Indigenous and Northern Affairs Canada | Affaires autochtones et du Nord Canada

Technical Review Written Submission
Agnico Eagle Mines Limited
Whale Tail Project - 2AM-WTP----

Indigenous and Northern Affairs Canada

Submitted to:
Nunavut Water Board

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EXECUTIVE SUMMARY

INAC has undertaken a review of documents submitted by Agnico Eagle Mines Limited in support of applications for the Whale Tail Pit Project. The review process included one round of Information Requests (IRs) and associated responses from the Applicant.

In general, the information, analysis and presentation of the submissions were good. However, many aspects of the proposed Project remain at a preliminary conceptual stage. As a consequence, a variety of potentially significant uncertainties regarding the design and environmental performance of the Project remain. 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 outcomes. Nonetheless, based on the information provided to date, there is a potential that some impacts have been under-estimated. This would put into question whether facilities are adequately designed, whether mitigation measures identified are sufficient, and whether additional monitoring programs and/or contingencies need to be developed. Of particular concern, the short operational life of the Project (3 years) and concurrent closure of some components (e.g., the Waste Rock Storage Facility (WRSF)) will significantly constrain the ability of the Applicant to resolve key uncertainties in a timely fashion.

In many respects, potential impacts associated with the operational phase are well understood, are of limited duration and/or are readily mitigated through active interventions. In contrast, uncertainties regarding the post-closure performance of the site could result in unintended and difficult to mitigate impacts. INAC has, therefore, placed an increased emphasis on potential concerns related to the post-closure phase of the Project. Notable concerns related to the Project include:

1. The Applicant intends to defer the design of the WRSF cover to the design phase and base the design on experience gained from other projects, particularly the Meadowbank Mine. The Applicant also confirmed that no thermal modelling of the WRSF had been completed to assess long term performance. There are three key issues associated with this approach: 1) the availability of suitable quantities of cover material to assure an adequate cover depth can be provided (the final quantity of cover material is unknown and the availability is limited); 2) the maximum thaw depth remains unknown; and 3) the time available to revise the cover design is insufficient given the project will be completed by 2021.
2. Ore from the Whale Tail Project will be processed at the Meadowbank site and the incremental tailings will be managed in the previously licensed Tailings Storage Facility (TSF). Based on past performance, some environmental concerns have occurred at the existing TSF. While these concerns appear to have been effectively mitigated, the situation highlights the need to confirm that a) the TSF is capable of handling increased tailings deposition from the Whale Tail Project and b) that security requirements are appropriate.
3. A water quality model was developed which uses data from the geochemical testing program to estimate the loadings of arsenic and other metals that could leach from the WRSF. The work was well done and provides a good basis for predictions. There are, however, two issues that have not been adequately addressed: 1) the predictions incorrectly assume no metal leaching waste will be included in the cover; and 2) the mine life may be too short to assess long-term seepage quality as little (if any) seepage may develop during the early years.

4. The predictions for post-closure water quality are based on three key assumptions: 1) groundwater from mineralized zones will not enter the pit; 2) the pit walls will not contribute loadings post closure; and 3) waste rock runoff is clean and will not contribute unacceptable metals loadings to surface water receivers post-closure. While these assumptions may eventually be proven to be accurate, INAC considers them to be optimistic and not well supported in the available documentation.

5. INAC-IR #4 requested estimates of ammonia and nitrate losses from blasting at the Whale Tail Pit be provided. No estimates were provided. The response reiterated that losses were estimated from average values from Meadowbank Pit water quality and waste rock runoff monitoring data. There is no data and/or analysis to suggest this quality would be similar for the Whale Tail Project. Ammonia and nitrate discharges from explosive losses can result in water quality impacts.

6. During the post-closure phase, seepage from the WRSF with elevated metal concentrations will be passively discharged to the aquatic environment (via the WRSF pond). Until sufficient mixing has occurred within the surface water receivers, metal concentrations from the seepage will remain above levels that are considered fully protective of the environment. Based on the available documentation, there has been insufficient analysis to determine the spatial extent of this mixing zone. As a result, there is ambiguity regarding the scale of the impact and the locations where regulatory criteria would be applied. In addition, potential ecological impacts within the mixing zone have not been evaluated.

7. Some components of the Whale Tail Project will be constructed, operated and closed within a four-year period. In contrast, there will be uncertainty regarding water quality for an extended period after closure has occurred (potentially for decades). If post-closure monitoring determines that water quality impacts are worse than anticipated, options to mitigate the situation may be limited to complex, costly and long-term solutions (e.g., active water treatment). To avoid such requirements, assurances are required to confirm that the Project will perform as intended. This could be achieved through additional modelling and/or by applying a greater degree of conservatism in designs.

8. The Applicant has placed a heavy emphasis on Adaptive Management and Reclamation Research to address current uncertainties regarding the environmental performance of the Project. While this is consistent with best practice, given the short duration of the Project's operational phase and the concurrent closure of some Project components, there will be limited opportunities to make necessary adjustments to the design of the Project. As a consequence, INAC has concluded there is an increased need for the Applicant to: a) eliminate/reduce uncertainties prior to Project initiation; and/or b) utilize the precautionary principle to mitigate any uncertainties with potentially significant adverse consequences.

9. Reclamation closure costs estimates have been developed by both the Applicant and INAC. Further discussions between all three parties will inform the closure costs estimate to be presented at the Public Hearing.

By addressing these concerns, the Applicant will provide increased certainty regarding the potential for long-term Project 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 3 of this report.

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LIST OF ACRONYMS

AANDC	Aboriginal Affairs and Northern Development Canada (now INAC)
ARD	Acid Rock Drainage
EIS	Environmental Impact Statement
ICRP	Interim Closure and Reclamation Plan
INAC	Indigenous and Northern Affairs Canada
IR	Information Request
MEND	Mine Effluent Neutral Drainage
ML	Metal Leaching
NWB	Nunavut Water Board
NPAG	Non Potentially Acid Generating
PAG	Potentially Acid Generating
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

On January 27, 2017, the Nunavut Impact Review Board (NIRB) and Nunavut Water Board (NWB) commenced the technical review period for Agnico Eagle Mines Ltd.'s (Agnico Eagle or the Applicant) Whale Tail Pit Environmental Impact Statement (EIS) and Water Licence Application. After a preliminary review in which Indigenous and Northern Affairs Canada (INAC) and other interveners submitted Information Requests (IR), the Applicant provided additional information to supplement and clarify the information contained within the EIS and Water Licence Application. A technical review of the information provided in the water licence application including all management plans as well as additional information provided in response to IRs forms the basis of the technical comments provided in this submission. While the review is being coordinated between the NIRB and NWB, this submission represents the Department's intervention to the NWB and its review process.

INAC has a broad mandate for the co-management of water resources and the management of Crown Land 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; and
- The Territorial Lands Act and Regulations.

As set out in the Nunavut Agreement, INAC's Minister, in concurrence with other responsible Ministers, will have a decision making role on the proposed project's approval to proceed based on the NIRB's assessment. If the proposed project is approved to proceed, the Department will be responsible for inspecting and enforcing those conditions contained within any Crown Land authorization and water licence issued for the Project.

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 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 any related management, mitigation and monitoring plans to ensure that they are appropriate.

As this is a coordinated process, INAC followed the guidance provided in Appendix A: NIRB's Suggested Format for Parties' Technical Review Comments from the NIRB's correspondence of January 27, 2017, "Commencement of Technical Review Period for the NIRB's Review and NWB Consideration of Agnico Eagle Mines Ltd.'s "Whale Tail Pit" Project Proposal and associated Water Licence Application".

2.0 SPECIFIC COMMENTS

2.1 Waste Rock Cover

Technical Review Comment	**INAC-TRC#: 1**
Subject	**Design and Depth of Waste Rock Cover to Assure Long Term Freezing of Metals Leaching and Potentially Acidic Generating Waste Rock**
Reference(s)	EIS Appendix 8-F.1: Interim Whale Tail Closure and Reclamation Plan, Page 8. 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 (Chapter 3 and 4). Appendix 8-A-1 Mine Waste Rock and Tailings Management Plan page 14-15. Final Information Request - Agnico Response to INAC IR#6. Meadowbank Gold Project 2015 Annual Report
Summary	In its response to IR#6, the Applicant reiterated that it intends to defer the design of the cover to the design phase and base the design on experience gained from other projects, particularly the Meadowbank Mine. The Applicant also confirmed that no thermal modelling of the WRSF had been completed to assess long term performance. Based upon the response, there are three key issues that remain:1) the availability of suitable quantities of cover material to assure an adequate cover depth can be provided (the final quantity of cover material is unknown and the availability is limited); 2) the maximum thaw depth remains unknown; and 3) the time available to revise the cover design is insufficient given the project will be completed by 2021.
Importance of Issue to Water Resources	Given the short mine life and the fact that cover will be applied to the waste pile starting in 2018, a defensible cover design must be available prior to project initiation. If the cover does not perform as intended, future metals leaching and acid drainage is possible.

Detailed Review Comment	**Issue 1 - Availability of Cover Material** The availability of non-metal leaching waste rock and potentially non-acid generating waste rock (i.e. clean rock) to use as cover is a material concern. Based upon Table 22 of Appendix 5E, all waste rock has the bulk designation of either being metals leaching or potentially acid generating. There is a potentially significant demand for "clean" waste rock (i.e., rock that is non-acid generating and does not leach elevated levels of metals) for use in infrastructure construction and for the cover. At a 4 m depth for the cover, the 110 ha waste rock facility would require 8 Mt of clean rock and the infrastructure construction will require an additional 2.1 Mt. Appendix 8A-1 indicates 27%, or 12.4 Mt, of waste rock may be available based upon testing completed to date. Waste segregation programs will never be 100 percent efficient and actual quantities of clean waste could be materially lower. Note the Interim Closure Plan acknowledges this concern on page 8 stating "*The covering of the top of the WRSF will be completed during the closure period using a storage of NPAG (and non-ML to the extent possible) waste rock*." (emphasis added). This suggests that there may be a shortage of clean waste rock for use in the cover. If additional cover material is required, the Applicant should indicate the availability of additional cover materials. **Issue 2 - Maximum thaw depths and potential requirement for additional cover** As discussed in the response to INAC IR #6, the Applicant plans to base the cover design on information obtained in the cover testing programs at Meadowbank Mine. Preliminary information from the testing programs at that site indicate that temperatures above freezing have been measured at depths in the waste pile of up to 5.5 m. Furthermore, no thermal modelling of the Whale Tail cover has been completed to assess the required depth of cover to assure that the thaw depth does not extend into contaminated waste rock and potentially result in the release of contaminated drainage. As a consequence, the thermal properties of the Whale Tail WRSF (i.e., 2-4 m of cover) have not been confirmed to be effective under current or future climate change scenarios. Considering that a lack of long term data and thermal modeling is currently available for comment, INAC notes the example of the Diavik Diamond Mine where extensive monitoring and thermal modelling was conducted to confirm the performance of the North Waste Pile. The research programs at that site studied the potential to use only clean waste rock for the cover and found that, based on initial design assumptions, the thaw depth could be excessive. The modelling data confirmed the need for 1.5 m of fine grained till with 3 m of clean waste rock to assure waste rock below the cover would remain frozen. While INAC recognizes that the climate of the Whale Tail and Diavik sites are not necessarily comparable, the approach used at the Diavik site demonstrates the value of combining monitoring data (e.g., from Meadowbank) and modelling to prepare

	a defensible design. **Issue 3 - Timing to Finalize Cover Design** The waste rock cover is to be applied over the short mine life. It is therefore critical that a proven design be available before the mine commences operation (June 2018) as cover will be applied starting in 2019. Based on current plans, it is unclear what new information will be available to complete the design over the next year which will confirm the cover design. (see also INAC TRC #10)
Recommendation/Request	Given the limited time to assess the performance of the cover and modify the cover design once constructed, INAC recommends: 1) A defensible cover design that considers the availability of cover material should be submitted for review. This design should include thermal modelling to confirm thaw depths and include the effects of climate change. INAC's guidance document entitled 'MEND Report 1.61.5c (2012) Cold Regions Cover System Design Technical Guidance Document, MEND, Funded by AANDC and Prepared for MEND, Edited by O'Kane Consultant Inc.' should be used in the design and analysis of the cover system (s). 2) A contingency plan to identify an alternative source of clean cover material(s) should be developed by the Applicant and provided for review. 3) A contingency plan for placement of additional cover, or alternative contingencies, should be developed in the event that future monitoring and assessment indicate the selected design will not prevent thawing below the cover. Given that the mine life is short, and that cover from the mining activity will no longer be available, it will be important to develop a plan for placement of additional cover material, or otherwise plan for additional contingencies, should monitoring indicate thaw depths are greater than predicted. The findings associated with the above-noted recommendations should be provided for review prior to the Public Hearing.

2.2 Tailings Management

Technical Review Comment	**INAC-TRC#: 2**
Subject	**Tailings Management**
Reference(s)	EIS Vol. 1, Project Description APPENDIX 8-A.1 Mine Waste Rock and Tailings Management Plan – Whale Tail Pit Addendum Meadowbank Gold Project 2015 Annual Report
Summary	Ore from the Whale Tail Project will be processed at the Meadowbank site and the incremental tailings will be managed in the previously licensed Tailings Storage Facility (TSF). Based on past performance, some environmental concerns have occurred at the existing TSF. While these concerns appear to have been effectively mitigated, the situation highlights the need to confirm that a) the TSF is capable of handling increased tailings deposition from the Whale Tail Project and b) that security requirements are appropriate.
Importance of Issue Water Resources	The TSF is located at the Meadowbank site and as such falls out of the purview of the Whale Tail water licence process. However, additional review of the Tailings Management Plan and security requirements under water licence 2AM-MEA1525 should be performed to ensure that increased tailings deposition can be adequately managed at the Meadowbank site.

Detailed Review Comment	Ore from the Whale Tail Project will be processed in the Meadowbank mill and disposed in the existing TSF, which is authorized under the current Project Certificate and Type A Water Licence # 2AM-MEA1525. The Whale Tail Project is estimated to generate approximately 8.3 Mt of tailings, for a revised Meadowbank TSF storage volume of 35.4 Mt (i.e., a 30% volumetric increase relative to the currently approved facility). The increased volume of tailings can reportedly be accommodated within the existing footprint of the TSF. While the Whale Tail tailings have slightly different geochemical properties, the Applicant indicates that the chemical nature of the tailings and process water at the Meadowbank TSF are not expected to significantly change from current operations. On this basis, the Applicant asserts that the Whale Tail tailings will require the same long-term environmental control mechanisms as are currently approved for Meadowbank. The current operating performance of the Meadowbank TSF warrants consideration when assessing whether the incremental tailings from the Whale Tail Project could result in adverse impacts. In this regard, monitoring of seepage from the TSF's Central Dike in 2014 contained unexpected exceedances of some parameters. The seepage was effectively managed/treated and TSF mitigations were put in place (filter barriers). Based on more recent monitoring, exceedances are no longer occurring and the seepage issue appears to have been resolved. It is significant to note, however, that the prior seepage appeared to increase as additional tailings were added to the TSF. Taking into consideration the incremental tailings deposition from the Whale Tail Project, the potential that similar TSF performance issues warrants consideration. Due to the concerns with increased tailings and their associated chemical composition, the TSF should be reassessed to confirm they are sufficient to accommodate the increased capacity attributable to the Whale Tail Project. Additionally, the tailings will be managed at the Meadowbank site through a separate certificate and licence, and as such, security requirements are not directly related to this water licence process. However, it is INAC's position that security requirements under water licence 2AM-MEA1525 be reconsidered in light of new tailing deposition.
Recommendation/Request	INAC recommends that the Tailings Management Plan under water licence 2AM-MEA1525 be updated to reflect the additional tailings from Whale Tail. INAC recommends that the NWB may have to reassess the security held under water licence 2AM-MEA1525 to confirm that is sufficient to manage the incremental tailings associated with the Whale Tail Project.

2.3 Long-Term Seepage/Runoff Water Quality from Waste Rock Piles

Technical Review Comment	**INAC-TRC#: 3**
Subject	**Predicted Post-Closure Arsenic Levels in Waste Rock Seepage/Runoff**
Reference(s)	EIS Appendix 6-H Mine Site and Receiving Environment Water Quality Predictions. 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 (Chapter 3 and 4).
Summary	A water quality model was developed which uses data from the geochemical testing program to estimate the loadings of arsenic and other metals that could leach from the WRSF. The work was well done and provides a good basis for predictions. There are, however, two issues that have not been adequately addressed: 1) The predictions incorrectly assume no metal leaching waste rock will be included in the cover; and 2) The mine life may be too short to assess long-term seepage quality as little (if any) seepage may develop during the early years.
Importance of Issue to Water Resources	Current plans may not adequately address the long-term contaminant concentrations in seepage due to incorrect assumptions and inefficient monitoring. As a consequence, potential impacts to water quality may be greater than predicted and not become evident until well after closure.
Detailed Review Comment	**Issue 1 - No allowance for metals leaching waste rock in the cover** The water quality model assumes there is no metal leaching waste rock in the cover and that the cover is 100% effective. This is an overly optimistic approach given the closure plan states that non-metal leaching waste rock will be used in the cover only “to the extent possible”. All waste rock used to construct the cover will leach some level of arsenic and, in addition, some contaminated waste rock will most certainly be incorporated into the cover. As a result, water quality modeling may understate the actual quality of seepage from the WRSF. This could result in the need for long-term collection and treatment of the drainage. **Issue 2 - Monitoring period is likely too short to assess impacts of seepage in the longer term** Seepage occurs when water infiltrating through the waste rock pile

	emerges from the toe of the pile. Because the piles act as sponges during the early years, seepage may be delayed for many years. For example, waste rock from the pit will have a low moisture content and, when placed in the waste rock storage facility (WRSF), fines will absorb much of the precipitation which falls on the pile. If the pile moisture content was to increase by 5%, an 80 m pile could store the equivalent of more than 50 years of net precipitation. In addition, the field capacity for storing water could be much greater given that many of the voids would be filled with ice. As a consequence, the monitoring program is unlikely to measure material quantities of metal bearing seepage for an extended period after the construction of the WRSF. The current monitoring plan shows post closure monitoring ending 6 years after the closure phase. Should the contaminated seepage emerge after the post closure phase without mitigation, downstream impacts to water quality are possible. This further emphasizes the importance of having a robust cover design that incorporates clean materials to assure long-term metals leaching does not occur (as indicated in INAC TRC#1). Regardless, further modelling and sensitivity analyses are required to predict post-closure seepage quality.
Recommendation/Request	Given the uncertainty in both the quality of seepage and potential delay in contaminated seepage release, INAC recommends: 1) The Applicant undertake a sensitivity analysis to assess the impact of including metals leaching waste rock in the cover materials. For the analysis, it would be appropriate to rerun the model with 2%, 5% and 10% of the cover containing metals leaching and acid generating rock to assess the implications of residual contamination in the cover. The current water quality model and leaching data collected from the testing programs would be suitable for use in the modelling. 2) If the updated water quality modelling results suggest that long-term treatment may be required, a modified cover design proven to be effective in mitigating potential seepage concerns should be considered and provided for review. 3) Given the potential for delayed onset of drainage from the WRSF (i.e., due to the water retention capacity of the waste rock deposit) INAC recommends that the Applicant justify and, if necessary, extend the duration of the currently proposed post-closure monitoring period. Any extension to the duration of the monitoring period could be limited to seepage monitoring of the waste rock pile to confirm seepage remains acceptable for discharge without treatment. The analyses should be provided for review prior to the Public Hearing.

