

November 17, 2022

Sara Wallace
Atlantic Mining NS Inc.
409 Billybell Way, Mooseland
Middle Musquodoboit, NS B0N 1X0

SUBJECT: Beaver Dam Mine Project – Review of DFO Technical Review Comments: Response Document (Response Document)

Dear Sara Wallace:

The Impact Assessment Agency of Canada (the Agency), along with federal authorities, has completed the review of the Response Document provided on August 12, 2022, for the proposed Beaver Dam Mine Project (the Project).

Background

As you know, the technical review of the Project is ongoing. Atlantic Mining NS Inc. has provided responses to two rounds of Information Requirements; a third round of Information Requirements was provided January 13, 2022, and February 3, 2022. Throughout the technical review, Fisheries and Oceans Canada (DFO) has reiterated the potential for the Project to result in significant adverse impacts to Southern Upland Atlantic Salmon in the Killag River. Most recently, on April 21, 2022, the Agency and DFO advised Atlantic Mining NS Inc. of the following:

“AMNS should focus on the primary concern, which is the proximity of the open pit to the Killag River/Cameron Flowage and the discharge of mining effluent to the Killag River. Conclusions regarding the potential for significant adverse effects to fish and fish habitat are unlikely to change without addressing these issues. As outlined in previous comments, it is recommended that AMNS redesign the project to avoid impacts to important habitat for Atlantic Salmon.”

Review Comments on the Response Document

Comments on the Response Document from DFO, Environment and Climate Change Canada, and Natural Resources Canada, are provided in Attachments 1, 2, and 3, respectively.

The Agency would like to highlight the DFO comment in which they state the following: “As explained in the previous email correspondence and advice to the proponent regarding this scope of work, it does not address DFO’s main concerns about the project effects on fish and fish habitat in West River Sheet Harbour watershed”.

Further, DFO notes that, “As per DFO’s December 2021 advice and as explained in the Department’s general comments above, the project has potential to result in significant adverse effects to SU Atlantic Salmon”.

Implications for the Technical Review of Fish and Fish Habitat

With respect to fish and fish habitat, the Agency will not be asking further Information Requirements, as we feel we have sufficient information to understand the potential effects of the project as a result of several Information Requirements and responses by the Proponent (including the Response Document).

Next steps

With respect to the Round 3 Information Requirements issued on January 13, 2022, and February 3, 2022, the Agency will review these responses once provided.

Once the Agency has concluded its technical reviews, we will complete the drafting of the draft Environmental Assessment Report, which will include the Agency's conclusions with respect to the likelihood that the project will result in significant environmental effects. The draft report will be made available for review and comment by the public and indigenous groups.

Sincerely,

Kathryn MacCarthy, Ph.D., P.Geo.

Project Manager, Impact Assessment Agency

Atlantic Region

Cc: Suzanne Wade, Stephen Zwicker & Michael Hingston - Environment and Climate Change Canada

Christopher Burbidge - Fisheries and Oceans Canada

Shelley Ball - Natural Resources Canada

Bridget Tutty – NS Environment and Climate Change

Attachment 1 – DFO Comments on Supplemental Information

Attachment 2 – ECCC Comments on Supplemental Information

Attachment 3 – NRCan Comments on Supplemental Information

Attachment 1- DFO Comments on Supplemental Information

The proponent's document [Beaver Dam Mine Project: DFO Technical Review Comments: Response Document](#) (1802 pages) presents information included in the 2021 EIS and presents new information and analysis. Some information is repeated from the 2021 EIS and some is new information. Therefore, the Agency is providing the following summary and guidance to help ensure that you do not have to review materials previously reviewed during the technical review of the EIS and to focus the review on the relevant information.

DFO General Comments

- DFO has reviewed the August 2022 submission from AMNS. As explained in the previous email correspondence and advice to the proponent regarding this scope of work, it does not address DFO's main concerns about the project effects on fish and fish habitat in West River Sheet Harbour watershed. This submission has raised additional questions and concerns, such as the newly proposed quarry associated with the haul road for which an effects assessment has not been undertaken.
- The effects of metal mining on salmonids are well documented and have recently been reviewed in Sergeant et al. (2022). As described in DFO's December 2021 advice, the proposed project involves a number of threats to Atlantic Salmon freshwater habitat identified in DFO's scientific Recovery Potential Assessment for SU Atlantic Salmon: acidification (acid rock drainage), decreased resilience to extreme temperature events, altered hydrology (surface water and groundwater), water extraction, chemical contaminants, and silt/sediment. There is a high causal certainty assigned to all of these threats, and they have all been identified as having potential to result in a substantial loss of population productivity. This project presents a high risk to Atlantic Salmon and their habitat based on the following considerations:
 - the habitat is important spawning and rearing habitat for the West River Sheet Harbour salmon population;
 - population viability modelling indicates that even relatively small decreases in the productivity of freshwater habitat increase the probability of extirpation of salmon from West River Sheet Harbour;
 - Killag River habitat will be facing multiple threats simultaneously from the project; and
 - governments and the NS Salmon Association have dedicated substantial resources toward fish habitat restoration in the West River Sheet Harbour watershed since the early 2000s.

Reference:

Christopher J. Sergeant, Erin K. Sexton, Jonathan W. Moore, Alana R. Westwood, Sonia A. Nagorski, Joseph L. Ebersole, David M. Chambers, Sarah L. O'Neal, Rachel L. Malison, F. Richard Hauer, Diane C. Whited, Jill Wdeitz, Jackie Caldwell, Marissa Capito, Mark Connor, Christopher A. Frissell, Greg Knox, Erin D. Lowery, Randal Macnair, Vicki Marlatt, Jenifer K. McIntyre, Megan V. McPhee, Nikki Skuce. 2022. Risks of mining to salmonid-bearing watersheds. *Science Advances* 8 (26): DOI: 10.1126/sciadv.abn0929

- The goal of Canada’s Wild Atlantic Salmon Policy (<https://www.dfo-mpo.gc.ca/reports-rapports/regs/wildsalmon-atl-saumonsauvage-eng.htm>) is to restore and maintain healthy wild Atlantic salmon populations. As proposed, the project is not consistent with this policy goal because its adverse effects present a high risk to the health of the salmon population in West River Sheet Harbour, and are likely to impede or reverse the progress made through the extensive habitat restoration activities in the watershed. In consideration of the proposed measures to avoid and mitigate the project impacts to fish and fish habitat, the project is likely to result in a residual HADD of fish habitat in Killag River. The conceptual offsetting measures presented to date are unlikely to counterbalance the project impacts to Atlantic Salmon.
- Although DFO’s comments during the project EA have focused on the Beaver Dam mine site, the Department is also concerned about the potential impacts to Moose River from the proposed in-pit tailings disposal and pit lake creation at the Touquoy mine. Moose River is part of the Ship Harbour Watershed, which has also been identified by DFO as important habitat for SU Atlantic Salmon. Numerous juvenile Atlantic Salmon and Brook Trout were reported in the river reach adjacent to the mine prior to development. Similar to the plans for the Beaver Dam Mine Project, AMNS has proposed in-pit tailings disposal as part of the proposed Touquoy Gold Project Site Modifications currently undergoing a provincial EA. Some of DFO’s comments related to the potential effects on fish and fish habitat in Moose River from this proposal are relevant to the Beaver Dam Mine Project: https://novascotia.ca/nse/ea/Touquoy-Gold-Project-Site-Modifications/Government_Comments_Addendum.pdf

Section 1 – Introduction (PDF page 12)

DFO/ECCC/NRCan: Review is discretionary.

