Final Written Submission
Agnico Eagle Mines Limited
New Water Licence Whale Tail Project
2AM-WTP and Water Licence Amendment for Meadowbank Project 2AM-MEA1525

Indigenous and Northern Affairs Canada
Nunavut Water Board Submission

Submitted to:
Nunavut Water Board

August 14, 2017

EXECUTIVE SUMMARY

Indigenous and Northern Affairs Canada (INAC) has undertaken a new type A water licence application review for the Whale Tail Pit Project submitted by Agnico Eagle Mines Limited. The review process included one round of Information Requests (IRs) and a Technical Review submission, both of which received responses from the Proponent. This was followed by a Technical Meeting in Baker Lake in April/May, 2017 which resulted in the Applicant making and responding to a series of additional commitments to address requests from INAC and other parties.

In general, the information, analysis and presentation of the submissions were complete. However, since aspects of the project are still conceptual many uncertainties remain regarding the design, environmental performance and its influence on water quality for the Project. The Applicant has identified many of these uncertainties and proposed reasonable strategies to obtain the information necessary to refine designs to ensure the Project achieves its intended environmental and water quality outcomes and objectives.

However, based on the information provided to date, it is INAC's opinion that some of the variables used to model water quality outcomes and objectives have been under-estimated. Of particular concern, the short operational life of the Project (3 years) and the proposed concurrent closure of some components (e.g., the Waste Rock Storage Facility (WRSF)) could significantly constrain the ability of the Applicant to resolve key uncertainties in a timely fashion through adaptive management.

INAC remains concerned that the post-closure performance of the site, as it relates to water quality, could result in unintended impacts that require mitigation.

Therefore, INAC has placed an increased emphasis on potential concerns related to water quality during the post-closure phase of the Project. Notable concerns identified by INAC include:

1. **Post-Closure Seepage from the Waste Rock Storage Facility (WRSF)** - Seepage from the active freeze/thaw zone of the WRSF will occur throughout the post-closure phase. The quantity and quality of the seepage will be determined by the depth of annual freeze/thaw, as well as the geochemical properties of the waste rock that is present in the active zone. Modelling of different WRSF scenarios indicates that arsenic concentrations in seepage could become elevated, thereby causing adverse impacts to downstream receivers if discharged without treatment. Arsenic concentrations in WRSF seepage will be particularly elevated if waste rock with high arsenic leaching rates is inadvertently incorporated into the cover (referred to as cover contamination). Best practices during mining operations can be used to reduce the extent and probability of cover contamination; however it cannot be completely eliminated. Further, given the short mine life, elevated seepage concentrations, if it were to occur, may not become apparent until several years after the site has been closed. Under this scenario, only a limited number of potential mitigations, such as cover enhancements and/or long-term treatment would be available

2. **WRSF Cover Thickness -** The closure concept for the WRSF is dependent upon the encapsulation (permanent freezeback) of waste rock with elevated Acid Rock Drainage (ARD) or Metal Leaching (ML) potential within the waste rock pile. Failure of the encapsulation could result

in seepage from the WRSF having highly elevated arsenic concentrations capable of causing adverse impacts to surface water bodies. The thickness of the active freeze/thaw zone is therefore a fundamental design consideration of the WRSF cover. The initial design concept submitted by the Applicant in the Environmental Impact Statement (EIS) indicated that the cover would be 2-4 m in thickness. The thermal modelling undertaken by the Applicant to determine the depth of the active zone under future climate change scenarios, predicts that the cover thickness should be at least 3.8 m under a 100-year climate change scenario. However, the modelling exercise did not incorporate observational data from the Meadowbank site and, as such, requires further calibration. The WRSF cover design incorporating the thermal modelling results should be submitted for review and approval prior to closure.

3. **Post-Closure Water Quality in the Flooded Pit / Lake -** After approximately three years of active mining, the Whale Tail Pit and Whale Tail Lake will be flooded until water levels reach their pre-development elevation. The Applicant's base case scenario predicts that water quality in the flooded pit/lake will be acceptable for direct discharge to the downstream receiving environment. However, when accessing scenarios to model water quality that included diffusion of arsenic into the pit/lake from the surrounding rock formations, arsenic concentrations in the flooded pit/lake were predicted to be approximately an order of magnitude greater than the proposed Site-Specific Water Quality Objective (SSWQO) for arsenic. These diffusion scenarios may therefore trigger the need for active interventions, most likely in the form of long-term water treatment. The strength and direction of hydraulic groundwater gradients in the vicinity of the pit are critical determinants in the probability of diffusion occurring. Additional studies and monitoring will be required to confirm the applicant's conclusions.

By addressing these concerns, the Applicant will provide increased certainty regarding the potential for long-term Project water quality impacts and the eventual relinquishment of the site. Towards this end, INAC has identified a series of recommendations to address each of the concerns. The recommendations are summarized in Section 6 of this report. As some of the recommendations require further evaluations and studies to determine effectiveness of the applicant's conclusions, security has been increased in the interim. INAC's security estimate for the Whale Tail Pit Project has been summarized in Section 5 with the detailed document being attached to this report as Appendix A. At this time, further discussions are on-going with the appropriate parties to come to agreement on amount for security.

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LIST OF ACRONYMS

ARD	Acid Rock Drainage
EA	Environmental Assessment
EIS	Environmental Impact Statement
EMZ	Effective Mixing Zone
EQC	Effluent Quality Criteria
ICRP	Interim Closure and Reclamation Plan
INAC	Indigenous and Northern Affairs Canada
IR	Information Request
MEND	Mine Environment Neutral Drainage Program
ML	Metal Leaching
MMER	Metal Mining Effluent Regulations
NIRB	Nunavut Impact Review Board
NPAG	Non-Potentially Acid Generating
NWB	Nunavut Water Board
PAG	Potentially Acid Generating
RCP	Representative Concentration Pathway
SSWQO	Site-Specific Water Quality Objective
TRC	Technical Review Comment
TSF	Tailings Storage Facility
WRSF	Waste Rock Storage Facility
WTP	Water Treatment Plant

1.0 INTRODUCTION

Agnico Eagle Mines Limited is the Applicant for the Whale Tail Pit Project in the Kivalliq Region of Nunavut. At the Applicant's request, the Nunavut Impact Review Board (NIRB) and Nunavut Water Board (NWB) are coordinating, to the extent possible, their respective processes for the assessment of the Whale Tail Pit project proposal (the Project) and the associated water licence application (NIRB File No. 16MN056 and NWB File No. 2AM-WTP----). The coordinated process has resulted in the NWB initiating its consideration of the water licensing required for the Project at a much earlier stage than would normally be the case and has engaged the NWB's consideration of the water licence application while the NIRB's assessment of the Project is ongoing.

On June 8th, 2017, the NIRB and the NWB issued a Pre-Hearing Conference Decision Concerning the Whale Tail Pit Project. That decision indicated that both Boards independently determined that the proposed project could proceed to a Final Hearing. This determination was predicated on the condition that all the information required to be submitted in advance of the Final Hearing is provided in accordance with the timelines set out in Pre-Hearing Conference Decision Report. Specifically, it was stated that all further and final written submissions to be provided by Interveners must be filed with the Boards on or before Monday, August 14, 2017. The current document represents the final submission of Indigenous and Northern Affairs Canada (INAC) to the NWB. A separate submission has been provided to the NIRB.

INAC has a broad mandate for the co-management of water resources in Nunavut under the following applicable acts and regulations:

- The Department of Indian Affairs and Northern Development Act (DIAND Act);
- The Nunavut Agreement;
- The Arctic Waters Pollution Prevention Act and Regulations;
- The Nunavut Waters and Nunavut Surface Rights Tribunal Act and Regulations;
- The Nunavut Planning and Project Assessment Act (NuPPAA); and
- The Territorial Land Act and Regulations

As set out in the Nunavut Agreement, INAC's Minister, has the authority to approve or not approve an applicant's type A water licence application. If the applicant is approved a water licence, the Department will be responsible for inspecting and enforcing those conditions contained within the water licence issued by the Nunavut Water Board.

According to the Department's current understanding of the proposed project, regulatory authorizations to be issued by INAC, if the Project is approved, would consist of any additional quarry permits that may be required for quarrying of material on Crown land during construction, operation, and/or closure of the Project. At present, Agnico Eagle holds authorizations for the construction, use, and maintenance of the Crown land portion of the all-season exploration access road connecting Meadowbank to the Whale Tail site.

As part of the NWB's review, INAC, along with other stakeholders, acts as an intervener in the process, providing advice and expertise to the NWB by way of this, prior and future submissions, where required. Based on the Department's regulatory mandate and decision-making roles, INAC is participating in the

review process by providing the following expertise related to potential Project works, activities, and plans:

- Surface water quality and quantity (including monitoring);
- Groundwater; and
- Reclamation security.

INAC has conducted its review of the water licence application and its associated management plans for the Whale Tail Project to assess whether water quality/quantity impacts, including cumulative impacts have been adequately identified and evaluated. INAC has also reviewed all related management, mitigation and monitoring plans to ensure that they are appropriate.

2.0 REVIEW CONTEXT

INAC's review consisted of a comprehensive review of all project components affecting both water use and water quality (directly and indirectly) and information filed by Agnico Eagle Mines (AEM or the Applicant) in relation to the Whale Tail Pit Project. The comments provided in this submission are also based on multiple meetings and discussions with the Applicant. In general, INAC has found that the presentation and quality of information in the Applicant's submission materials were adequate, especially when responses to additional requests for information are considered. However, INAC has identified remaining areas of concern that need to be addressed.

INAC's detailed review comments are presented in the following sections:

Section 3: Whale Tail Project Water Quality Comments and Recommendations / Requests

Section 4: Meadowbank Licence Amendment Water Quality Comments and Recommendations / Requests

Section 5: Whale Tail Pit Project Closure Cost Estimate

Section 6: Summary of Recommendations / Requests.

While reviewing the detailed comments, INAC's review of the water licence and associated documentation focused on post-closure, water quality and arsenic concentrations.

3.0 WHALE TAIL PROJECT WATER QUALITY COMMENTS AND RECOMMENDATIONS / REQUESTS

3.1 Post-Closure WRSF Seepage Affecting Water Quality

Technical Review Comment	**INAC Final Comment #1**
Subject	**Post-Closure WRSF Seepage Affecting Water Quality**
Reference(s)	• APPENDIX 5-E Evaluation of the Geochemical Properties of Waste Rock, Ore, Tailing, Overburden and Sediment from the Whale Tail Pit and Road Aggregate Materials • EIS Volume 6 Freshwater Environment • APPENDIX 6-H Mine Site and Receiving Environment Water Quality Predictions • APPENDIX 6-I Water Quality Prediction Summary Tables • VOLUME 8 - MONITORING, MITIGATION, AND MANAGEMENT PLANS • Plan 8-A.1: Mine Waste Rock and Tailings Management • 8-E.5: Operational ARD/ML Sampling and Testing Plan • 8-F.1: Interim Whale Tail Closure and Reclamation Plan • AEM Response to INAC TRC#1 - Design and Depth of Waste Rock Cover [to Assure Long Term Freezing of Metals Leaching and Potentially Acidic Generating Waste Rock] • AEM Response to INAC TRC#3 - Predicted Post-Closure Arsenic Levels in Waste Rock Seepage/Runoff • AEM Response to INAC TRC#6 - Post-Closure Surface Water Impacts • AEM Response to INAC TRC#7 - Post-Closure Water Quality Uncertainty • AEM Response to Commitment #39 – WRSF Thermal Modelling • AEM Response to Commitment #s 30, 36, 37, 42 – Water Quality Modelling Sensitivity Analysis • AEM Presentation to INAC: Clarifications and Comments – Water Quality Model (June 12, 2017) • AEM Presentation to INAC: Phase 1 Site and Receiving Environment Water Quality Model Sensitivity Analyses (June 29, 2017) • Meadowbank 2016 Annual Report
Summary	Seepage from the active freeze/thaw zone of the WRSF will occur throughout the post-closure phase (i.e., for centuries). The quantity and quality of the seepage will be determined by the depth of annual freeze/thaw, as well as the geochemical properties of the waste rock that is present in the active zone. Modelling of different WRSF scenarios indicates that arsenic concentrations in seepage could become elevated, thereby causing adverse impacts to downstream receivers if discharged without treatment. Arsenic concentrations in WRSF seepage could be particularly elevated if waste rock with high arsenic leaching rates is inadvertently incorporated into the cover (referred to as cover