2.4 Long-Term Water Quality in the Flooded Pit

Technical Review Comment	**INAC-TRC#: 4**
Subject	**Long-Term Water Quality in the Flooded Pit**
Reference(s)	EIS Appendix 6-H Mine Site and Receiving Environment Water Quality Predictions. Final Information Request – Agnico Response to INAC IR#3.
Summary	The predictions for water quality are based on three key assumptions: 1) groundwater from mineralized zones will not enter the pit; 2) the pit walls will not contribute loadings post closure; and 3) waste rock runoff is clean and will not contribute unacceptable metals loadings to surface water receivers post-closure. While these assumptions may eventually be proven to be accurate, INAC considers them to be optimistic and not well supported in the available documentation.
Importance of Issue to Water Resources	Several potential sources of water contamination are potentially underestimated which could have unplanned adverse impacts on surface water chemistry.
Detailed Review Comment	The current water quality model assumes there are no post closure contributions of metals from the pit walls or ground water. Further, modelling assumes there will be no metal leaching from the WRSF cover. These assumptions are both unproven and highly optimistic and therefore require considerable additional study to confirm. The Applicant acknowledges these uncertainties and indicates further study is required. The current plan is to defer additional investigations to the closure phase, to monitor water quality during operations / flooding and to reconnect the pit to Whale Tail Lake only once it has been confirmed that water quality is acceptable. Based on the short operational life of the Project and the fact that closure activities will commence as early as 2019, this approach will involve reacting to emerging concerns instead of proactively addressing known uncertainties. In an effort to evaluate the implications of known uncertainties, the Applicant has conducted some sensitivity analyses. For example, modelling evaluated the potential effects of arsenic diffusion from the pit walls. Those analyses predicted that concentrations of contaminants (e.g., arsenic) will be higher than anticipated if diffusion from the pit walls does occur. This illustrates the importance of resolving known uncertainties prior to Project initiation. INAC is

	therefore of the opinion that additional sensitivity analyses are required to determine the potential impacts associated with a wider range of credible scenarios. The potential for stable meromictic conditions in the flooded pit would likely improve the overall water quality in Whale Tail Lake and should be thoroughly assessed if the sensitivity analysis indicates that contributions from pit walls and the ore zone could produce elevated levels of contaminants.
Recommendation/Request	INAC recommends: 1) A detailed sensitivity analysis be performed to assess the potential implications of ground water inputs from mineralized zones around the pit and the implications of additional contributions from the pit walls and the WRSF cover. If this assessment indicates no concerns with long-term water quality, then INAC would be assured this is not a material issue. The existing water quality model is acceptable for use in this analysis. 2) If the assessment suggests 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 provide a detailed 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.). The analyses should be provided for review prior to the Public Hearing.

2.5 Ammonia and Nitrate Levels in Pit Water / Waste Pile Drainage

Technical Review Comment	**INAC-TRC#: 5**
Subject	**Ammonia and Nitrate Levels from Explosive Use**
Reference(s)	EIS Appendix 6-H Mine Site and Receiving Environment Water Quality Predictions. Final Information Request – Agnico Response to INAC IR#4.
Summary	INAC-IR #4 requested estimates of ammonia and nitrate losses from blasting at the Whale Tail Pit be provided. No estimates were provided. The response reiterated that losses were estimated from average values from Meadowbank Pit water quality and waste rock runoff monitoring data. There is no data and/or analysis to suggest this quality would be similar for the Whale Tail Project. Ammonia and nitrate discharges from explosive losses can result in water quality impacts.
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. This could result in elevated levels of ammonia and nitrate in mine discharges that could exceed limits and potentially result in toxicity.
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. In response to INAC IR#4, the Applicant states that '*average measured concentrations of ammonia and nitrate in Meadowbank Mine pit sumps and RSF seepage monitoring locations were assigned as a surrogate to source terms for mine water pumped from the Whale Tail Pit sump and collected in the Whale Tail Pit WRSF pond*'. The direct use of ammonia and nitrate data from Meadowbank is not appropriate. The use of the data from Meadowbank would be appropriate if the data was corrected to account for quantities of waste rock blasted, the projected powder factor (kg explosive used/t blasted) and amount of dilution water. For example, if the powder factors are similar, then the loadings of ammonia and nitrate per tonne of rock

	blasted and per tonne of rock placed in the pile each year at Meadowbank would be expected to be similar to the loadings at Whale Tail. This loading data could then be used to estimate the concentrations of ammonia and nitrate in the pit water and runoff from the waste pile.
Recommendation/Request	INAC recommends that the Applicant estimate ammonia and nitrate concentrations using loading data from Meadowbank Mine. In this case the annual losses in mine water and pit water would be reported 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. The analysis should be conducted for each year of operation as explosives use will vary annually with the quantity of rock blasted. The analyses should be provided for review prior to any licencing determination; therefore before the Public Hearing with enough time for adequate review.

2.6 Post-Closure Surface Water Impacts

Technical Review Comment	**INAC-TRC#: 6**
Subject	**Post-Closure Surface Water Impacts**
Reference(s)	EIS Vol. 6, Freshwater Environment APPENDIX 6-H Mine Site and Receiving Environment Water Quality Predictions APPENDIX 6-I Water Quality Summary Tables EIS Vol. 8, Monitoring, Mitigation and Management Plans APPENDIX 8-B.2 Water Management Plan APPENDIX 8-B.3 Water Quality and Flow Monitoring Plan Final Information Request – Agnico Response to INAC IR#3.
Summary	During the post-closure phase, water in the WRSF pond will drain passively and discharge to Mammoth Lake. Based on current predictions, some water quality parameters will exceed applicable criteria for protection of the aquatic environment. As a consequence, it is INAC's understanding that the passive drainage from the WRSF pond to Mammoth Lake will be non-compliant. This situation will persist until sufficient mixing has occurred within Mammoth Lake. Based on the available documentation, there has been insufficient analysis to determine the spatial extent of this mixing zone. As a result, there is ambiguity regarding the scale of the impact and the locations where regulatory criteria would be applied. In addition, potential ecological impacts within the mixing zone have not been evaluated.
Importance of Issue to Water Resources	Passive discharges to surface water receivers during the post-closure phase are predicted to exceed applicable criteria. The EIS has not fully characterized the spatial extent, nature and ecological impacts to surface water receivers associated with discharges from the site that will have water quality concentrations above the proposed criteria by Applicant, during the post-closure phase.
Detailed Review Comment	Table 11 of Appendix 6-H indicates that the average and maximum post-closure concentrations of arsenic in the WRSF pond are predicted to be 0.12 and 0.38 mg/L, respectively (i.e., 4 and 14 times above the Site-Specific Water Quality Objective (SSWQO) for arsenic). The Applicant has indicated that multiple conservative assumptions were used and, as a result, the assessment may over-

	estimate both the volume of WRSF seepage and the concentrations of potential contaminants. However, the Applicant also states that: "…. *the predicted concentrations are considered to be order-of-magnitude estimates*." (emphasis added). The Applicant has not conducted a sensitivity analysis to evaluate the full range of scenarios that could result in WRSF pond arsenic concentrations that are higher than anticipated (refer to INAC TRC #2 for an example of such a scenario). Following closure, water from the WRSF pond will drain directly to Mammoth Lake. It is currently envisaged that this drainage and subsequent mixing will occur passively (i.e., without active treatment and discharge through a diffuser). As a result, the predicted elevated concentrations within the drainage from the WRSF pond will remain above the SSWQO until such time that sufficient mixing has occurred within Mammoth Lake. Within this mixing zone, some parameters will be present at concentrations that are above levels considered to be sufficiently protective of aquatic life. The Applicant's submission does not provide clarity on the spatial extent in which the elevated arsenic concentrations within surface water receivers will exceed the SSWQO during the post-closure phase. Furthermore, an assessment of potential ecological impacts associated with the exceedances has not been provided. This information was requested in INAC IR #3 but was not provided in the Applicant's response. While the Applicant has proposed operational and post-closure water quality criteria that would be applied to the undertaking, in some instances there is a lack of clarity regarding where those criteria would be applied. For example, it isn't clear whether the post closure SSWQO would be achieved at all locations within a receiver or only on average. Ambiguity regarding the size of the post-closure mixing zone contributes to this uncertainty. The deficiencies noted above make it difficult to assess the physical extent, nature and significance of potential adverse impacts in areas that have water quality concentrations above the proposed criteria. Furthermore, INAC notes that allowing the discharge of contaminated water (i.e., above SSWQO) to surface water receivers is inconsistent with past practices in Nunavut and remains a significant concern.
Recommendation/Request	Ultimately INAC is against any contaminated water (i.e above set criteria) entering the natural receiving environment. However, if the water quality entering Mammoth Lake from the WRSF is above recommend criteria (as set by the NWB), and this is deemed unavoidable, then INAC recommends that the Applicant be required to present additional analyses as detailed below.

	INAC recommends that the Applicant clearly indicate the spatial extent within all surface water receivers in which concentrations of potential contaminants may remain above the SSWQO or other applicable criteria during the post-closure phase. Consistent with the Applicant's assertion that current modeling provides "*order of magnitude*" estimates, the assessment should include a sensitivity analysis that considers a broad range of contaminant loading scenarios for the post-closure phase. The evaluation should identify and characterize potential water quality of the receiving water body and ecological impacts in areas where the proposed water quality criteria may be exceeded. Using the above-noted assessment and sensitivity analysis, INAC recommends that the Applicant clearly indicate the monitoring and compliance points that will be used to assess performance against the SSWQO. The analyses should be provided for review prior to the Public Hearing.

2.7 Post-Closure Water Quality Uncertainty

Technical Review Comment	**INAC-TRC#: 7**
Subject	**Post-Closure Water Quality Uncertainty**
Reference(s)	EIS Vol. 6, Freshwater Environment APPENDIX 6-H Mine Site and Receiving Environment Water Quality Predictions APPENDIX 8-F Addendum for Closure and Reclamation Plan Final Information Request – Agnico Response to INAC IR#5.
Summary	Some components of the Whale Tail Project will be constructed, operated and closed within a four-year period. In contrast, there will be uncertainty regarding water quality for an extended period after closure has occurred (potentially for decades). If post-closure monitoring determines that water quality impacts are worse than anticipated, options to mitigate the situation may be limited to complex, costly and long-term solutions (e.g., active water treatment). To avoid such requirements, assurances are required to confirm that the Project will perform as intended. This could be achieved through additional modelling and/or by applying a greater degree of conservatism in designs.
Importance of Issue to Water Resources	There is significant uncertainty regarding the long-term, post-closure water quality of the site. The Applicant has proposed reactive mitigations if water quality is worse than anticipated (e.g., active water treatment). Impacts may not be effectively mitigated if only addressed reactively. A more proactive approach that confirms current predictions and/or applies a greater degree of conservatism is therefore justified.
Detailed Review Comment	The need for post-closure water treatment will be determined based on water quality monitoring before the Whale Tail Dike and the Mammoth Dike are breached. Prior to back-flooding of the pit, the quality of surface water and any groundwater seepage reporting from the pit walls will be sampled to assess the potential for contamination of the pit water during filling. In addition, the surface water and profiles of the back-flooded area will be sampled. Drainage from the WRSF will also be assessed to determine long-term water treatment needs. Based on current assumptions and water quality modelling, the Applicant anticipates that water management will not be required during the post-closure phase. However, at various points

	throughout the documentation, the Applicant identifies loading scenarios that could result in water quality that is unsuitable for direct discharge. To address this possibility, the Closure and Reclamation Plan states that the following alternatives will be considered as contingencies: • *in-situ* treatment (e.g., within the flooded pit); and • active treatment through the Water Treatment Plant (WTP) prior to discharge into the receiving environment. In its response to INAC IR #5, the Applicant provided a preliminary discussion of scenarios that may trigger the need for active post-closure water treatment. In general, INAC agrees with the preliminary discussion. However, as described in INAC TRC #2, there continues to be significant uncertainty regarding the post-closure quality of seepage from the WRSF. Importantly, there is a potential that the onset of contaminated seepage from the WRSF will be delayed until well after the formal closure of the mining operation (i.e., for decades). If this were to occur, the only viable mitigation would likely be to initiate water treatment, potentially for an extended period. This could require significant capital and long-term operational expenditures. The potential need for such expenditures may remain uncertain until long after closure has occurred. The approach would also be inconsistent with the generally accepted principle of achieving a "walk-away" closure solution for the site. For the reasons noted above, a more proactive approach to mitigating potential water quality impacts is justified.
Recommendation/Request	In an effort to reduce uncertainties prior to Project initiation, INAC recommends that the Applicant provide a detailed assessment of proactive measures it will undertake to confirm and/or enhance the assumed water quality performance of the Project. These measures should include additional scientific studies and/or revised Project designs that reduce water quality uncertainties and risks. By definition, these proactive measures would need to be implemented prior to Project initiation. The detailed assessment should be provided for review prior to the Public Hearing.

2.8 Adaptive Management and Reclamation Research

Technical Review Comment	**INAC-TRC#: 8**
Subject	**Adaptive Management and Reclamation Research**
Reference(s)	EIS Vol. 1, Project Description APPENDIX 8-F Addendum for Closure and Reclamation Plan Final Information Request – Agnico Response to INAC IR#9
Summary	The Applicant has placed a heavy emphasis on Adaptive Management and Reclamation Research to address current uncertainties regarding the environmental performance of the Project. While this is consistent with best practice, given the short duration of the Project's operational phase and the concurrent closure of some Project components, there will be limited opportunities to make necessary adjustments to the design of the Project. As a consequence, INAC has concluded there is an increased need for the Applicant to: a) eliminate/reduce uncertainties prior to Project initiation; and/or b) utilize the precautionary principle to mitigate any uncertainties with potentially significant adverse consequences.
Importance of Issue Water Resources	Several important Project components will be constructed, operated and closed prior to sufficient information becoming available on their environmental performance. This could result in worse than anticipated outcomes and may require significant post-closure interventions / mitigations.
Detailed Review Comment	Throughout the Project Description and the Interim Closure & Reclamation Plan (ICRP), the Applicant makes multiple references to the use of adaptive management as a means to ensure that the operational, closure and post-closure phases of the Project perform as intended. As part of its adaptive management approach, the Applicant has committed to monitoring Project performance and to making appropriate adjustments to address any emerging concerns. Further, consistent with applicable guidance, the ICRP identifies known uncertainties that are associated with each of the selected closure methods. In an effort to address these uncertainties, the Applicant has committed to undertake a variety of research initiatives and to incorporating the findings from research into revised closure plans, where appropriate. The reader is referred to the following Technical Review

	comments for examples of situations where a heavy reliance has been placed on adaptive management: • INAC TRC #1: Waste Rock Cover Design • INAC TRC #6: Post-Closure Water Quality Uncertainty INAC acknowledges that the Applicant has committed to incorporate adaptive management and reclamation research into the Whale Tail Project. However, the Department draws attention to the short duration of the operational phase (3 years beginning in 2018) and the fact that critical elements of the closure plan will be implemented concurrently. Given this timeline, it is INAC's view that there will be limited opportunities for meaningful reclamation research and adaptive management of the closure plan. Specifically, the time required to obtain useful information from the reclamation research will extend well beyond the operational phase of the Project and opportunities to adjust the designs prior to the closure of the site will be minimal. In an effort to determine the validity of the timing concern noted above, INAC requested that the Applicant provide a schedule indicating the timing of each research program to address uncertainties and a description of linkages to key decisions in the closure planning process (see INAC IR#9). The Applicant's response did not include sufficient information to demonstrate that critical uncertainties would be resolved in a timely fashion, prior to the construction and closure of the Project. Unless such information is provided, it is INAC's position that Project designs should place a greater emphasis on the precautionary principle to mitigate any uncertainties that could result in potentially significant adverse consequences.
Recommendation/Request	INAC recommends that: a. The Applicant provide an Adaptive Management Plan that provides clear evidence of the approach that will be taken to ensure the post-closure performance of each Project component. The evidence should identify specific reclamation research and/or mitigations that will be taken to proactively and reactively address any potential situations where environmental performance is worse than anticipated. Evidence should include: 1) reclamation research that will provide useful information prior to the construction of the Project; 2) potential modifications to the Project designs to

	further mitigate uncertainties; and 3) clear action plans to address worse than anticipated closure performance. The Adaptive Management Plan should identify applicable trigger levels and associated actions. It should also be provided prior to the Public Hearing. b. Consistent with the precautionary principle, sufficient financial security should be posted to implement future mitigations that may be required to address uncertainties that could result in credible post-closure outcomes that are worse than predicted (e.g., the potential need for long-term water treatment).

2.9 Reclamation Cost Estimate

Technical Review Comment	**INAC-TRC#: 9**
Subject	**Reclamation Security**
Reference(s)	ARCADIS RECLAIM Estimate for the Whale Tail Pit Project (Appendix 1)
Summary	Reclamation and closure costs estimates have been developed by both the Applicant and INAC. Please see Appendix 1. To date INAC is unaware if the Kivalliq Inuit Association has developed a closure cost estimate for the Whale Tail Pit Project. Further discussions between all three parties will inform the estimate and the department will present this as part of the Public Hearing.
Importance of Issue Water Resources	Pursuant to INAC's Mine Site Reclamation Policy, reclamation security is required for all mining and milling Type A water licences.
Detailed Review Comment	The Applicant has provided a reclamation security estimate of approximately $19 Million. Following a site visit in 2016 and using INAC's Mine Site Reclamation Policy a preliminary detailed reclamation security estimate was produced by ARCADIS (INAC Consultant) with an approximate amount of $27 Million. For direct costs, an initial review of both estimates indicates a difference of $2,806,977. This difference was primarily the result of higher costs calculated by Arcadis for scarifying and decommissioning of waste rock laydown pads for the ore stockpiles and camp infrastructure, costs associated with the mitigation of potential petroleum hydrocarbon concerns, and interim care and maintenance costs. For indirect costs, an initial review of both estimates indicates a difference of $4,574,894. This difference was primarily due to the difference in mobilization/demobilization costs, the difference in the direct costs which increased the costs that were calculated on the basis of percentage of direct cost and the post-closure monitoring costs (i.e. 11 vs 25 years).

Recommendation/Request	INAC requests further discussions between the Applicant, INAC and the Kivalliq Inuit Association in an effort to come to an agreement on a revised reclamation closure cost amount prior to the Public Hearing.

3.0 SUMMARY OF RECOMMENDATIONS

INAC has undertaken a review of documents submitted by Agnico Eagle Mines Limited in support of applications for the Whale Tail Pit Project. The review process included one round of Information Requests (IRs) and associated responses from the Applicant.

In general, the information, analysis and presentation of the submissions were good. However, many aspects of the proposed Project remain at a preliminary conceptual stage. As a consequence, a variety of potentially significant uncertainties regarding the design and environmental performance of the Project remain. 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 outcomes. Nonetheless, based on the information provided to date, there are concerns that predicted impacts may potentially be under-estimated. This would put into question whether facilities are adequately designed, whether mitigation measures identified are sufficient, and whether additional monitoring programs and/or contingencies need to be developed. Of particular concern, the short operational life of the Project (3 years) and concurrent closure of some components will significantly constrain the ability of the Applicant to resolve key uncertainties in a timely fashion. Failure to proactively address these uncertainties and/or provide for appropriate contingencies could result in unintended Project consequences.

In many respects, potential impacts associated with the operational phase are well understood, are of limited duration and/or are readily mitigated through active interventions. In contrast, uncertainties regarding the post-closure performance of the site could result in significant unintended and difficult to mitigate Project consequences. INAC has therefore placed an increased emphasis on potential concerns related to the post-closure phase of the Project. By addressing these concerns, the Applicant will provide increased certainty regarding the potential for long-term Project impacts and the eventual relinquishment of the site.