Agency note: DFO/ECCC/NRCan review should be conducted in the context of the DFO Advice letter ([15-HMAR-00463 - Beaver Dam Project - DFO Tech Review comments Redacted.pdf \(windows.net\)](#)), AMNS proposed work plan (see attached PDF), and the Agency/DFO’s response to that submitted workplan (see attached email).

DFO/ECCC/NRCan: Review the attached “*Notes on Beaver Dam Mine Project DFO Technical Review Comments: Response Document August 2022*” to see if comments provided in relation to DFO’s Advice letter and the proponent’s work plan have been addressed.

Section 2 – Aquatic Effects Monitoring Plan (PDF page 14)

In the December 15, 2021 letter, [15-HMAR-00463 - Beaver Dam Project - DFO Tech Review comments Redacted.pdf \(windows.net\)](#), DFO recommended a Before-After-Control-Impact (BACI) study as the basis of monitoring effects to fish and fish habitat.

DFO: Please review page 2-1 (PDF page 14) of the document to assess if the changes listed represent an improvement.

Agency note: Proponent is intending to do BACI, “where applicable”, and have some commitments for future work. Some of this may be able to be turned into conditions.

DFO Comments

- The development of a draft aquatic effects monitoring plan that incorporates a BACI study design does not address DFO's concerns related to project effects on fish and fish habitat in Killag River.

Annex II – Draft Aquatic Effects Monitoring Plan Version 1b (PDF page 86)

This was Appendix P.5 in the EIS and has updates. The Agency has noted where changes have been made from the 2021 EIS.

Plain language summary – no need to review

Section 1 – Introduction (PDF page 83)

DFO: Please review Figure 1-3 (PDF page 97, comparative figure is 1-3 Appendix P.5 PDF page 8 EIS 2021). The Figure illustrates that surface water sampling points have been removed closest to the low grade ore stockpile (SW24), Water treatment system (SW26), and PAG Stockpile (SW25) from what was proposed in the EIS. Is it acceptable to remove these samples?

DFO Comments

- ECCC is the federal department responsible for the monitoring requirements under the MDMER, including those related to surface water quality. NS ECC is the provincial department responsible for surface water quality monitoring requirements. Questions about the acceptability of the sampling locations should be directed to these departments.
- DFO recommends the proponent provide a rationale for changing the location of the sampling points, and for not including sampling points in locations where water quality monitoring is relevant (e.g., low grade ore stockpile, water treatment system, PAG stockpile).

DFO: Please review Figure 1-4A through D (PDF page 98 – 101) of surface water baseline data locations from the 2021 EIS. These new sampling locations are along the Haul Road. Are these sampling locations acceptable?

DFO Comments

- There is insufficient information about the proposed haul road for DFO to provide detailed advice on monitoring locations at this time. In general, monitoring for TSS would involve continuous sampling upstream and downstream of the works to establish baseline and impact TSS concentrations, and TSS thresholds for specific management actions.

Section 2 – Environmental Setting (PDF page 103)

Agency note: This has been revised from 2021 EIS. Now includes descriptions of environmental setting at Beaver Dam mine site and proposed haul road. Sets the context but the information was previously reviewed and included in other areas of the 2021 EIS. Includes some info from the DFO advice letter.

DFO: Review is discretionary.

Section 3 – AEMP Design Overview (PDF page 106)

Agency Note: Re-written to reflect Agency guidance and DFO documents.

DFO: Please review Section 3 PDF pages 106 – 109 (4 pages in total). Note Section 3.3 is largely unchanged from 2021 EIS so review is discretionary.

DFO Comments

- This section consists of a brief summary of advice from DFO guidance documents, and there is sparse project-specific information provided.

Section 4 – AEMP Design – Monitoring Components (PDF page 111 – 139)

Re-written to reflect BACI methods and use Pathways of Effects.

DFO: Please comment as to the appropriateness of the proposed monitoring locations, methods, frequency, trigger criteria, etc.

DFO Comments

- While DFO has concerns about the proposed monitoring plans, the Department's main concerns relate to the residual effects on fish and fish habitat in Killag River.
- The Department has concerns about the proponent's ability to accurately monitor changes in flows from the project. The proponent has been monitoring flow in Moose River since 2018 adjacent to the open pit at Touquoy, and this program continues to have challenges due to ongoing issues with the data quality and with the proponent's analysis and interpretation of the results.
- Based on DFO's experience with the proponent's flow monitoring program in Moose River at the Touquoy mine, the proposed flow monitoring has a low likelihood of being effective. The proponent did not collect baseline flow data before mine development, and the control station upstream of the mine intended to measure the natural, unaffected flow in Moose River was installed in an area of dense in-stream aquatic vegetation which affects the data reliability. Attempts have the proponent address data quality issues at this station have been unsuccessful. There are also issues and inconsistencies with the root cause analysis and interpretation of results. For example, the proponent has asserted that 20-50% of the instantaneous flow in Moose River between locations and upstream and downstream of the mine could be lost to evapotranspiration during summer. This is an unexpected statement based on the flow and evapotranspiration monitoring data available for Nova Scotia. See Section 3.3 and Appendix F here: <https://novascotia.ca/nse/ea/Touquoy-Gold-Project-Site-Modifications/>

Agency Note: Section 4.5.1 states that surface water quality sampling locations that are in areas of historic tailings have concentrations exceeding CCME FWAL (now). Proponent indicates this means CCME FWAL may not be an effective monitoring tool.

DFO: Understanding that historic tailings are not caused by the Project (the Province may require remediation of historic tailings as part of the Project), please comment on the potential cumulative effects of current mining activities in an area already impacted by historical tailings.

DFO Comments

- As noted above, ECCC and NSECC are the departments with the lead responsibility for water quality. DFO's view is that it is important to have an understanding of baseline water quality in locations affected by historic tailings; however, baseline contaminant concentrations from these areas should not be used for water quality targets in aquatic habitats outside of these areas (e.g., Killag River). The disturbance of historic tailings sites has potential to result in the transportation and deposition of deleterious substances into water frequented by fish.

Agency Note: Section 4.5.2.1 (PDF page 132) proposes sampling sediments once a year in September-October.

DFO: Would annual sampling be sufficient/typical for a BACI study?

DFO Comments

- No, annual sediment sampling is not sufficient to characterize the habitat given the highly sensitive nature of the affected habitat to sedimentation. Baseline and impact monitoring of sediment should occur seasonally in concert with continuous daily monitoring of TSS. Should monitoring data show that there are no changes from baseline conditions over an extended period (e.g., years), then a transition to annual sampling could be considered.
- The proponent has only committed to "a root cause investigation" in the event that significant effects are determined on a consistent basis. It is not clear what would constitute a "significant effects determination" or a "consistent basis", nor is it clear if or how flow, temperature, contaminant or sedimentation issues could be addressed in time to avoid or mitigate effects on Atlantic Salmon. As an example, a large sedimentation event or the chronic release of suspended sediment into Killag River spawning habitat from the mine site could adversely affect the population productivity through decreased spawning success and egg/larval fish mortality.
- Given the sensitivity of SU Atlantic Salmon and their habitat to the various project effects, DFO has low confidence that the proposed monitoring approach would be able to detect issues, identify the cause, and remediate the problem in timely manner such that the Atlantic Salmon population is not impacted. As described above, effective flow monitoring in Moose River at the Touquoy mine has proven exceedingly difficult.

DFO: Please review Section 4 PDF pages 111 – 138 (28 pages in total).

Section 5 – AEMP Design – Data analysis and Reporting (PDF page 139)

Proponent removed explicitly stating what type of data analysis will be performed other than stating that spatial and temporal trends will be documented and compared against predicted effects.

DFO: Please review Section5 PDF page 139.

