the Project area are said not to have an impact on the Mi'kmaq of Nova Scotia and their traditional practices.
- Temporary disturbances to wildlife and bird usage patterns may affect the traditional practices of the Mi'kmaq of Nova Scotia in close proximity to site during construction, operation and reclamation phases.
- Seven archaeological sites were identified within the FMF Study Area, though none are Mi'kmaq resources. All sites were associated with historical mining activities and all sites will be impacted by pit and associated infrastructure development.

The MEKS also states that increased concentration of harvesting activities on remaining resource areas, greater competition amongst active harvesters, and increased harvesting pressure on resources of those remaining areas is expected to occur.

Overall, access to the Project area for harvesting activities, spiritual ceremonies, and other Mi'kmaq traditional activities within the Fifteen Mile Stream Mine site will be limited throughout the life of the Project. After closure and reclamation of the site, access will be resumed. During reclamation, historical tailings will be cleaned up and removed along with

all other planned infrastructure. Stockpiles will be re-vegetated and ground disturbance will be restored.

The EIS states that the Project may result in an impact to the socioeconomic, mental, and social well-being of the Mi'kmaq of Nova Scotia. Potential positive and negative effects were identified for socioeconomic conditions, along with mental and social well-being; however, these were not quantified. The key findings and Project impacts on the socioeconomic and mental and social well-being of the Mi'kmaq of Nova Scotia include the following.

- With loss of access to the Project site, the proponent acknowledged that patterns of traditional use may change. These changes could increase cost of living for Mi'kmaq families who rely on traditional resources.
- There are possible positive effects on the economic condition for the Mi'kmaq with the provision of potential new job opportunities.
- Proponent anticipated limited effect on Mi'kmaq use of navigable waters. There is limited open water in the Project area, except for Seloam Brook. Proponent stated there is limited expectation that the brook is currently being used by the Mi'kmaq for travel.
- There is a Project impact on traditional practices of the Mi'kmaq due to a loss of access, which potentially includes Mi'kmaq forestry and logging operations, commercial outfitters, and traditional practices in the context of moderate livelihood.
- The EIS acknowledges that the Mi'kmaq of Nova Scotia may use the Fifteen Mile Stream Mine Site and surrounding area for recreational purposes and for non-commercial/trade economy purposes. These activities will be limited during Project construction, operation and active reclamation to areas surrounding the Fifteen Mile Stream Mine Site, which will impact the Mi'kmaq individuals and communities who carry out these activities.
- The development of the mine will change the baseline conditions in the local area. There will be an increase in background noise, dust, and light near the mine. This may affect the spiritual and cultural experience and sense of well-being for the Mi'kmaq of Nova Scotia on the nearby landscape of the Fifteen Mile Stream Mine Site.
- The overall conclusion of the proponent is that this Project will have a net positive impact on the socioeconomic and mental and social well-being of the Mi'kmaq of Nova Scotia through an increase in job opportunities and economic prosperity in the local region around the Project.
- The EIS states that although the Project may have a negative localized impact on Mi'kmaq individuals partaking in traditional practices within close proximity to the mine, overall, the impact on the Mi'kmaq of Nova Scotia as it relates to mental and social wellbeing will be low, given the very remote location of the mine, the distance to Mi'kmaq communities, the available crown land surrounding the property that can continue to be used by the Mi'kmaq, and the short temporal scale of the Project (11 years).

In brief, the mitigation measures include continuing engagement with the Mi'kmaq communities of Nova Scotia, support of third-party review of the proponent documents, outlining and adhering to a transparent communications process, possible establishment

of an environmental protection committee, design of bypass roads, procedures for handling archaeological features should they be encountered, encouragement in participation and enhanced open dialogue along with cultural awareness programs.

Following the implementation of the mitigation measures, the proponent concluded that residual effects would be adverse, but not significant.