Based on this review, INAC offers the following recommendations and requests to the NWB for their consideration. In all instances, INAC recommends that the required information be made available prior to the Public Hearing. This will allow INAC, NWB and other parties to consider the information when making a determination regarding the licensing of the Project.

Technical Review Comment	Subject	Recommendation / Request
INAC-TRC #1	**Design and Depth of Waste Rock Cover to Assure Long Term Freezing of Metals Leaching and Potentially Acidic Generating Waste Rock**	INAC recommends: 1) A defensible cover design that considers the availability of cover material should be submitted for review. This design should include thermal modelling to confirm thaw depths and include the effects of climate change. 2) A contingency plan to identify an alternative source of clean cover material should be developed and

Technical Review Comment	Subject	Recommendation / Request
		provided for review. 3) A contingency plan for placement of additional cover, or alternative contingencies, should be developed in the event that future monitoring and assessment indicate the selected design will not prevent thawing below the cover. Given that the mine life is short, and that cover from the mining activity will no longer be available, it will be important to develop a plan for placement of additional cover material, or otherwise plan for additional contingencies, should monitoring indicate thaw depths are greater than predicted.
INAC-TRC #2	**Tailings Management**	INAC recommends that the Tailings Management Plan under water licence 2AM-MEA1525 be updated to reflect the additional tailings from Whale Tail. INAC recommends that the NWB may have to reassess the security held under water licence 2AM-MEA1525 to confirm that is sufficient to manage the incremental tailings associated with the Whale Tail Project.
INAC-TRC #3	**Predicted Post-Closure Arsenic Levels in Waste Rock Seepage/Runoff**	INAC recommends: 1) The Applicant undertake a sensitivity analysis to assess the impact of including metals leaching waste rock in the cover materials. For the analysis, it would be appropriate to rerun the model with 2%, 5% and 10% of the cover containing metals leaching and acid generating rock to assess the implications of residual contamination in the cover. The current water quality model and leaching data collected from the testing programs would be suitable for use in the modelling. 2) If the updated water quality modelling results suggest that long-term treatment may be required, a modified cover design proven to be effective in mitigating potential seepage concerns should be considered and provided for review. 3) Given the potential for delayed onset of drainage from the WRSF (i.e., due to the water retention capacity of the waste rock deposit) INAC recommends that the Applicant justify and, if necessary, extend the duration of the currently proposed post-closure monitoring period. Any extension to the duration of the monitoring period could be limited to seepage monitoring of the waste

Technical Review Comment	Subject	Recommendation / Request
		pile to confirm seepage remains acceptable for discharge without treatment.
INAC-TRC #4	**Long-Term Water Quality in the Flooded Pit**	INAC recommends: 1) A detailed sensitivity analysis be performed to assess the potential implications of ground water inputs from mineralized zones around the pit and the implications of additional contributions from the pit walls and the WRSF cover. If this assessment indicates no concerns with long-term water quality, then INAC would be assured this is not a material issue. The existing water quality model is acceptable for use in this analysis. 2) If the assessment suggests 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 provide a detailed 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.).
INAC-TRC #5	**Ammonia and Nitrate Levels from Explosive Use**	INAC recommends that the Applicant estimate ammonia and nitrate concentrations using loading data from Meadowbank Mine. The annual losses in mine water and pit water should be reported per tonne of rock blasted and per tonne of rock placed in the pile. These loading data should then be applied to the Whale Tail Project to assess whether or not ammonia and nitrate levels are of potential concern. The analysis should be conducted for each year of operation as explosives use will vary annually with the quantity of rock blasted.
INAC-TRC #6	**Post-Closure Surface Water Impacts**	INAC recommends that the Applicant clearly indicate the spatial extent within all surface water receivers in which concentrations of potential contaminants may remain above the SSWQO or other applicable criteria during the post-closure phase. Consistent with the Applicant's assertion that current modeling provides "*order of magnitude*" estimates, the assessment should include a sensitivity analysis that considers a broad range of contaminant loading scenarios for the post-closure phase. The evaluation should identify and characterize potential ecological impacts in areas where the proposed water quality criteria may be exceeded.

Technical Review Comment	Subject	Recommendation / Request
		Using the above-noted assessment and sensitivity analysis, INAC recommends that the Applicant clearly indicate the monitoring and compliance points that will be used to assess performance against the SSWQO.
INAC-TRC #7	**Post-Closure Water Quality Uncertainty**	INAC recommends that the Applicant provide a detailed assessment of proactive measures it will undertake to confirm and/or enhance the assumed water quality performance of the Project. These measures should include additional scientific studies and/or revised Project designs that reduce water quality uncertainties and risks. By definition, these proactive measures would need to be implemented prior to Project initiation.
INAC-TRC #8	**Adaptive Management and Reclamation Research**	INAC recommends that the Applicant provide an Adaptive Management Plan that provides clear evidence of the approach that will be taken to ensure the post-closure performance of each Project component. The evidence should identify specific reclamation research and/or mitigations that will be taken to proactively and reactively address any potential situations where environmental performance is worse than anticipated. Evidence should include: 1) reclamation research that will provide useful information prior to the construction of the Project; 2) potential modifications to the Project designs to further mitigate uncertainties; and 3) clear action plans to address worse than anticipated closure performance. The Adaptive Management Plan should identify applicable trigger levels and associated actions.
INAC-TRC #9	**Reclamation Cost Estimate**	INAC requests further discussions between the Applicant, INAC and the Kivalliq Inuit Association in order to come to an agreement on a reclamation closure cost estimate prior to the Public Hearing.

APPENDIX

Appendix 1 – RECLAIM Estimate for Whale Tail Pit Project (2017) prepared for Indigenous and Northern Affairs Canada by ARCADIS.

ARCADIS Design & Consultancy for natural and built assets

INDIGENOUS AND NORTHERN AFFAIRS CANADA

RECLAIM ESTIMATE FOR WHALE TAIL PIT PROJECT

Water Licence Application

2AM-WTP----

27 March 2017

702615-002

RECLAIM ESTIMATE FOR WHALE TAIL PIT PROJECT

Water Licence Application

2AM-WTP----

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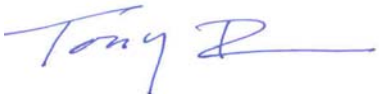
Principal



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Appendix A ARCADIS RECLAIM Worksheets

Appendix B Agnico RECLAIM Worksheets

ACRONYMS AND ABBREVIATIONS

Agnico	Agnico Eagle Mines Limited
Arcadis	Arcadis Canada Inc.
ESA	Environmental Site Assessment
ICRP	Interim Closure and Reclamation Plan
INAC	Indigenous and Northern Affairs Canada
IOL	Inuit Owned Lands
NIRB	Nunavut Impact Review Board
NPAG	Non-Potentially Acid Generating
NWB	Nunavut Water Board
PAG	Potential Acid Generating
TSF	Tailings Storage Facility
WRSF	Waste Rock Storage Facility

EXECUTIVE SUMMARY

Further to the request of INAC, Arcadis was retained to complete an independent quantum of security estimate for the proposed Whale Tail mine development project as part of a water licence application request set forth by Agnico. Agnico has applied to the NWB for a Type A Water Licence (No. 2AM-WTP----) to include mining of the Whale Tail Pit and construction/operation of associated infrastructure. This application is separate from the existing water licences for; the all-weather road between the existing Meadowbank mine and the Amaruq Property, 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 order to prepare the quantum of security estimate, Arcadis reviewed the following documents;

- Agnico Eagle Meadowbank Division, Whale Tail Pit, Interim Closure and Reclamation Plan, June 2016 Version WT;
- RECLAIM ESTIMATE for the Whale Tail Pit Project, as prepared by Golder Associates and Agnico dated 25 June 2016;
- Volume 1 – Project Description, Whale Tail Pit Project Meadowbank Division dated May 2016;
- RECLAIM ESTIMATEs for the Amaruq Exploration Camp and Underground Mine proposal and the All-Weather Road proposal dated September 2016;

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 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 $27,213,276.

TABLE 1: SUMMARY OF COSTS

Cost Items	Agnico RECLAIM	Arcadis RECLAIM
CAPITAL COSTS		
Open Pit	$4,050,038	$4,050,038
Rock Pile	$2,923,088	$2,943,088
Building and Equipment	$920,225	$1,691,254
Chemicals and Contaminated Soil Management	$168,853	$662,700
Surface and Groundwater Management	$482,595	$482,595
Interim Care and Maintenance	$0	$1,522,101
SUB-TOTAL	$8,544,799	$11,351,776
INDIRECT COSTS		
Mobilization/Demobilization	$5,420,771	$6,281,220
Post-Closure Monitoring and Maintenance	$3,131,499	$5,947,712
Engineering (5%)	$427,240	$567,589
Project Management (5%)	$427,240	$567,589
Health and Safety Plans/Monitoring & QA/QC (1%)	$85,448	$113,518
Bonding/Insurance (1%)	$85,448	$113,518
Contingency (20%)	$1,708,960	$2,270,355
Market Price Factor Adjustment	$0	$0
SUB-TOTAL	$11,286,606	$15,861,500
TOTAL COSTS	$19,831,405	$27,213,276

1 INTRODUCTION

1.1 General

Arcadis was retained by INAC to complete a quantum of security evaluation for the Whale Tail Pit Project. The security estimate was to be prepared based on the existing information provided in the proponent's water licence amendment application.

1.2 Background

Agnico Eagle Mines Limited – Meadowbank Division (Agnico) is proposing to develop Whale Tail Pit, a satellite deposit located on the Amaruq property, to continue mine operations and milling at Meadowbank Mine. Concurrent with the reconsideration of the Project Certificate by the NIRB, Agnico is seeking a new water licence (2AM-WTP----) to include mining of ore at the Whale Tail Pit and construction and operations of associated infrastructure from the NWB.

Agnico has provided financial security for the Meadowbank mine, the All-weather road between the Meadowbank mine and the Amaruq property, and for the Amaruq mine/exploration camp as part of other water licences. The current estimate therefore focuses exclusively on the incremental components associated with the Whale Tail Project.

As part of the Whale Tail Pit Project, ore would be mined from an open pit and segregated by grade with high grade ore first being transported to the mill at Meadowbank for processing and lower grade ore being transported to the mill during the later stages of the pit development. Some crushing would be done on the Whale Tail property; however, all tailings will be managed at the Meadowbank TSF while waste rock from the Whale Tail property will be managed on site. In order to facilitate the transfer of ore to the mill, Agnico is proposing to upgrade the current road design from a 6.5 m wide road to a 9.5 m wide road. Existing road designs already considered this possibility during the design of culverts and bridges and, as such, no additional infrastructure design work is required in this regard.

Agnico expects to begin construction in 2018 and ultimately have full production in 2019. The operational phase of the pit will span three to four years. Mining activities are expected to end in 2021, with milling operations completed by the end of 2022. The reclamation phase of the mine will begin in 2022 with the flooding of the pit which is expected to take seven to eight years (done in 2030). At this point, the post-closure monitoring will begin with the long-term monitoring expected to extend to 2035. More details on the mine life cycle are provided in the ICRP.

1.3 Scope of Work

The scope of work (SOW) developed by INAC for the quantum of security evaluation is outlined in Section 2 of this report. In general, the SOW for this task was to review existing

documentation on the closure and reclamation of the Whale Tail Pit Project and prepare a quantum of security estimate based on the RECLAIM Version 7.0 model for the costing of mine reclamation programs.

2 METHODOLOGY

2.1 General Approach

Arcadis' approach to this quantum of security review consisted of the following:

- A review of the Whale Tail Pit ICRP and Project Description as prepared by Agnico with their consultant Golder Associates;
- A review of the existing Amaruq quantum of security RECLAIM estimates including the all-weather road RECLAIM estimate; and
- A review of the RECLAIM Version 7.0 Manual.

The security review was completed considering the application of the financial security provisions of the Mine Site Reclamation Policy for Nunavut (INAC, 2002) summarized as follows:

- Total financial security for final reclamation should be equal to the total outstanding reclamation liability for land and water combined. The financial security should be sufficient to cover the highest liability over the applicable time period.
- Reclamation cost estimates for financial security purposes should be based on the cost of having the reclamation work completed by a third-party contractor if the operator defaults.
- Estimates should include a contingency that is appropriate to the particular work to be undertaken.
- A recognized methodology such as RECLAIM or some other appropriate model should be used to calculate reclamation costs.
- Consideration should be given to alternate or innovative forms of security.
- Financial security requirements should be clearly set out in water licences, land leases and other regulatory instruments. Alternatively, the security requirements can be specified within a separate agreement if this approach is more applicable.
- Mine operators should be credited for approved progressive reclamation, and the value of financial security required should be adjusted in a timely fashion.

Arcadis initially completed its quantum of security estimate using the Agnico RECLAIM estimate and reviewed the differences between the two to make sure the Arcadis assumptions were reasonable and consistent with other RECLAIM estimates done on Agnico properties in the Baker Lake and Rankin Inlet areas.

2.2 Limitations

The quantum of security estimate is based on the information provided by INAC to Arcadis and, as such, the assessment is primarily based on the ICRP prepared by Agnico for the Whale Tail Pit program. Should any of the underlying assumptions outlined in the ICRP change over the lifetime of the mine site, then the quantum of security estimate should be reviewed in light of any new information. As with all NWB water licences, the proponent will have the opportunity to amend the quantum of security based on progressive reclamation works.

Furthermore, given the number of water licences currently held on the Amaruq property and the associated all-weather road, it may be more expedient to have one single security held for this property thus avoiding any potential confusion with respect to which security would be pulled in the event that only part of the Meadowbank/Whale Tail Pit mine sites were abandoned.

3 FINDINGS

3.1 General

The RECLAIM worksheets detailing the direct and indirect costs used to develop the quantum of security estimate are provided in Appendix A. A copy of the RECLAIM estimate as prepared by Agnico is provided in Appendix B. Further discussion on each major cost item is provided herein, organized based on the RECALIM 7.0 layout developed and used by INAC.

3.2 Direct Costs

The Direct Costs for the Arcadis RECLAIM estimate are provided in the RECLAIM worksheets found in Appendix A. The Land and Water Liability costs are presented in these worksheets. In summary, the Land Liability has been calculated to be $2,620,021 while the Water Liability has been calculated to be $8,731,755. Given that the site is completely contained within IOL lands, we have not provided a breakdown of the costs into IOL versus Crown land even though there is a small component of the work (i.e. all-weather road reclamation) that could be considered to be on Crown Land. The ratio of work used to calculate the ratio of costs for the all-weather road between the Meadowbank mine and the Amaruq property could be applied here should the Crown wish.

3.2.1 Open Pit

The closure of the open pit will entail the flooding of the pit using natural inflows and the pumping of water originally displaced from the section of Whale Tail Lake. From the ICRP, it is understood that the flood back work will take up to 8 years to complete. In addition to the flooding, the work will include the closure of access roads to the pit, signage and the removal of pumps and piping from within the pit. The work under this cost item also includes the completion of a stability and setback study.

In general, the Arcadis estimate is in agreement with the Agnico estimate for this work.

Note that the costs for the breaching of the dikes on site is covered under the Water Management costs. Furthermore, it is understood that the security for the closure of the local borrow sources has been included in the RECLAIM estimate for the All-weather Road.

3.2.2 Underground Mine

Not applicable to this water licence application. It has been assumed that the security for the reclamation work related to the underground exploration activities has been already retained as part of an earlier water licence application for the Amaruq property.

3.2.3 Tailings Facility

Not applicable to this water licence application. It has been assumed that the security for the reclamation work related to the tailings facility will be already retained as part of the Meadowbank mine property security. While it is unclear how all the tailings from the Whale Tail Pit program will fit within the existing Meadowbank tailings storage area, it has been assumed by Arcadis that Agnico will provide the necessary information confirming that sufficient storage capacity exists within the Meadowbank TSF and that the security amounts currently in place for the Meadowbank mine will cover any reclamation work that may be required at the Meadowbank TSF.

3.2.4 Waste Rock Pile

Under the ICRP, the closure of the waste rock pile will take place progressively with sections left open in order to accommodate the decommissioning of the water treatment plant and associated piping and diffuser. Per the ICRP, the quantity of NPAG waste rock was based on a 4 m thick cap, however, no details were provided on the area of the WRSF that will remain to be capped at the end of mine operations. Back calculating from the information provided in the Agnico estimate, it is assumed that 16.7 ha of the WRSF would require capping. This is considered reasonable for this size of operation.

In addition to the placement of NPAG waste rock, the cost associated with this task include for the installation of thermistors. In the absence of a definitive number of thermistors, it has been assumed that five to seven thermistors will be installed and, as such, the allowance of $50,000 provided by Agnico is reasonable.

The same quantum of security as presented by Agnico for this work element has been assumed by Arcadis.

3.2.5 Buildings and Equipment

For the purposes of the Arcadis estimate, the building footprint areas provided by Agnico were used to estimate the building removal costs and grading and contouring of the waste rock pads underlying the buildings. The incremental area of road surface as provided by Agnico was also included in the Arcadis estimate. In addition to these cost items, costs were also included for; an assumed area of the laydown area that were part of common areas not included in the building area footprints; the decommissioning of seven culverts shown in the ICRP as being present; the scarifying of local roads; and the removal of the explosives storage containers.

The additional work items resulted in a substantial increase in the quantum of security for this work, $771,029 when compared to the Agnico estimate. More details are provided in the RECLAIM worksheet in Appendix A.

3.2.6 Chemicals and Contaminated Soil Management

The work under this task includes; completing a Phase I/II ESA; decontaminating the power house and fuel storage facilities; removal of hazardous wastes (i.e. batteries, waste fuel/oil, glycol, etc.); and management of petroleum hydrocarbons. For the Arcadis estimate, the work also included the following activities not included in the Agnico estimate; decontamination of the explosives storage areas; removal and off-site disposal of waste oils and fuels (based on the quantities used in the Amaruq mine estimate); and management of a large volume of light fraction petroleum hydrocarbons (i.e. 2,000 m^3) as assumed for the Amaruq mine with a 10% heavy oil fraction that would require off-site disposal.

The additional work items resulted in an increase of $493,847 when compared to the Agnico estimate. More details are provided in the RECLAIM worksheet in Appendix A.

3.2.7 Surface and Groundwater Management

The work included under this task entailed; the breaching of the Whale Tail, Northeast, Mammoth and WRSF dikes and the saddle dam; the removal of sediment from the WRSF pond; backfilling and contouring of containment ditches; and decommissioning of the

freshwater supply system. The material quantities used by Arcadis in its estimate for the removal and/or relocation on site material are the same as those presented by Agnico in their estimate.

No concerns with the quantities or unit rates provided by Agnico for this work were identified by Arcadis.

3.2.8 Interim Care and Maintenance

Consistent with the approach used by INAC for other mine properties, Arcadis used a five-year care and maintenance period for this estimate. The tasks to be completed under this activity are consistent with those used in the development of Amaruq security estimates.

This cost was not carried by Agnico in their RECLAIM estimate.

3.2.9 Summary of Direct Cost Review

The net result of the Arcadis assessment was a total capital or direct cost of $11,351,776 as compared to a cost of $8,544,799 reported by Agnico. The $2,806,977 difference was primarily the result of higher costs calculated by Arcadis for scarifying and decommissioning of waste rock laydown pads for the ore stockpiles and camp infrastructure, costs associated with the mitigation of potential petroleum hydrocarbon concerns, and interim care and maintenance costs.