	contamination). Best practices for material segregation and monitoring will be critical to reduce the extent and probability of cover contamination.
Importance of Issue to Water Resources	There is uncertainty regarding the quality of WRSF seepage during the post-closure phase. In an effort to address the implications of this uncertainty, sensitivity analyses were performed to assess the environmental impacts associated with different WRSF scenarios. The sensitivity analyses concluded that, under some scenarios, WRSF seepage could result in adverse impacts to downstream receivers. Elevated seepage concentrations would not become apparent until several years after the site has been closed. If this were to occur there would be a limited number of potential mitigations (e.g., cover enhancements and/or long-term water treatment).
Detailed Review Comment	The Applicant has indicated that all waste rock below the active freeze/thaw zone of the WRSF cover will remain permanently frozen and that it will be a negligible source of arsenic seepage during the post-closure phase. INAC agrees with this assertion; any water entering the permanently frozen portion of the WRSF is expected to freeze, thereby mitigating the potential for seepage from this portion of the pile. However, as indicated in the Environmental Impact Statement (EIS) and supporting documentation, the active zone of the WRSF will be an ongoing source of arsenic seepage and loadings to downstream receivers during the post-closure phase of the project. Several INAC Information Requests and Technical Review comments identified uncertainties and potential concerns associated with the Applicant's assessment of post-closure seepage from the active zone of the WRSF. During the Pre-Hearing Conference in Baker Lake and follow-up discussions, the Applicant made various commitments to provide additional information and analysis to address the requests from INAC. The information and analysis was consolidated into a single technical memorandum that also addressed requests made by other parties. The memorandum, which was provided to INAC on July 11th, 2017 is titled: *Addendum to Agnico Eagle Mines Whale Tail EIS Appendix 6-H. Sensitivity Analysis on Water Quality Modelling in Support of Responses to Technical Commitments 30, 36, 37 and 42 and Intervenor Comments ECCC #15 and INAC-TRC #3 and #5 on the Water Licence A Application to the Nunavut Water Board.* Based on our review of the sensitivity analysis and other documentation, INAC has reached the following conclusions regarding the Applicant's assessment of seepage from the WRSF. For the purpose of this submission, the conclusions have been grouped into the following topics:

Topic 1: Seepage Discharge Without Treatment;
Topic 2: Cover Thickness;
Topic 3: Cover Contamination; and
Topic 4: Changes in Waste Rock Quantities and Composition.

Topic 1: Impact of WRSF Seepage Discharge Without Treatment

The EIS and related documentation indicates that seepage from the WRSF will only be discharged to the receiving environment if it meets applicable effluent quality criteria (EQC). EIS modelling assumed that elevated concentrations of arsenic and other contaminants in the WRSF seepage would be actively treated until such time that direct discharges to surface water receivers were deemed acceptable. While INAC supports this approach during the operational and closure phases of the project, long-term active water treatment during post closure is generally not an acceptable closure alternative, particularly for remote northern sites.[1]

On this basis, INAC requested that the sensitivity analyses evaluate the impacts of *untreated* WRSF seepage on downstream surface water receivers. This approach was considered necessary to reflect the potential for downstream impacts if uncontrolled seepage were to occur during the post-closure phase. The approach was also intended to indicate the likelihood that the Project would need to treat seepage for an extended period; in general, scenarios that are predicted to result in seepage with highly elevated contaminant concentrations are more likely to trigger requirements for long-term treatment.

Topic 2: Impact of Cover Thickness on WRSF Seepage

The quality and quantity of seepage from the WRSF will be directly proportional to the depth of the active layer; if the active layer is deeper than anticipated, chemical loads from the WRSF can be expected to increase accordingly.

The seepage predictions presented in the EIS were based on a 2 m active layer thickness but, as indicated in Final Comment #2, there is uncertainty that the active zone will remain at this depth. As a result, INAC concluded that the EIS may have underestimated the chemical

[1] As indicated in relevant mine closure guidance including: a) The Mine Site Reclamation Policy for Nunavut (INAC 2002) and b) Cold Regions Cover System Design Technical Guidance Document (INAC/MEND 2012).

	loads in the WRSF seepage. INAC therefore requested that the modelling be revised to evaluate seepage from a 4 m active thaw depth.[2] The Applicant's findings associated with this additional analysis are presented in the above-noted sensitivity analysis. As shown Figures 1 and 2, the maximum seasonal arsenic concentrations for the 4 m thaw depth are approximately double the predicted concentrations for the 2 m depth (0.35 mg/L as compared to 0.21 mg/L). This illustrates the general relationship between the depth of the active zone and arsenic concentrations in seepage. It is important to note that arsenic concentrations in seepage from a 4 m thaw depth are 3.5 times greater than the Applicant's proposed operational Effluent Quality Criterion (EQC) for arsenic of 0.1 mg/L. While operational EQC are not intended for application to closed facilities, this emphasizes the potential need for seepage management/treatment during the post-closure phase of the project. There is also a need for clearly defined WRSF closure criteria that address seepage quality. The modeled increased arsenic concentrations in seepage attributable to the thicker cover could result in higher arsenic loadings to the downstream receiving environment. Nonetheless, as shown in Figure 3, the sensitivity analysis predicted that arsenic concentrations in Mammoth Lake (i.e., the immediate downstream receiver) would remain below the SSWQO, even without treatment. This conclusion applies only to the spatial *average* of arsenic concentrations in the receivers; localized exceedances of the SSWQO within Mammoth Lake will exist until sufficient mixing/dilution has occurred. While the Applicant has indicated that any such exceedances will be limited to a proposed 100 m Effective Mixing Zone (EMZ), this conclusion is based on simplified mass balance assumptions, not detailed hydrodynamic modelling. As a result, there is insufficient information to determine the spatial extent of potential adverse impacts within Mammoth Lake that could result from the WRSF seepage. With regard to the risks associated with seepage, it is important to note that the length of time required for WRSF seepage to reach a state of equilibrium is unknown. This is attributable to a variety of factors, including but not limited to the number of years needed for the WRSF to reach its field capacity (i.e., moisture storage limits). While the Applicant's modelling predicts that the field capacity will be reached during or soon after closure (see Figures 1 and 2), INAC is of the view that seepage quality may not reach equilibrium until well into the post-closure phase. As a result, there is a potential that the WRSF will not start to generate unacceptable seepage quality until several years after closure has been implemented. At that stage, there will be relatively few mitigations that could be implemented to control the impacts associated

[2] For reference, the WRSF thermal modelling performed by the Applicant (see Final Comment #2) recommended that the design thickness of the cover be at least 3.8 m. This supports INAC's request that the Applicant evaluate the seepage associated with a 4 m cover.

	with the seepage (e.g., cover enhancements, long-term water treatment). **Topic 3: Impact of Cover Contamination on WRSF Seepage** EIS water quality modelling assumed that the WRSF cover would be constructed exclusively of clean waste rock. The modelling made no allowances for potential "contamination" of the cover with waste rock that has elevated acid generating and/or metal leaching potential. Based on the practical realities of waste rock management at operating sites, INAC considered this to be an optimistic approach and requested that the Applicant perform a sensitivity analysis that included 2% and 5% contamination of the cover with other waste rock types. In performing the requested analyses, the Applicant modeled the water quality impacts of incorporating north wall ultramafic rock into the cover (referred to herein as cover contamination)[3]. The findings associated with the analyses are presented in Figures 4 to 7. As indicated in Figure 4, the inclusion of 2% north wall ultramafic rock within the WRSF cover would result in seepage that has arsenic concentrations of 3.5 mg/L. This is approximately ten times greater than the concentrations predicted for a 100% clean cover. As expected, Figure 5 illustrates that the elevated results increase even further under the 5% scenario, with annual arsenic concentrations in the seepage as high as 8.3 mg/L (i.e., 24 times greater than a 100% clean cover). Table 1 summarizes the maximum predicted concentrations of arsenic in WRSF seepage under various cover contamination scenarios. For context, the predicted arsenic concentrations are compared against the proposed interim MMER criterion (0.3 mg/L), the Applicant's proposed EQC (0.1 mg/L) and the Applicant's proposed SSWQO (0.025 mg/L) for arsenic. The comparisons illustrate that all scenarios involving a 4 m cover result in elevated arsenic concentrations in seepage, even in circumstances with no cover contamination. **Table 1** – Summary of Maximum Predicted Arsenic Seepage Concentrations Under Different Cover Contamination Scenarios

[3] While north wall ultramafic rock is a concern due to elevated arsenic leach rates that are approximately 5,000 times greater than the rest of the WRSF cover material, other waste rock (e.g., iron formation) and overburden (sediments) are predicted to have similar arsenic leach rates. Collectively, these waste streams represent more than one-third of the total waste rock that will require management.

Cover Thickness (m)	% Cover Contam.	WRSF Pond Arsenic Concentration without Treatment (mg/L)		Times Greater than Proposed Interim MMER Criterion	Times Greater than AEM's Proposed EQC	Times Greater than AEM's Proposed SSWQO
		Max	Min	0.3	0.1	0.025
2	0	0.21	0.11	0.7	2.1	8.4
4	0	0.35	0.17	1.2	3.5	14
4	2	3.5	1.7	11.7	35	140
4	5	8.3	4	27.7	83	332

As shown in Figures 6 and 7, seepage from the 2% and 5% cover contamination scenarios is predicted to result in arsenic concentrations that are above the SSWQO in multiple downstream receivers, if discharged without treatment. Concentrations would be particularly elevated in Mammoth Lake but other downstream lakes would also witness elevated arsenic levels.

Given the magnitude of predicted arsenic concentrations, the probability of cover contamination warrants consideration. Towards this end, the Applicant's sensitivity analysis included a qualitative discussion that addresses the likelihood of cover contamination. The discussion focuses on the waste rock management practices that will be used to minimize mixing of potentially problematic waste rock within the otherwise clean cover. The Applicant stated they are confident these practices will essentially eliminate the risk of cover contamination and that the probability of seepage having the elevated arsenic concentrations predicted in Figures 4 to 7 was classified as low.

INAC agrees that the waste rock management approaches described by the Applicant are generally consistent with common best practices and that they should be effective in reducing the extent and probability of cover contamination. However, the department does not support the conclusion that such contamination can be eliminated. Within the context of an operating mine, many factors are likely to result in some degree of cover contamination, including but not limited to: ineffective geochemical characterization; physical mixing of waste types during extraction, transport, storage and cover construction; and human error (e.g., placing waste rock in the wrong dump). All of these factors are known to have occurred at other mine sites, some of which possessed robust waste rock management practices.

While INAC does agree that there is a low risk of contamination, some degree of contamination is likely. While it is possible that the 2% and 5% scenarios represent the upper bound of potential cover contamination, the elevated arsenic concentrations associated with those scenarios suggest that lower levels of cover contamination (e.g., 1% or 0.5%) would also result in seepage with highly elevated arsenic concentrations.

In response to INAC's concerns, the Applicant emphasized that

environmental performance at the Meadowbank site indicates that cover contamination can be effectively eliminated. To support this position, the Applicant compared actual monitoring data for the Meadowbank site against the EIS predictions that were developed for that project. The comparison emphasized that virtually all of the monitoring data points were well below the EIS predictions. On this basis, it was suggested that a high degree of conservatism had been used in the assessment. The Proponent indicated that the same general relationship between predicted and actual performance is anticipated for the Whale Tail Project.