2.10.3 Identified Gaps

- The EIS Guidelines require consideration of particular sub-populations within the Mi'kmaq of Nova Scotia. This does not appear to be addressed in the report; additional discussion is warranted.
- The EIS states that there are limitations associated with the data collected and shared. Specific details and locations are not provided in the MEKS relating to specific foods consumed, or harvesting locations, nor does the EIS include details on locations of commercial and traditional harvesting locations within or near the Project. As a result, analysis of Project effects on the Mi'kmaq of Nova Scotia is limited.
- The proponent's EIS suggests that plant species of significance to the Mi'kmaq of Nova Scotia will remain in the area immediately surrounding the project and access will continue; however, the EIS does not appear to consider the other project-related effects, such as noise and altered landscape, that may deter people from gathering in these areas.
- Although the EIS states that the project will generate employment and require a significant labour force during construction and operation, there are no numbers provided associated with that labour force. Considering that the labour force is described as significant, it is reasonable to expect that an influx of employees to the area over the project construction and operation periods could increase pressures on species that are traditionally used by the Mi'kmaq of Nova Scotia. The EIS fails to consider this in the evaluation of potential environmental effects.
- As with the analysis of Project impacts to traditional use, specificity relating to Mi'kmaq land use, baseline health and socioeconomic condition is not fully understood, and as a result, some analyses relating to health and socio-economic conditions have been completed utilizing a series of assumptions.
- The proponent commitments to mitigation measures are primarily focussed on continuing engagement and opportunities for the Mi'kmaq communities of Nova Scotia to participate in the EIS review and monitoring. It is not clear how these mitigation measures will effectively avoid or reduce the potential adverse environmental effects identified, particularly lose of access to and use of traditional resources, and any associated increased cost of living or loss of income.
- In the absence of detailed quantitative data on the current use of traditional lands and resources, the proponent's EIS substitutes measures of duration to describe the magnitude of the potential effects. Magnitude is a description or measure of the severity of an environmental effect and is an important concept in the determination of significance. In contrast, duration refers to the amount of time over which an effect will occur or be

observed. While duration is also an important factor in deciding whether an environmental effect is significant, it is not typically considered a replacement for magnitude[3].

- Although access to the site may be restored after 11 years, the EIS does not consider the longer-term impacts to the availability of traditional resources. The restoration efforts described in the EIS are not likely to leave the site in the same condition at closure as it is before construction of the project. It can take decades to re-establish forest conditions. The residual effect on traditional use could extend well beyond the 11 years of construction, operation, and closure and could be considered a significant adverse residual environmental effect, even by the threshold used in the EIS.

2.10.4 Monitoring Programs

The proponent states a commitment to the following monitoring programs:

- Wetland monitoring.
- Wildlife monitoring, including moose.
- Monitoring programs for air, surface water, groundwater, and noise.

2.10.5 Recommendations

- Analysis of Project effects on the Mi'kmaq of Nova Scotia is limited. Because information related to Mi'kmaq land use for the Project area is lacking, a general analysis of Project impacts was completed. If/when additional information becomes available, a Project effects assessment related to the Mi'kmaq of Nova Scotia should be revised/updated.
- The proponent should consider alternate approaches to obtaining the information or completing the analysis in a manner that is acceptable to, and respectful of, the Mi'kmaq keepers of that information.
- Project effects on individual Mi'kmaq communities should be considered.
- Consideration should be given to the potential effects of an increased work force in the region on the Mi'kmaq of Nova Scotia.
- The proponent should consider the long-term impacts to availability of traditional resources.
- The proponent should consider additional mitigation measures to avoid or reduce potential adverse environmental effects, including offering training and employment opportunities to the First Nations people, work with the First Nations to facilitate advance harvest of resources prior to site preparation and construction activities, and reclamation plans that include traditional resources.

[3] To demonstrate how magnitude and duration can contribute to significance determination, a loss of use that is experienced by one person out of 10,000 people (low magnitude) over 25 years (the EIS identifies this as long-term) could be considered not significant, whereas a loss of use that is experienced by 9,000 out of 10,000 people (high magnitude) over 10 years (the EIS identifies this as short-term) could be considered significant.

In the MEKS, Mi'kma'ki All Points Services (2018) outlined the following recommendations for consideration and to minimize potential adverse effects of the Project (Appendix H.1.).

- Details of the infrastructure layout (e.g., locations of waste rock deposits and tailings ponds) be developed in cooperation with Mi'kmaq environmental research institutions and experts such as the Unama'ki Institute of Natural Resources and the Mi'kmaq Conservation Group (Confederacy of Mainland Mi'kmaq).
- An environmental protection committee be established to develop environmental impact mitigation protocols, oversee monitoring procedures and evaluate test results. This committee should have an equal tri-partite composition of environmental experts of the proponent, Mi'kmaq representatives the Unama'ki Institute of Natural Resources and the Mi'kmaq Conservation Group, and the NS Department of the Environment.
- Atlantic Gold cease all on-site activities that significantly alter the local environment (e.g.: clearcutting, road construction, ground leveling or excavating, wetland draining) until the environmental assessment process is concluded and licences and permits are granted. This recommendation applies to all of Atlantic Gold's proposals under review and become accepted policy for all future large-scale industrial developments.
- The proponent and the Province be open to address the issue of Mi'kmaq access to impacted lands and resources.
- Future development planning by the Province of Nova Scotia be carried out with early-stage planning involvement by the Mi'kmaq, rather than attempts at late-stage consultation.