3.3 Indirect Costs

The Indirect Costs for the Arcadis RECLAIM estimate are provided in the RECLAIM worksheets found in Appendix A. The Land and Water Liability costs are presented in these worksheets. In summary, the Land Liability has been calculated to be $3,660,878 while the Water Liability has been calculated to be $12,200,622. Given that the site is completely contained within IOL lands, we have not provided a breakdown of the costs into IOL versus Crown land even though there is a component of the work (i.e. all-weather road reclamation) that could be considered to be on Crown Land. The ratio of work used to calculate the ratio of costs for the all-weather road between the Meadowbank mine and the Amaruq property could be applied here should the Crown wish.

3.3.1 Mobilization and Demobilization

For the purposes of the Arcadis security assessment, it was assumed that equipment would need to be mobilized to site in order to complete the site closure and reclamation works. The equipment for the reclamation work would be sourced from Baker Lake. The

results of the earlier Amaruq RECLAIM estimates were used to generate the costs for this activity.

This is a departure from the assumptions made by Agnico which assumed equipment would be on site to complete the closure and reclamation work.

In general, the costs for the movement and housing of staff during the closure and reclamation works were consistent with those used by Agnico. Small differences were calculated where Agnico used partial numbers to calculate the number of person trips and man hours for the mobilization of workers whereas Arcadis used whole numbers (i.e 8.6 versus 9).

3.3.2 Post-Closure Monitoring and Maintenance

The Post-Closure Monitoring and Maintenance costs are based on 25 years of monitoring for geotechnical and environmental concerns. The 25 years is based on current INAC practice and has been set to protect against uncertainties related to the long-term water quality of the site. Those uncertainties include but are not limited to the effectiveness of the proposed waste rock cover and the potential for metal loadings to surface water receivers to be higher than currently predicted.

The approach used by Arcadis was consistent with the post closure periods set for other Agnico properties in the area.

3.3.3 Engineering

The amount of engineering work required to implement the closure and reclamation plan as set out by Agnico is minimal given the amount of plant and infrastructure that will be on site during operations. For this reason, the use of 5% of direct costs is considered acceptable. This is also consistent with the approach taken by Agnico.

3.3.4 Project Management

Given the relatively minimal amount of work required to reclaim this site a project management percentage of 5% is reasonable. This level of effort was also used by Agnico.

3.3.5 Health and Safety Plans/Monitoring and QA/QC

The percentage used for this task is 1% and is consistent with the level used in industry and has also been used by Agnico in their estimate.

3.3.6 Bonding/Insurance

The percentage used for bonding and insurance is 1% and is consistent with the level used by Agnico.

3.3.7 Contingency

Given the level of mine development, a 20% contingency is appropriate. This is consistent with the approach used by Agnico.

3.3.8 Market Factor Adjustment

No market factor adjustment was used in the Arcadis estimate. This is consistent with the approach used by Agnico.

3.3.9 Summary of Indirect Cost Review

The net result of the Arcadis assessment was a total indirect cost of $15,861,500 as compared to a cost of $11,286,606 reported by Agnico. The $4,574,894 difference was primarily due to the difference in mobilization/demobilization costs, the difference in the direct costs which increased the costs that were calculated on the basis of percentage of direct cost and the post-closure monitoring costs (i.e. 11 vs 25 years).

4 CONCLUSIONS AND RECOMMENDATIONS

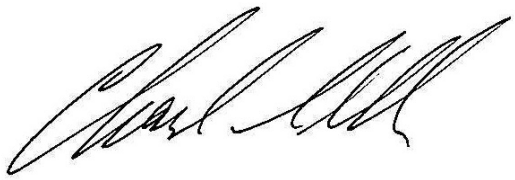
On the basis of the review completed by Arcadis, the quantum of security has assessed to be $27,213,276. This estimate is approximately $7.4 M higher than the Agnico estimate and is based primarily on increased costs for the management of NPAG waste rock laydowns, management of petroleum hydrocarbons, mobilization/demobilization, an incremental increase in contingency cost and the post-closure monitoring costs. A comparison of the two RECLAIM estimates is tabulated below.

Table 2: SUMMARY OF COSTS

Cost Items	Agnico RECLAIM	Arcadis RECLAIM
CAPITAL COSTS		
Open Pit	$4,050,038	$4,050,038
Rock Pile	$2,923,088	$2,943,088
Building and Equipment	$920,225	$1,691,254
Chemicals and Contaminated Soil Management	$168,853	$662,700
Surface and Groundwater Management	$482,595	$482,595
Interim Care and Maintenance	$0	$1,522,101
SUB-TOTAL	$8,544,799	$11,351,776
INDIRECT COSTS		
Mobilization/Demobilization	$5,420,771	$6,281,220
Post-Closure Monitoring and Maintenance	$3,131,499	$5,947,712
Engineering (5%)	$427,240	$567,589
Project Management (5%)	$427,240	$567,589
Health and Safety Plans/Monitoring & QA/QC (1%)	$85,448	$113,518
Bonding/Insurance (1%)	$85,448	$113,518
Contingency (20%)	$1,708,960	$2,270,355
Market Price Factor Adjustment	$0	$0
SUB-TOTAL	$11,286,606	$15,861,500
TOTAL COSTS	$19,831,405	$27,213,276

5 CLOSURE

We trust the information provided herein meets your current needs. Should you require any additional information please do not hesitate to contact us.



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Principal

6 REFERENCES

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Agnico Eagle June 2016. Whale Tail Pit Interim Closure and Reclamation Plan.

Arcadis Canada Inc. September 2016. RECLAIM Estimate for Amaruq All-weather Road, Amaruq Mine and Exploration Camp.

Indian and Northern Affairs Canada (INAC), 2002. Mine Site Reclamation Policy for Nunavut. ISBN 0-662-32073-5. Copyright: Minister of Public Works and Government Services Canada.

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APPENDIX A

ARCADIS RECLAIM Worksheets

SUMMARY OF COSTS

CAPITAL COSTS	COMPONENT NAME	COST	LAND LIABILITY	WATER LIABILITY
OPEN PIT		$4,050,038	$0	$4,050,038
UNDERGROUND MINE		$0	$0	$0
TAILINGS FACILITY		$0	$0	$0
ROCK PILE	Whale Tail WRSF	$2,943,088	$1,446,544	$1,496,544
BUILDINGS AND EQUIPMENT		$1,691,254	$842,127	$849,127
CHEMICALS AND CONTAMINATED SOIL MANAGEME		$662,700	$331,350	$331,350
SURFACE AND GROUNDWATER MANAGEMENT		$482,595	-	$482,595
INTERIM CARE AND MAINTENANCE		$1,522,101	-	$1,522,101
	SUBTOTAL: Capital Costs	**$11,351,776**	**$2,620,021**	**$8,731,755**
	PERCENT OF SUBTOTAL		**23%**	**77%**

INDIRECT COSTS		COST	LAND LIABILITY	WATER LIABILITY
MOBILIZATION/DEMOBILIZATION		$6,281,220	$1,449,723	$4,831,497
POST-CLOSURE MONITORING AND MAINTENANCE		$5,947,712	$1,372,748	$4,574,964
ENGINEERING	5%	$567,589	$131,001	$436,588
PROJECT MANAGEMENT	5%	$567,589	$131,001	$436,588
HEALTH AND SAFETY PLANS/MONITORING & QA/QC	1%	$113,518	$26,200	$87,318
BONDING/INSURANCE	1%	$113,518	$26,200	$87,318
CONTINGENCY	20%	$2,270,355	$524,004	$1,746,351
MARKET PRICE FACTOR ADJUSTMENT	0%	$0	$0	$0
	SUBTOTAL: Indirect Costs	**$15,861,500**	**$3,660,878**	**$12,200,622**

TOTAL COSTS	**$27,213,276**	**$6,280,899**	**$20,932,377**

1 **Open Pit Name:** **Pit # 1**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
CONTROL ACCESS									
Fence		m		#N/A	$0.00	$0		$0	$0
Signs	Assumed	each	15	SH	$37.08	$556		$0	$556
Berm at crest		m3		#N/A	$0.00	$0		$0	$0
Block roads	per Golder Design	m3	270	RB1H	$17.05	$4,604		$0	$4,604
Other				#N/A	$0.00	$0		$0	$0
STABILITY STUDY									
Conduct stability and setback study		allow	1	EA	$20,000.00	$20,000		$0	$20,000
STABILIZE SLOPES									
Off-load crest, soil A		m3		#N/A	$0.00	$0		$0	$0
Off-load crest, soil B		m3		#N/A	$0.00	$0		$0	$0
Doze/trim overburden at crest		m3		#N/A	$0.00	$0		$0	$0
Drill & blast pit crest		m3		#N/A	$0.00	$0		$0	$0
Buttress slope		m3		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
COVER/CONTOUR SLOPES									
Place fill, soil A		m3		#N/A	$0.00	$0		$0	$0
Place fill, soil B		m3		#N/A	$0.00	$0		$0	$0
Rip rap		m3		#N/A	$0.00	$0		$0	$0
Vegetate slopes		ha		#N/A	$0.00	$0		$0	$0
Vegetate pit floor		ha		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
CONSTRUCT DIVERSION DITCHES									
Excavate ditches -soil	covered under Surface Water Mgmt	m3		#N/A	$0.00	$0		$0	$0
Excavate ditches -rock		m3		#N/A	$0.00	$0		$0	$0
Rip rap in channel base		m3		#N/A	$0.00	$0		$0	$0
CONSTRUCT SPILLWAY									
Excavate channel		m3		#N/A	$0.00	$0		$0	$0
Concrete		m3		#N/A	$0.00	$0		$0	$0
Rip rap		m3		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
RECLAIM QUARRIES									
Contour slopes	Assumed to be covered under road security	m3		#N/A	$0.00	$0		$0	$0
Place overburden		m3		#N/A	$0.00	$0		$0	$0
Vegetate		m3		#N/A	$0.00	$0		$0	$0
FLOOD PIT-Captital									
Remove stationary equipment (sump pumps)	from Meadowbank estimate	Allow	1	AE	$10,000.00	$10,000		$0	$10,000
Remove dewatering pipeline		m		#N/A	$0.00	$0		$0	$0
Remove power lines		each		#N/A	$0.00	$0		$0	$0
Construct diversion ditches		m3		#N/A	$0.00	$0		$0	$0
-Ditch, mat'l A		m3		#N/A	$0.00	$0		$0	$0
-Ditch, mat'l B		m3		#N/A	$0.00	$0		$0	$0
Construct embankment/dam		m3		#N/A	$0.00	$0		$0	$0
Supply/install pump station	from Meadowbank estimate	Allow	1	AE	$500,000.00	$500,000		$0	$500,000
Supply/install piping system		m		#N/A	$0.00	$0		$0	$0
Remove pump post-closure		each		#N/A	$0.00	$0		$0	$0
Remove pipeline post-closure		m		#N/A	$0.00	$0		$0	$0
FLOOD PIT-Annual Cost									
Operate pumps (power)	based on Meadowbank estimate	each	1	AE	$439,359.80	$439,360		$0	$439,360
Maintain pump/pipeline		allow		#N/A	$0.00	$0		$0	$0
Labour:fuel management, comissioning/decom		$/h		#N/A	$0.00	$0		$0	$0
Chemical addition, _____ kg/m3 of water		tonne		#N/A	$0.00	$0		$0	$0
Chemicals, purchase and shipping		tonne		#N/A	$0.00	$0		$0	$0
Passive/biological additives		$/ha		#N/A	$0.00	$0		$0	$0
Passive additives purchase and shipping		tonne		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
					Annual pumping costs	$439,360			
Number of years of pump flooding		years	8						
					Total pumping costs	$3,514,878		$0	$3,514,878
					Total	$4,050,038		$0	$4,050,038
					% of Total			0%	100%

1 **Tailings Impoundment Name:** **Pond # 1**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
CONTROL ACCESS									
Fence		m		#N/A	$0.00	$0		$0	$0
Signs		each		#N/A	$0.00	$0		$0	$0
Berm		m3		#N/A	$0.00	$0		$0	$0
Block roads		m3		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
STABILIZE EMBANKMENT(S)									
Toe buttress, drainage layer		m3		#N/A	$0.00	$0		$0	$0
Toe buttress, bulk fill		m3		#N/A	$0.00	$0		$0	$0
Rip rap		m3		RB2	$17.80	$0	50%	$0	$0
Vegetate		ha		#N/A	$0.00	$0		$0	$0
Raise crest		m3		#N/A	$0.00	$0		$0	$0
Flatten slopes		m3		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
COVER TAILINGS									
Grade/shape tailings surface		m3		#N/A	$0.00	$0		$0	$0
Liner bedding		m3		#N/A	$0.00	$0		$0	$0
Subgrade preparation - compact		m2		#N/A	$0.00	$0		$0	$0
Supply geotextile/geosynthetic		m2		#N/A	$0.00	$0		$0	$0
Install geotextile/geosynthetic		m2		#N/A	$0.00	$0		$0	$0
Soil cover		m3		SC4L	$9.30	$0	50%	$0	$0
Rock cover		m3		#N/A	$0.00	$0		$0	$0
Vegetate		ha		VHF	$4,000.00	$0	50%	$0	$0
Other		m3		SC4L	$9.30	$0	50%	$0	$0
BURY PAG ROCK									
Relocate PAG rock		m3		#N/A	$0.00	$0		$0	$0
Place cover over PAG rock		m3		#N/A	$0.00	$0		$0	$0
Raise crest of dam		m3		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
STABILIZE DECANT SYSTEM									
Excavate and replace		m3		#N/A	$0.00	$0		$0	$0
Plug/backfill with concrete or clay		m3		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
REMOVE TAILINGS DISCHARGE									
Cyclones		m3		#N/A	$0.00	$0		$0	$0
Pipe		m		ppls	$57.33	$0		$0	$0
Remove reclaim barge		allow		#N/A	$0.00	$0		$0	$0
CONSTRUCT DIVERSION DITCHES									
Excavate ditches -soil		m3		#N/A	$0.00	$0		$0	$0
Excavate ditches -rock		m3		#N/A	$0.00	$0		$0	$0
Rip rap in channel base		m3		#N/A	$0.00	$0		$0	$0
FLOOD TAILINGS									
Doze tailings to final contour		m3		#N/A	$0.00	$0		$0	$0
Raise crest of dam		m3		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
UPGRADE SPILLWAY									
Excavate channel, rock		m3		#N/A	$0.00	$0		$0	$0
Excavate channel, soil		m3		SC3H	$14.20	$0		$0	$0
Concrete		m3		#N/A	$0.00	$0		$0	$0
Rip rap		m3		RB4H	$30.75	$0		$0	$0
Geotextile		m2		GSTL	$3.44	$0		$0	$0
CONSTRUCT SEEPAGE COLLECTION POND									
Excavate seepage collection pond		m3		#N/A	$0.00	$0		$0	$0
Doze & spread excavated material		m3		#N/A	$0.00	$0		$0	$0
Vegetate spread material		ha		#N/A	$0.00	$0		$0	$0
Bedding layer		m3		#N/A	$0.00	$0		$0	$0
Supply geomembrane		m2		#N/A	$0.00	$0		$0	$0
Install geomembrane		m2		#N/A	$0.00	$0		$0	$0
Erosion protection layer		m3		#N/A	$0.00	$0		$0	$0
INSTALL GROUNDWATER COLLECTION SYSTEM									
Excavate/install sumps		m3		#N/A	$0.00	$0		$0	$0
Install pumping wells		m3		#N/A	$0.00	$0		$0	$0
Install pumps/pipelines/power supply		LS		#N/A	$0.00	$0		$0	$0
SPECIALIZED ITEMS									
Install permanent instrumentation, supply & technican		each		#N/A	$30,000.00	$0		$0	$0
Install permanent instrumentation, drilling		each		#N/A	$30,000.00	$0			$0
TREAT SEEPAGE - see "Water Management" and "Water Treatment"									
TREAT SUPERNATANT									
Pump water (to pit, U/G)		m3		#N/A	$0.00	$0		$0	$0
Equipment maintenance and parts		allow		#N/A	$100,000.00	$0		$0	$0
Supply reagents		tonne		#N/A	$0.00	$0		$0	$0
					Annual treatment costs	$0			
Number of years of treatment		years							
					Total treatment costs	$0			$0
					Total	$0		$0	$0
					% of Total			0%	0%

* for construction of passive treatment system refer to "Water Management"

1 **Rock Pile Name:** **Whale Tail WRSF**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
STABILIZE SLOPES									
Flatten slopes with dozer		m3		#N/A	$0.00	$0		$0	$0
Flatten "bubble dump" areas		m3		#N/A	$0.00	$0		$0	$0
Divert runon, ditch mat'l A		m3		#N/A	$0.00	$0		$0	$0
Divert runon, ditch mat'l B		m3		#N/A	$0.00	$0		$0	$0
Toe buttress, drain mat'l		m3		#N/A	$0.00	$0		$0	$0
Toe buttress, fill mat'l A		m3		#N/A	$0.00	$0		$0	$0
Toe buttress, fill mat'l B		m3		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
COVER ROCK PILE									
Subgrade preparation - doze surface		m3		#N/A	$0.00	$0		$0	$0
Soil cover - excavate,haul,spread&compact	per Golder design with 4 m cap of NPAG waste rock (Conservative Assumption)	m3	668160	SB1L	$4.30	$2,873,088	50%	$1,436,544	$1,436,544
Rock cover - excavate,haul & spread		m3		#N/A	$0.00	$0		$0	$0
Excavate downslope drainage channel & chute		m3		#N/A	$0.00	$0		$0	$0
Rip rap drainage channel and chute		m3		#N/A	$0.00	$0		$0	$0
Vegetate		ha		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
VERY LOW PERMEABILITY COVER (in addition to above)									
Liner subgrade preparation - compact		m2		#N/A	$0.00	$0		$0	$0
Supply geomembrame		m2		#N/A	$0.00	$0		$0	$0
Install geomembrane		m2		#N/A	$0.00	$0		$0	$0
Protective cover - excavate,haul,spread&compact		m3		#N/A	$0.00	$0		$0	$0
Vegetate		ha		#N/A	$0.00	$0		$0	$0
Install infiltration/seepage instrumentation		allow		#N/A	$0.00	$0		$0	$0
CONSTRUCT DIVERSION DITCHES									
Excavate ditches -soil		m3		#N/A	$0.00	$0		$0	$0
Excavate ditches -rock		m3		#N/A	$0.00	$0		$0	$0
Rip rap in channel base		m3		#N/A	$0.00	$0		$0	$0
CONSTRUCT SEEPAGE COLLECTION POND									
Excavate seepage collection pond		m3		#N/A	$0.00	$0		$0	$0
Doze & spread excavated material		m3		#N/A	$0.00	$0		$0	$0
Vegetate spread material		ha		#N/A	$0.00	$0		$0	$0
Bedding layer		m3		#N/A	$0.00	$0		$0	$0
Supply geomembrane		m2		#N/A	$0.00	$0		$0	$0
Install geomembrane		m2		#N/A	$0.00	$0		$0	$0
Erosion protection layer		m3		#N/A	$0.00	$0		$0	$0
INSTALL GROUNDWATER COLLECTION SYSTEM									
Excavate/install sumps		m3		#N/A	$0.00	$0		$0	$0
Install pumping wells		m3		#N/A	$0.00	$0		$0	$0
Install pumps/pipelines/power supply		allow		#N/A	$0.00	$0		$0	$0
RELOCATE DUMPS									
Load, haul, dump or doze		m3		SC3L	$8.90	$0		$0	$0
Add lime		tonne		#N/A	$0.00	$0		$0	$0
Contour reclaimed area		ha		#N/A	$0.00	$0		$0	$0
Other	Waste Rock Survey (100 samples)	allow	1	#N/A	$20,000.00	$20,000	50%	$10,000	$10,000
SPECIALIZED ITEMS									
Install permanent instrumentation	Thermistors to be installed assume 5	allow	1	Ea	$50,000.00	$50,000		$0	$50,000
Install permanent instrumentation, drilling		each		#N/A	$0.00	$0		$0	$0
TREAT ROCK PILE SEEPAGE - see "Water Management"									
HEAP LEACH SEEPAGE TREATMENT - Cyanide Detox									
Cyanide destruction water treatment pumping		m3		#N/A	$0.00	$0		$0	$0
Reagents		tonnes		#N/A	$0.00	$0		$0	$0
Electrician/mechanic to maintain treatment plant		allow		#N/A	$0.00	$0		$0	$0
Equipment maintenance and parts		allow		#N/A	$0.00	$0		$0	$0
				Annual treatment costs		$0			
Number of years of treatment		years							
				Total treatment costs		$0			$0
HEAP LEACH SEEPAGE TREATMENT - ARD/ML**									
Upgrade/modify pumping system - report to WTP		allow		#N/A	$0.00	$0			$0
					Total	$2,943,088		$1,446,544	$1,496,544
					% of Total			49%	51%

* For construction of passive treatment system refer to "Water Management". ARD/ML seepage treatment becomes post-closure water treatment cost

**Heap leach ARD/ML seepage treatment becomes post-closure water treatment cost

1 **Chemicals/Soil Area Name:**

Note: The procedures, equipment and packaging for clean up and removal of chemicals or contaminated soils are highly dependent on the nature of the chemicals and their existing state of containment. Government guidelines should be consulted on an individual chemical basis. Any estimate made here should be considered very rough unless specific evaluations have been conducted.