DFO Comments

- The proposed monitoring frequency for aquatic effects is not sufficient given the sensitivity of SU Atlantic Salmon and their habitat to various project effects. For example, fish sampling would need to occur at least seasonally with more quantitative methods (e.g., mark-recapture), including several years of baseline sampling, to be effective at detecting changes in the fish population and

community structure. It is also important to consider the potential effects of such frequent sampling on the health of fish in Killag River.

- The detail provided about the data analysis and interpretation methods is insufficient. DFO requires a detailed description of the data analysis and interpretation methods to understand potential sources of error and to understand how project effects will be distinguished from natural variation and processes (e.g., evapotranspiration rate on river flow, interflow in adjacent wetlands, “backwatering” from low profile features in the stream, etc.).
- Most importantly, DFO requires detailed information about what monitoring results will trigger management actions as well as what those management actions would be and how they would address the problem in a timely manner such that impacts to the Atlantic Salmon population are avoided. DFO’s experience and ongoing challenges with the flow monitoring in Moose River at Touquoy does not give the Department confidence that a timely response is likely.
- Should the project receive approvals and permits, a robust monitoring plan should be required to monitor for various effects and to identify thresholds and timely interventions to avoid impacts to SU Atlantic Salmon.

Section 6 – References (PDF page 140)

DFO: Review is discretionary.

Appendix A – Summary of Effects Assessment Mitigations (PDF page 142)

Table A-1 (PDF page 143) is a copy of Table 9.1-1 (PDF page 1381) of the 2021 EIS. No need to review.

Appendix B – Additional Aquatic Ecosystem Baseline Data (PDF page 173)

Information in these tables appears to be tabulated data which was previously presented as text in the 2021 EIS and includes:

- Table B-1: Watershed Physical Characteristics within the Beaver Dam Mine Site (PDF page 174)
- Table B-2: Beaver Dam Mike Site – Physical Characteristics of Watercourses (PDF page 175)

Agency Note: Section 2 and associated Annexes (Annex II) now include a BACI study

DFO: Please determine sufficiency of information and if the information provided would change your conclusions regarding the Project’s effects on fish and fish habitat.

DFO Comments

No this does not change DFO’s conclusions. See above comments.

Section 3 – Flow Modelling (PDF page 16)

Agency note: The proponent resubmitted the Water Balance Analysis in Annex III. No changes were made therefore no need for DFO to review. Unclear if there is new information in Section 3.1 and 3.2 (PDF page 16-18).

DFO: Please review Section 3 PDF page 16-28 (13 pages in total) to determine if this addresses the issues previously identified with the Ecological Flow assessment. Would this change your conclusions regarding the Project's effects on fish and fish habitat?

DFO Comments

- This information does not change DFO's conclusions regarding the risks of the project to fish and fish habitat in Killag River.
- The proponent has improved the baseline conditions in the Water Balance Analysis, although there remains some doubt about the analysis. For example, PDF page 19 states that the proponent's analysis found the mean annual flow for the period of record (from 1970 to 2019) to be 111.2 m³/d (0.0013 m³/s). This estimate is unrealistically low. DFO estimated the mean annual flow of Killag River in the project area to be approximately 101,000 m³/d (1.17 m³/s) using prorated data from six hydrometric stations.
- As per DFO's analysis of the natural flow regime of Killag River from the Department's December 2021 comments, Figures 3-3 and 3-4 show that during the summer low flow period, the natural flow of the river reaches levels well below the 30% MAD criterion identified in DFO's Ecological Flow Framework. During these periods, permanent hydrological alterations from the project to Killag River represent a high risk of adverse impacts to Atlantic Salmon and their habitat.
- There remains a high degree of uncertainty regarding the End-of-Mine and Post-Closure predictions of the Water Balance Analysis, and the resulting effects on fish and fish habitat from these hydrological alterations. See DFO's December 2021 comments regarding: the use of such models to predict effects to fish habitat from large-scale, complex hydrological alterations to groundwater and surface water; and the threat of altered hydrology to Atlantic Salmon habitat, and the potential consequences to population productivity.
- The proponent's Touquoy mine is a relevant example of the uncertainty associated with model predictions. The proponent predicted that there was no risk of dewatering Moose River from the open pit because the river was well protected by the geology. In a March 2022 submission to NSECC for the ongoing Touquoy Site Modifications Project EA, the proponent described 22 faults identified in the pit wall, including major faults and historic underground mine works in the vicinity of Moose River, and seasonal and perennial seepages on the pit walls in the vicinity of the river. A third party review of the groundwater model identified a number of issues with the model, and the model's predicted flow changes to Moose River are significantly less than indicated by the flow monitoring data.

DFO: Please review as it is unclear if the modelling for the Killag River assumes effluent is being discharged to increase flows in the Killag.

DFO Comments

- DFO agrees. It is not exactly clear whether the revised WBA for the Killag River assumes effluent is being discharged to increase flows, however, this is DFO's current understanding based on the previous WBA.

Section 4 – Thermal Impacts (PDF Page 30)

Agency Notes: New information based on data gathered between October and December 2021. The proponent proposes a new mitigation "rock cooling trenches".

DFO: Please review Section 4 (PDF page 30) and comment on effectiveness of this potential mitigation.

DFO Comments

- There are a variety of factors that can influence the effectiveness of cooling the effluent via the proposed rock cooling trenches at the effluent discharge outflow. The cooling trenches may help cool the effluent, but how effective the trenches may be at achieving this objective is uncertain. What is certain is that the rock cooling trenches will not counterbalance the adverse impacts to fish habitat from permanent project alterations to the natural flow regime of Killag River in the vicinity of the mine. Cooled effluent discharge will not fulfill the ecological functions of natural flows and groundwater discharge in the river. The proposed rock cooling trench mitigation does not change DFO's advice regarding the potential impacts of the project on the Atlantic Salmon population.
- As explained in the document referenced in the proponent's submission (CVC 2011), one of the ways that rock cooling trenches act to cool water is by the displacement or mixing of the effluent with groundwater. However, this only happens if the groundwater table lies within the trench. The proponent's submission does not appear to consider that the drawdown of the water table around Cameron Flowage and the proposed effluent outfalls from the open pit will reduce the potential for groundwater mixing within the trench, and thus reduce the effectiveness of the proposed mitigation. For example, a persistent drawdown of the water table in the vicinity of Moose River coinciding with development of the Touquoy open pit has been observed. See the Touquoy Annual Surface and Groundwater Monitoring Report: [https://novascotia.ca/nse/ea/Touquoy-Gold-Project-Site-Modifications/Supporting-Documents/19a.2020 annual report sw gw monitoring.pdf](https://novascotia.ca/nse/ea/Touquoy-Gold-Project-Site-Modifications/Supporting-Documents/19a.2020%20annual%20report%20sw%20gw%20monitoring.pdf)
- The effects of temperature of the EOM pit lake outfall on Killag River have not been considered in the assessment. Halfyard (2008) found that the warmest river temperatures measured in the Wet River Sheet Harbour system were downstream of Lake Alma and Sheet Harbour Lake, and this observation was attributed to the relatively large surface areas of the lakes which absorb heat energy from the sun. In addition to the temperature increases associated with the alteration and disruption of groundwater discharges to the river, the pit lake is likely to result in a permanent temperature increase in portions of the river downstream of the outfall.

[Annex IV – Draft Update on Cameron Flowage Thermal Data \(PDF page 855 – 870\)](#)

DFO: Please review Annex IV PDF page 855- 870 (16 pages in total). Data in Annex IV supports that there are thermal refugia in Cameron Flowage in at least two and potentially three of the four studied locations. Would this change your conclusions regarding the Project’s effects on fish and fish habitat?

DFO Comments

- No, this does not change DFO’s conclusions regarding the Project’s effects on fish and fish habitat. See comments above regarding thermal impacts on the Killag River from the project.