2.11 Human Health Risk Review

2.11.1 General Comments

In the proponent's EIS, the assessment of potential Project-related effects to human health is based on the human health risk assessment, which was completed by Intrinsic (2019). The report by Intrinsik (2019) provided an assessment of potential physical human health effects related to the following three specific elements:

- Potential changes in air quality associated with ore dust, and associated inhalation related effects.
- Potential changes to contaminant concentrations in soil and vegetation due to ore dust deposition, and associated food-chain related effects.
- Potential changes in water quality and associated effects related to drinking, recreational, or cultural uses and fish consumption.

Three scenarios were considered to evaluate the incremental effects of the project on human health: (1) the baseline or current scenario, (2) the project scenario, (3) and the baseline plus project scenario. In the baseline scenario, real data is collected to evaluate current health effects while in the project scenario future conditions are predictively modeled based on established methods as well as several assumptions.

In consideration of air quality, baseline dust concentrations in air were collected and future emissions were modelled by Wood (2019). A dust deposition rate onto soil and vegetation was predicted at the mine site boundary and a distance 1 km from the boundary.

For soils and vegetation, baseline data collected by McCallum Environmental in 2018 (in Intrinsik, 2019) from the Beaver Dam Mine Project area, approximately 20 km from the Fifteen Mile Stream Mine Site Area, were considered representative. Berries and leaves were collected from the following plant types: blackberry, black huckleberry, blueberry, bunch berry, cranberry, and raspberry. Future concentrations of metals in soils and vegetation were predicted using the dust deposition rates (onto soil and vegetation), the geochemistry of the waste rock, and bioconcentration factors for the prediction of root uptake of metals into vegetation calculated from the baseline data (or literature data in the absence of baseline data).

Baseline water quality data was available from the Fifteen Mile Stream Mine Study area at numerous sampling locations. From the human health effects perspective, the most relevant sampling locations included the receiving environment of the Anti-Dam flowage (sampling locations EMZ-2 and SW6) considered most relevant for recreational water usage. Future water quality concentrations were predicted by Golder (2019).

The data described above (baseline and predicted) were used to assess potential physical health risks to people nearby. The nearest village to the Fifteen Mile Stream Mine Site is Sheet Harbour, 33 km to the south. The two closest Mi'kmaq communities, including Beaver Lake Indian Reserve 17 and Sheet Harbour Indian Reserve 36, are both approximately 33 km from the site. Based on these distances, it was considered improbable that potable groundwater resources would be affected. Recreational activities in the vicinity of the Fifteen Mile Stream Mine Site include snowmobiling, ATV'ing, camping, fishing, and swimming. It was noted, however, that fishing in Anti-Dam Flowage is infrequent with limited success.

Exposure pathways considered in the risk assessment included:

- Inhalation and ingestion of dust.
- Deposition of dust onto soil and vegetation and subsequent ingestion of soil and vegetation (e.g., berries, traditional vegetation).
- Uptake of metals to vegetation or game via food chain pathways and subsequent consumption by people (e.g., berries, traditional vegetation, game).
- Inputs of chemicals to watercourses and exposure through consumption of water directly or during recreational activities.
- Uptake of metals into fish and subsequent consumption of fish by people.

2.11.2 Summary of Results

For the inhalation of dust in air pathway, concentrations of metals in dust were calculated for the three scenarios and compared to Ontario Ministry of the Environment,

Conservation and Parks air quality guidelines (2012) as well as Toxicity Reference Values selected from reputable jurisdictions. For all scenarios, concentrations of metals in dust were well below selected benchmarks. Based on the reported conservatism, it was concluded that dust from the Fifteen Mile Stream Mine Site is unlikely to present inhalation risks to people in the Fifteen Mile Stream study area.