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
HAZARDOUS MATERIALS AUDIT									
Hazardous materials audit	Not required	allow		#N/A	$25,000.00	$0	100%	$0	$0
BUILDING DECONTAMINATION & CONSOLIDATION OF HAZARDOUS MATERIALS									
Environmental technician/coordinator		mandays		#N/A	$0.00	$0		$0	$0
Decontaminate: oil, fuel		manhours	20	AE	$1,000.00	$20,000	50%	$10,000	$10,000
Decontaminate maintenance shop		mandays		#N/A	$0.00	$0		$0	$0
Decontaminate power plant		mandays	10	AE	$1,000.00	$10,000	50%	$5,000	$5,000
Decontaminate bulk fuel storage	No cost provided in Golder estimate to decontaminate the bulk fuel storage facility	mandays	5	AE	$1,000.00	$5,000	50%	$2,500	$2,500
Decontaminate ANFO plant	No cost provided in Golder estimate	mandays	1	AE	$1,000.00	$1,000	50%	$500	$500
Decontaminate offices/warehouse/accom		m2		BDAL	$25.60	$0		$0	$0
Removal of asbestos siding on buildings		m2		BDAL	$25.60	$0		$0	$0
Removal of friable asbestos on equipment		m2		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
HAZARDOUS MATERIALS REMOVAL									
Waste oils	Volume from Amarug RECLAIM Est.	litre	30000	orl	$0.43	$12,900	50%	$6,450	$6,450
Waste fuel	Volume from Amarug RECLAIM Est.	litre	160000	orl	$0.43	$68,800	50%	$34,400	$34,400
Waste batteries	includes fee and transportation	allow	1	AE	$3,000.00	$3,000	50%	$1,500	$1,500
Assay & environmental lab reagents		kg		#N/A	$25.00	$0		$0	$0
Machine shop paints, solvents etc	includes fee and transportation	litre	1	AE	$10,000.00	$10,000	50%	$5,000	$5,000
Glycol	includes fee and transportation	litre	1	AE	$20,000.00	$20,000	50%	$10,000	$10,000
Process reagents		kg		#N/A	$0.00	$0		$0	$0
Nuclear sources		allow		#N/A	$0.00	$0		$0	$0
Other hazardous materials	assumes no ANFO reamins on site includes fee and transportation	allow	1	AE	$20,000.00	$20,000	50%	$10,000	$10,000
HAZARDOUS MATERIALS									
Transportation to disposal facility	for waste fuel and oils	allow	1	ea	$10,000.00	$10,000	50%	$5,000	$5,000
Disposal fees	same cost as for Amaruq	allow	1	ea	$20,000.00	$20,000	50%	$10,000	$10,000
Other	Supervision of hazmat abatement	allow	1	ea	$40,000.00	$40,000	50%	$20,000	$20,000
CONTAMINATED SOILS									
Contam. soil investigation - Phase 1		each	1	CS1L	$7,500.00	$7,500	50%	$3,750	$3,750
Contam. soil investigation - Phase 2	More money required for INAC to complete an ESA program	allow	1	EA	$100,000.00	$100,000	50%	$50,000	$50,000
CONTAMINATED SOIL REMOVAL									
Excavate and transport to Meadowbank facility	Volume from Amarug RECLAIM Est.	m3	2000	sc4L	$9.30	$18,600	50%	$9,300	$9,300
Manage hydrocarbon remediation at Meadowbank facility	Volume from Amarug RECLAIM Est.	m3	2000	CSRL	$47.00	$94,000	50%	$47,000	$47,000
Reagents/stabilizing agent		m2		#N/A	$0.00	$0		$0	$0
Excavate and transport to offsite facility	Allowance for heavy oil impacts (10% of light fraction)	m3	200	est.	$1,000.00	$200,000	50%	$100,000	$100,000
Contour decontaminated area	Volume from Amarug RECLAIM Est.	m3	2000	dsl	$0.95	$1,900	50%	$950	$950
CONTAMINATED SOIL VERY LOW PERMEABILITY COVER									
Supply geomembrame, HDPE, ES3, GCL		m2		#N/A	$0.00	$0		$0	$0
Upper and lower bedding layers		m3		#N/A	$0.00	$0		$0	$0
Install geomembrane, HDPE, ES3, GCL		m2		#N/A	$0.00	$0		$0	$0
Erosion protection layer		m3		#N/A	$0.00	$0		$0	$0
Vegetate		m2		#N/A	$0.00	$0		$0	$0
Install infiltration/seepage instrumentation		allow		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
OTHER									
				#N/A	$0.00	$0		$0	$0
					Total	$662,700		$331,350	$331,350
					% of Total			50%	50%

1 **Building / Equip Name:** **Bldg / Equip #: 1**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
DISPOSE MOBILE EQUIPMENT									
Decontaminate and ship off-site		allow		#N/A	$0.00	$0		$0	$0
Decontaminate and dispose on-site	per ICRP	ınhours	300	mechl	$49.00	$14,700	50%	$7,350	$7,350
Other				#N/A	$0.00	$0		$0	$0
REMOVE BUILDINGS - see note below									
Accomodation Complex	per Golder	m2	4668	brs1l	$45.00	$210,060	50%	$105,030	$105,030
Process Facilities	Crusher Bldg	m2	700	brs1h	$65.00	$45,500	50%	$22,750	$22,750
Offices, Repair, Lab, Warehouse	per Golder	m2	1311.31	brs1l	$45.00	$59,009	50%	$29,504	$29,504
Storage Facilites	per Golder	m2	3699	brs1l	$45.00	$166,455	50%	$83,228	$83,228
Water and Wastewater Treatment Facilities	per Golder	m2	178.44	brs1l	$45.00	$8,030	50%	$4,015	$4,015
Power Plant	per Golder	m2	215.6	brs1h	$65.00	$14,014	50%	$7,007	$7,007
Communication Tower	per Golder	m2	100	brs1h	$65.00	$6,500	50%	$3,250	$3,250
U/G Heating Plant		m2		#N/A	$0.00	$0		$0	$0
Emulsion Plant		m2		#N/A	$0.00	$0		$0	$0
AN Storage Facility	two seacans	m2	50	brs1s	$128.00	$6,400	50%	$3,200	$3,200
Warehouse, Shops and Other	per Golder	m2	1222.1	brs1l	$45.00	$54,995	50%	$27,497	$27,497
Storage Facility at Laydown/Airstrip		m2		#N/A	$0.00	$0		$0	$0
Fuel tanks	On-Site bulk fuel tanks	m2	213.09	brs1h	$65.00	$13,851	50%	$6,925	$6,925
Fire Protection pumping station	per Golder	m	29.74	brs1h	$65.00	$1,933	50%	$967	$967
Freshwater intake	per Golder	m2	200	brs1l	$45.00	$9,000	50%	$4,500	$4,500
Reclaim pumps		m2		#N/A	$0.00	$0		$0	$0
Outfall & Diffuser		m2		#N/A	$0.00	$0		$0	$0
Airstrip lighting, navigation, electrician		mandays		#N/A	$0.00	$0		$0	$0
Airstrip lighting, navigation, mechanical		mandays		#N/A	$0.00	$0		$0	$0
Break foundation slabs	per Golder	m2	1222.1	brcs	$6.00	$7,333	50%	$3,666	$3,666
Consolidate & dump boneyard debris		allow		brs1l	$45.00	$0		$0	$0
Worker Dry	per Golder	m2	667.6	brs1l	$45.00	$30,042	50%	$15,021	$15,021
WTP & Fresh Water Pumping Station	per Golder	m2	832.09	brs1l	$45.00	$37,444	50%	$18,722	$18,722
WRSF Pond and Attenuation Pond Pumphouses	per Golder	m2	24.4	brs1l	$45.00	$1,098	50%	$549	$549
Water Intake		m2		brcs	$6.00	$0		$0	$0
Other		m2		bdcs	$12.63	$0		$0	$0
LANDFILL FOR DEMOLITION WASTE									
Place rock cover	in WRSF Cover Cost see Rock Pile	m3		#N/A	$0.00	$0		$0	$0
Place soil cover		allow		#N/A		$0		$0	$0
Vegetate		ha		#N/A	$0.00	$0		$0	$0
GRADE AND CONTOUR PADS									
Accomodation Complex	per Golder	m2	867.35	AE	$8.47	$7,346	50%	$3,673	$3,673
Process Facilities	per Golder	m2	700	AE	$8.47	$5,929	50%	$2,965	$2,965
Offices, Repair, Lab, Warehouse	per Golder	m2	1203.75	AE	$8.47	$10,196	50%	$5,098	$5,098
Storage Facilites	per Golder	m2	3699	AE	$8.47	$31,331	50%	$15,665	$15,665
Water and Wastewater Treatment Facilities	per Golder	m2	178.44	AE	$8.47	$1,511	50%	$756	$756
Power Plant	per Golder	m2	215.6	AE	$8.47	$1,826	50%	$913	$913
Communication Tower	per Golder	m2	100	AE	$8.47	$847	50%	$424	$424
U/G Heating Plant		m2		#N/A	$0.00	$0	50%	$0	$0
Emulsion Plant		m2		#N/A	$0.00	$0	50%	$0	$0
Warehouse, Shops and Other	per Golder	m2	1222.1	AE	$8.47	$10,351	50%	$5,176	$5,176
Fuel tanks on site for bulk fuel storage	Add 500 m2 for containment berm.	m2	713.09	AE	$8.47	$6,040	50%	$3,020	$3,020
Fire Protection pumping station	per Golder	m2	29.74	AE	$8.47	$252	50%	$126	$126
Worker Dry	per Golder	m2	667.6	AE	$8.47	$5,655	50%	$2,827	$2,827
WTP & Fresh Water Pumping Station	per Golder	m2	832.09	AE	$8.47	$7,048	50%	$3,524	$3,524
WRSF Pond and Attenuation Pond Pumphouses	per Golder	m2	24.4	AE	$8.47	$207	50%	$103	$103
Other	Camp pad not under building	ha	10	scfyl	$4,300.00	$43,000	50%	$21,500	$21,500
PUNCTURE LINED SUMPS									
Puncture liner and place soil cover		m3		#N/A	$0.00	$0		$0	$0
RECLAIM ROADS									
Remove culverts	per ICRP	each	7	#N/A	$1,000.00	$7,000		$0	$7,000
Remove bridges	covered under Amaruq AWR security	each		#N/A	$0.00	$0		$0	$0
Scarify roads	incremental amount of AWR security + 8 km of local roads	ha	32.43	scfyh	$6,030.00	$195,553	50%	$97,776	$97,776
Scarify airstriip	covered under Amaruq Exploration Mine security	ha		scfyh	$6,030.00	$0		$0	$0
Scarify ore piles laydown area	per ICRP	ha	156	scfyl	$4,300.00	$670,800	50%	$335,400	$335,400
Vegetate		allow		ea	$20,000.00	$0		$0	$0
Other	scarify roads	ha		scfyh	$6,030.00	$0		$0	$0
SPECIALIZED ITEMS									
Dispose of misc. debris and laydown area refuse				#N/A	$0.00	$0		$0	$0
					Total	$1,691,254		$842,127	$849,127
					% of Total			50%	50%

Note:

1 **Capital Expenditures and Short Term Water Treatment identified in 'Instructions' worksheet**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost
BREACH DYKE EMBANKMENT						
Remove fill	per Golder	m3	20000	sc3l	$8.90	$178,000
Contour water intake area		m3		#N/A	$0.00	$0
STABILIZE SEDIMENT PONDS/WATER MANAGEMENT PONDS						
Place soil cover		m3		#N/A	$0.00	$0
Doze & spread excavated material		m3		#N/A	$0.00	$0
Vegetate spread material		ha		#N/A	$0.00	$0
Rip rap in channel base		each		#N/A	$0.00	$0
Remove sediment from WRSF Pond	Relocate to landfill	allow	1	AE	$10,000.00	$10,000
REDIRECT RUNOFF/CONSTRUCT DIVERSION DITCHES						
Excavate ditches -soil	assume 100 m per Golder	m3	720	sc3l	$8.90	$6,408
Excavate ditches -rock		m3		#N/A	$0.00	$0
Stabilize side slopes		m3		#N/A	$0.00	$0
Rip rap in channel base	assume 100 m per Golder	m3	220	rr2l	$14.20	$3,124
BREACH DITCHES						
Excavate breaches		m3		#N/A	$0.00	$0
Backfill/recontour	per Golder/SNC	m3	44130	SB3l	$5.10	$225,063
Install flow dissipation		m3		#N/A	$0.00	$0
Vegetate remainder of ditch		m2		#N/A	$0.00	$0
DECOMISSION FRESH WATER SUPPLY						
Breach embankment		m		#N/A	$0.00	$0
Remove pump	Nemo Lake and Whale Tail (south Basin)	LS	1	AE	$20,000.00	$20,000
Remove pipeline	per Golder	LS	1	AE	$40,000.00	$40,000
WATER CONTROL IN RECLAMATION QUARRY						
Install pumping system		LS		#N/A	$0.00	$0
Remove pumping system		LS		#N/A	$0.00	$0
REMOVE PIPELINES						
Remove pipes		m		#N/A	$0.00	$0
Concrete plug deep pipes		m3		#N/A	$0.00	$0
Other				#N/A	$0.00	$0
GROUNDWATER COLLECTION SYSTEM						
Excavate/install sumps		m3		#N/A	$0.00	$0
Install pumping wells		m3		#N/A	$0.00	$0
Install pumps/pipelines/power supply		LS		#N/A	$0.00	$0
CONSTRUCT CONTAMINATED WATER STORAGE POND						
Excavate pond		m3		#N/A	$0.00	$0
Doze & spread excavated material		m3		#N/A	$0.00	$0
Vegetate spread material		ha		#N/A	$0.00	$0
Bedding layer		m3		#N/A	$0.00	$0
Supply geomembrane		m2		#N/A	$0.00	$0
Install geomembrane		m2		#N/A	$0.00	$0
Erosion protection layer		m3		#N/A	$0.00	$0
CONSTRUCT PASSIVE TREATMENT SYSTEM (e.g. Constructed Wetland)						
Construct access roads		km		#N/A	$0.00	$0
Install HDPE piping system from collection pond		m		#N/A	$0.00	$0
Inter-cell flow structures		allow		#N/A	$0.00	$0
Install liners		m2		#N/A	$0.00	$0
Install growth media		m3		#N/A	$0.00	$0
Wetland vegetation		ha		#N/A	$0.00	$0
CONSTRUCT WATER TREATMENT PLANT						
Build treatment plant		LS		#N/A	$0.00	$0
Build sludge containment facility		LS		#N/A	$0.00	$0
					Total	$482,595

For cost of long-term/post-closure water treatment see "WATER TREATMENT" Worksheet"

1 **Post Closure Water Treatment - Identified as long term/post-closure in 'Instructions' worksheet**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost
ADDITION OF REAGENTS TO WTP						
H2O2		kg		#N/A	$0.00	$0
lime		kg		#N/A	$0.00	$0
ferric sulphate		kg		#N/A	$0.00	$0
ferrous sulphate		kg		#N/A	$0.00	$0
flocculents		kg		#N/A	$0.00	$0
Other				#N/A	$0.00	$0
LABOUR AND SUPPLIES						
Annual fuel		litres		#N/A	$0.00	$0
Annual power		kW-h		#N/A	$0.00	$0
Electrician/mechanic to maintain treatment plant		allow		#N/A	$0.00	$0
Equipment maintenance and parts		allow		#N/A	$0.00	$0
Misc. supplies, hoses, tools		allow		#N/A	$0.00	$0
Communications		allow		#N/A	$0.00	$0
Other				#N/A	$0.00	$0
WATER MANAGEMENT						
Water Treatment (reagents, equip Op. labour)		m3	154740	AE	$0.62	$95,939
Water pumping from sumps and ponds to treatment plant		allow	1	AE	$29,367.83	$29,368
Annual Treatment Plant Servicing		manho	169	lab-ss	$120.00	$20,280
Treatment Plant Servicing Travel Allowance		visit	2	AE	$4,000.00	$8,000
Other				#N/A	$0.00	$0
WTP WATER SAMPLING AND ANALYSES						
Sampling equipment		allow		#N/A	$0.00	$0
Analyses		allow		#N/A	$0.00	$0
Shipping to laboratory		allow		#N/A	$0.00	$0
Reporting		allow		#N/A	$0.00	$0
Other				#N/A	$0.00	$0
SITE ACCESS						
Road maintenance (incl. snow removal)		allow	1	AE	$50,000.00	$50,000
Winter road tariff		allow		#N/A	$0.00	$0
Truck rental		allow		#N/A	$0.00	$0
Air support		allow		#N/A	$0.00	$0
					Annual water treatment costs	$203,587
Number of years of water treatment		years	25			
					Total	$5,089,666

1 **Interim Care and Maintenance**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost
INTERIM CARE & MAINTENANCE						
on-site caretaker	supervisor	manmonths	2	superh	91.84	$184
extra personnel	one skilled labourer	manmonths	2	lab-sl	41	$82
-electrician	assumes water treatment still required	manmonths	1	elech	95	$95
-mechanic	assumes water treatment still required	manmonths	1	mechh	72.85	$73
annual fuel		litre	10000	fcdh	1.39	$13,900
misc. supplies		allow	180	accmh	175	$31,500
pick-up truck		each		#N/A	0	$0
small dozer		allow		#N/A	0	$0
small excavator		allow		#N/A	0	$0
snow machine		allow		#N/A	0	$0
communications		allow	1	#N/A	5000	$5,000
SNP/AEMP water sampling & reporting		each	1	#N/A	25000	$25,000
geotechnical assessment		each	1	#N/A	25000	$25,000
interim water treatment				#N/A		$203,587
other		each		#N/A	0	$0
			Annual	Interim C&M Cost		$304,420
Number of years of ICM		years	5		**Total**	$1,522,101

1 **Post-Closure Monitoring & Maintenance:**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost
MONITORING & INSPECTIONS						
Annual geotechnical inspection		each	1	VIH	$7,977.79	$7,978
Surface water sampling		each	1	wsh	$10,000.00	$10,000
Groundwater sampling		each	1	wsh	$10,000.00	$10,000
Receiving.downstream water sampling		each	1	wsh	$10,000.00	$10,000
Monitoring program		each	1	AE	$100,000.00	$100,000
Survey inspection		each		#N/A	$0.00	$0
Regulatory costs*		each		#N/A	$15,500.00	$0
Site water monitoring (AEMP and SNP)		each		#N/A	$25,000.00	$0
- Active closure and flooding		each		#N/A	$0.00	$0
- Post pit flooding		each		#N/A	$0.00	$0
Air Quality Monitoring Program (AQMP)		each		#N/A	$0.00	$0
Wildlife Effects Monitoring Program (WEMP)		each		#N/A	$0.00	$0
Vegetation Monitoring		each		#N/A	$0.00	$0
Other				#N/A	$0.00	$0
COVER MAINTENANCE						
Repair erosion - infill gullies		allow		#N/A	$0.00	$0
Repair erosion - upgrade diversion ditches		allow		#N/A	$0.00	$0
Remove problem vegetation		allow		#N/A	$0.00	$0
Repair animal damage		allow		#N/A	$0.00	$0
Repair/upgrade access controls		allow		#N/A	$0.00	$0
Other				#N/A	$0.00	$0
SPILLWAY MAINTENANCE						
Repair erosion		m3		#N/A	$0.00	$0
Clear spillway		each		#N/A	$0.00	$0
CWTS MAINTENANCE						
Maintain flow, restore vegetation		allow		#N/A	$0.00	$0
POST-CLOSURE WATER TREATMENT						
water treatment - refer to water treatment tab			1	wt tab	$203,586.63	$203,587
Subtotal, Annual post-closure costs						$341,564
Discount rate for calculation of net present value of post-closure cost, %				3.00%		
Number of years of post-closure activity				25	years	
Present Value of payment stream						$5,947,712

*Regulatory costs - annual reporting, management plans, progress reports etc.