[Annex V – Compilation and review of Water Temperature Data and Evaluation of Potential Impacts of Baseflow Reduction on Surface Water Temperature in Cameron Flowage \(PDF page 888\)](#)

This is new information dated July 12, 2022. This annex attempts to calculate the predicted change in temperature in Cameron Flowage. Has a disclaimer at the bottom of each page *“This Technical Memorandum is provided as an interim output under our agreement with Atlantic Mining NS Inc. It is provided to foster discussion in relation to technical matters associated with the project and should not be relied upon in any way.”*

DFO Comments

- Page 888 also includes this disclaimer: *“This technical memorandum has been prepared by GHD for Atlantic Mining NS Inc. It is not prepared as, and is not represented to be, a deliverable suitable for reliance by any person for any purpose.”*

DFO: Please review Annex V PDF page 888-895 (8 pages in total). Are the assumptions (PDF page 893) valid? Specifically:

- **Section 6 (PDF pages 892-894) presents the assumptions used in the calculation for changes in surface water temperature. Are each of these assumptions reasonable?**
- **Are the surface water monitoring locations used for the calculations reasonable?**
- **Are you satisfied with the temporal data inputs (use of averages, seasonality of data, etc)?**
- **Do these calculations account for variables such as the reduction of baseflow (groundwater seeps) which cause the current thermal anomalies or the temperature of the effluent which will be released into the receiving environment?**
- **Does this address concerns raised in DFO advice from December 2021?**

DFO Comments

- The disclaimer implies a high degree of uncertainty in the predicted effects to water temperature in Killag River and therefore this document does not change DFO’s conclusions regarding the project effects to fish and fish habitat.
- A fundamental assumption of this calculation is that the WBA predications are accurate. As per DFO’s December 2021 comments, there is a high degree of uncertainty regarding the proponent’s predictions regarding hydrological alterations to the natural groundwater and surface water regime

from the project. Since these model outputs have been used as inputs into the thermal modelling along with additional assumptions and limited data inputs, the model predictions are also subject to high uncertainty.

- The calculation assumes that the river temperature is uniform throughout the affected area, and that the temperature loggers were located in areas that are representative of all affected areas of the river. By focusing the assessment on model predictions of changes in average ambient stream temperature, the proponent is underestimating both the important role that localized groundwater seeps and upwellings can have in supporting the life processes of Atlantic Salmon and Brook Trout, and the potential thermal implications of changes to baseflows during summer. Groundwater is an important feature of Atlantic Salmon habitat (Caissie 2003), and the area of Cameron Flowage is a groundwater discharge area. Salmonids may use groundwater upwelling areas for thermal refuge during periods of warm stream temperatures in summer and to support egg incubation and larval development. Caissie and Giberson (2003) measured significant temporal differences between surface water and the intragravel thermal regime in Atlantic Salmon habitat in New Brunswick.
 - Caissie, D. 2003. The importance of groundwater to fish habitat: Base flow characteristics for three Gulf Region rivers. Can. Data. Fish. Rep. Aquat. Sci. 814. 25 pp.
 - Caissie, D. and D.J. Giberson. 2003. Temporal variation of stream and intragravel water temperatures in an Atlantic salmon (*Salmo salar*) spawning area in Catamaran Brook (New Brunswick). Can. Tech. Rep. Fish. Aquat. Sci. 2464: 26p.
- Pages 891-892 describe a number of gaps and unexpected results regarding the flow measurements from SW-1A and SW-2A, and how the data was modified based on a number of assumptions made by the proponent. This introduces further uncertainties into the calculations. As noted above, based on DFO's experience with the proponent's flow monitoring program in Moose River at the Touquoy mine, the Department does not have confidence in the proponent's ability to obtain reliable measurements of flow. The gaps and inconsistencies in the Beaver Dam data suggest that similar challenges can be expected at the Beaver Dam mine.
- DFO has previously provided advice regarding the limitations of using average flows as the basis for an assessment of impacts to fish and fish habitat, and using average temperatures are subject to similar limitations.
- As per DFO's previous advice, these models are not well suited for providing accurate predictions regarding the potential impacts to fish and fish habitat from complex, large-scale hydrological alterations from project works, undertakings, and activities. In consideration of DFO's Ecological Flow Framework, the natural flow regime of Killag River, the location and spatial extent of the project, and the high sensitivity of the affected Atlantic Salmon spawning and rearing habitat to altered hydrology, DFO's advice is that the project represents a high risk to the salmon population.

Table 5 (PDF page 894) indicates that the number of days per year above 24°C shows no change from unmitigated unless the cooling trench is at its maximum effectiveness. Would this mitigation address your concerns with respect to the Project's effects on fish and fish habitat?

DFO Comments

- There is high uncertainty in the predicted changes to ambient stream temperature on a daily time scale, and a moderate to high uncertainty in the effectiveness of the cooling trench. Even if the cooling trench is effective in cooling the effluent prior to discharging into the river, this cooled effluent will not fulfill the ecological functions of natural flows and groundwater discharge in the river.
- A cooling trench for mining effluent is not an adequate mitigation measure for the large spatial extent of permanent alterations and disruptions to the natural flow regime of important Atlantic Salmon habitat in Killag River.

Section 5 Water Treatment (PDF page 31)

ECCC/DFO to review (PDF page 31 – 34 – 4 pages)

Agency notes: Refers to Annex III which was previously submitted as Appendix P.4 of the 2021 EIS; therefore no need to re-review. May require clarification from the proponent as this section refers to “potential water treatment system alternatives (PDF page 31). Material is submitted twice within this document (once as Section 5 of the main report and again in Annex III)

ECCC/DFO: Please let us know if clarification is required on: water treatment types and alternatives for each phase of the project; infrastructure required for each alternative; and timing for implementation. Is the commitment to meet MDMER sufficient?

DFO Comments

- This document discusses various water treatment types and alternatives, but it is not clear if or what treatments will be implemented. Given the sensitivity of the receiving environment in Killag River and the fact that the treatment plans remain highly uncertain after many years, DFO remains concerned about the potential adverse effects to Atlantic Salmon from the deposit of deleterious substances into the river.
- As per DFO’s December 2021 advice, EEM data from metal mines in Canada indicates that the MDMER have potential to result in a variety of effects to fish and fish habitat. DFO understands that the MDMER concentration limits were not established to avoid all potential effects to fish and fish habitat from the deposit of deleterious substances in mining effluent, but are instead intended to set maximum limits to lessen the effects from these deposits, and to allow metal mines to operate without contravening the s.36 prohibition. The limits established by the CCME Water Quality Guidelines for the Protection of Aquatic Life are more appropriate for the conservation and protection of fish and fish habitat, and in many cases are much lower than the MDMER concentration limits. The deposit of chemical contaminants and silt/sediment have been identified as key threats to freshwater habitat of Atlantic Salmon that have potential to result in substantial reductions in salmon population productivity.
- Bowlby et al. (2016) found that straying Atlantic salmon in the SU Region likely avoid watersheds with reduced water quality from abandoned metal mines due to individuals preferentially entering or experiencing higher spawning success in rivers that contain fewer contaminants relative to their natal watershed.

- Reference: Bowlby, H.D., Fleming, I.A., and A.J.F. Gibson. 2016. Applying landscape genetics to evaluate threats affecting endangered Atlantic salmon populations. *Conservation Genetics* 17: 823–838.

Agency note: The Agency notes that the Killag River is the location of the West River Sheet Harbour Acid Mitigation Project which is currently treating the river both upstream and downstream of the proposed mine location with lime. However, Figure 5-1 (PDF page 32) indicates that lime softening is considered an alternative.