In reviewing Appendix C4 of the Proponent's 2016 Annual Report for the Meadowbank Gold Project, INAC reached different conclusions. Specifically, with regard to arsenic concentrations:

1. The Proponent's assessment (as described above) compared the Meadowbank monitoring data to the "Possible Poor Case". INAC disagrees with this approach; the "Probable Case" is a far more appropriate point of comparison when evaluating the quality (and conservatism) of EIS predictions. The fact that most monitoring results were below the upper-bound of the EIS predictions is not surprising.
2. While the majority of monitoring results were below the "Possible Poor Case", some data points were far above. Using this data, INAC calculated that arsenic concentrations in the Meadowbank sumps were, on average, approximately 20% above than the "Possible Poor Case" EIS prediction. When compared to the "Probable Case", arsenic concentrations were, on average, more than 7,000% greater than the EIS prediction.

The above discussion demonstrates the uncertainty associated with environmental predictions. On this basis, INAC cautions against assuming that the conservatism embedded in the Whale Tail EIS will necessarily result in an over-prediction of environmental impacts.

Topic 4: Impact of Waste Rock Composition on WRSF Seepage

In an effort to address potential water quality concerns in the flooded pit (post-closure) the Applicant is evaluating the merits of a "north wall pushback" that would increase the volume of waste rock requiring disposal in the WRSF by 15.4 Mt. The incremental waste rock volume represents an increase of approximately 33% relative to the original WRSF volume, as proposed in the EIS. INAC therefore requested that the WRSF seepage modelling be revised to account for the incremental waste rock volumes and types associated with this potential change. The Applicant's assessment was presented in the above-referenced sensitivity

	analysis. The Applicant indicated that the incremental waste rock volume from the north wall push back will be accommodated without increasing the footprint of the originally proposed WRSF. This will require increasing the height of the facility to approximately 66 m. The disposal of waste rock from the north wall push back in the WRSF is predicted to result in slightly higher arsenic concentrations in seepage generated by the facility prior to full closure. The Applicant concluded that those changes are minor and that they can be effectively mitigated. During the post-closure phase, the incremental volume of waste rock associated with the north wall push back will be located beneath the cover, within the permanently frozen core of the WRSF. As a consequence, the Applicant concluded that the additional waste rock volume will not have a material impact on seepage water quality during the post closure phase. INAC agrees with the conclusions reached by the Applicant in this regard.
Recommendation/Request	a. **WRSF Seepage Management:** To manage the low probability but high consequent scenario of water quality from the WRSF being above set criteria as proposed by the applicant at closure and post closure, INAC recommends **i)** that the waste rock management plan be revised and updated to include more waste rock sampling to provide improved confidence that cover contamination is not occurring, and **ii)** the monitoring plan for the WRSF and associated attenuation pond be updated to include WRSF seepage monitoring criteria that must be met before AEM considers breaching the dike/dam of the associated attenuation pond. This criteria in addition to specifying acceptable water quality, would include required number of acceptable sampling events that would be necessary to confirm that stable seepage had been attained and over a specified time frame (this may also include increased sampling events during certain times of year e.g., spring freshet). b. **Conduct Hydrodynamic Modelling of Seepage Discharges**: INAC recommends that the Applicant conduct detailed hydrodynamic modelling to evaluate the mixing of WRSF seepage discharges to Mammoth Lake during the post-closure phase of the project. The modelling should evaluate a range of potential seepage discharge scenarios (clean/contaminated cover, increased active zone depth, etc.). Any results from the modelling should be incorporated into the appropriate monitoring plan for review and approval. c. **Incremental Security:** Due to a number of uncertainties surrounding water quality INAC's security estimate has taken into account the potential for long-term treatment. If in the future,

	monitoring indicates no exceedances then the applicant can ask for a reduction in security.

Note: The following figures (#1 to #7) are provided to support the discussion presented in INAC Final Comment #1. All of the figures were extracted from the following document:

Addendum to Agnico Eagle Mines Whale Tail EIS Appendix 6-H. Sensitivity Analysis on Water Quality Modelling in Support of Responses to Technical Commitments 30, 36, 37 and 42 and Intervenor Comments ECCC #15 and INAC-TRC #3 and #5 on the Water Licence A Application to the Nunavut Water Board.

Figure 1 – WRSF Seepage with 2 m Active Thaw Depth (without treatment)

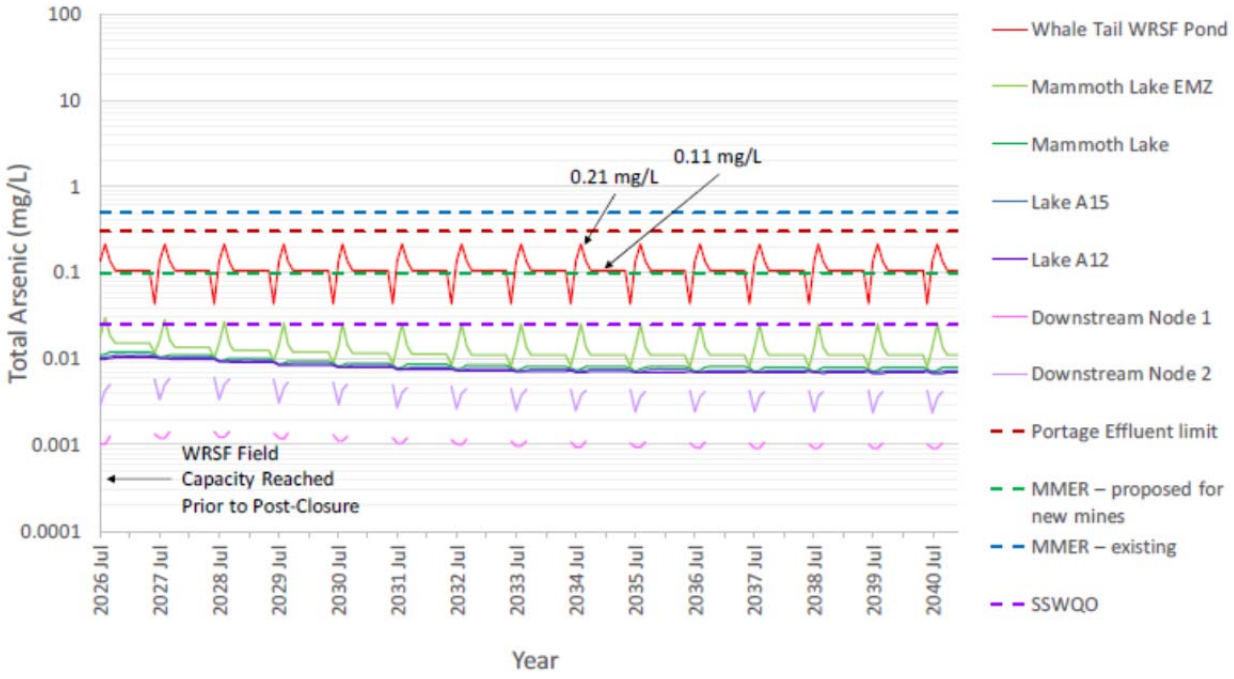


Figure 2 – WRSF Seepage with 4 m Active Thaw Depth (without treatment)

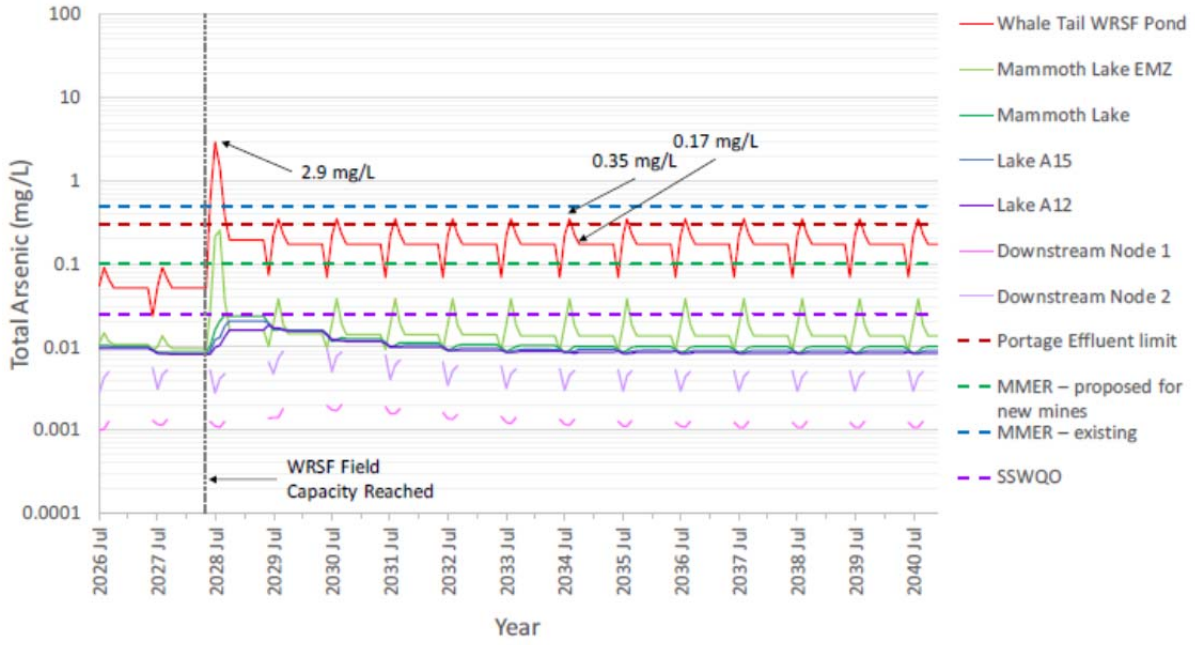


Figure 3 – Downstream arsenic concentrations for a 4 m Active Thaw Depth (without treatment)

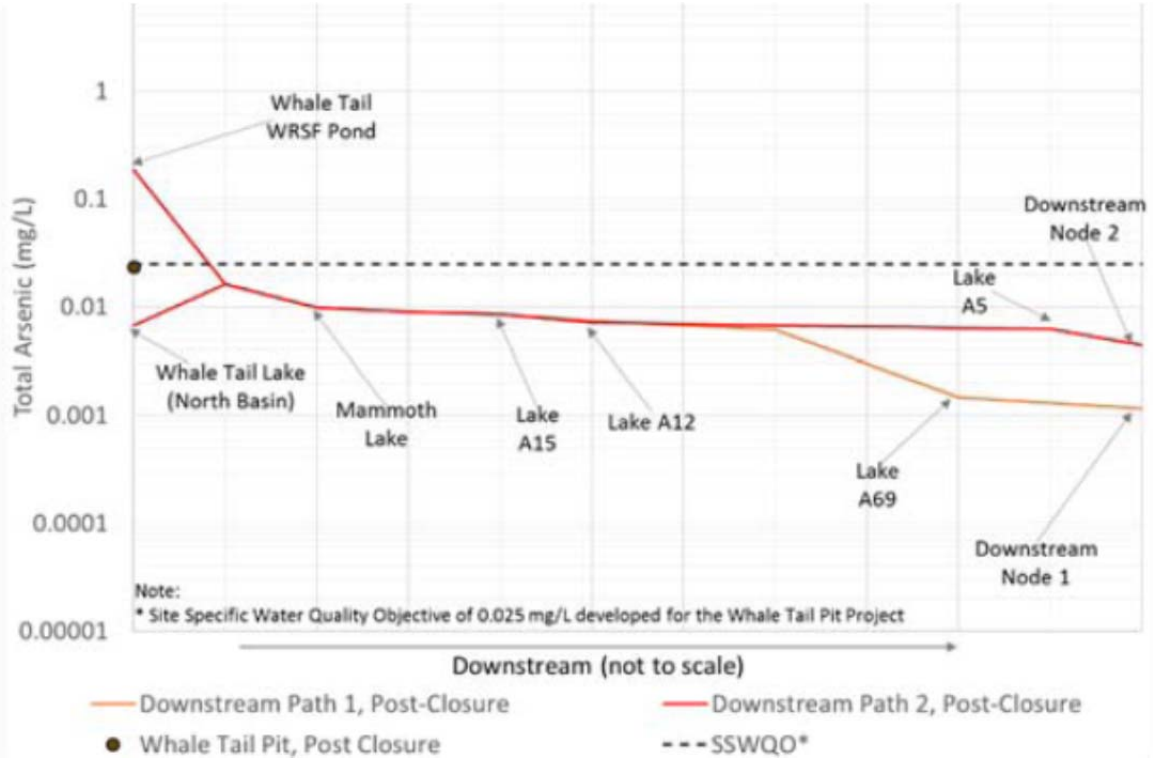


Figure 4 – WRSF Seepage with 2% Cover Contamination (4 m active depth, without treatment)