1 **Mobilization/Demobilization:**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost
MOBILIZE HEAVY EQUIPMENT						
Excavators	assume two excavators	km	300	mherh	10.25	$3,075
Dump trucks	assume four dump trucks	km	600	mherl	3.4	$2,040
Dozers	assume two dozers	km	300	mherh	10.25	$3,075
Demolition shears	assume one set of shears	km	150	mherh	10.25	$1,538
Crane	assume one crane	km	150	mherh	10.25	$1,538
Loader	assume one loader	km	300	mherh	10.25	$3,075
Compactor		km		#N/A	0	$0
Light duty vehicles	assume three trucks	km	450	mherl	3.4	$1,530
MOBILIZE MISC. EQUIPMENT						
Pump shipping		each		#N/A	0	$0
Pipe shipping		m		#N/A	0	$0
Minor tools and equipment		allow	1	#N/A	100000	$100,000
Truck tires		allow		#N/A	0	$0
Other				#N/A	0	$0
MOBILIZE CAMP						
Maintain Camp Accomodations		mandays	13786	accml	100	$1,378,600
Reclamation activities		allow		#N/A	0	$0
Long term reclamation activities (eg pump flooding)		allow		#N/A	0	$0
MOBILIZE WORKERS						
Reclamation activities - transport		manhours	678	AE	3500	$2,373,000
Reclamation activities - travel time	ten workers two hours two trips	ınhours	24408	AE	80	$1,952,640
Long term reclamation activities (eg pump flooding) - transport		each	70	AE	3500	$245,000
Long term reclamation activities (eg pump flooding) - travel time		manhours	2503	AE	80	$200,240
Monitoring Airfare		each		mwl	4500	$0
WORKER ACCOMODATIONS						
Reclamation activities		manmonths		#N/A	2225	$0
Long term reclamation activities (eg pump flooding)		manmonths		#N/A	0	$0
MOBILIZE FUEL						
Fuel freight - reclamation activities	assumes sufficient fuel is on site to complete the work	litre		fcdh	1.39	$0
Fuel freight - long term reclamation activities	assumes sufficient fuel is on site to complete the work	litre		#N/A	0	$0
Fuel freight accomodations		litre		#N/A	0	$0
WINTER ROAD						
Construction and operation		km		#N/A	0	$0
Limited winter use		km		#N/A	0	$0
Winter road tarriff		km		#N/A	0	$0
DEMOBILIZE HEAVY EQUIPMENT						
Excavators	assume two excavators	km	300	mherh	10.25	$3,075
Dump trucks	assume four dump trucks	km	600	mherl	3.4	$2,040
Dozers	assume two dozers	km	300	mherh	10.25	$3,075
Demolition shears	assume one set of shears	km	150	mherh	10.25	$1,538
Crane	assume one crane	km	150	mherh	10.25	$1,538
Loader	assume one loader	km	300	mherh	10.25	$3,075
Compactor		each		#N/A	0	$0
Light duty vehicles	assume three trucks	km	450	mherl	3.4	$1,530
Other		km		#N/A	0	$0
DEMOBILIZE CAMP						
		allow		#N/A	0	$0
DEMOBILIZE WORKERS						
crew travel time		andays		#N/A	0	$0
crew transportation	cost in mobilization of workers.	each		#N/A	0	$0
WINTER ROAD						
Construction and operation		km		wrcl	2000	$0
Limited winter use		km		#N/A	0	$0
Winter road tarriff		tonnekm		wrul	0.29	$0
					Total	**$6,281,220**

APPENDIX B

Agnico RECLAIM Worksheets

Project Name: ***Whale Tail Project***

Reclaim Model - Overview of Program

All users are urged to read the Reclaim Model User Manual - Scroll down for overview description of program.

Important! Reclaim 7.0 works better with no other excel files open.
If other excel files are open ignore run time error and proceed

Reclaim Menu

The default Excel menu bar has an additional tab labelled "Add-Ins" that provides options specific to the Reclaim Model.

Clear	This option deletes all input data, deletes any duplicated elements and blanks out the project name. It also allows for segregation into land costs vs water costs if required.
Duplicate	This option Duplicates components of the project. E.g. if there is more than one Open Pit, use duplicate to add a second Open Pit. Quantities for the new Open Pit are erased, but the Activities and Cost Codes are carried over from the original Open Pit. The new Open Pit subtotal is added to the Summary page.
Unit Costs	This option opens a window of unit costs to provide easy reference. NOTE: the unit cost table has a filter in the 'UNITS' column. You can select to only see a particular unit (eg km) or multiple units (km and m3) or all units.
Print All	This option prints the Summary Worksheet, Unit Cost Worksheet, and the individual component worksheets having non-zero balances. Individual worksheets can be printed directly using standard printing methods, such as Ctl - P.
Quit	Select Quit to exit the program
Help	Redirects user to Instructions worksheet.

WorkSheets

Summary	This worksheet contains a cumulative summary of costs for each component of the project. Associated costs such as engineering and project management are added as a percentage of the component costs.
Components	Costs are derived for individual closure and reclamation activities by multiplying a "quantity" of activity by a "unit cost". An activity can be edited, added, or deleted from worksheet. However, care should be taken not to modify cells that are defined and used elsewhere in the program. ***Do not change the content or column width of the first column of each component worksheet.***
Unit Costs	This worksheet contains a look up table with costs for typical work associated with each closure and reclamation activity

Limitations

The Reclaim Program will NOT work if the worksheets are changed such that the following requirements are not met. Please review the following prior to modifiying worksheets.

WorkSheet Names	*The names of the worksheets must not be changed.*
Defined Names	Certain cells have defined names, which must not be changed. Where the cell is named, the name will appear in the "Name Box" to the left of the formula bar.
First line of data	The first line of data for any component worksheet starts on line 4.***Do not change the first line of a component worksheet, ie the component name.***
Cell A1	Cell A1 on the component sheet MUST always contain the count of that component for the duplicate function to operate.***DO NOT CHANGE.***
Adding Lines	You can add lines to components and the unit cost table, as long as they are not the last lines. The last line might fall outside the named ranges. You can check the size of the named range by selecting the name from the drop down box at the top left of the sheet. Usually this box has a cell reference, or a name.
Printing	A component will only be printed if its sub-total is greater than zero. In addition, a component and the summary sheet cannot be printed if there is an error. Printing has been set to print 1 page per component.

Conditions of Use

The Reclamation Cost Estimating Model was prepared to serve as a guide for Government Agencies, mining companies, and others to estimate the cost of mine reclamation. This model is not intended to replace reclamation planning or to be used to determine the activities required to reclaim a site or to dictate how much should be spent on reclamation.

Reclaim was prepared by Brodie Consulting Ltd. on behalf of AANDC. AANDC and Brodie Consulting Ltd. are not responsible for tl completeness or accuracy of any reclamation estimate made using this model. The user agrees to check and take responsibility for all aspects of any cost estimate made using this model.

The following table provides guidance as to whether water management and treatment is considered short term or long term. Short term closure activities may be costed within a component (eg 'Open Pit' or 'Rock Pile') or 'Water Management'. Long term or post-closure water treatment is costed in 'Water Treatment'.

		Short Term/ Capital Ex.	Long term/ NPV
Open Pit	flood pit - install/operate pumping system	x	
	construct diversion ditches	x	
	treat 1st filling	x	
	install pump/decant system	x	
	passive/biological treatment	x	
	overflow treatment		x
Rock Pile/Heap Leach Facility	construct diversion ditches	x	
	install groundwater collection system	x	
	install toe seepage collection system	x	
	collect and treat groundwater		x
	collect and treat seepage (ARD/ML)		x
	install passive treatment system	x	
	operate and maintain passive treatment system		x
	operate pump and detoxify heap leach pile (cyanide destruction)	x	
Tailings Facility	construct diversion ditches	x	
	pump supernatant (to pit, U/G)	x	
	treat supernatant	x	
	install toe seepage collection system	x	
	collect and treat seepage (ARD/ML)		x
	install passive treatment system	x	
	operate and maintain passive treatment system		x
U/G Mine	accelerate flooding	x	
	install seepage collection system	x	
	install dewatering/pumping system	x	
	operate seepage/dewatering system (ARD/ML)		x
Water Management	refill lakes		
	redirect creeks/streams	x	
	stabilize water management ponds	x	
	stabilize/close sediment ponds	x	
	fresh water supply - breach embankment	x	
	fresh water supply - remove piping system	x	
	construct water treatment plant	x	
	construct sludge pond	x	
	water control in reclamation quarry	x	
	operate/maintain water treatment plant		x

SUMMARY OF COSTS

CAPITAL COSTS	COMPONENT NAME	COST	LAND LIABILITY	WATER LIABILITY
OPEN PIT	Whale Tail Pit	$4,050,038	$0	$4,050,038
UNDERGROUND MINE		$0	$0	$0
TAILINGS FACILITY		$0	$0	$0
ROCK PILE		$2,923,088	$0	$2,923,088
BUILDINGS AND EQUIPMENT		$920,225	$0	$920,225
CHEMICALS AND CONTAMINATED SOIL MANAGEME		$168,853	$0	$168,853
SURFACE AND GROUNDWATER MANAGEMENT		$482,595	-	$482,595
INTERIM CARE AND MAINTENANCE		$0	-	$0
SUBTOTAL: Capital Costs		**$8,544,799**	**$0**	**$8,544,799**
PERCENT OF SUBTOTAL			**0%**	**100%**

INDIRECT COSTS		COST	LAND LIABILITY	WATER LIABILITY
MOBILIZATION/DEMOBILIZATION		$5,420,771	$0	$5,420,771
POST-CLOSURE MONITORING AND MAINTENANCE		$3,131,499	$0	$3,131,499
ENGINEERING	5%	$427,240	$0	$427,240
PROJECT MANAGEMENT	5%	$427,240	$0	$427,240
HEALTH AND SAFETY PLANS/MONITORING & QA/QC	1%	$85,448	$0	$85,448
BONDING/INSURANCE	1%	$85,448	$0	$85,448
CONTINGENCY	20%	$1,708,960	$0	$1,708,960
MARKET PRICE FACTOR ADJUSTMENT	0%	$0	$0	$0
SUBTOTAL: Indirect Costs		**$11,286,606**	**$0**	**$11,286,606**

TOTAL COSTS	**$19,831,405**	**$0**	**$19,831,405**

Note: Existing underground workings from explorations are covered under Type B land and water permits

1 **Open Pit Name:** **Whale Tail Pit** **Pit # 1**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	% Cost Land	Land Cost	Water Cost
CONTROL ACCESS								
Fence,		m		#N/A	$0.00	$0	$0	$0
Signs	Assumed	each	15	SH	$37.08	$556	$0	$556
Berm at crest	In place from perimeter road	m3		#N/A	$0.00	$0	$0	$0
Block roads	Assumed: 3 entrances, each block 5m base, 1 m crest width, 1 m high, 2H:1V slopes and 30m long	m3	270	RB1H	$17.05	$4,604	$0	$4,604
Other				#N/A	$0.00	$0	$0	$0
STABILITY STUDY								
Conduct stability and setback study		allow	1	EA	$20,000.00	$20,000	$0	$20,000
STABILIZE SLOPES								
Off-load crest, soil A		m3		#N/A	$0.00	$0	$0	$0
Off-load crest, soil B		m3		#N/A	$0.00	$0	$0	$0
Doze/trim overburden at crest		m3		#N/A	$0.00	$0	$0	$0
Drill & blast pit crest		m3		#N/A	$0.00	$0	$0	$0
Buttress slope		m3		#N/A	$0.00	$0	$0	$0
Other				#N/A	$0.00	$0	$0	$0
COVER/CONTOUR SLOPES								
Place fill, soil A		m3		#N/A	$0.00	$0	$0	$0
Place fill, soil B		m3		#N/A	$0.00	$0	$0	$0
Rip rap		m3		#N/A	$0.00	$0	$0	$0
Vegetate slopes		ha		#N/A	$0.00	$0	$0	$0
Vegetate pit floor		ha		#N/A	$0.00	$0	$0	$0
Other				#N/A	$0.00	$0	$0	$0
CONSTRUCT DIVERSION DITCHES								
Excavate ditches -soil		m3		#N/A	$0.00	$0	$0	$0
Excavate ditches -rock		m3		#N/A	$0.00	$0	$0	$0
Rip rap in channel base		m3		#N/A	$0.00	$0	$0	$0
CONSTRUCT SPILLWAY								
Excavate channel	Mammoth channel culvert in operations Breach Mammoth Dike in Surface Water Management cost	m3		#N/A	$0.00	$0	$0	$0
Concrete		m3		#N/A	$0.00	$0	$0	$0
Rip rap		m3		#N/A	$0.00	$0	$0	$0
Other				#N/A	$0.00	$0	$0	$0
RECLAIM QUARRIES								
Contour slopes		m3		#N/A	$0.00	$0	$0	$0
Place overburden		m3		#N/A	$0.00	$0	$0	$0
Vegetate		m3		#N/A	$0.00	$0	$0	$0
FLOOD PIT-Captital								
Remove stationary equipment (sump pumps) and dewatering pipeline		Allow	1	AE	$10,000.00	$10,000	$0	$10,000
Remove dewatering pipeline		m		#N/A	$0.00	$0	$0	$0
Remove power lines		each		#N/A	$0.00	$0	$0	$0
Construct diversion ditches		m3		#N/A	$0.00	$0	$0	$0
-Ditch, mat'l A		m3		#N/A	$0.00	$0	$0	$0
-Ditch, mat'l B		m3		#N/A	$0.00	$0	$0	$0
Construct embankment/dam		m3		#N/A	$0.00	$0	$0	$0
Supply/install pump station and piping system (including pump:		Allow	1	AE	$500,000.00	$500,000	$0	$500,000
Supply/install piping system		m		#N/A	$0.00	$0	$0	$0
Remove pump post-closure		each		#N/A	$0.00	$0	$0	$0
Remove pipeline post-closure		m		#N/A	$0.00	$0	$0	$0
FLOOD PIT-Annual Cost								
Operate pumps to flood pit		each	1	AE	$439,359.8	$439,360	$0	$439,360
Maintain pump/pipeline		allow		#N/A	$0.00	$0	$0	$0
Labour:fuel management, comissioning/decom		$/h		#N/A	$0.00	$0	$0	$0
Chemical addition, _____ kg/m3 of water		tonne		#N/A	$0.00	$0	$0	$0
Chemicals, purchase and shipping		tonne		#N/A	$0.00	$0	$0	$0
Passive/biological additives		$/ha		#N/A	$0.00	$0	$0	$0
Passive additives purchase and shipping		tonne		#N/A	$0.00	$0	$0	$0
Other- Pump operation cost		m3		#N/A	$0.00	$0	$0	$0
					Annual pumping costs	$439,360		
Number of years of pump flooding		years	8					
					Total pumping costs	$3,514,878	$0	$3,514,878
					Total	$4,050,038	$0	$4,050,038
					% of Total		0%	100%

Note: No water purchase is needed for back-flooding

1 **Rock Pile Name:**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	% Cost Land	Land Cost	Water Cost
STABILIZE SLOPES								
Flatten slopes with dozer		m3		#N/A	$0.00	$0	$0	$0
Flatten "bubble dump" areas		m3		#N/A	$0.00	$0	$0	$0
Divert runon, ditch mat'l A		m3		#N/A	$0.00	$0	$0	$0
Divert runon, ditch mat'l B		m3		#N/A	$0.00	$0	$0	$0
Toe buttress, drain mat'l		m3		#N/A	$0.00	$0	$0	$0
Toe buttress, fill mat'l A		m3		#N/A	$0.00	$0	$0	$0
Toe buttress, fill mat'l B		m3		#N/A	$0.00	$0	$0	$0
COVER ROCK PILE								
Subgrade preparation - doze surface		m3		#N/A	$0.00	$0	$0	$0
Soil cover - excavate,haul,spread&compact		m3		#N/A	$0.00	$0	$0	$0
non-PAG waste rock cover (4 m thick)	Cover will be 2 to 4 m thick - 4 m was used . Assumes that 80% will be placed during operations and therefore assumed as capital cost as the non-PAG will be placed with the PAG in the facility	m3	668160	SB1L	$4.30	$2,873,088	$0	$2,873,088
Excavate downslope drainage channel & chute		m3		#N/A	$0.00	$0	$0	$0
Rip rap drainage channel and chute		m3		#N/A	$0.00	$0	$0	$0
Vegetate		ha		#N/A	$0.00	$0	$0	$0
Other				#N/A	$0.00	$0	$0	$0
VERY LOW PERMEABILITY COVER (in addition to above)								
Liner subgrade preparation - compact		m2		#N/A	$0.00	$0	$0	$0
Supply geomembrame		m2		#N/A	$0.00	$0	$0	$0
Install geomembrane		m2		#N/A	$0.00	$0	$0	$0
Protective cover - excavate,haul,spread&compact		m3		#N/A	$0.00	$0	$0	$0
Vegetate		ha		#N/A	$0.00	$0	$0	$0
Install infiltration/seepage instrumentation		allow		#N/A	$0.00	$0	$0	$0
CONSTRUCT DIVERSION DITCHES								
Excavate ditches -soil		m3		#N/A	$0.00	$0	$0	$0
Excavate ditches -rock		m3		#N/A	$0.00	$0	$0	$0
Rip rap in channel base		m3		#N/A	$0.00	$0	$0	$0
CONSTRUCT SEEPAGE COLLECTION POND								
Excavate seepage collection pond		m3		#N/A	$0.00	$0	$0	$0
Doze & spread excavated material		m3		#N/A	$0.00	$0	$0	$0
Vegetate spread material		ha		#N/A	$0.00	$0	$0	$0
Bedding layer		m3		#N/A	$0.00	$0	$0	$0
Supply geomembrane		m2		#N/A	$0.00	$0	$0	$0
Install geomembrane		m2		#N/A	$0.00	$0	$0	$0
Erosion protection layer		m3		#N/A	$0.00	$0	$0	$0
INSTALL GROUNDWATER COLLECTION SYSTEM								
Excavate/install sumps		m3		#N/A	$0.00	$0	$0	$0
Install pumping wells		m3		#N/A	$0.00	$0	$0	$0
Install pumps/pipelines/power supply		allow		#N/A	$0.00	$0	$0	$0
RELOCATE DUMPS								
Load, haul, dump or doze		m3		#N/A	$0.00	$0	$0	$0
Add lime		tonne		#N/A	$0.00	$0	$0	$0
Contour reclaimed area		ha		#N/A	$0.00	$0	$0	$0
Other				#N/A	$0.00	$0	$0	$0
SPECIALIZED ITEMS								
Install permanent instrumentation	thermistors	Allow	1	EA	$50,000.00	$50,000	$0	$50,000
Install permanent instrumentation, drilling		each		#N/A	$0.00	$0	$0	$0
TREAT ROCK PILE SEEPAGE - "It is included on Water Treatment Sheet"								
HEAP LEACH SEEPAGE TREATMENT - Cyanide Detox								
Cyanide destruction water treatment pumping		m3		#N/A	$0.00	$0	$0	$0
Reagents		tonnes		#N/A	$0.00	$0	$0	$0
Electrician/mechanic to maintain treatment plant		allow		#N/A	$0.00	$0	$0	$0
Equipment maintenance and parts		allow		#N/A	$0.00	$0	$0	$0
					Annual treatment costs	$0		
Number of years of treatment		years						
					Total treatment costs	$0		$0
HEAP LEACH SEEPAGE TREATMENT - ARD/ML**								
Upgrade/modify pumping system - report to WTP		allow		#N/A	$0.00	$0		$0
					Total	$2,923,088	$0	$2,923,088
					% of Total		0%	100%