For the recreational water assessment, Health Canada guidance (2016) was followed to evaluate exposure to surface water while conducting recreational activities such as swimming. Based on the predicted water quality at the Anti-Dam Flowage locations (EMZ-2 and SW6) during operations and post-closure, metals concentrations will be below Canadian Drinking Water Quality Guidelines. The use of drinking water guidelines that consider daily consumption of 1.5 L of water is conservative and protective of recreational water use.

For the ingestion of soil, vegetation, and game pathways, future concentrations in these items were dependent on the dust deposition rate predicted by Wood (2019). The incremental contribution of dust at the site boundary to the concentrations of metals in soil, berries, and leaves was negligible for most metals, with a slight incremental increase in predicted arsenic in soil, berries, and leafy vegetation concentrations. Deer meat was used to represent all game. Concentrations of metals in deer meat was estimated using accepted equations and approaches.

Concentrations of metals in fish tissue were estimated using future water quality predictions and surface water-to-fish bioconcentration factors established from baseline data.

The amount of each food type consumed (berries, leafy vegetation, fish, and deer) was based on the First Nations Food, Nutrition and Environment Study (FNFNES) for Atlantic Canada by Chan et al. (2017). Predicted exposures to soil, dust in air, and water during recreational swimming were based on recommendations from Health Canada (2012). Effects levels or Toxicity Reference Values were from Health Canada or other reputable jurisdictions. Risks were calculated and considered to be negligible for all pathways considered.

2.11.3 Identified Gaps

- As outlined in Section 1 of the EIS, the EIS Guidelines include consideration of particular sub-populations within the Mi'kmaq of Nova Scotia. This does not appear to be addressed in the report; additional discussion is warranted.
- Section 2.4 identifies that ATV trails are commonly used in the vicinity of the site. It is unclear if consideration has been given to dust levels associated with this activity.
- The Human Health Conceptual Site Model identifies the ingestion of berries or traditional vegetation. Based on the plants identified in the MEKS for food, medicinal and/or decorative purposes, it is possible that some of the plants could be used as

dermatological aids and applied topically (e.g., Bloodroot, Goldthread). Consideration could be given to dermal and inhalation pathways associated with medicinal or traditional uses of plants, if warranted.

- The Human Health Conceptual Site Model identifies the ingestion of deer as a surrogate for all game consumption. Based on the game animals identified in the MEKS, a variety of mammals and birds are harvested, including non-herbivores. Discussion of the use of an herbivore as an appropriate representative for all game, including higher order receptors, is warranted.
- Section 3 provides baseline data collection methods and considerations. Rationale for the species of berries/vegetation collected is recommended as well as discussion of the representativeness of the vegetation collected for the plants identified in the MEKS.
- Section 5 provides a summary of the air dispersion predictions. Although noted in Figures 5-1 and 5-2, it would provide clarity to discuss in the text that the estimated PM10 and PM2.5 concentrations are with no mitigation, if that is the case, and what the 'no mitigation' scenario means in terms of the predictions.
- Section 5 also provides a predicted dustfall rate of 1.4 g/m2/year at the mine site boundary. Most of the pathways assessed in the risk assessment are dependent on this value from the perspective of the incremental project contribution. A review of Wood (2019) is outside the scope of the current review.
- For the predicted water concentrations shown in Table 7-1, a number of metal parameters show decreasing concentrations associated with operations and post-closure; of particular note is the marked decrease in arsenic concentrations. Some discussion on these predictions would help to provide context for the decreases.
- Consumption rates for country foods were adopted from FNFNES for Atlantic Canada, which may or may not be representative of local Mi'kmaq populations. This uncertainty was discussed in Section 10 and conservative assumptions were made in the assessment that likely overestimate risk. However, this remains an area of uncertainty.

2.11.4 Recommendations

- Consider completing a country food survey that would address a number of the data gaps identified above, particularly related to consumption rates, medicinal uses of plants, specific plants consumed and used for medicinal purposes, and consideration of sub-populations.
- It is recognized that the incremental risks associated with the Project were considered negligible and numerous conservative assumptions were made. For many of the identified data gaps, additional discussion is warranted, as opposed to additional data collection or calculations.
- The calculated risks were highly dependent on the dust deposition rate predicted by Wood (2019). While a review of the air deposition model and results was outside the current scope of work.