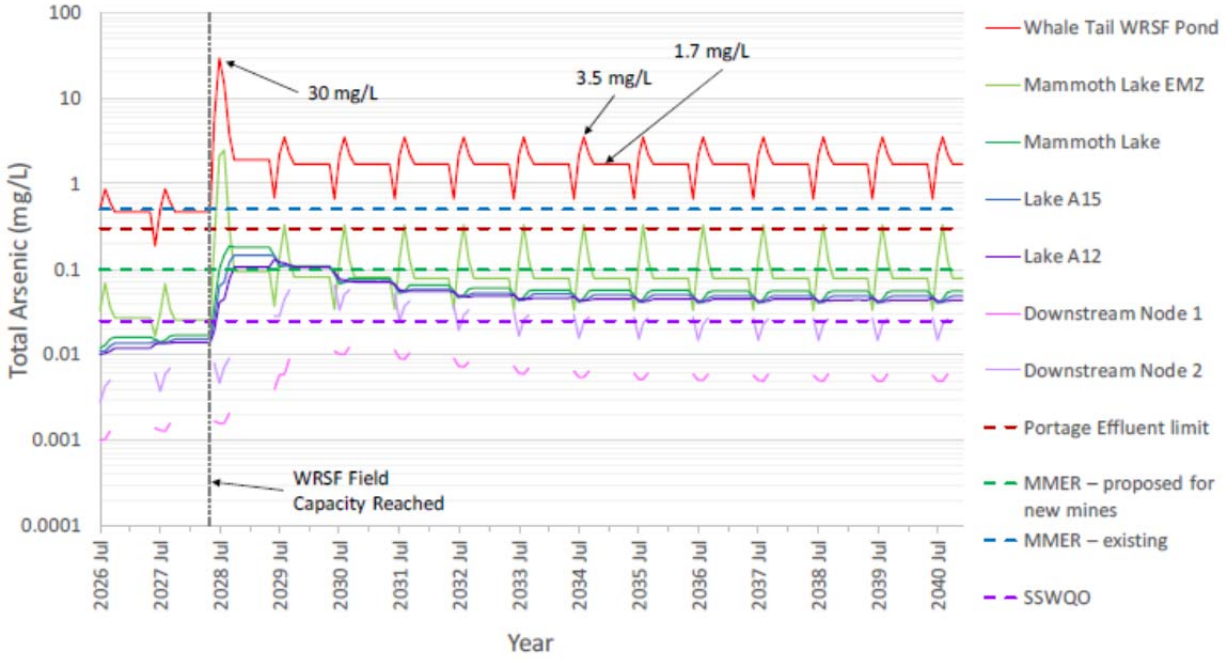


Figure 5 – WRSF Seepage with 5% Cover Contamination (4 m active depth, without treatment)

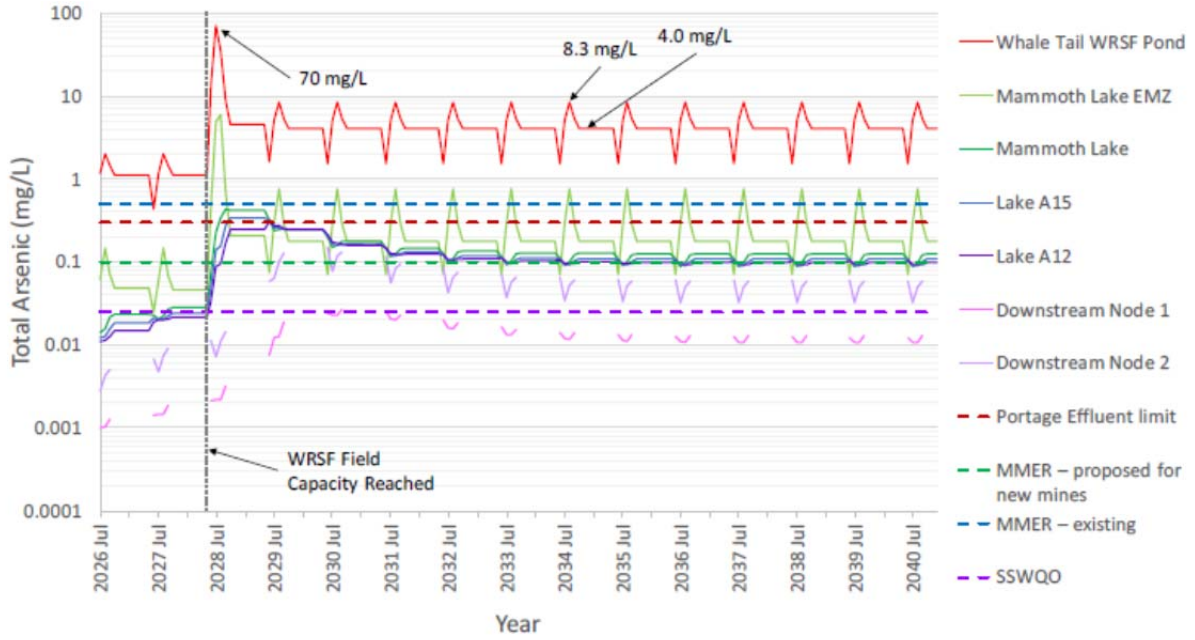


Figure 6 – Downstream arsenic concentrations with 2% Cover Contamination (4m active depth, without treatment)

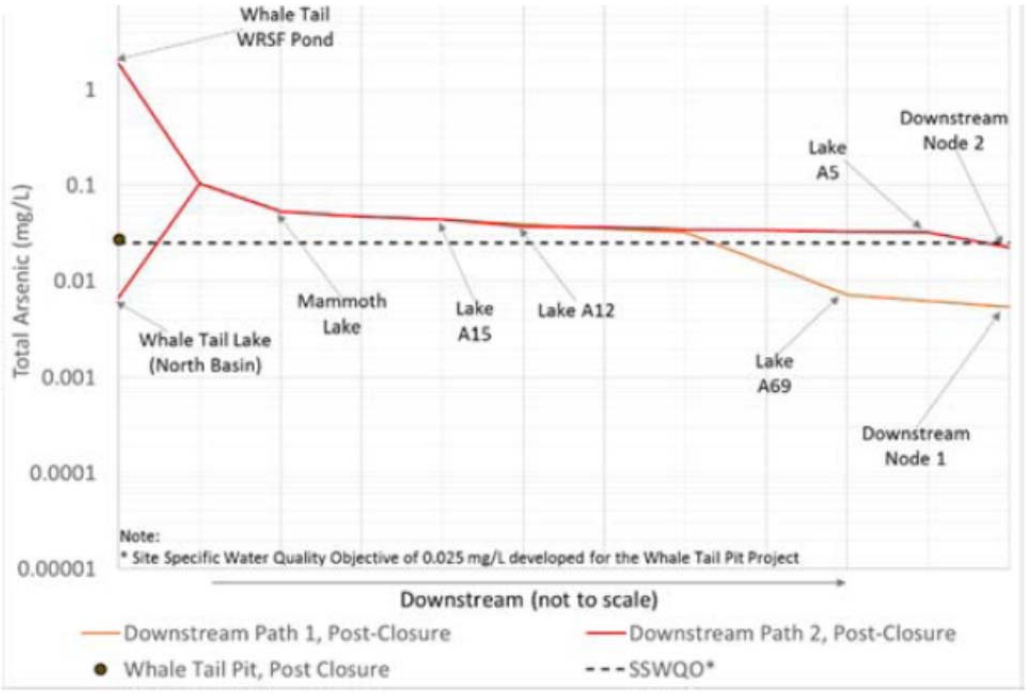
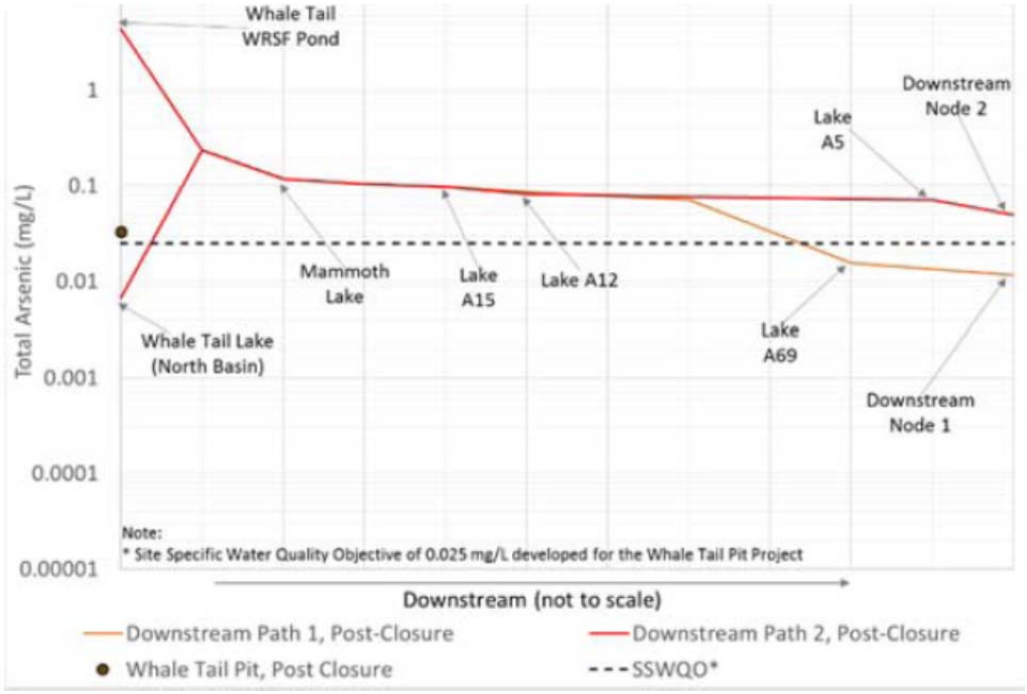


Figure 7 – Downstream arsenic concentrations with 5% Cover Contamination (4m active depth, without treatment)