ECCC/DFO: Please comment as to the reasonableness of water treatment, such as pH adjustment, being an “alternative” given the sensitivity of Atlantic Salmon within the Killag River and the existing Acid Mitigation Project. Are other gold mines in Canada able to achieve MDMER/CCME FWAL after mixing zone without any form of treatment other than a settling pond?

DFO Comment

- Given that the river system is currently be treated with lime using two doser stations and a helicopter to address the threat of acidification to Atlantic Salmon, it would be reasonable to conclude that lime treatments are a necessary mitigation for the excavation of large quantities of potentially acid generating rock and the direct release of effluent into the river.

Section 6 – Flow Reductions (PDF page 35)

Agency Notes: This section looks at the loss of flow to Mud Lake. The proponent proposes five options:

1. Flow augmentation from North Settling Pond
2. Additional Water Treatment near the NAG Pile
3. Upstream groundwater wells – Proponent deemed not feasible due to low pumping rates.
4. Pumping from south and/or East Settling Pond – Proponent deemed not feasible due to South and East Settling ponds being decommissioned in post-closure.
5. Flow augmentation from adjacent waterbody – Proponent deemed not feasible due to it requiring a pipeline to be installed through dense forest, reduction of flow within

Previous sections assume 100% replacement of baseflow in the Killag with treated effluent and it is unclear if this would be possible with the diversion of water to Mud Lake under low flow conditions.

DFO: Please review Section 6 PDF page 35-36 (2 pages in total). Can you comment on the effectiveness of the proposed replacement of effluent to Mud Lake? Would this diversion of effluent from the Killag to Mud Lake be beneficial, harmful or neutral?

DFO Comment

- The Department’s main concerns about the project are the effects to important Atlantic Salmon habitat in Killag River from permanent alterations and disruptions to the natural flow regime of the river and the deposit of suspended sediment and deleterious substances into the river. Since Mud Lake discharges into Killag River, these effects are likely under both scenarios and therefore there is really no obvious preferred option that would avoid or mitigate impacts to SU Atlantic Salmon.

- DFO agrees that it is not clear whether it is possible to balance baseflow losses with effluent. Complete efficiency in the site drainage and water management is unlikely because an unknown portion of the runoff and effluent will be lost to evaporation and to groundwater recharging the depressed water table. During periods of low flow in Killag River, these tributaries also experience low flows and the proponent's flow monitoring data suggest that some of the affected tributaries have very little flow during summer under existing conditions.

Section 7 – Erosion and Sediment Control (PDF page 38)

Agency Notes: Resubmitted Erosion and Sediment Control Plan from 2021 EIS, Appendix C in Annex III (was Appendix C in Appendix P.4 of the EIS). Therefore no need to review.

One difference (PDF page 39) Cope Brook has been added to the list of sensitive receptors which was absent in 2021 EIS.

Section 7.3.2 may contain information not previously provided.

DFO: Please review Section 7.3.2 (PDF Pages 42 – 43 – 2 pages). Does this address your concerns regarding potential sediment in the Killag River and generated from proposed offsetting?

DFO Comments

- This information does not address DFO's concerns regarding the release of sediment into fish habitat from the project, particularly suspended sediment in the effluent that would be released into the Killag River and tributaries. Given the spatial extent and nature of the project – an open pit mine in an area characterized by numerous surface water features upstream and adjacent to important spawning and rearing habitat for Atlantic Salmon – it is unrealistic to predict that there will not be an increase in suspended sediment concentrations or effects to fish habitat.
- Any release of sediment into fish habitat from haul road construction or use has potential to result in prohibited effects to fish and fish habitat, including a HADD of fish habitat. DFO expects all linear developments and watercourse crossings will be designed and constructed in a manner that avoids sediment releases that contravene these prohibitions.
- DFO is also concerned about the following statement on page 43: *"For the off-site haul road between Beaver Dam and Mooseland Road, it is planned to open a quarry just south of Hwy 224 across from Beaver Dam Mines Road."* A quarry is a major project component with potential for adverse environmental effects to fish and fish habitat that have not been assessed or included in the information provided to date.

Annex VI Geotechnical Pit Slope Description PDF Page 934-1708 (775 pages)

NRCan: Please review the following selected PDF pages. It may be necessary to review additional material to obtain context around the Agency notes. The Agency notes provided below are intended to assist your review but not intended to limit your review. The focus of this review is the intersection between the material presented here and the potential for the Project to cause significant adverse impacts to fish and fish habitat.

Agency notes: Plate 9 illustrates (PDF page 964) the mapped rock type on the northeast wall of the pit is a breccia

Plate 12 (PDF page 969) illustrates potential faults that intersect with the pit walls.

Section 4.2.6.1 (PDF page 974) presents Rock Quality Designation (RQD) data which shows that the northeast side of the pit (the side closest to the Cameron flowage) has RQD's less than 25% and between 25% and 50% thus is classified as "very poor" to "poor" quality rock. Table 10 (PDF page 975) presents the Rock Mass Rating which classifies the breccia as "fair rock".

Section 6.1 (PDF page 980) states *"EW BRECCIA and HW BRECCIA: Walls in breccia with an increased potential for raveling, toppling, and wedges due to the lower rock mass quality. Walls will be more affected by blast damage and additional scaling efforts are expected in these areas. The inter-ramp slope stability and toppling mechanisms are related to water pressure. Depressurization of the walls will be required on that wall to limit toppling and increase the inter-ramp stability."*

Section 6.7.2 Kinematic Assessment Results (PDF page 984) states *"The rock quality in Breccia is Poor. Although no clear structural concentrations are observed in the data, toppling or wedge failures on joints and bedding are likely to occur due to the jointed nature of the breccia. Water pressure in the slope presents a risk for flexural block toppling in the north wall breccia. Toppling could generate excessive bench losses. Section 6.9 discuss the risks of toppling failure of the slope."*

Section 6.9.1 North Wall RS2 Assessment (PDF page 992) presents modelling results of slope stability on the Northeast wall where the breccia is located. *"To identify failure potential, plastic yield, represented by shear strain, was examined alongside SRF. The RS2 results suggest that plastic yield around the MLFZ, potentially leading to a larger shear strain plane developing above the ramp is possible if the phreatic surface is left unmitigated. Drainholes were simulated as part of an RS2 sensitivity assessment to identify the difference in rock mass behaviour if the north wall is partially drained. Plate 24 presents a side-by-side comparison of the shear strain resulting from pit excavation for models with a joint persistence of 0.8, a damage factor of 0.5, and (a) with and (b) without drains. The simulations without drains present SRF values less than 1.0 suggesting a failed slope; however, the drained condition increases the SRF above 1.0. Note that the shear strain contours are presented at different scales in the two models, as the necessary scales to show the behaviour of the rock mass differ by a factor of 300; underlining the reduction in yield when drainholes are incorporated."*

Agency notes: Section 6.10 (PDF page 996) further discusses the risks of water pressure in the north wall breccia.

Section 7.0 Risks to be mitigated through slope design and monitoring (PDF page 997). Table 14 identifies the potential for high groundwater level to impact slope stability as a design hazard and states **"Low Confidence in Data** *Ground water has been identified as a strong control for overall slope stability at Beaver Dam based on slope stability analyses completed. Limited data is available for static water level and there is potential for higher pore pressures to accumulate in the north wall of Beaver Dam due to the proximity of the pit to Cameron Flowage lake."* And **"High Risk** *Stability analysis results have indicated that the north pit wall would be unstable considering a fully saturated slope, resulting in multi-bench scale instabilities."* Breccia rock mass failure (PDF page 1001) was also identified as a design hazard **"Moderate Confidence in Data** *The Breccia at Beaver Dam can be classified as Fair. Limited rock*

strength laboratory testing was done in Breccia and assumptions were made to evaluate the strength of the unit. **Moderate risk** The Beaver Dam open pit will expose a maximum depth of approximately 125 m in the Breccia, with the lower contact intersecting the MLFZ. The rock mass strength of the Breccia is low enough that rock mass failure is a concern for overall slopes when controlled blasting techniques and slope depressurization are not implemented. The factor of safety for the Breccia slopes up to 125 m high with the recommended slope angles can be <1.3 when depressurization or controlled blasting are not implemented”.