2.12 Aquatic Effects Review

2.12.1 General Comments

The aquatic effects assessment completed by Intrinsik (2019) considered the effects to the Fifteen Mile Stream receiving environment and Moose River. The Fifteen Mile Stream receiving environment includes three components located within and directly downstream of the Project footprint: the Anti-Dam Flowage outflow, which will receive treated mine water effluent; Seloam Brook, located downstream of Seloam Lake that collects drainage from an area that is in part downgradient of the project area; and an unnamed stream (known as Watercourse 43) that is within a stream system that collects drainage from an area downgradient of the tailings management facility .

2.12.1.1 Fifteen Mile Stream Receiving Environment

The baseline surface water quality program started in July 2017 and included the collection of routine field parameters, general chemistry, total metals, total mercury, and dissolved mercury. Sampling was conducted quarterly at thirteen stations through to June 2019; two additional stations were used to sample deep water at the Anti-Dam Flowage reservoir. Baseline concentrations were generally below applicable water quality guidelines, except for aluminum, arsenic and iron. The concentrations of aluminum and iron were reported to be naturally occurring while the concentrations of arsenic were reported to be associated with historical tailings from previous gold mining activities.

2.12.1.2 Moose River

Intrinsik (2019) report that Moose River is the largest watercourse at the Touquoy Mine Site. It may host a small salmon population; in some years, it dries up into a series of pools.

Baseline surface water data of interest to the effects assessment are from monitoring station SW-2, which is where discharge from the Mine Pit at Touquoy will be released once the pit fills. Baseline exceedances of water quality guidelines were described as commonplace for aluminum, iron, and arsenic. Other occasional exceedances noted included lead, cadmium, copper, selenium, and zinc. Alkalinity was low and pH was highly variable.

2.12.2 Summary of Results

2.12.2.1 Fifteen Mile Stream Receiving Environment

Future concentrations in the Fifteen Mile Stream receiving environment were modeled by Golder (2019). These were compared to benchmarks selected for comparison; either Nova Scotia Environment Tier 1 surface water guidelines for use in freshwater (NSE, 2014) or Canadian Council of Ministers of the Environment (CCME) water quality guidelines for the protection of aquatic life (CCME, 2019). One exception was arsenic where a site-specific water quality objective was developed based on guideline modification procedures outlined by CCME (2003).

In the Operations scenario, predicted annual average concentrations were below selected water quality benchmarks or baseline, except for iron, which marginally exceeded the 75th percentile baseline concentration. This exceedance notwithstanding, predicted levels are within the range of baseline and considered unlikely to pose a risk to aquatic life.

In the Post Closure scenario, all predicted annual average concentrations were below selected water quality benchmarks or baseline except iron and cobalt, which both showed marginal exceedances. When an analysis of monthly concentrations was conducted, there were some exceedances of cadmium, cobalt, iron, and zinc in select months. Considering the conservatism inherent in the water quality benchmarks, the marginal and transient nature of the exceedances, and the conservatism of the predicted future water quality concentrations, the likelihood of aquatic effects was considered to be low.

2.12.2.2 Moose River

Future concentrations in Moose River were predicted by Stantec (2021). Based on the aquatic effects assessment in Moose River, predicted concentrations of total cyanide exceed the selected water quality benchmark. The selected water quality benchmark, however, is based on dissolved cyanide. Since the predicted concentration of total cyanide only marginally exceeds the benchmark and because most of the predicted cyanide was anticipated to be strong acid dissociable, risks to aquatic life were predicted to be low (Intrinsik, 2019).

2.12.3 Identified Gaps

Section 1: Intrinsik (2019) indicates that mine infrastructure will include fuel storage. Please indicate the fuel storage capacity that is anticipated at the site and if the potential for petroleum hydrocarbon spills has been considered in the effects assessment.

Section 4.1 indicates that other exceedances included lead, cadmium, copper, selenium, and zinc. Table 4-1 does not identify exceedances of the benchmarks for these metals. Further clarification of the presence or absence of these metals in surface water is recommended.

There is potential for metals to increase in the food chain during the operation of the mine. Concentrations of metals in biota as a result of the mine operation should be predicted for comparison to baseline concentrations in biota.

It is unclear whether concentrations of metals have been considered or measured in aquatic sediment. Sediment dwelling organisms (e.g., benthic fish, benthic macroinvertebrates) may provide food for aquatic species at higher levels of the food chain; thus, bioaccumulation via the food chain is possible.

The benthic macroinvertebrate community is an indicator of the general health of the aquatic ecosystem. Establishing baseline sediment concentrations and macroinvertebrate assemblages may be useful to determine the effects of the mine on the aquatic ecosystem.