* For construction of passive treatment system refer to "Water Management". ARD/ML seepage treatment becomes post-closure water treatment cost

**Heap leach ARD/ML seepage treatment becomes post-closure water treatment cost

1 **Building / Equip Name:** **Bldg / Equip #:**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
DISPOSE MOBILE EQUIPMENT									
Decontaminate and ship off-site		allow		#N/A	$0.00	$0		$0	$0
Decontaminate and dispose on-site		manhours	300	MECHL	$49.00	$14,700		$0	$14,700
Other				#N/A	$0.00	$0		$0	$0
REMOVE BUILDINGS - see note below									
Accomodation Complex - Main Camp		m2	4668.0	BRS1L	$45.00	$210,060		$0	$210,060
Process Facilities - Crushers		m2	700	BRS1H	$65.00	$45,500		$0	$45,500
Offices, kitchen, ERT		m2	1311.31	BRS1L	$45.00	$59,009		$0	$59,009
Storage Facilites (Main Warehouse)		m2	3699	BRS1L	$45.00	$166,455		$0	$166,455
Water and Wastewater Treatment Facilities		m2	178.44	BRS1L	$45.00	$8,030		$0	$8,030
Power Plant		m2	215.6	BRS1H	$65.00	$14,014		$0	$14,014
Communication Tower		m2	100	BRS1H	$65.00	$6,500		$0	$6,500
U/G Heating Plant		m2		#N/A	$0.00	$0		$0	$0
Emulsion Plant		m2		#N/A	$0.00	$0		$0	$0
AN Storage Facility		m2		#N/A	$0.00	$0		$0	$0
Shops and Other		m2	1222.1	BRS1L	$45.00	$54,996		$0	$54,996
Storage Facility at Laydown/Airstrip		m2		#N/A	$0.00	$0		$0	$0
Fuel tanks on site / Bulk fuel tank		m2	213.09	BRS1H	$65.00	$13,851		$0	$13,851
Fuel Tanks		m2		#N/A	$0.00	$0		$0	$0
Fire protection- Pumping station		m2	29.74	BRS1H	$65.00	$1,933		$0	$1,933
Freshwater intake		m2	200	BRS1L	$45.00	$9,000		$0	$9,000
Reclaim pumps		m2		#N/A	$0.00	$0		$0	$0
Outfall & Diffuser		allow	1	EA	$20,000.00	$20,000		$0	$20,000
Airstrip lighting, navigation, electrician		mandays		#N/A	$0.00	$0		$0	$0
Airstrip lighting, navigation, mechanical		mandays		#N/A	$0.00	$0		$0	$0
Break foundation slabs	total of all buildings	m2	1222.1	BRCS	$6.00	$7,333		$0	$7,333
Consolidate & dump boneyard debris		m3		#N/A	$0.00	$0		$0	$0
Ramp portal		m2		#N/A	$0.00	$0		$0	$0
Workers Dry		m2	667.6	BRS1L	$45.00	$30,042		$0	$30,042
WTP & Fresh water pumping station		m2	832.09	BRS1L	$45.00	$37,444		$0	$37,444
WRSF Pond, Attenuation Pond pumphouses		m2	24.4	BRS1L	$45.00	$1,098		$0	$1,098
Water Intake		m2		#N/A	$0.00	$0		$0	$0
LANDFILL FOR DEMOLITION WASTE									
Place rock cover	in WRSF cover cost	m3		#N/A	$0.00	$0		$0	$0
Place soil cover		m3		#N/A	$0.00	$0		$0	$0
Vegetate		ha		#N/A	$0.00	$0		$0	$0
GRADE AND CONTOUR PADS									
Accomodation Complex - Main Camp		m3	867.35	AE	$8.47	$7,346		$0	$7,346
Process Facilities - Crushers		m3	700	AE	$8.47	$5,929		$0	$5,929
Offices, kitchen, ERT		m3	1203.75	AE	$8.47	$10,196		$0	$10,196
Storage Facilites (Main Warehouse)		m3	3699	AE	$8.47	$31,331		$0	$31,331
Water and Wastewater Treatment Facilities		m3	178.44	AE	$8.47	$1,511		$0	$1,511
Power Plant		m3	215.6	AE	$8.47	$1,826		$0	$1,826
Communication Tower		m2	100	AE	$8.47	$847		$0	$847
U/G Heating Plant		m3		#N/A	$0.00	$0		$0	$0
Emulsion Plant		m3		#N/A	$0.00	$0		$0	$0
Shops and Other		m3	1222.1	AE	$8.47	$10,352		$0	$10,352
Fuel tanks on site / Bulk fuel tank		m3	213.09	AE	$8.47	$1,805		$0	$1,805
Fire protection- Pumping station		m3	29.74	AE	$8.47	$252		$0	$252
Ramp portal	in Type B permit	m3		#N/A	$0.00	$0		$0	$0
Workers Dry		m3	667.6	AE	$8.47	$5,655		$0	$5,655
Place rock cover		m3		#N/A	$0.00	$0		$0	$0
Vegetate		ha		#N/A	$0.00	$0		$0	$0
WTP & Fresh water pumping station		m3	832.09	AE	$8.47	$7,048		$0	$7,048
WRSF Pond, Attenuation Pond pumphouses		m3	24.4	AE	$8.47	$207		$0	$207
PUNCTURE LINED SUMPS									
Puncture liner and place soil cover		m3		#N/A	$0.00	$0		$0	$0
RECLAIM ROADS									
Remove culverts		each		#N/A	$0.00	$0		$0	$0
Remove bridges		each		#N/A	$0.00	$0		$0	$0
Scarify and install water breaks	Account only remain width from exploration road (9.5-6.5)	ha	19.23	SCFYH	$6,030.00	$115,957		$0	$115,957
Scarify airstriip		ha		#N/A	$0.00	$0		$0	$0
Scarify laydown and ore stockpile areas		allow	1	EA	$20,000.00	$20,000		$0	$20,000
Vegetate		ha		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
SPECIALIZED ITEMS									
Dispose of misc. debris and laydown area	refuse			#N/A	$0.00	$0		$0	$0
					Total	$920,225		$0	$920,225
					% of Total			0%	100%

Note
Costs are based on file "6108 Building Listing_RA.xlsx" dated 3/14/2016, total area used for remove buildings section, and ground area for grade and contour pads

1 **Chemicals/Soil Area Name:**

Note: The procedures, equipment and packaging for clean up and removal of chemicals or contaminated soils are highly dependent on the nature of the chemicals and their existing state of containment. Government guidelines should be consulted on an individual chemical basis. Any estimate made here should be considered very rough unless specific evaluations have been conducted.

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
HAZARDOUS MATERIALS AUDIT									
Hazardous materials audit		mandays		#N/A	$0.00	$0		$0	$0
Phase 1 audit		each	1	CS1L	$7,500.00	$7,500		$0	$7,500
Phase 2 audit		each	1	CS2L	$50,000.00	$50,000		$0	$50,000
BUILDING DECONTAMINATION & CONSOLIDATION OF HAZARDOUS MATERIALS									
Environmental technician/coordinator		mandays		#N/A	$0.00	$0		$0	$0
Decontaminate: oil, fuel		mandays	20	AE	$1,000.00	$20,000		$0	$20,000
Decontaminate maintenance shop		mandays		#N/A	$0.00	$0		$0	$0
Decontaminate power plant		mandays	10	AE	$1,000.00	$10,000		$0	$10,000
Decontaminate bulk fuel storage		mandays		#N/A	$0.00	$0		$0	$0
Decontaminate ANFO plant		mandays		#N/A	$0.00	$0		$0	$0
Decontaminate offices/warehouse/accom		mandays		#N/A	$0.00	$0		$0	$0
Removal of asbestos siding on buildings		m2		#N/A	$0.00	$0		$0	$0
Removal of friable asbestos on equipment		m2		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
HAZARDOUS MATERIALS REMOVAL									
Waste oils	Burn on site	litre		#N/A	$0.00	$0		$0	$0
Waste fuel	Burn on site	litre		#N/A	$0.00	$0		$0	$0
Waste batteries	includes fee and transportation	allow	1	AE	$3,000.00	$3,000		$0	$3,000
Assay & environmental lab reagents		kg		#N/A	$0.00	$0		$0	$0
Machine shop paints, solvents etc	includes fee and transportation	allow	1	AE	$10,000.00	$10,000		$0	$10,000
Glycol	includes fee and transportation	allow	1	AE	$20,000.00	$20,000		$0	$20,000
Process reagents		kg		#N/A	$0.00	$0		$0	$0
Nuclear sources		allow		#N/A	$0.00	$0		$0	$0
Other hazardous materials	includes fee and transportation	allow	1	AE	$20,000.00	$20,000		$0	$20,000
HAZARDOUS MATERIALS									
Transportation to disposal facility		allow		#N/A	$0.00	$0		$0	$0
Disposal fees		allow		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
CONTAMINATED SOILS									
Contam. soil investigation - Phase 1		each		#N/A	$0.00	$0		$0	$0
Contam. soil investigation - Phase 2	in Audit above	each		#N/A	$0.00	$0		$0	$0
CONTAMINATED SOIL REMOVAL									
Excavate and transport to Meadowbank landfarm (Site fuel, power plant,Mine maitenance shop)		m3	495	SC4L	$9.30	$4,606		$0	$4,606
Manage hydrocarbon remediation at Meadowbank landfarm		m3	495	CSRL	$47.00	$23,277		$0	$23,277
Reagents/stabilizing agent		m2		#N/A	$0.00	$0		$0	$0
Excavate and transport to offsite facility		m3		#N/A	$0.00	$0		$0	$0
Contour decontaminated area		m3	495	DSL	$0.95	$470		$0	$470
CONTAMINATED SOIL VERY LOW PERMEABILITY COVER									
Supply geomembrame, HDPE, ES3, GCL		m2		#N/A	$0.00	$0		$0	$0
Upper and lower bedding layers		m3		#N/A	$0.00	$0		$0	$0
Install geomembrane, HDPE, ES3, GCL		m2		#N/A	$0.00	$0		$0	$0
Erosion protection layer		m3		#N/A	$0.00	$0		$0	$0
Vegetate		m2		#N/A	$0.00	$0		$0	$0
Install infiltration/seepage instrumentation		allow		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
OTHER									
				#N/A	$0.00	$0		$0	$0
					Total	$168,853		$0	$168,853
					% of Total			0%	100%

1 **Capital Expenditures and Short Term Water Treatment identified in 'Instructions' worksheet**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost
BREACH DYKE EMBANKMENT						
Remove (excavate) fill	Assumed a total of 8 breaches: 3 on Whale Tail Dyke, 2 on Northeast Dyke,1 on Mammoth Dyke, 1 on WRSF Dyke and 1 on Saddle Dam. Total dyke material will be removed and places on the WRSF	m3	20000	SC3L	$8.90	$178,000
Contour water intake area		m3		#N/A	$0.00	$0
STABILIZE SEDIMENT PONDS/WATER MANAGEMENT PONDS						
Place soil cover		m3		#N/A	$0.00	$0
Doze & spread excavated material		m3		#N/A	$0.00	$0
Vegetate spread material		ha		#N/A	$0.00	$0
Rip rap in channel base		each		#N/A	$0.00	$0
Remove sediments from WRSF pond and place them in the landfill	assumed	allow	1	AE	$10,000.00	$10,000
REDIRECT RUNOFF/CONSTRUCT DIVERSION DITCHES						
Excavate ditches -soil	assumed 100 m	m3	720	SC3L	$8.90	$6,408
Excavate ditches -rock		m3		#N/A	$0.00	$0
Stabilize side slopes		m3		#N/A	$0.00	$0
Rip rap in channel base	assumed 100 m	m3	220	RR2L	$14.20	$3,124
BREACH DITCHES						
Excavate breaches		m3		#N/A	$0.00	$0
Backfill/recontour	Assumed - total excavacation volume for channels construction = 147,100 m3 from SNC Lavalin report. 30% of this volume was asssumed for recontour of channels to restore drainage path (remaining assumed that will be filled with sediments with time)	m3	44130	SB3L	$5.10	$225,063
Install flow dissipation		m3		#N/A	$0.00	$0
Vegetate remainder of ditch		m2		#N/A	$0.00	$0
DECOMMISSION FRESH WATER SUPPLY						
Breach embankment		m		#N/A	$0.00	$0
Remove pump	Nemo Lake and Whale Tail (South Basin)	LS	1	EA	$20,000.00	$20,000
Remove pipeline	to Nemo Lake and Whale Tail (South Basin)	LS	1	EA	$40,000.00	$40,000
WATER CONTROL IN RECLAMATION QUARRY						
Install pumping system		LS		#N/A	$0.00	$0
Remove pumping system		LS		#N/A	$0.00	$0
REMOVE PIPELINES						
Remove pipes		m		#N/A	$0.00	$0
Concrete plug deep pipes		m3		#N/A	$0.00	$0
Other				#N/A	$0.00	$0
GROUNDWATER COLLECTION SYSTEM						
Excavate/install sumps		m3		#N/A	$0.00	$0
Install pumping wells		m3		#N/A	$0.00	$0
Install pumps/pipelines/power supply		LS		#N/A	$0.00	$0
CONSTRUCT CONTAMINATED WATER STORAGE POND						
Excavate pond		m3		#N/A	$0.00	$0
Doze & spread excavated material		m3		#N/A	$0.00	$0
Vegetate spread material		ha		#N/A	$0.00	$0
Bedding layer		m3		#N/A	$0.00	$0
Supply geomembrane		m2		#N/A	$0.00	$0
Install geomembrane		m2		#N/A	$0.00	$0
Erosion protection layer		m3		#N/A	$0.00	$0
CONSTRUCT PASSIVE TREATMENT SYSTEM (e.g. Constructed Wetland)						
Construct access roads		km		#N/A	$0.00	$0
Install HDPE piping system from collection pond		m		#N/A	$0.00	$0
Inter-cell flow structures		allow		#N/A	$0.00	$0
Install liners		m2		#N/A	$0.00	$0
Install growth media		m3		#N/A	$0.00	$0
Wetland vegetation		ha		#N/A	$0.00	$0
CONSTRUCT WATER TREATMENT PLANT						
Build treatment plant		LS		#N/A	$0.00	$0
Build sludge containment facility		LS		#N/A	$0.00	$0
					Total	$482,595

For cost of long-term/post-closure water treatment see "WATER TREATMENT" Worksheet"

1 **Post Closure Water Treatment - Identified as long term/post-closure in 'Instructions' worksheet**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost
ADDITION OF REAGENTS TO WTP						
H2O2		kg		#N/A	$0.00	$0
lime		kg		#N/A	$0.00	$0
ferric sulphate		kg		#N/A	$0.00	$0
ferrous sulphate		kg		#N/A	$0.00	$0
flocculents		kg		#N/A	$0.00	$0
Other		kg		#N/A	$0.00	$0
LABOUR AND SUPPLIES						
Annual fuel		litres		#N/A	$0.00	$0
Annual power		kW-h		#N/A	$0.00	$0
Electrician/mechanic to maintain treatment plant		allow		#N/A	$0.00	$0
Equipment maintenance and parts		allow		#N/A	$0.00	$0
Misc. supplies, hoses, tools		allow		#N/A	$0.00	$0
Communications		allow		#N/A	$0.00	$0
Other				#N/A	$0.00	$0
WATER MANAGEMENT						
Water Treatment (reagents, equip. Op., labour)		m3	154,740	AE	$0.62	$95,939
Water pumping from sumps and ponds to treatment plant		allow	1	AE	$29,367.83	$29,368
Annual Treatment Plant Servicing (2 Consultants x 7days/year)		manhours	168	LAB-SS	$120.00	$20,160
Treatment Plant Servicing Travel Allowance (Round Trip Flight/person)		visits	2	AE	2500.00	$5,000
WTP WATER SAMPLING AND ANALYSES						
Sampling equipment		allow		#N/A	$0.00	$0
Analyses		allow		#N/A	$0.00	$0
Shipping to laboratory		allow		#N/A	$0.00	$0
Reporting		allow		#N/A	$0.00	$0
Other				#N/A	$0.00	$0
SITE ACCESS						
Road maintenance (incl. snow removal)		allow	1	AE	$50,000.00	$50,000
Winter road tariff		allow		#N/A	$0.00	$0
Truck rental		allow		#N/A	$0.00	$0
Air support		allow		#N/A	$0.00	$0
					Annual water treatment costs	$200,467
Number of years of water treatment		years	11			
					Total	$2,205,133

1 **Interim Care and Maintenance**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost
INTERIM CARE & MAINTENANCE						
on-site caretaker		manmonths		#N/A	0	$0
extra personnel		manmonths		#N/A	0	$0
-electrician		manmonths		#N/A	0	$0
-mechanic		manmonths		#N/A	0	$0
annual fuel		litre		#N/A	0	$0
misc. supplies		allow		#N/A	0	$0
pick-up truck		each		#N/A	0	$0
small dozer		allow		#N/A	0	$0
small excavator		allow		#N/A	0	$0
snow machine		allow		#N/A	0	$0
communications		allow		#N/A	0	$0
SNP/AEMP water sampling & reporting		each		#N/A	0	$0
geotechnical assessment		each		#N/A	0	$0
interim water treatment		each		#N/A	0	$0
other		each		#N/A	0	$0
			Annual	Interim C&M Cost		$0
Number of years of ICM		years			**Total**	$0