Please review Section 8.1 Groundwater Consideration (PDF page 1002 – 1003 - 2 pages) and Section 9 Summary of the key recommendations (PDF Page 1010 -1011 – 2 pages)

NRCan: PDF Page 3 of the DFO Advice document raises the concern “The pathway of effects to fish and fish habitat from hydrological alterations is not clearly described in the assessment, and this is one of DFO’s main concerns regarding the project. Atlantic Salmon and Brook Trout are particularly sensitive to hydrological alterations to their habitat, and altered hydrology has been identified in the RPA for SU Atlantic Salmon as threat to their freshwater habitat (Bowlby et al. 2014). The RPA ranks Altered Hydrology as a high level of concern and severity due its potential to lead to substantial impacts to fish habitat and loss of population productivity. Please refer to DFO’s Pathways of Effects for “Excavation” and “Change in Timing, Duration, and Frequency of Flow” as well as the reference list below for additional information about how hydrological and temperature variations influence the life processes of Atlantic Salmon and Brook Trout (particularly during summer low flow periods).”

Please comment on if the information provided above indicates if there is a potential for hydrological alterations to fish habitat based on the geological/geotechnical information presented in Annex VI. Does the evidence presented regarding the geology on the northeast side of the open pit which was not previously presented in the 2021 EIS, have the potential to change the predicted effects on fish and fish habitat? The Agency refers the reviewer to Appendix F.5 of the 2021 EIS (Hydrogeological model) <https://iaac-aeic.gc.ca/050/documents/p80111/141983E.pdf> which assumed the northeast side of the pit had the same hydraulic conductivity as the greywackes (Figure 5.3 through 5.14 PDF pages 72-84 and Table 6.4 Calibrated Hydraulic conductivities PDF page 164) to see what was assumed in the 2021 EIS.

DFO Comments

- DFO is concerned about the new information described in the submission and how the breccia may increase the risk to fish habitat from baseflow alterations to Killag River. It is not clear whether the implications of this feature have been adequately considered in the effects assessment and predictions, and this information introduces additional uncertainties in the effect predictions related to fish and fish habitat.

Annex VI – Appendix A – Field Investigation (PDF page 1022)

Section 3.6 (PDF page 1028) states “Less than 3.5% (25.76 m) of all drilled core was logged as faults, with most of this length (9.17 m) occurring within the Mud Lake Fault Zone (MLFZ). The MFLZ was logged as a combination fault structures, gouge, broken core, and lost core, extending over a total drilled length of 12 m (Plate A3). The MLFZ also included some intact rock that is primarily characterized as intensely micro-defected, extremely to very weak (R0-R1), highly weathered (W4), and slightly to highly silica altered (A2-A4). The remaining examples of faults at Beaver Dam are generally infilled with clay material

or broken rock, as seen below in Plate A3.” In December 2021, DFO raised the concern that the fault could represent a zone of increased hydraulic conductivity increasing the connection between the open pit and the Killag River.

Table A9 (PDF page 1036) presents hydraulic conductivity testing. Values range from 2×10^{-6} to 1×10^{-8} m/s. Section 4.3 (PDF page 1036 -1037 – 2 pages) presents the interpretation of the hydraulic conductivity testing. PDF Page 1222 states that *“Test 3 is among the deepest tests carried out in 2020 and shows that the Mud Lake Fault Zone does not appear to be a preferential pathway for groundwater at the tested depths”*

NRCan: Do you agree with the proponent’s information? Does this information change the risk of hydraulic connection between the open pit and the Killag River which could impact fish and fish habitat?

More information on the strength of the breccia is presented in PDF page 1236.

NRCan: Please review (PDF page 1236).

Note PDF Pages 1431 to 1678 are blank. Ask proponent if information is missing or if these pages should not have been included.

[Annex VII – Beaver Dam Bottle Neck Review - Ausenco Memorandum \(PDF page 1709\)](#)

Agency notes: Section 6.1 (PDF page 1717) states *“Beaver Dam blasting simulations show ROM particle size distributions significantly finer than Touquoy and is expected to have higher screening efficiency”*. Section 7 Erosion and Sediment Control Plan of the main body of the document says that fines will be less of a concern at Beaver Dam than they were at Touquoy.

NRCan: Does the information provided in this Annex support that there is a lower risk of fines being generated at Beaver Dam causing sedimentation into watercourses to be less of a concern?

[Annex VIII - Proposed Quarry Location - Beaver Dam Haul Road, Geotechnical Investigation - WSP Report \(211-00376-03\) PDF page 1736](#)

Agency notes: Table 5-1 in Section 5.1 (PDF page 1748) provides the aggregate properties. Values seem to be within provincial requirements.

NRCan: Please review to advise if information presented would indicate that this material is suitable to build roads without generating excess fines as was the case at Touquoy.

[Section 8 –eDNA Analysis \(PDF Page 44\)](#)

DFO: Please review (PDF page 44) – Does DFO agree that Watercourses 20 and 22 are not fish habitat? Does this address your concerns with the proponent’s use of eDNA? Would it change your conclusions regarding significance?

DFO Comments

- ECCC is the federal department with the lead responsibility for administering the MDMER and determining whether waterbodies overprinted by proposed tailings impoundment areas (TIAs) are water frequented by fish. ECCC often requests advice from DFO regarding fish presence/absence in

such waterbodies to inform their determination. The issues identified during DFO's review of the eDNA report are not a primary concern about the project, and this additional information does not change the Department's concerns about impacts to important Atlantic Salmon habitat in Killag River from the project.

- DFO had previously reviewed the proponent's eDNA report as part of the regulatory process for the determining whether the waterbodies that would be overprinted by the WRSA are considered water frequented by fish. DFO's comments on the eDNA report provided in the proponent's 2021 EIS were previously provided to ECCC, who then determined that the waterbodies were not water frequented by fish and therefore not subject to the provisions of the MDMER related to TIAs. Since the proponent included the eDNA report in their EIS submission, DFO provided the Agency with a summary of the comments that previously been provided to ECCC for completeness.
- The presence of fish in the waterbodies is also a plausible explanation for the weak eDNA detections.

[Annex IX – Beaver Dam Mine Project – Addition of waterbodies to Schedule 2 of the Metal and Diamond Mining Effluent Regulations \(PDF page 1786 -1788 – 3 pages\)](#)

Agency notes: PDF page 1788 states *“Based on the above reference documents submitted by AMNS and in consideration of expert advice provided by Fisheries and Oceans Canada (DFO), ECCC is in the opinion that the waterbodies WL220, WL205, WC21 and WC20 are not “waters frequented by fish” and therefore will not be required to be added to Schedule 2 of the MDMER.”*

ECCC: As this document was submitted to ECCC it has been previously reviewed. Please comment if Watercourse 22 will need a Schedule 2.

[Annex X – Fish Species Assay Validation Information \(PDF pages 1790 – 1792 – 2 pages in total\)](#)

DFO: Please review. Does this change your concerns on the effects of the project on fish and fish habitat?

DFO Comment

- See comment above regarding the eDNA analysis.

[Annex XI Sample Collection and Filtration Data \(PDF page 1793-1794 – 2 pages in total\) –](#)

Agency notes: contains field data (YSI) collected during eDNA sampling.

DFO: Please review. Does this change your concerns on the effects of the project on fish and fish habitat.

DFO Comment

- See comment above regarding the eDNA analysis.