2.12.4 Monitoring Programs

CBCL recommends the measurement of baseline sediment concentrations and aquatic biota tissue concentrations. Further, once baseline sediment and tissue concentrations are established, a monitoring program which includes sediment and tissue measurements during and post mine operation is recommended.

2.12.5 Recommendations

- Request that the proponent collect baseline sediment and representative aquatic biota tissue samples with analysis for metals.
- Request that the proponent predict concentrations of metals in aquatic biota tissue as a result of mining activities.
- Request that the proponent include the collection of sediment and aquatic biota tissue with analysis for metals as part of during and post mine operation monitoring. programs. Concentrations of metals in sediment and tissue should be compared to baseline concentrations.
- Request that the proponent conduct a baseline benthic macroinvertebrate community study.
- Request that the proponent include benthic macroinvertebrate community study as part of a monitoring program for assessment of aquatic ecosystem health.

2.13 Cumulative Effects Review

2.13.1 General Comments

Cumulative environmental effects occur when the environmental effects resulting from a project combine with the environmental effects of other projects and activities and have a combined effect on a VC. The proponent's EIS considers the potential cumulative environmental effects of the Fifteen Mile Stream Gold Mine Project generally following the guidance of the IAAC, at least for the scoping stage. It is not clear whether the guidance on how to complete the analysis was followed.

The VCs selected for the cumulative effects assessment are those for which a residual environmental effect—an effect that is predicted to occur even after mitigation measures are applied—was identified. The following VCs were included in the cumulative effects assessment: noise; air; light; surface water; fish and fish habitat; species at risk and species of conservation concern; and Mi'kmaq of Nova Scotia. The socio-economic VC was not considered in the cumulative effects assessment as it was considered in the EIS to have a positive residual effect. Potential for cumulative environmental effects to wetlands, habitat,

wildlife, and plants was dismissed as unlikely based on no spatial overlap of the effects among the projects included in the assessment.

Although not fully explained in the EIS, the spatial boundaries are defined as the regional assessment area for each VC, which suggests that a VC-centred or ecosystem-centred approach was used to establish the geographic areas for the cumulative effects assessment, although a political or administrative approach appears to have been applied to the socio-economic VC.

The temporal boundaries used in the EIS for the cumulative effects assessment are no different than those of the project: 11 years from construction to closure and reclamation. An effective cumulative effects assessment should consider the timeframe of the effects of the project (not just the timeframe of the project phases) as well as the timeframe of other projects and activities when establishing the temporal boundaries.

The EIS states that other projects were selected for the cumulative effects assessment if they fall within the defined regional assessment area for each VC. This approach risks failing to consider other projects and activities that are not physically located within that area but have environmental effects that overlap that area. The EIS describes 40 projects and activities that were included in the cumulative environmental effects assessment. The included projects are predominantly large industrial project and include historic and current mining activity at the Touquoy Mine Site; historic mining activity at the Fifteen Mile Stream study area; trucking from Fifteen Mile Stream, Beaver Dam Mine Project, and Cochrane Hill Gold Project; regional forestry operations at the Fifteen Mile Stream study area; and the NSPI hydroelectric infrastructure (East Sheet Harbour Hydro System) at the Fifteen Mile Stream study area.

The analysis of the cumulative effects is qualitative. The significance criteria are specific to the project-related effects, rather than the cumulative environmental effects.

2.13.2 Summary of Results

The combined activities of the Fifteen Mile Stream project, Touquoy project, Beaver Dam project, Cochrane Hill project, trucking on the haul roads, and forestry in the Fifteen Mile Stream study area were evaluated as having adverse cumulative effects on air quality, noise, and light. The effects were evaluated as not significant. The EIS stated that there was no need for additional mitigation measures.

The potential for cumulative environmental effects on surface water through historical mining activities on combination with the project and the Touquoy project was summarily dismissed based on the implementation of the Historical Tailings Management Plan prepared by Stantec (2019). The plan recommends additional analysis, including metals, to understand the potential impacts of the historical tailings on the receiving environment.

Reduction in streamflow from Scraggy Lake to the Fish River system. The EIS states that the withdrawal is sustainable, but that the potential cumulative environmental effects are uncertain, and therefore the proponent will establish a monitoring and follow-up program. No cumulative environmental effects to surface water quantity in Moose River are predicted; potential cumulative effects to surface water quality are predicted to be adverse, but similar to those of the project and will be mitigated through treatment of the effluent prior to discharge.