3.2 Water Quality Affected by Maximum Thaw Depths in the WRSF Cover

Technical Review Comment	**INAC Final Comment #2**
Subject	**Water Quality affected by Maximum Thaw Depths in the WRSF Cover**
Reference(s)	• APPENDIX 5-E Evaluation of the Geochemical Properties of Waste Rock, Ore, Tailing, Overburden and Sediment from the Whale Tail Pit and Road Aggregate Materials • Plan 8-A.1: Mine Waste Rock and Tailings Management • 8-E.5: Operational ARD/ML Sampling and Testing Plan • 8-F.1: Interim Whale Tail Closure and Reclamation Plan • AEM Response to INAC TRC#1 - Design and Depth of Waste Rock Cover [to Assure Long Term Freezing of Metals Leaching and Potentially Acidic Generating Waste Rock] • AEM Response to Commitment #39 – WRSF Thermal Modelling • AEM Response to Commitment #s 30, 36, 37, 42 – Water Quality Modelling Sensitivity Analysis
Summary	The thickness of the active freeze/thaw zone is a fundamental design consideration of the WRSF cover. The EIS indicated that the cover would be 2-4 m in thickness. Failure to accurately predict and account for the depth of the active zone could result in WRSF seepage that has elevated arsenic concentrations. At INAC's request, the Applicant performed thermal modelling to determine the depth of the active zone under future climate change scenarios. The modelling predicted that the cover thickness should be at least 3.8 m under a 100-year climate change scenario. However, the modelling exercise did not incorporate observational data from the Meadowbank site and, as such, requires further calibration.
Importance of Issue to Water Resources	The closure concept for the WRSF is dependent on waste rock with elevated ARD/ML potential being permanently frozen (i.e., encapsulated) within the waste rock pile. Failure to meet this requirement could result in WRSF seepage with elevated arsenic concentrations capable of causing adverse impacts to the downstream surface water bodies. It is therefore important that the applicant diligently predicts the depth of the active zone under current and future climate change scenarios.
Detailed Review Comment	The WRSF closure concept presented in the EIS is based on the credible assumption that all waste rock below the active freeze/thaw zone will remain permanently frozen, thereby mitigating the potential for seepage from this portion of the pile. Once permafrost conditions have established, seepage will be generated only from the active freeze/thaw zone of the WRSF. To improve the quality of seepage

	from the WRSF during the post-closure phase, the Applicant intends to construct a cover of "clean" waste rock that has limited arsenic leaching potential. To be effective, it is critical that the active zone remain within the clean cover. If the active zone were to penetrate areas of the pile with elevated ARD/ML potential, seepage with elevated arsenic concentrations could occur. To illustrate, as indicated in Final Comment #1, the presence of small quantities (e.g., 2%) of ARD/ML waste rock in the active zone would result in unacceptable seepage quality. Based on the above, the depth of the active zone is a fundamental design consideration for the WRSF cover. Within the EIS, the Applicant indicated their intent to defer the design of the WRSF cover until the operational/closure phases of the project. However, for planning purposes, the Applicant assumed a cover thickness of between 2 and 4 m would be sufficient to achieve the design objectives. No thermal modelling had been performed to support this assumption and none was planned. Instead, it was suggested that the design would be based on experience gained at other projects, particularly the Meadowbank Mine. Given the short mine life and the fact that cover will be applied to the waste pile starting as early as the first year of operations, INAC's Technical Review submission indicated that a defensible cover design must be available prior to project initiation (TRC #1). To inform the design process, INAC requested that the Applicant perform thermal modelling to determine the depth of the WRSF active zone under current and future climate change scenarios. The Applicant agreed to perform the thermal modelling and the wording of their commitment #34 was as follows (emphasis added): *Agnico Eagle commits to provide information in the form of a technical memo regarding the thermal modelling of the WRSF, incorporating climate change and acquired information from the Meadowbank WRSF monitoring program, and will use the result of the model to support final design of the WRSF including that of the proposed cover and revised designs prior to the final hearing.* On July 11th, 2017 the Applicant submitted the following technical memorandum that summarized the findings of thermal modelling exercise: *Addendum to Agnico Eagle Mines Whale Tail EIS Appendix 6-H. Sensitivity Analysis on Water Quality Modelling in Support of Responses to Technical Commitments 30, 36, 37 and 42 and Intervenor Comments ECCC #15 and INAC-TRC #3 and #5 on the Water Licence A Application to the Nunavut Water Board.*

	Based on our review of this technical memorandum and other EIS documentation, INAC notes the following: 1. Modelled Active Layer Depth – The assessment concluded that the active layer would gradually increase to a depth of 3.3 m after 100 years. With a contingency buffer of 0.5 m, it was recommended that the conceptual cover design be based on a thickness of 3.8 m. This is at the upper end of the 2-4 m range specified in the EIS. 2. Contingency – The report indicates that thicker cover may be required in some locations and, consistent with earlier recommendations from INAC, specifies that adequate contingencies of clean waste rock would be available to increase the cover thickness if necessary. 3. Meadowbank Monitoring Evidence – The Applicant's commitment indicated they would incorporate acquired information from the WRSF monitoring program into the modelling exercise. INAC notes that observational data from Meadowbank does not appear to have been used to calibrate the Whale Tail thermal model. Furthermore, the thermistors installed in the Meadowbank Portage WRSF indicate that the waste rock currently remains below freezing at a depth range between 2 and 5.5 m. The upper end of this range (i.e., 5.5 m) is significantly deeper than the maximum thaw depths that were predicted for the Whale Tail under the 100-year climate change scenario (i.e., 3.3 m). Further assessment and calibration of the thermal model is therefore required prior to confirming the thickness of the Whale Tail WRSF cover. 4. Modelled Depth – The thermal modelling was based on a WRSF with a total depth of 50 m, not the 66 m depth that will be required to accommodate the incremental volume associated with the north wall push back. Further calibrations of the thermal modelling should account for the change in WRSF design.
Recommendation/Request	a. **Revised Thermal Modelling:** The thermal modelling should be calibrated and re-run using ground temperature monitoring data from the Meadowbank site. The findings of the revised thermal modelling should be submitted for review and should inform the detailed WRSF cover designs as part of the final closure plan. b. **Final WRSF Cover Designs:** The Applicant's commitment

	#34 indicated they would use the results of the thermal modelling exercise to support the final design of the WRSF, including that of the proposed cover and that the revised designs would be submitted prior to the final hearing. INAC notes that the 3.8 m recommended cover thickness determined by the thermal modelling falls within the 2-4 m range originally specified by the Applicant and, on that basis, a revised final cover design is not required by INAC prior to the final hearing. However, INAC still recommends that the applicant continue to provide constant updates to the modelling to be able to provide more accuracy and confidence in the Final WRSF cover design. The WRSF cover design should make up part of the final closure plan and thus be submitted to the NWB 12 months prior to closure. c. **Incremental Security:** Due to a number of uncertainties surrounding the performance of the WRSF, our security estimate has taken into account for mitigation measures, such as long-term water treatment. If in the future, monitoring indicates no exceedances then the applicant can ask for a reduction in security.

3.3 Post-Closure Water Quality in the Flooded Pit and Whale Tail Lake

Technical Review Comment	**INAC Final Comment #3**
Subject	**Post-Closure Water Quality in the Flooded Pit and Whale Tail Lake**
Reference(s)	• APPENDIX 5-E Evaluation of the Geochemical Properties of Waste Rock, Ore, Tailing, Overburden and Sediment from the Whale Tail Pit and Road Aggregate Materials • EIS Volume 6 Freshwater Environment • APPENDIX 6-A Hydrogeology Baseline Report • APPENDIX 6-B Hydrogeological Model Pre-Mining, During Mining and Closure • APPENDIX 6-H Mine Site and Receiving Environment Water Quality Predictions • 8-E.3: Groundwater Monitoring Plan • 8-E.5: Operational ARD/ML Sampling and Testing Plan • 8-F.1: Interim Whale Tail Closure and Reclamation Plan • AEM Response to INAC TRC#4 - Long-Term Water Quality in the Flooded Pit • AEM Response to INAC TRC#6 - Post-Closure Surface Water Impacts • AEM Response to INAC TRC#7 - Post-Closure Water Quality Uncertainty • AEM Response to Commitment #29 – Whale Tail Pit Cross Section Schematic • AEM Response to Commitment #s 30, 36, 37, 42 – Water Quality Modelling Sensitivity Analysis • AEM Presentation to INAC: Clarifications and Comments – Water Quality Model (June 12, 2017) • AEM Presentation to INAC: Phase 1 Site and Receiving Environment Water Quality Model Sensitivity Analyses (June 29, 2017) • Meadowbank 2016 Annual Report
Summary	After approximately three years of active mining, the Whale Tail Pit and Whale Tail Lake will be flooded until water levels reach their pre-development elevation. The Applicant's base case scenario predicts that water quality in the flooded pit/lake will be acceptable for direct discharge to the downstream receiving environment. However, water quality modelling assessed other scenarios that included diffusion of arsenic into the pit/lake from the surrounding rock formations. Under those scenarios, arsenic concentrations in the flooded pit/lake were predicted to be approximately an order of magnitude greater than the proposed Site-Specific Water Quality Objective for arsenic. The diffusion scenarios may therefore trigger the need for active interventions, most likely in the form of long-term water treatment. The strength and direction of hydraulic groundwater gradients in the

	vicinity of the pit are significant determinants in the probability of diffusion occurring. At present, the Applicant's conclusions regarding the hydraulic gradients are based on a high-level overview of local lake levels And additional studies and monitoring will be required to confirm these conclusions.
Importance of Issue to Water Resources	There is uncertainty regarding the post-closure water quality of the back-flooded pit/lake. Of particular importance, there is a potential that arsenic diffusion from the pit walls will result in arsenic concentrations in the pit/lake that are above acceptable discharge criteria. These elevated concentrations would have the potential to cause adverse impacts to the freshwater environment.
Detailed Review Comment	During closure, the Whale Tail Pit and dewatered portion of Whale Tail Lake will be allowed to flood naturally with non-contact freshwater from direct precipitation, runoff from adjacent land, and Whale Tail Lake (South Basin). The Whale Tail Dike and the Mammoth Dike will be breached when water quality monitoring results meet discharge criteria, as set forth in an approved monitoring plan under a water licence thereby allowing water to return to the natural flow patterns downstream. The EIS and related documentation acknowledges there is uncertainty regarding the water quality of the back-flooded pit and lake. The current plan is to defer additional investigations to the closure phase, to monitor water quality during operations / flooding and to reconnect the reflooded pit/lake to the downstream receiving environment only once it has been confirmed that water quality is acceptable. If deemed necessary, the Applicant has committed to treat water from the back-flooded area until it is suitable for direct discharge. Based on our review of the documentation provided by the Applicant, INAC has reached the following conclusions regarding the assessment of post-closure water quality in the Whale Tail Lake/Pit. For the purpose of this submission, the conclusions have been grouped into the following topics: Topic 1: High Diffusion Scenario Impacts; Topic 2: Recharge / Discharge Uncertainty; Topic 3: Additional Considerations. **<u>Topic 1: High Diffusion Scenario Impacts</u>** The Applicant has assumed there will be no diffusion of arsenic into the pit during the post-closure phase. Water quality predictions of the base-case scenario (i.e., no diffusion) indicate that arsenic concentrations in the back-flooded pit/lake will be acceptable for direct discharge, without treatment. However, the Applicant also recognizes there is uncertainty and risk associated with the no-diffusion scenario, as indicated in the following statements from the Interim Closure and

	Reclamation Plan (Appendix 8-F of the EIS): "*Arsenic release from submerged Whale Tail Pit walls is a source of uncertainty in the prediction of the long-term water quality of the flooded pit lake and Whale Tail Lake (North Basin). The actual interaction between the two water bodies (water within the pit and water above it forming North Whale Tail Lake) as well as possible chemical stratification of the flooded pit lake (which would result in improved water quality in the shallow pit lake) should be investigated."* *"There is also uncertainty in the hydrogeochemical and hydrological conditions that will occur in the waste stockpiles and pit walls, and in the hydrological conditions in the Pit Lake and Whale Tail Lake, neither of which have been studied in detail."* INAC concurs with the Applicant that diffusion is an important source of uncertainty and that it warrants further investigation. To partially account for this uncertainty, the Applicant has modelled scenarios that include arsenic loadings with and without diffusion. As shown in Figure 8, water quality within the flooded pit (below the lake level) is essentially the same as the SSWQO under the no-diffusion scenario (solid green line). Water quality in North Whale Tail Lake (i.e., the area above the flooded pit) is predicted to be well below the SSWQO and would therefore be amenable to direct discharge during the post-closure phase (solid blue line). However, if diffusion were to occur, arsenic concentrations in the flooded pit would be elevated (dashed green line). In addition, peak arsenic concentrations in North Whale Tail Lake (dashed blue line) are predicted to be 0.32 mg/L which is 13 times greater than the SSWQO. As such, under the diffusion scenario, water quality within North Whale Tail Lake could not be discharged without treatment during the post-closure phase. In response to diffusion concerns identified by INAC and others, the Applicant assessed an alternate pit configuration that would reduce the potential for diffusion. Referred to as the North Wall Push Back, the alternate configuration would reduce the extent to which ultramafic rock (which has high arsenic leach rates) would be exposed in the pit wall, thereby reducing the amount of diffusion. The water quality results of the North Wall Push Back modelling are presented in Figure 9. The diffusion scenario (dashed blue line) results in arsenic concentrations of 0.23 mg/L, which is nine times greater than the SSWQO. On this basis, the benefits of the North Wall Push Back appear to be marginal, particularly since the alternate configuration would result in a 33% increase in the total volume of waste rock requiring disposal in the WRSF. Despite uncertainties and an absence of detailed studies, the Applicant considers the diffusion presented in Figures 8 and 9 to represent a hypothetical worst-case scenario. INAC agrees; based on the available information, it is unlikely that diffusion would occur to the extent predicted. However, INAC believes there is insufficient evidence to support the conclusion, that diffusive flux into the pit is improbable, particularly given the degree of uncertainty associated