Section 9 – Cumulative Effects in the Southern Upland Region (PDF page 45)

Agency notes: DFO had suggested that the entire Southern upland region be considered for cumulative effects in December 2021. AMNS provides reasons in this section as to why they only considered West River Sheet Harbour, Tangier River and Fish River – Lake Charlotte. No change from 2021 EIS. PDF page 46 states *“the projects listed by DFO in the Letter of Concern cannot currently be meaningfully incorporated into a cumulative effects assessment, even if the spatial boundary was expanded. The approved Touquoy Project is described in the CEEA (2014), and proposed revisions to the Project cannot be incorporated as the effects assessment is currently underway.”*

DFO: Please review (PDF pages 45 – 46) – does DFO agree with their above explanation as to why the proponent did not change the cumulative effects assessment?

DFO Comments

- DFO does not agree with the proponent’s explanation. As per DFO’s December 2021 advice and as explained in the Department’s general comments above, the project has potential to result in significant adverse effects to SU Atlantic Salmon.
- The other projects referenced in DFO’s 2021 comments involve many of the same project works, undertakings, and activities and are located in close proximity to river systems that have been identified as important habitat for SU Atlantic Salmon. While DFO’s comments during this EA have focused on the Beaver Dam mine site, the Department is also concerned about the proponent’s plans to discharge effluent into Moose River from the pit lake at Touquoy after it has been used for tailings disposal, and about ongoing and potential flow alterations to the river. Moose River is located within the Ship Harbour Watershed which has also been identified by DFO as important habitat for SU Atlantic Salmon, and numerous juvenile Atlantic Salmon and Brook Trout were identified in the river prior to mine development.
- DFO’s Salmon Fishing Areas (SFAs) are used by the Department for purposes of stock management and are smaller in spatial extent than the Southern Upland DU (see figure below). Even if the smaller SFA 20 were used as a basis of a cumulative effects assessment on Atlantic Salmon from these mining projects, all of the projects occur within SFA 20.
- The goal of DFO’s Wild Atlantic Salmon Conservation Policy is to restore and maintain healthy wild Atlantic salmon populations. Guiding Principle 1 of the Policy states that the conservation of wild Atlantic salmon populations, their genetic diversity and their habitats must be given the highest priority in management decisions. There is potential for these projects to have cumulative effects on the SU Atlantic Salmon DU that are greater than “insignificant”:
 - the projects involve works, undertakings, and activities that have potential to result in a substantial loss of population productivity within the watersheds where these projects are occurring/proposed;
 - these watersheds are among the highest priority populations and habitats for the SU Atlantic Salmon DU;

- decreased genetic diversity, population productivity or extirpation of Atlantic Salmon within these watersheds would increase the probability of extirpation of the DU.
- DFO does not understand the rationale for the proponent's claim that there is no way to assess the cumulative effects of these projects in a meaningful way.

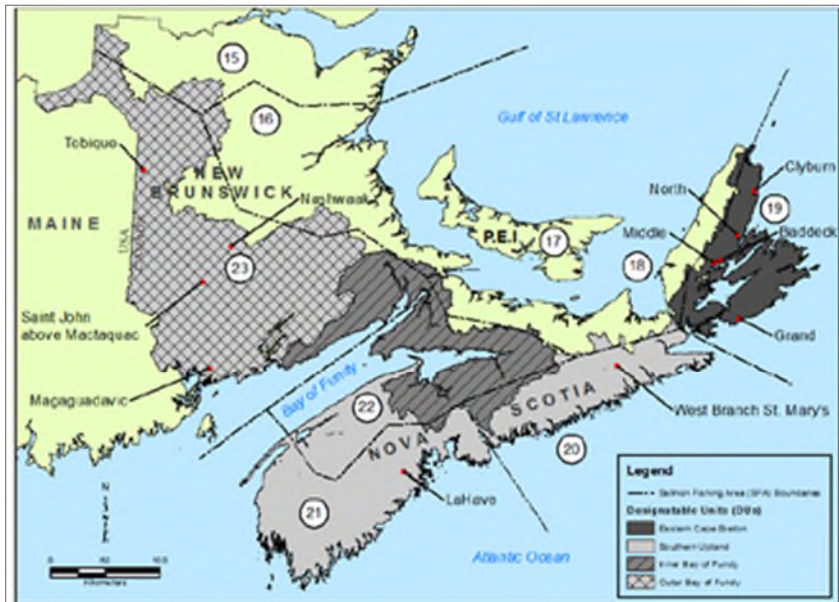


Figure A1. Map showing the locations of Atlantic Salmon rivers where monitoring predominately occurred, Salmon Fishing Areas (SFAs), and Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Designatable Units (DUs) mentioned in this update. SFA numbers are labeled inside the white circles. Data Source for DUs derived from NS Secondary Watershed Layer (NS Dept. of Environment) and NB Watershed Level 1 Layer (NB Dept. of Natural Resources).

Section 10 – Haul Road Upgrades and Harmful Alteration, Disruption and Destruction (HADD) Offsetting (PDF page 47)

Agency notes: DFO raised concerns with respect to underestimating HADD on the Haul Road. PDF page 47 states “Detailed design of the Haul Road is ongoing; as a result, at this time updates to Section 6.9, Tables 6.9-19 and 6.9-25 of the Updated 2021 EIS (AMNS 2021) are not available”. The proponent has not provided new information in this section.

DFO: Please review (PDF page 47) and comment on the sufficiency of this response to address your concerns. Would additional updates change your assessment of effects?

DFO Comments

- The haul road involves a relatively large number of watercourse crossings and road upgrades in and near fish habitat, including crossings of rivers that provide habitat for Atlantic Salmon, Brook Trout, and American Eel. Additional information is required for DFO to understand exactly what the haul road development entails and to assess the potential effects to fish and fish habitat. Linear developments and watercourse crossings have potential to affect flows and result in sedimentation of fish habitat. Nevertheless, the outstanding information about the haul road is not DFO’s primary

concern about the project at this time, and does not change the Department's concerns about impacts to important Atlantic Salmon habitat in Killag River from the project.

Section 11 – Wetland Alternations Resulting from Haul Road Upgrades (PDF page 48)

Agency notes: Table 11-1 (PDF page 48) is a copy of Table 6.8-18 in Section 6.8.7.1 of the EIS.

DFO: Please review (PDF pages 48-50, 3 pages) and advise as to whether this addresses the concerns raised by DFO in December 2021.

DFO Comments

- See comments above regarding section 10.

Things that do not need to be reviewed

Annex I - DFO comments from December 15, 2021 PDF page 51-85 (35 pages in total)

Annex II – Appendix A – Summary of Effects Assessment Mitigations PDF page 142 – 172 (31 pages in total) Copy and paste of Table 9.1-1 of the 2021 EIS

Annex III – Appendix P.4 Mine Water Management Plan of the Updated 2021 EIS PDF page 181 – 853 (673 pages in total)

Annex XII - Re-issued eDNA results (PDF pages 1795-1802) – PDF page 44 states that this was reissued with an annotation confirming that eFish primer detects yellow perch. Previously submitted as Appendix D of Appendix J.2 (PDF page 214) in the 2021 EIS. PDF page 1798 contains a new notation regarding brook trout and yellow perch. Otherwise unchanged.

Attachment 2 – ECCC Comments on Supplemental Information

Environment and Climate Change Canada (ECCC) have reviewed IACC's specific questions regarding the proponent's responses to DFO's Letter of Advice for the Beaver Dam Mine project and we offer the following comments. Our responses are consistent with DFO's and NRCan's positions on the quality of work that the proponent has presented on their water treatment options:

ECCC/DFO: Please comment as to the reasonableness of water treatment, such as pH adjustment, being an "alternative" given the sensitivity of Atlantic Salmon within the Killag River and the existing Acid Mitigation Project.