Potential cumulative effects on fish and fish habitat were evaluated as not significant based on fish habitat offsetting (compensation) and through historical tailings management. However, the potential cumulative environmental effects on fish and fish habitat are uncertain, and therefore the proponent will establish a monitoring and follow-up program.

Potential cumulative environmental effects to species at risk and species of conservation concern are primarily related to vascular flora and lichens. The EIS stated that the potential cumulative effects were unknown, but that the contribution of the project was small, and therefore negligible. The same conclusions are stated for wildlife species at risk, specifically turtles.

Mining, pits and quarries, forestry activities, wind power projects, and industrial or transportation projects were evaluated for cumulative effects on the Mi'kmaq of Nova Scotia. Potential was identified for cumulative effects related to loss of access to lands for traditional purposes; this was quantified as the loss of the physical footprint of the projects within the regional assessment area.

2.13.3 Identified Gaps

- The assessment of cumulative effects is qualitative, with limited information on the other projects and activities. The lack of detail on the projects, and their environmental effects, limits the ability to adequately characterize the cumulative environmental effects. Some of the other projects that are included in the assessment are also owned by the same proponent and it is expected that detailed information on these other projects could have been incorporated into this EIS to allow a more robust and quantitative assessment.
- Cumulative environmental effects appear to be identified only when project activities overlap spatially. There is little or no discussion of cumulative effects that occur through aggregate impacts or through overlapping environmental effects.
- The estimation of the cumulative loss of access to lands for the Mi'kmaq is based solely on the project footprints and did not consider the loss of traditional use as a result of the environmental effects of all those projects in combination. Forestry and other select projects are excluded as they are considered in the EIS as not resulting in loss of access. Justification for not considering loss of use for traditional purposes should be provided.
- The cumulative effects assessment primarily focuses on future impacts that will occur. For a meaningful assessment of cumulative effects, consideration should be given to

spatial boundaries that extend into the past. This is particularly important for assessing the cumulative effects on Indigenous peoples to consider the historical context of the lands that they have traditionally used and how that has been affected over generations.

- As noted in section 2.10.3 of this report, the EIS does not consider the longer-term impacts to the availability of traditional resources and does not consider them in the context of other past activities that may have also affected the same resources, or access to those resource.
- Past impacts were not considered for species at risk; these species are typically assigned an at-risk status because of cumulative impacts that have occurred over time.
- With the acknowledged uncertainty surrounding the potential cumulative effects on plant and wildlife species at risk and species of conservation concern, there is no justification to dismiss the significance of the potential cumulative environmental effects, including the contribution of the project. There is limited data to support the dismissal of potential cumulative environmental effects where there is significant, or even moderate, uncertainty. In this case, more information should be sought, or the precautionary principle should be applied.
- The EIS does not provide a convincing rationale for dismissing project contributions to cumulative effects based on the small size of the project's contributions, particularly when the assessment is qualitative with no clear description of the magnitude of the effect.
- The scoping and analysis in the cumulative effects assessment is based on the results of the project-related effects assessment. The data gaps identified in each of the previous review sections are also relevant to the cumulative effects assessment.

2.13.4 Monitoring Programs

No additional monitoring programs are identified in the EIS beyond those identified for each VC for the project-related environmental effects.

2.13.5 Recommendations

- Request that the proponent consider temporal boundaries that extend into the past to appropriately consider cumulative effects on the Mi'kmaq of Nova Scotia.
- Request that the proponent provide additional quantitative information, where it is available, and clearly demonstrate and justify the assessment methods applied to support the conclusions of the assessment.
- Cumulative effects on individual Mi'kmaq communities should be considered.
- The loss of use of traditional resources should consider the loss during the project phases, plus the long-term impact that extend into the future after closure, plus the historical disturbances, plus other present and future projects and activities.

2.14 Conclusion

The Fifteen Mile Stream Gold Project EIS provided additional information however, as outlined throughout this report, several gaps have been identified and clarification, additional baseline information, and established monitoring plans are required for many VCs. The gaps and concerns identified herein are in line with concerns that have been raised by and discussed with KMKNO. Given the interests and rights of the Mi'kmaq with respect to the land and waters and given their current land use within and surrounding the Project area, these concerns are justified.

2.15 Closure

This report has been prepared for the sole benefit of KMKNO. The report may not be relied upon by any other person or entity without the express written consent of CBCL and KMKNO.