	with the hydrogeological and hydrogeochemical properties in the vicinity of the pit. Further, based on the elevated arsenic concentrations that were predicted for the diffusion scenarios, it is reasonable to assume that partial diffusion would also result in poor water quality in some situations. INAC notes that, a definitive answer regarding diffusion may not become available until the pit and lake have been fully back-flooded and the water table has been restored to pre-mining levels.[4] Prior to that point, there will continue to be a uncertainty regarding the hydrogeological conditions and potential diffusion during the post-closure phase. **Topic 2: Recharge / Discharge Scenarios** As indicated in the previous section, arsenic diffusion into the back-flooded pit/lake is a potential concern during the post-closure phase. At a conceptual level, diffusion can occur only in situations where both of the following conditions are met: 1. Rock with leachable arsenic is present in the vicinity of the back-flooded pit; and 2. Hydraulic gradients result in groundwater discharging to the pit. Geochemical characterization studies have demonstrated the first condition is met through the presence of ultramafic and iron formation lithologies, both of which leach arsenic at high rates. With respect to hydraulic gradients, no detailed studies have been undertaken, to date. In determining the baseline hydraulic gradients of the area, the Applicant has relied on an overview of local lake water elevations. On the basis of that overview, the Applicant concluded the following (EIS Volume 6): *"The elevations of these lakes in the baseline study area indicate that Whale Tail is likely both a groundwater recharge and discharge zone. Hydraulic gradients are expected to range from slightly downward to slightly upward."* Based on the above, the hydraulic gradients in the vicinity of the pit are best described as circum-neutral (i.e., on aggregate, the pit is neither a clear recharge or discharge zone). After considering their analysis of local lake levels, the Applicant deduced that specific areas of the flooded pit will be in a groundwater recharge zone, while other areas will experience discharge. Of particular importance, it was hypothesized that the discharge zones do not coincide with rock formations that have high arsenic leach rates (e.g., ultramafic and iron formations). The Applicant has therefore concluded, with a high degree of confidence that arsenic diffusion will not occur in the back-flooded pit/lake.

[4] This is particularly important when considering whether the flooded pit/lake will be a recharge or discharge zone, as discussed under Topic #2.

	While general trends in hydraulic gradients can be deduced from regional lake levels, INAC notes that groundwater flows within the circum-neutral regime could be highly variable for a variety of reasons, including but not limited to: 1. Localized Water Table Mounding – The water table will be elevated in proportion to localized topographic highs that surround the pit/lake. This has the potential to result in localized groundwater gradients, flows and diffusion that is contrary to the overall trend. 2. Preferential Flow Paths – Pre-existing and mine-induced rock fracturing will create localized preferential flow paths and gradients, some of which could result in flows that are also contrary to the overall trend. 3. Talik Changes – Water levels in lakes overlying open taliks provide the driving force for groundwater flow in the deep groundwater regime that connects regional lakes. Following development of the mine, the talik beneath Whale Tail Lake will be highly modified relative to pre-development conditions. As a result, there is a potential that regional lake levels and hydraulic gradients will be temporarily or permanently affected by the change. These changes could occur locally (i.e., in the immediate vicinity of the pit) and/or regionally (i.e., between lakes). While the Applicant's conclusions regarding the groundwater regime may ultimately prove to be correct, there is presently insufficient information to confidently predict hydrogeological conditions in specific areas of the back-flooded pit. **Topic 3: Additional Considerations** Potential Contingencies The Applicant has indicated that mitigation measures and contingency plans will be put in place to address concerns that may arise if water quality predictions are worse than predicted. First, the Applicant is evaluating the merits of reconfiguring the pit geometry to proactively minimize the exposure of certain lithologies within the pit (i.e., the North Wall Push Back). However, as demonstrated by a comparison of Figures 8 and 9, that modification would result in only minor improvements in the water quality of Whale Tail Lake. As a consequence, there remains a potential that additional mitigations would be required. Specifically, the Applicant has stated that the following reactive measures will be considered if water quality in the back-flooded pit is worse than anticipated: 1. *In-situ* treatment within the pit; and 2. Water treatment in a Water Treatment Plant (WTP) prior to discharge to the receiving environment. In this regard, INAC is concerned that water treatment is the only potential mitigation identified by the Applicant to manage pit water

	quality if arsenic concentrations prove to be worse than predicted. As discussed in Final Comment #1, INAC supports the use of water treatment during the operational and closure phases of projects, when deemed necessary. However, long-term water treatment during post closure is generally not an acceptable closure alternative, particularly for remote northern sites. Pit Stratification Meromixis is the layering of water quality due different thermal regimes and/or chemical concentrations. For pit lakes at other mines, meromixis results in a denser, more concentrated water quality at the base of the pit, away from interaction with biota, and a much cleaner water quality at the surface. In the case of the Whale Tail Project, INAC is of the view that stable meromictic conditions in the flooded pit may improve the overall water quality within Whale Tail Lake. Further evaluation of this phenomenon could provide support for the additional mitigation measure.
Recommendation/Request	a. **Perform Hydrogeological Characterization Studies**: INAC recommends that additional hydrogeological characterization studies be performed to address uncertainties and to validate the Applicant's current conclusions regarding hydraulic gradients and arsenic diffusion potential. INAC has looked at the proposed schedule of activities at Whale Tail and interprets there to be enough time during the 2018 field season to undertake these studies prior to the dewatering of Whale Tail Lake and the development of the pit. The studies will serve as an important pre-development baseline and will help to address current uncertainties regarding water quality in the back-flooded pit/lake. b. **Evaluate Meromixis**: If the additional hydrogeological characterization studies indicate that future metals levels are of potential concern, then the importance of establishing a stable stratified pit would be amplified. In that case, the Applicant should undertake a detailed quantitative analysis confirming that stable meromictic conditions will occur within the flooded pit. The analysis should include modelling that demonstrates meromixis will remain stable under a range of conditions (groundwater discharge, high wind, pit wall failure, etc.). c. **Monitoring Plan:** To supplement the monitoring plans already submitted by the Applicant, INAC recommends that a revised and updated monitoring plan for the flooded pit of the Whale Tail Project be submitted to the NWB for review and approval prior to construction. The updated plan would include specified

	criteria that must be met before the flooded pit is considered to be effectively closed and any breaching of dams/dikes to be considered. In addition to specifying acceptable water quality, the criteria would include a required number of acceptable sampling events that would be necessary to confirm that stable conditions had been attained (this may include increased sampling events during certain times of year, etc).

Note: The following figures (#8 and #9) are provided to support the discussion presented in INAC Final Comment #3. Both figures were extracted from the following document:

Addendum to Agnico Eagle Mines Whale Tail EIS Appendix 6-H. Sensitivity Analysis on Water Quality Modelling in Support of Responses to Technical Commitments 30, 36, 37 and 42 and Intervenor Comments ECCC #15 and INAC-TRC #3 and #5 on the Water Licence A Application to the Nunavut Water Board.

Figure 8 – Arsenic Concentrations in the Pit and North Whale Tail Lake, with and without Diffusion from the Pit Walls, for the Base Case Scenario (i.e., without north wall push back)

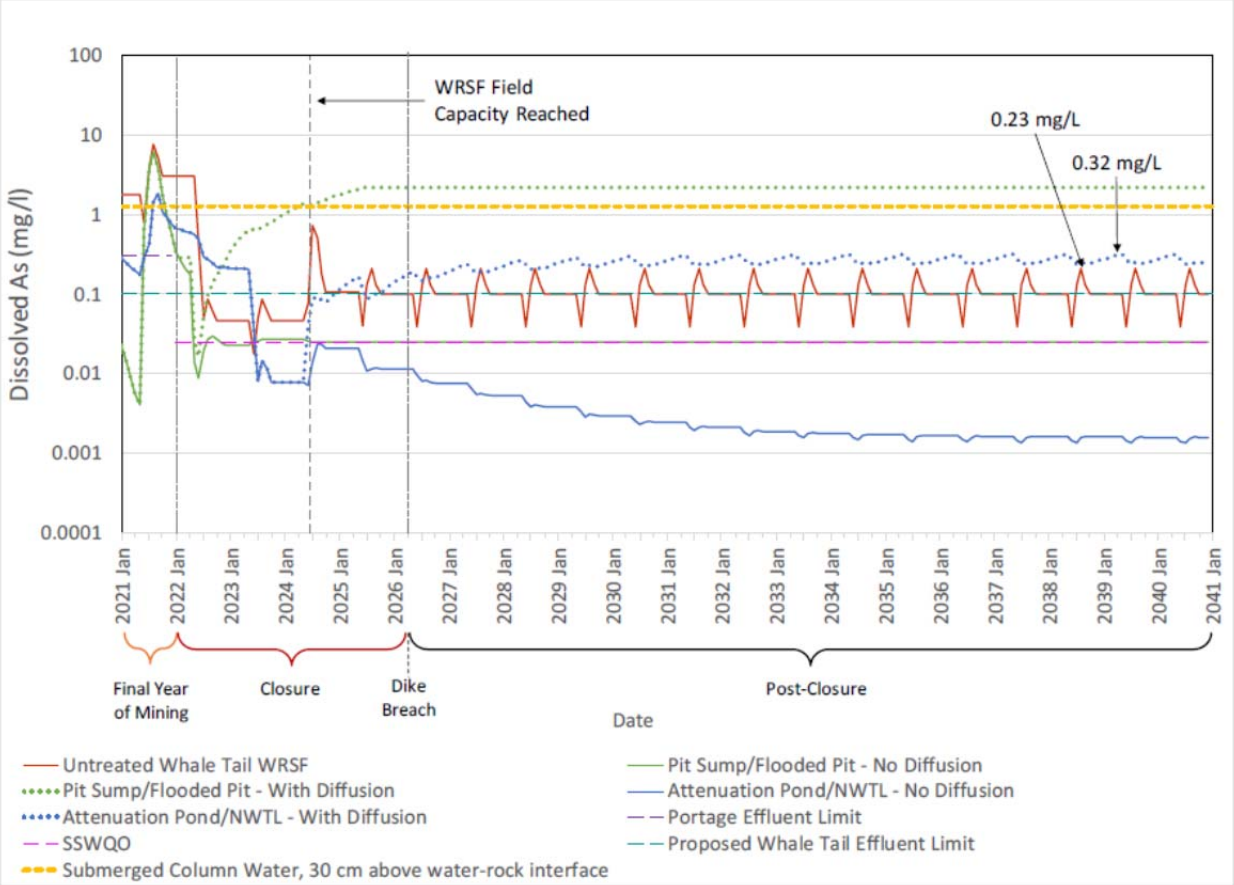
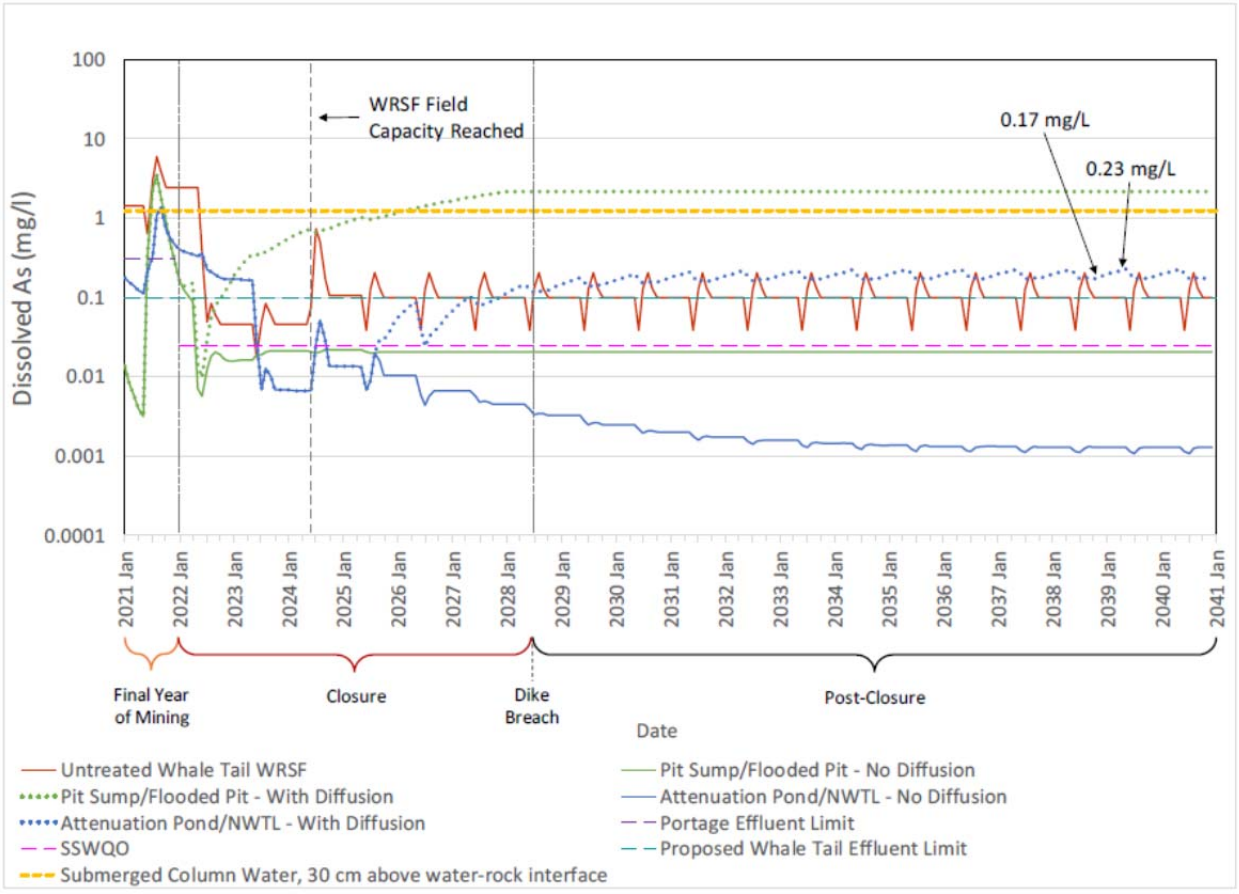