The proponent has presented near and far field mixing zones for the deposit of mine effluent into the receiving environment. It was not clear how concentrations of various parameters in the receiving environment were calculated nor was it clear which guidance was used to derive mixing zone distances. Guidance from CCME and others on these calculations typically include those assumptions that must be met in order to derive such mixing zones in the receiving environment; such assumptions were not provided.

Alternatives for water treatment for all stages of the mine life are presented in Appendix F. The summary of these alternatives is discussed in Section 7. This section does not make it clear which components of treatment systems are being committed to and which components are considered optional. A conservative water treatment design should include contingencies to protect any sensitive environments against reasonably foreseeable conditions. Without more detail and clarity on the specifics of the water treatment system, it is difficult to comment on the reasonableness of the proponent's approach.

It is also not clear whether the design of the water treatment system(s) has fully taken into account criteria other than the MDMER effluent limits that may be needed for the protection of sensitive ecosystems such as the Killag River. It should be noted that while MDMER discharge limits establish national standards for mine effluent quality, more stringent requirements/guidelines may be stipulated in EA conditions or industrial approvals for projects in these more sensitive environments.

ECCC: Are other gold mines in Canada able to achieve MDMER/CCME FWAL after mixing zone without any form of treatment other than a settling pond?

Each mine is different and it is up to the proponent to demonstrate that their plan, including alternatives, is sufficient to meet the required limits under the specific conditions related to the mine.

ECCC: As this document was submitted to ECCC it has been previously reviewed. Please comment if Watercourse 22 will need a Schedule 2.

The proponent should consult ECCC if there are questions as to whether a Schedule 2 amendment may be appropriate under the MDMER. The process for amending Schedule 2, if required, is led by ECCC, in consultation with DFO and takes place outside of the Environmental Assessment process.



Natural Resources
Canada

Ressources naturelles
Canada

3 October, 2022

Kathryn MacCarthy,
Project Manager - Atlantic Regional Office
Impact Assessment Agency of Canada - Government of Canada
kathryn.maccarthy@canada.ca

SENT BY EMAIL

Subject: Natural Resources Canada's Review of Additional Information Related to Groundwater Flow and Potential Movement of Contaminants for the Beaver Dam Gold Mine Project

Dear Kathy,

In response to your request, via email on September 22, 2022, for review of the additional information provided by the proponent with regards to potential impacts of the project on fish and fish habitat, Natural Resources Canada is providing the attached comments. The additional information was reviewed by experts in hydrogeology, sediment and historical mine tailings, and mine waste and metal leaching/acid rock drainage.

If you have any questions regarding our submission, please do not hesitate to contact me at shelley.ball@canada.ca or 613-240-1696.

Sincerely,

Shelley Ball
Senior Environmental Assessment Office
Office of the Chief Scientists

Cc: Peter Unger
Aruna Dixit
Jennifer Cole



Natural Resources Canada's Review of Additional Information Related to Groundwater Flow and Potential Movement of Contaminants for the Beaver Dam Gold Mine Project

NRCan has reviewed the additional project information submitted by the proponent for the Beaver Dam Gold Mine Project. The additional information was reviewed by NRCan experts in the areas of hydrogeology, sediment and historical mine tailings, and mine waste and metal leaching/acid rock drainage, to support understanding of the potential impacts of the project on fish and fish habitat.

Hydrogeology

Hydrological monitoring data show that Killag River levels are naturally very low in the summer. Therefore, any lowering of the water table could have an impact on fish populations.

NRCan offers the following specific comments to support the understanding of potential impacts to fish and fish habitat:

- **Mud Lake fault zone impact:** Given the proximity of the fault zone to the Killag River, there was a concern that the fault might drain the river into the open pit. The proponent's fieldwork indicates that this fault has low to moderate permeability and is not directly connected to the river (at > 100 m depth). Therefore, there is a moderate risk that the hydrology of the river could be altered by this fault as numerical modelling simulations indicate. Recent fieldwork conducted by the proponent also mapped secondary faults farther south to the river, but the risk of hydrological alteration was not assessed by the proponent;
- **Groundwater discharge alteration:** According to the groundwater flow model, mine dewatering operations will reduce groundwater discharge to the river, mainly by intercepting groundwater through the pit and exfiltration through the riverbed. The numerical modelling simulations indicate that the reduction in groundwater discharge may be small. However, the timing, magnitude, and location(s) of this reduction have not been assessed and therefore, impacts to the Killag River are uncertain;
- **Mine pit wall instability:** New fieldwork indicates that the wall of the pit near the Killag River (within 50-100 m) may be unstable if not properly treated. This includes draining the wall and controlling blasting. The effects of pit wall instability on the risk of hydrologic alteration were not evaluated. In discussions with DFO, NRCan agrees that the concerns with respect to the pit wall instability have not been assessed by the proponent.

In conclusion, from a hydrogeological perspective and with the additional information provided, NRCan has no further information requests and is aware of DFO's concerns regarding fish and fish habitat. NRCan agrees with these concerns.

Sediment Erosion

With respect to the proponent's Erosion and Sediment Control Plan (Section 7, Response Document, PDF pg. 38-43, Appendix C of Annex III PDF pg. 340-364), NRCan agrees with DFO's concerns regarding the ability of the on-site sedimentation ponds to remove fine sediment particles from surface water before release into the nearby Killag River.

NRCan recommends that the proponent, prior to the full-scale construction of these settling ponds:

- Conduct particle size analyses of typical runoff from soils at the Beaver Dam Project Site to assess the percentage of particles less than 10 microns and the potential need for flocculants or other settling methods to augment the performance of these settling ponds (see BC MOE 2015 for guidance);
- Given the proximity of these settling ponds to Killag River, additional measures may be required (e.g., constructed wetlands) to mitigate the release of fine sediment and/or excess flocculant, to fish-bearing waters;

- Provides details regarding the frequency of water quality sampling and flow monitoring in effluent from the settling ponds, and whether or not real-time monitoring of influent total suspended solids (TSS) will be used to rapidly respond to unusually high sedimentation events;
- Clarifies how any exceedances of water quality objectives in discharge from the settling ponds, including for TSS, metals, and other contaminants, will be addressed during operation, especially for the East Settling Pond and South Settling Pond that are not located close to the on-site Water Treatment Facility.

Reference: British Columbia Ministry of Environment (2015) Environmental Management Act Technical Guidance 7: Assessing the Design, Size, and Operation of Sediment Ponds Used in Mining. https://www2.gov.bc.ca/assets/gov/environment/waste-management/industrial-waste/industrial-waste/mining-smelt-energy/assessing_design_size_and_operation_of_sediment_ponds.pdf

Mining Waste and Metal Leaching/Acid Rock Drainage

It is NRCan's understanding that the proposed operation of the Beaver Dam open pit mining project may be connected to the nearby Killag River and may present a significant risk (in terms of both water quantity and quality) for Atlantic Salmon. Deposit of mining effluent is another potential environmental risk. This assessment of risks to fish and fish habitat is not within NRCan's mandate.

During review of the Environmental Impact Statement (EIS), NRCan provided an assessment of the proposed management of potentially acid generating and metal leaching rock. NRCan's comments and recommendations on the EIS were intended to help improve ARD/ML management, and if these are adhered to, along with regular monitoring, ARD/ML would likely be kept to a minimum, reducing potential risks of metals to Atlantic Salmon. NRCan notes that the processing of the ore at the Touquoy Mine site is an important mitigation measure which will help to protect the receiving environment at the Beaver Dam site. With that said, impacts to fish and fish habitat are not within NRCan's mandate, therefore, we defer to DFO to understand potential impacts to fish and fish habitat."