Any use which a third party makes of this report and any reliance on decisions made based on it, are the responsibility of such third parties. CBCL Limited accepts no responsibility for damages, if any, suffered by any third party as a result of decisions or actions made based on this report. Information presented in this report was provided through existing documents and interviews conducted with KMKNO personnel.

The conclusions presented represent the best judgement of the assessors based on the information provided, and the current environmental legislation and regulation at the time of the assessment.

Yours truly,

CBCL Limited

<Original signed by>

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APPENDIX A

Technical Background on Open Pit Mines and Impacts to Groundwater

Open pit mines can affect groundwater in two ways:

1. Quantity

Dewatering of the active mine will lower the water table and cause some of the groundwater that normally flows into streams to flow into the open pit mine. Wetlands and lakes may be affected too. This means that local waterways may not be able to sustain fish and other wildlife at current levels.

- While the mine is operating (7 to 10 years), the rate of seepage into the open pit (655 m^3/day, about the same as the water use of a community of 1,400 people).
- There will be a cone-shaped zone of dewatered rock.
- This will redirect some of the water that sustains local water courses and wetlands.
- This water will discharge to another part of the stream system, effectively balancing the water budget, but with a potential deficit in areas close to the pit.
- When mining is complete the pit will flood, and receive all stormwater flowing across the property, including water from the tailings management facility.
- Groundwater will seep outward from the tailings management facility into the surrounding landscape, raising the local water table.

2. Quality

Mining activity will generate dust that settles into waterways, waste materials, and wastewater that need to be collected and stored. Although the mine will use a variety of techniques to control these waste streams, experience shows that there will be changes to the environment surrounding the mine. Two types of waste will be generated at the Fifteen Mile Stream mine:

a) Waste Rock:

- Some of the rock that is extracted from the pit mine will be stored in piles before processing, and some of this rock will form a permanent waste pile.
- Some types of waste rock can make rainwater acidic as it seeps down through the rock pile.
- The resulting Acid Rock Drainage (ARD) needs to be collected and neutralized, as it is harmful to the environment.
- Waste rock at Fifteen Mile Stream will be separated into two separate piles:
  - One for Potential Acid Generating (PAG) rock.
  - One for waste rock that is not predicted to have any harmful effects.
- The waste rock piles will be covered with soil when the mine is closed, which will reduce the amount of acidic water that can be generated.

b) Tailings

- Rock containing the gold ore will be crushed and separated into a waste stream and a gold ore concentrate.
- The waste material is referred to as the tailings, and has the consistency of slippery, sticky mud, often similar to clay.

- Tailings from the crusher at Fifteen Mile Stream will be deposited in the tailings management facility , a large area flooded by process water and contained by large berms.
- The gold ore concentrate will be sent to Touquoy for additional chemical processing to extract the gold metal.
- This final extraction step will generate additional waste tailings that will be deposited into the empty Touquoy pit.
- Water that flows over or down through the tailings will tend to enter the environment with high concentrations of heavy metals; when concentrations are high enough this contamination can affect wildlife.

Gold mining activities tend to degrade the quality of water near the mine:

- Arsenic, which is naturally present in gold-bearing rock, may become concentrated by ore processing, or it may be leached by rainfall from waste rock piles.
- Cyanide, which is used to leach the gold, needs to be destroyed chemically before release of the process water into the environment.
- Ammonium is present in blasting agents and can enter the groundwater.
- If the rock contains sulphide minerals, exposure to air and water can cause the groundwater to become acidic.
- Current reporting cites existing or predicted elevated concentrations of aluminum, arsenic, bismuth, cadmium, cobalt, copper, iron, manganese, selenium, silver, zinc, cyanide, ammonium, and nitrate.

The affected groundwater can flow from the mine and discharge into nearby surface water, with negative consequences for the environment, and potentially for the health of people in direct contact with these waterways and the life that they support. Groundwater studies concluded that there is no risk to drinking water wells, because they are at considerable distance from the mine, and there is no flow from the mine toward the nearest wells.

<u>Tailings Management, Touquoy Site</u>

- Tailings from the Beaver Dam Mine and the Fifteen Mile Stream Mine will be processed at Touquoy and deposited directly into the Touquoy pit.
- The tailings will be in direct contact with the fracture networks intersected by the pit.
- These fractures represent an open pathway between the tailings and the Moose River, 100 metres from the pit.