Figure 9 – Arsenic Concentrations in the Pit and North Whale Tail Lake, with and without Diffusion from the Pit Walls, for the North Wall Push Back Contingency



3.4 Availability of Cover Material

Technical Review Comment	**INAC Final Comment #4**
Subject	**Availability of Cover Material**
Reference(s)	• APPENDIX 5-E Evaluation of the Geochemical Properties of Waste Rock, Ore, Tailing, Overburden and Sediment from the Whale Tail Pit and Road Aggregate Materials • Plan 8-A.1: Mine Waste Rock and Tailings Management • 8-E.5: Operational ARD/ML Sampling and Testing Plan • 8-F.1: Interim Whale Tail Closure and Reclamation Plan • AEM Response to INAC TRC#1 - Design and Depth of Waste Rock Cover [to Assure Long Term Freezing of Metals Leaching and Potentially Acidic Generating Waste Rock] • AEM Response to Commitment #39 – WRSF Thermal Modelling
Summary	During the IR and TRC stages INAC identified concerns related to the availability of clean cover material. Using information presented in the EIS, INAC determined that there may be insufficient material to construct the WRSF cover and other earth works. Based on additional information provided by the Applicant, it was clarified that sufficient cover material is available to meet all current project needs and potential contingencies. As a result, INAC's concerns regarding this issue have been addressed.
Importance of Issue to Water Resources	During the post-closure phase, the environmental performance of the project will be contingent on controlling seepage from the WRSF. To ensure this occurs, any construction materials that are in the active freeze/thaw zone of the WRSF (or elsewhere on the site) site should have a low arsenic leaching potential. If this requirement is not met, arsenic concentrations in seepage will be higher than predicted. Without treatment, this could result in adverse impacts to surface water receivers.
Detailed Review Comment	The WRSF closure concept specified in the EIS involves a 2-4 m thick cover of waste rock that is both: a) non-acid generating; and b) has a low metal leaching potential (referred to here as "clean" cover). The EIS also stated that the WRSF would have a footprint of 110 ha. Assuming a 4 m depth, INAC previously calculated that the total quantity of clean waste rock would need to be 8 Mt and that an additional 2.1 Mt of clean rock would be required for the construction of other infrastructure (for a total of 10.1 Mt). Appendix 8A-1 of the EIS indicates that 12.4 Mt of clean waste rock would be available based upon testing completed to date. While this is theoretically enough to meet the above noted requirements of 10.1

	Mt, waste segregation programs will never be 100 percent efficient and actual quantities of clean waste could be materially lower. Furthermore, requirements for clean cover may increase (e.g., if cover thicknesses need to increase due to the active zone being deeper than predicted). As a result, INAC expressed a concern that there may be insufficient clean cover material to address known closure requirements and potential contingencies (see TRC #1). The Applicant's response to TRC #1 indirectly clarified that the WRSF footprint will be approximately 63 ha, not the 110 ha specified in the EIS. Using this reduced footprint, the Applicant also indicated that there is sufficient clean waste rock to construct a cover that is 7-8 m in thickness and that additional material could be made available, if necessary (e.g., rock obtained by a pushback of the south pit wall). Based on the revised information provided by the Applicant, INAC now supports the conclusion that sufficient clean waste rock is available to construct the conceptual cover specified in the EIS (i.e., a cover that is 2-4 m thick) with sufficient contingency for design modifications.
Recommendation/Request	INAC is satisfied with the Applicant's responses and considers the issue resolved.

3.5 Ammonia and Nitrate Levels from Explosive Use

Technical Review Comment	INAC Final Comment #5
Subject	**Ammonia and Nitrate Levels from Explosive Use**
Reference(s)	• APPENDIX 6-H Mine Site and Receiving Environment Water Quality Predictions • VOLUME 8 - MONITORING, MITIGATION, AND MANAGEMENT PLANS • 8-D.1: Ammonia Management Plan • Appendix 8-E Addendums for Environmental Protection and Monitoring Plans • AEM Response to INAC TRC#5 - Ammonia and Nitrate Levels from Explosive Use • AEM Response to Commitment #s 30, 36, 37, 42 – Water Quality Modelling Sensitivity Analysis • AEM Presentation to ECCC: Predicted Water Quality and Planned Water Treatment (June 7, 2017) • AEM Presentation to INAC: Phase 1 Site and Receiving Environment Water Quality Model Sensitivity Analyses (June 29, 2017)
Summary	Ammonia and nitrate residuals from explosive use are common contaminants associated with mining operations. The EIS for the Whale Tail project predicted ammonia and nitrate concentrations based on monitoring data from the Meadowbank project. In an effort to account for site-specific variables, INAC recommended that a loadings-based approach be used to correlate explosives use with ammonia and nitrate concentrations. The Applicant presented a number of counter-arguments and has not implemented the approach recommended by INAC. While INAC maintains that a loading-based approach would yield superior results, the department is of the view that the risks associated with using the Applicant's approach are minimal. As a result, INAC will not be pursuing the issue further at the present time.
Importance of Issue to Water Resources	Ammonia and nitrate levels could become a potential issue if the Meadowbank data are not representative of the Whale Tail Project. In theory, this could result in elevated ammonia and nitrate concentrations in mine discharges that could exceed limits and potentially result in toxicity. However, INAC anticipates that any elevated concentrations will be detected and managed accordingly. As such, adverse impacts to surface water receivers are not anticipated.
Detailed Review Comment	Ammonia and nitrate are used in blasting agents. Some losses occur as a result of spillage, incomplete ignition, dissolution in water in the blast holes etc. These losses can report to both the mine water in the pit and to the drainage in the waste pile. At some mines, these losses have been excessive and have resulted in exceedance of licence

	limits and toxicity of the discharge. It is therefore important to estimate what potential losses could occur and calculate what residual levels of ammonia and nitrate may be present in the drainage. Predictions presented in the EIS are based on the assumption that ammonia and nitrate concentrations in pit sums and WRSF seepage at the Meadowbank site are representative of conditions that will occur at the Whale Tail Pit project. INAC indicated (in TRC #4) that the direct use of ammonia and nitrate data from Meadowbank was inappropriate because it failed to account for site-specific differences. INAC therefore recommended that ammonia and nitrate concentrations should be correlated to loading data from the Meadowbank Mine and that this correlation should be used to determine the annual losses in mine water and pit water per tonne of rock blasted and per tonne of rock placed in the pile. These loading data would then be applied to the Whale Tail Project to assess whether or not ammonia and nitrate levels are of potential concern. In their response to TRC #4 and follow-up discussions, the Applicant indicated there was a poor correlation between the loading data and measured ammonia/nitrate concentrations at the Meadowbank site. Further, the Applicant clarified that there are no major site-specific differences between the Meadowbank and Whale Tail projects that would influence ammonia/nitrate concentrations (e.g., explosives practices, site conditions and climate are similar). On this basis, the Applicant asserted that the waste rock quantity loading-based approach proposed by INAC is not as reliable or representative of expected conditions as using actual Meadowbank operational data as a proxy. While INAC maintains that loading-based calculations are a more effective and flexible approach to predict ammonia/nitrate concentrations, the department also accepts the use of the Meadowbank proxy approach. This acceptance is based on the reasonable expectation that the two approaches would likely result in predictions that are similar in magnitude. Further, the issue relates only to the operational and closure phases of the project when a range of options will be available to manage any results that deviate from the predicted concentrations. Based on the arguments provided by the Applicant and the low risk associated with the difference of opinion, INAC has concluded that there are no further concerns associated with this topic. That conclusion will be revisited if there are substantive modifications to the project designs.
Recommendation/Request	INAC is satisfied with the Applicant's responses and considers the issue resolved.

4.0 MEADOWBANK LICENCE AMENDMENT WATER QUALITY COMMENTS AND RECOMMENDATIONS / REQUESTS

4.1 Meadowbank Tailings Management

Technical Review Comment	**INAC Final Comment #6**
Subject	**Meadowbank Tailings Management**
Reference(s)	• APPENDIX 5-E Evaluation of the Geochemical Properties of Waste Rock, Ore, Tailing, Overburden and Sediment from the Whale Tail Pit and Road Aggregate Materials • 8-E.5: Operational ARD/ML Sampling and Testing Plan • Appendix WT- TAILING S MANAGEMENT PLAN • AEM Response to INAC TRC#2 – Tailings Management • AEM Response to Commitment #43 – Arsenic Leaching in the Meadowbank Tailings Storage Facility
Summary	The Applicant has indicated through their EIS that ore from Whale Tail Project will be processed at the Meadowbank Mill and that the associated tailings will be deposited into the approved tailings facility at Meadowbank under water Licence 2AM-MEA1525. These additional tailings have necessitated a change to the tailings facility design. The Applicant has indicated that they will need to raise the South Cell Wall from 50 m to 54 m in order to accommodate the incremental tailings associated with the ore from the Whale Tail Project. It is INAC's opinion that this facility design change should be submitted to the Board for review and approval. Aspects to consider would include, but not be limited to: capacity of the tailings facility, integrity of retaining structures with the increased loading of tailings, the raise of the wall itself, as well as any security adjustments that may be required.
Importance of Issue to Water Resources	The closure concept for tailings at the Meadowbank site (including tailings from the Whale Tail Project) is based on maintaining the mine waste in a physically and chemically stable condition. This will require the long-term geotechnical stability of containment structures (e.g., dams) and the physical / geochemical isolation of the tailings (through freezing).
Detailed Review Comment	Since tailings from a mining and milling process will contain contaminants that could have negative effects on water quality, they are contained in an impermeable structure. For Meadowbank this facility and its associated management plan was approved when the water licence was renewed and issued in 2015. The approval of the facility was based on the Meadowbank property only and did not include any loadings from the Whale Tail Project. The Whale Tail pit deposit will add a significant amount of tailings to this facility and the properties of the tailings will differ from those produced by

	Meadowbank. A rigorous review process is required to confirm that the incremental volumes of tailings with different properties can be effectively managed within the Meadowbank facility without causing adverse environmental impacts.
Recommendation/Request	a. **Meadowbank Tailings Management**: INAC recommends that the Applicant submit a stand-alone revised and updated tailings management plan for review and approval under the Meadowbank Water Licence 2AM-MEA1525. The plan should include but not be limited to: confirmation of capacity of the facility, details on how increase tailing loadings from Whale Tail will not have any adverse effects on the facility and details on the increase in berm height of the South Cell.

4.2 Term of Meadowbank Water Licence

Technical Review Comment	**INAC Final Comment #7**
Subject	**Term of Meadowbank Water Licence**
Reference(s)	AEM letter to the NWB dated May 25th, 2017
Summary	In Table 2.4.4 of their May 25th, 2017 submission to the NWB, the Applicant indicated their proposed water use for the Meadowbank Project will extend up to the year 2026. Given this, the water licence should be amended to reflect current water use predictions.
Importance of Issue to Water Resources	In order to have a water licence that is a reflection of the activities being undertaken, the water licence term and conditions have to be aligned with all aspects of the water licence, including the term of the licence. If the term of the licence is not adjusted during this amendment process, there is a risk that the Applicant will be in non-compliance with their water licence
Detailed Review Comment	Table 2.4.4 of the Applicant's May 25th, 2017 letter to the NWB proposes that water use will extend up to the year 2026. In this same submission, the Applicant indicated that they do not intend to change the term of the licence. Currently, AEM has a water licence that expires in 2025. Therefore, in order to have an effective water licence that is aligned with all aspects of the proposed undertaking, the water licence must be amended to reflect the proposed water use up to 2026.
Recommendation/Request	a. **Meadowbank Licence Term**: INAC recommends that the Applicant's amendment application for the Meadowbank water licence 2AM-MEA1525 include amending the term of licence to 2026 in order to reflect the planned and proposed water use.

5.0 WHALE TAIL PIT PROJECT CLOSURE COST ESTIMATE

Agnico has applied to the NWB for a Type A Water Licence (No. 2AM-WTP----) to include mining of the Whale Tail Pit including the construction/operation of associated infrastructure. As part of any Type A water licence application, a closure cost estimate (security) is required to be provided to the NWB. INAC is currently working with AEM and the Regional Inuit Organization (Kivalliq Inuit Association) to come to agreement on the amount of security for the project to be presented to the NWB for consideration. At the request of the Nunavut Water Board the security estimate for this site includes the All-Weather Road to be constructed between the Meadowbank and Whale Tail facilities. This application is separate from the existing water licences for the Advanced Exploration Camp and the Underground Mine proposal on the Amaruq Property. Furthermore, the components of the closure work being done at the Meadowbank mine as part of the Whale Tail Pit development are not included in the security estimate outlined herein. It is understood the quantum of security to cover those work items, such as tailings management and capping at the Meadowbank mine, will be included in an amendment to the security for the Meadowbank mine.

In preparing the estimate, Arcadis used the latest version of the RECLAIM model as provided by INAC. In general, the material, equipment and labour quantities, and reclamation activities outlined in the Interim Closure and Reclamation Plan, as prepared by Golder Associates and Agnico, were used in preparing this quantum of security estimate.

A summary of the direct and indirect costs with a comparison to the Agnico RECLAIM estimate (as amended further to the 19 May 2017 meeting and review of the Golder 2017 addendum document) is provided in Table 1. Based on the outcome of the Arcadis review, it is recommended that the quantum of security estimate for the Whale Tail Pit project should be set at $28,239,526.

The Closure Cost estimate document is being submitted to the NWB as an appendix to this report.

Table 1: SUMMARY OF COSTS

Cost Items	Agnico RECLAIM	Arcadis RECLAIM
CAPITAL COSTS		
Open Pit	$4,050,038	$4,050,224
Rock Pile	$2,923,088	$4,065,088
Building and Equipment	$1,038,088	$2,391,931
Chemicals and Contaminated Soil Management	$178,853	$662,700
Surface and Groundwater Management	$482,595	$482,595
Interim Care and Maintenance	$0	$1,539,601
SUB-TOTAL	$8,672,662	$13,192,138
INDIRECT COSTS		
Mobilization/Demobilization	$5,420,771	$5,669,900
Post-Closure Monitoring and Maintenance	$3,131,499	$5,156,003
Engineering (5%)	$433,633	$659,607
Project Management (5%)	$433,633	$659,607
Health and Safety Plans/Monitoring & QA/QC (1%)	$86,727	$131,921
Bonding/Insurance (1%)	$86,727	$131,921
Contingency (20%)	$1,734,532	$2,638,428
Market Price Factor Adjustment	$0	$0
SUB-TOTAL	$11,327,522	$15,047,388
TOTAL COSTS	$20,000,185	$28,239,526

6.0 SUMMARY OF RECOMMENDATIONS

INAC has undertaken a new type A water licence application review for the Whale Tail Pit Project submitted by Agnico Eagle Mines Limited. The review process included one round of Information Requests (IRs) and a Technical Review submission, both of which received responses from the Proponent. This was followed by a Technical Meeting in Baker Lake in April/May, 2017 which resulted in the Applicant making and responding to a series of additional commitments to address requests from INAC and other parties.

In general, the information, analysis and presentation of the submissions were complete. However, since aspects of the project are still conceptual many uncertainties remain regarding the design, environmental performance and their influence on water quality for the Project. In some cases, the Applicant has identified these uncertainties and proposed reasonable strategies to obtain the information necessary to refine designs to ensure the Project achieves its intended environmental and water quality outcomes and objectives. . However, based on the information provided to date, it is INAC's opinion that some of the variables used to model impacts water quality outcomes and objectives have been under-estimated. Of particular concern, the short operational life of the Project (3 years) and the proposed concurrent closure of some components (e.g., the Waste Rock Storage Facility (WRSF)) could significantly constrain the ability of the Applicant to resolve key uncertainties in a timely fashion through adaptive management.

INAC remains concerned that the post-closure performance of the site as it relates to water quality, could result in unintended impacts that require mitigation. Therefore, INAC has placed an increased emphasis on potential concerns related water quality during to the the post-closure phase of the Project. Notable concerns identified by INAC include:

Based on this review, INAC offers the following recommendations and requests to the NWB for their consideration.

Technical Review Comment	Subject	Recommendation / Request
INAC- **Final Comment #1**	**Post-Closure WRSF Seepage Affecting Water Quality**	a. **WRSF Seepage Management:** To supplement the monitoring plans already submitted by the Applicant, INAC recommends that revised and updated monitoring plans as well as the WRSF management plan for the Whale Tail Project be submitted to the NWB for review and approval prior to construction. The updated plans would include WRSF seepage monitoring criteria that must be met before the WRSF is considered to be effectively closed and possible additional sampling sites. In addition to specifying

Technical Review Comment	Subject	Recommendation / Request
		acceptable water quality, the criteria should indicate the required number of acceptable sampling events that would be necessary to confirm that stable seepage had been attained (this may also include increased sampling events during certain times of year e.g., spring freshet). b. **Conduct Hydrodynamic Modelling of Seepage Discharges**: INAC recommends that the Applicant conduct detailed hydrodynamic modelling to evaluate the mixing of WRSF seepage discharges to Mammoth Lake during the post-closure phase of the project. The modelling should evaluate a range of potential seepage discharge scenarios (clean/contaminated cover, increased active zone depth, etc.). Results from the modelling should be incorporated into any approved monitoring plan. c. **Incremental Security:** Due to a number of uncertainties surrounding water quality INAC's security estimate has taken into account for potential long-term treatment. If in the future, monitoring indicates no exceedances then the applicant can ask for a reduction in security.
INAC- **Final Comment #2**	**Water Quality affected by Maximum Thaw Depths in the WRSF Cover**	a. **Revised Thermal Modelling:** The thermal modelling should) be calibrated and re-run using ground temperature monitoring data from the Meadowbank site. The findings of the revised thermal modelling should be submitted for review and should inform the detailed WRSF cover designs as part of the final closure plan, to be submitted 12 months prior to closure. b. **Final WRSF Cover Designs:** The Applicant's

Technical Review Comment	Subject	Recommendation / Request
		commitment #34 indicated they would use the results of the thermal modelling exercise to support the final design of the WRSF, including that of the proposed cover, and that the revised designs would be submitted prior to the final hearing. INAC notes that the 3.8 m recommended cover thickness determined by the thermal modelling falls within the 2-4 m range originally specified by the Applicant and, on that basis, a revised final cover design is not required by INAC prior to the final hearing. However, INAC still recommends that the applicant continue to provide constant updates to the modelling to be able to provide more accuracy and confidence in the final WRSF cover design. The WRSF cover design should make up part of the final closure plan and thus be submitted to the NWB 12 months prior to closure c. **Incremental Security:** Due to a number of uncertainties surrounding the performance of the WRSF, our security estimate has taken into account for mitigation measures, such as long-term water treatment. If in the future, monitoring indicates no exceedances then the applicant can ask for a reduction in security.
INAC- **Final Comment #3**	**Post-Closure Water Quality in the Flooded Pit and Whale Tail Lake**	a. **Perform Hydrogeological Characterization Studies**: INAC recommends that additional hydrogeological characterization studies be performed to address uncertainties and to validate the Applicant's current conclusions regarding hydraulic gradients and arsenic diffusion potential. INAC has looked at the proposed schedule of activities at Whale Tail and interprets there to be enough time during the 2018 field season to undertake these

Technical Review Comment	Subject	Recommendation / Request
		studies prior to the dewatering of Whale Tail Lake and the development of the pit. The studies will serve as an important pre-development baseline and will help to address current uncertainties regarding water quality in the back-flooded pit/lake. b. **Evaluate Meromixis**: If the additional hydrogeological characterization studies indicate that future metals levels are of potential concern, then the importance of establishing a stable stratified pit would be amplified. In that case, the Applicant should undertake a detailed quantitative analysis confirming that stable meromictic conditions will occur within the flooded pit. The analysis should include modelling that demonstrates meromixis will remain stable under a range of conditions (groundwater discharge, high wind, pit wall failure, etc.). c. **Monitoring Plan:** To supplement the monitoring plans already submitted by the Applicant, INAC recommends that a revised and updated monitoring plan for the flooded pit of the Whale Tail Project be submitted to the NWB for review and approval prior to construction. The updated plan would include specified criteria that must be met before the flooded pit is considered to be effectively closed and any breaching of dams/dikes to be considered. In addition to specifying acceptable water quality, the criteria would include a required number of acceptable sampling events that would be necessary to confirm that stable conditions had been attained (this may include increased sampling events during certain times of year, etc).

Technical Review Comment	Subject	Recommendation / Request
INAC- **Final Comment #6**	**Meadowbank Tailings Management**	**Meadowbank Tailings Management**: INAC recommends that the Applicant submit a stand-alone revised and updated tailings management plan for review and approval under the Meadowbank Water Licence 2AM-MEA1525. The plan should include but not be limited to: confirmation of capacity of the facility, details on how increase tailing loadings from Whale Tail will not have any adverse effects on the facility and details on the increase in berm height of the South Cell.
INAC- **Final Comment #7**	**Term of Meadowbank Water Licence**	**Meadowbank Licence Term**: INAC recommends that the Applicant's amendment application for the Meadowbank water licence 2AM-MEA1525 include amending the term of licence to 2026 in order to reflect the planned and proposed water use.

APPENDIX A – RECLAIM ESTIMATE FOR THE WHALE TAIL PIT PROJECT