1 Post-Closure Monitoring & Maintenance:

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost
MONITORING & INSPECTIONS						
Annual geotechnical inspection		each	1	VIH	$7,977.79	$7,978
Surface water sampling		each	1	WSH	$10,000.00	$10,000
Ground water sampling		each	1	WSH	$10,000.00	$10,000
Receiving/downstream water sampling		each	1	WSH	$10,000.00	$10,000
Monitoring program	Assumed	ech	1	AE	$100,000.00	$100,000
Survey inspection		each		#N/A	$0.00	$0
Regulatory costs*		each		#N/A	$0.00	$0
Site water monitoring (AEMP and SNP)		each		#N/A	$0.00	$0
- Active closure and flooding		each		#N/A	$0.00	$0
- Post pit flooding		each		#N/A	$0.00	$0
Air Quality Monitoring Program (AQMP)		each		#N/A	$0.00	$0
Wildlife Effects Monitoring Program (WEMP)		each		#N/A	$0.00	$0
Vegetation Monitoring		each		#N/A	$0.00	$0
Other				#N/A	$0.00	$0
COVER MAINTENANCE						
Repair erosion - infill gullies		allow		#N/A	$0.00	$0
Repair erosion - upgrade diversion ditches		allow		#N/A	$0.00	$0
Remove problem vegetation		allow		#N/A	$0.00	$0
Repair animal damage		allow		#N/A	$0.00	$0
Repair/upgrade access controls		allow		#N/A	$0.00	$0
Other				#N/A	$0.00	$0
SPILLWAY MAINTENANCE						
Repair erosion		m3		#N/A	$0.00	$0
Clear spillway		each		#N/A	$0.00	$0
CWTS MAINTENANCE						
Maintain flow, restore vegetation		allow		#N/A	$0.00	$0
WATER TREATMENT						
Water treatment - refer to water treatment tab		each	1	WT tab	$200,466.63	$200,467
POST-CLOSURE WATER TREATMENT						
Subtotal, Annual post-closure costs						$338,444
Discount rate for calculation of net present value of post-closure cost, %				3.00%		
Number of years of post-closure activity				11	years	
Present Value of payment stream						$3,131,499

*Regulatory costs - annual reporting, management plans, progress reports etc

1 **Mobilization/Demobilization:**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost
MOBILIZE HEAVY EQUIPMENT						
Excavators		each		#N/A	0	$0
Dump trucks		each		#N/A	0	$0
Dozers		each		#N/A	0	$0
Demolition shears	use of hoe ram and cutting torches	each				
				#N/A	0	$0
Crane		each		#N/A	0	$0
Loader		each		#N/A	0	$0
Compactor		each		#N/A	0	$0
Light duty vehicles		each		#N/A	0	$0
MOBILIZE MISC. EQUIPMENT						
Pump shipping		each		#N/A	0	$0
Pipe shipping		m		#N/A	0	$0
Minor tools and equipment		allow		#N/A	0	$0
Truck tires		allow		#N/A	0	$0
Other				#N/A	0	$0
MOBILIZE CAMP						
Maintain Camp Accomodations		mandays	13748	ACCML	100	$1,374,833
Reclamation activities		allow		#N/A	0	$0
Long term reclamation activities (eg pump flooding)		allow		#N/A	0	$0
MOBILIZE WORKERS						
Reclamation activities - travel time		manhours	21066	AE	80	$1,685,257
Crew transportation (ticket and travel accomodation)		each	585	AE	3300	$1,931,024
Reclamation activities - transport		each		#N/A	0	$0
Long term reclamation activities (eg pump flooding) - travel time		manhours	2503	#N/A	80	$200,229
Long term reclamation activities (eg pump flooding) - ticket and travel accomodation		each	70	AE	3300	$229,429
Monitoring Airfare		each		#N/A	0	$0
WORKER ACCOMODATIONS						
Reclamation activities		manmonths		#N/A	0	$0
Long term reclamation activities (eg pump flooding)		manmonths		#N/A	0	$0
MOBILIZE FUEL						
Fuel freight - reclamation activities		litre		#N/A	0	$0
Fuel freight - long term reclamation activities		litre		#N/A	0	$0
Fuel freight accomodations		litre		#N/A	0	$0
WINTER ROAD						
Construction and operation		km		#N/A	0	$0
Limited winter use		km		#N/A	0	$0
Wintar road tariff		km		#N/A	0	$0
DEMOBILIZE HEAVY EQUIPMENT						
Excavators		km		#N/A	0	$0
Dump trucks		km		#N/A	0	$0
Dozers		km		#N/A	0	$0
Demolition shears		km		#N/A	0	$0
Crane		km		#N/A	0	$0
Loader		km		#N/A	0	$0
Compactor		each		#N/A	0	$0
Light duty vehicles		km		#N/A	0	$0
Other		km		#N/A	0	$0
DEMOBILIZE CAMP						
		allow		#N/A	0	$0
DEMOBILIZE WORKERS						
crew travel time		mandays		#N/A	0	$0
crew transportation		each		#N/A	0	$0
WINTER ROAD						
Construction and operation		km		#N/A	0	$0
Limited winter use		km		#N/A	0	$0
Wintar road tariff		km		#N/A	0	$0
					Total	$5,420,771

Note: Labour costs not included under mobilization - included elsewhere

Assumptions

Stage/description	Duration (years)	2 shifts - day # Staff - permanent	hours/person	days/year	total hours	3 weeks rotation one-way transportation/year	Total crew transportation
Active closure, back-flooding, treatment, monitoring	1	30	12	182.5	65700	261	261
Passive closure, back-flooding, treatment, monitoring	7	8	12	122	81760	46	324
Post-closure, treatment, monitoring	3	4	12	122	17520	23	70
Post-closure - assumed no monitoring will be necessary (walk away condition)	0						
Total	11						

Unit Cost Table (for refining unit costs see "Estimator" worksheet)

Filter by unit

ITEM	Detail	COST CODE	UNITS	LOW $	HIGH $	SPECIFIED $	COMMENTS
Accomodation							
		ACCM	manday	100.00	175.00		
Buildings - Decontaminate							
	Asbestos	BDA	m2	25.60	51.20		Low: removal of asbestos siding & flooring; High: removal of insulated pipes, friable asbestos
Buildings - Remove							Unit costs are based on 3m high, single storey building. Scale areas accordingly.
	Wood	BRW	m2	27.50	41.00		
	Concrete	BRC	m2	40.00	65.00	6.00	Specified: puncture concrete foundation slabs
	Steel - teardown	BRS1	m2	45.00	65.00		
	Steel - for salvage	BRS2	m2	67.00	100.00		
Concrete work							
	Small pour	CSF	m3	426.50	639.75		Low: YK; High=1.5xLow
	Large pour	CLF	m3	353.50	530.25	2,130.00	Specified: concrete crown pillar
Contaminated Soils							
	ESA Phase 1	CS1	each	7500.00			Low: small, "clean" site
	ESA Phase 1	CS2	each	50000.00			Low: small, "clean" site
	Remediate on site	CSR	m3	47.00	146.00		
Dozing							
	doze rock piles	DR	m3	1.05	2.40		Low cost: doze crest off dump
	doze overburden/soil piles	DS	m3	0.95	3.80		High cost: push up to 300 m
Excavate Rock; Low Spec's and QA/QC							
	drill/blast/load/short haul	RB1	m3	11.40	17.05		Low:quarry operations for bulk fill
	drill/blast/load/long haul	RB2	m3	12.05	17.80		
	RB1 + spread and compact	RB3	m3	12.05	17.80		
	RB2 + spread and compact	RB4	m3	12.50	30.75		
	Specified activity	RBS	m3				
Excavate Rock; High Spec's and QA/QC							(e.g. ditch/spillway excavation)
	drill/blast/load/short haul	RC1	m3	12.05	17.80		Low:foundation excavation;High:spillway excavation
	drill/blast/load/long haul	RC2	m3	12.70	18.40		
	RC1 + spread and compact	RC3	m3	12.70	18.40		e,g, cover construction
	RC2 + spread and compact	RC4	m3	13.50	19.20		e,g, cover construction
	Specified activity	RCS	m3			175.00	Specified-drift excavation
Excavate Rip Rap							
	drill/blast/load/short haul/place	RR1	m3	13.50	17.75		High: quarry & place rip rap in channel
	drill/blast/load/long haul/place	RR2	m3	14.20	20.65		
	source is waste dump/short haul	RR3	m3	7.00			cost includes sorting
	source is waste dump/long haul	RR4	m3	7.60			
	Specified activity	RRS	m3				
Excavate Soil; Low Spec's and QA/QC							
	clear & grub	SBC	m2	3.40	5.00		
	excavate/load/short haul	SB1	m3	4.30	5.90		
	excavate/load/long haul	SB2	m3	4.60	7.30		
	SB1 + spread and compact	SB3	m3	5.10	8.90		Low: non-engineered; High:engineered
	SB2 + spread and compact	SB4	m3	5.50	11.00		Low: non-engineered; High:engineered
	Specified activity	SBS	m3	3.20	6.30		Low: rehandle waste rock dump by dozing; High:rehandle waste rock by hauling
	Tailings	SBT	m3	1.35	3.70	15.50	High:contour surface - wet or frozen; Specified:haul/place wet infill
Excavate Soil, High Spec's and QA/QC							
	excavate/load/short haul	SC1	m3	6.80	9.30		
	excavate/load/long haul	SC2	m3	7.10	11.75		
	SC1 + spread and compact	SC3	m3	8.90	14.20		Low: non-engineered; High:engineered
	SC2 + spread and compact	SC4	m3	9.30	23.20		Low: non-engineered; High:engineered (e.g. complex covers, low volume dam construction)
	Specified activity	SCS	m3			18.80	Backfill adit with waste rock
Fence							
		FNC	m	13.55	203.00		
Fuel and Electricity							
	Fuel cost - gas	FCG	litre	1.05	1.40		
	Fuel cost - diesel	FCD	litre	0.99	1.39		
	Fuel mobilization	FCM	litre	0.22	0.42		High: winter road usage
	Electricity	FCE	kW-h	0.17	0.19	0.49	Low and High:Yellowknife; Specified:diesel generator
Geo-Synthetics							
	geotextile	GST	m2	3.44			Supply and install

Unit Cost Table (for refining unit costs see "Estimator" worksheet)

	Filter by unit					
geogrid	GSG	m2	5.75			
liner, HDPE	GSHDPE	m2	7.95			Supply and install; large quantity
liner, ES3	GSES3	m2	20.20			FOB Yellowknife
geosynthetic installation	GSI	m2	3.16	14.00		Low:geotextile; High:ES3 or HDPE
bentonite soil ammendment	GSBA	tonne	308.30	348.50		FOB Edmonton, add shipping & mixing
Grouting (/m3 of rock grouted)						
	grout	m3	236.55	286.75		High: cement, FOB Yellowknife
Laboratory Chemicals						
Remove from site	LCR	pallet	1966.36	2606.83		
Labour & Equipment Rates						
Site manager	sman	$/hr	125.00	152.00		
Supervisor	super	$/hr	52.00	91.84		
Registered engineer	eng	$/hr	95.00	220.00		
Environmental coordinator	envco	$/hr	74.16	130.00		
Evironmental technologist	envtech	$/hr	36.00			
Electrician	elec	$/hr	74.00	95.00		
Journeyman - various	journey	$/hr	44.00	71.79		
Labour - skilled	lab-s	$/hr	41.00	49.60	120.00	Specified - Skilled Manufacturer Mechanic
Labour - unskilled	lab-us	$/hr	31.00	43.98		
Equipment operator	oper	$/hr	41.00	65.00		
Heavy duty mechanic	mech	$/hr	49.00	72.85		
Water treatment plant operator	oper-wt	$/hr	41.00	59.86		
Security / first aid	safety	$/hr	36.00	66.97		
Administative staff	admin	$/hr	38.00	57.89		
Equipment rates include operator and fuel						
Loader - 4 cu.yd (3.06m3)	load-s	$/hr	175.00			
Loader - 7 cu.yd (5.35m3)	load-l	$/hr	315.00			
Excavator - 26.76-30.84 tonnes	exc-s	$/hr	190.00			
Excavator - 68.95+tonnes	exc-l	$/hr	420.00			
Grader	grad	$/hr	190.00			
Dump truck off hwy 30-50 tonnes	truck-s	$/hr	225.00			
Dump truck off hwy 55-75 tonnes	truck-l	$/hr	300.00			
dozer, small	dozers	$/hr	205.00	260.00		
dozer, large	dozerl	$/hr	490.00	565.00		
smooth drum compactor	comp	$/hr	155.00			
scooptram, 6 yd3 bucket	scoop	$/hr	170.00			
flat bed truck with hiab	hiab	$/hr	155.00			
fuel truck	ftruck	$/hr	150.00			
water truck	wtruck	$/hr	58.00	150.00		
Mobilize Heavy Equipment						
Road access	MHER	kmtonne	3.40	10.25		
Air access	MHEA	kmtonne	12.00			cargo rate>500lb
Mobilize Camp						
Road access	MCR	each	50000.00			refurbish existing camp
Mobilize Workers						
flight	MW	each	4500.00	9100.00		Low:e.g. 8 passenger; High: Dash 7
Oil Removal						
oil removal	OR	litre	0.43	1.20		Low:waste oil heater; High: ship offsite
PCB Removal						
Remove from site	PCBR	litre	40.20	46.90		Low: shipping, handling & disposal from Yellowknife
Pipes, small (<6in dia.)						
remove/dispose on site	PSR	m	1.00	24.00		Low: remove/dispose on site; High: remove/re-use
supply	PSS	m	6.10	11.10		Low:supply; High:supply and ship
install	PSI	m	25.00			
Pipes, large (>6in dia.)						
remove/dispose on site	PLR	m	22.00	72.00		Low: remove/dispose on site; High: remove/re-use
supply	PLS	m	129.00	143.00		Low:supply; High:supply and ship
install	PLI	m	50.00			
Power Lines						
remove/dispose on site	POWR	m	25.50			
Process Chemicals						
Remove from site	PCR	kg	0.45	2.50		Low: shipping, handling & disposal from Yellowknife

Unit Cost Table (for refining unit costs see "Estimator" worksheet)

Filter by unit

Pumps						
Pump capital cost	PC	each	195000.00			
Pump shipping	PS	each	2500.00			
Pump operating cost	POC	m3	0.12			pump operating costs should be calculated based on pump capacity, fuel costs, etc.
Pump maintenance	PM	allow	25000.00			
Pump sand BackFill						
	PBF	m3	85.00	300.00		
Scarify - road/mine site						
	SCFY	ha	4300	6030	2150	
Shaft, Raise & Portal Closures						
Shaft & Raises	SR	m2	645.00	2132.00		Low:pre-cast concrete slabs, little site prep. Area=shaft+>1m all around
Portals	POR	m3	18.80	250.00	1200.00	Low:unit cost code SCS;High:excavate & backfill collapsed portal;Spec: installed pressure plug
Signs						
Signs	S	each	12.36	37.08		
Site Inspection Report						
	RPT	each	10000.00	20000.00		
SpillWay - Clear						
	SW	each	3000.00	7000.00		
Survey/Instrumentation						
	SI	each	1800.00	3600.00		2 person crew
Treatment Plant - Construct						
Small (< 1000 m3/d)	TPS	lump sum	9000000	15000000		
Large (> 1000 m3/d)	TPL	lump sum	15000000	46000000		
Constructed Wetland	CWTS	ha	200000	300000		
Treatment Plant - Operate						
	TPO	m3	0.35	2.00		
Treatment Chemicals						
ferric sulphate	ferric	kg	1.19			
ferrous sulphate	ferrous	kg	1.32			
lime	lime	kg	0.56			
hydrogen peroxide, 35%	hperox	kg	1.50			
Sodium Metabisulfate	Nametab	kg	1.18			
Caustic soda, 50%	caustic	kg	0.74			
Sulfuric acid, 93%	sulfuric	kg	0.31			
flocculant	flocc	kg	6.00			
copper sulphate	copper	kg				
shipping	shipping	kg	0.20			
Vegetation						
Hydroseed, Flat	VHF	ha	4000.00			
Hydroseed, Sloped	VHS	ha	4500.00			
Veg. blanket/erosion mat	VB	ha	13000.00			
Tree planting	VT	ha	2600.00	6000.00		
Wetland species	VW	ha			47.72	Specified= /m3, Wetland Growth Media Substrate mixed and installed (sand, biochar and fertilizer, woodchips)
Visual Site Inspection						
Visual site inspection	VI	each	3955.18	7977.79	11000.00	
Water Sampling/Analysis/Reporting						
	WS	each	7000.00	10000.00		
Winter Road						
Construction	WRC	km	2000.00	11500.00		
Usage	WRU	kmtonne	0.29			

Unit Cost Estimator

1 Equipment Productivity Figures and Graphs have been reproduced from Caterpillar Performance Handbook - Edition 42

EXCAVATION

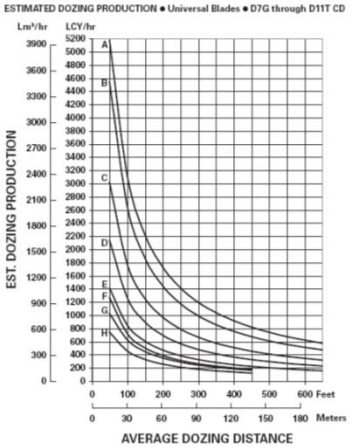
Productivity		
Machine Cat 336EL		
bucket capacity	3.16	m3
fill factor	75%	%
cycle time	45	seconds
operator skill	80%	%
machine availability	83%	%
altitude adjustment	100%	%
Hourly productivity	125.89	m3/hr
Operating Costs		
- Contractor		
Contractor hourly rate	$180.00	$/hr
Excavation cost - contractor rate	1.43	$/m3
- Owner		
ownership, daily		$/day
maintenance		$/hr
fuel		$/hr
consumables (cutters, tires)		$/hr
operator		$/hr
Owner hourly rate	$0.00	$/hr
Excavation cost - owner rate	$0.00	$/m3
Excavation cost - select contractor or owner rate (D22 or D31)		$/m3

HAUL AND DUMPING

Productivity		
Machine Cat 770		
truck capacity	25.1	m3
fill factor	80%	%
load time	6.0	min.
haul distance	1.5	km
average velocity	20.0	km/hr
haul time + return time	9.0	min.
wait time	0.5	min.
dump time	1.0	min.
cycle time	16.5	min.
machine availability	83%	%
altitude adjustment	100%	%
	13.7	/e. min/cycle
Hourly productivity	88.0	m3/hr
Operating Costs		
- Contractor		
Contractor hourly rate	$225.00	$/hr
Haul and Dump - contractor rate	2.56	$/m3
- Owner		
ownership, daily		$/day
maintenance		$/hr
fuel		$/hr
consumables (cutters, tires)		$/hr
operator		$/hr
Owner hourly rate	$0.00	$/hr
Haul/Dumping Cost - owner rate	$0.00	$/m3
Haul/Dumping Cost - select contractor or owner rate (I22 or I31		$/m3

SPREADING/DOZING

Productivity		
Machine Cat D8		
Estimate production using example curves provided or equivalent from other supplier	600	m3/hr
Correction factors (see table provided)		
operator skill	0.75	
material type, see table	0.80	
slot dozing	1.00	
side by side dozing	1.00	
visibility	1.00	
job efficiency	0.83	
altitude adjustment	1.00	
slope adjustment	1.00	
Hourly productivity	298.8	m3/hr
Operating Costs		
- Contractor		
Hourly rate - contractor supplied	$260.00	$/hr
Dozing - contractor rate	0.87	$/m3
- Owner		
ownership, daily		$/day
maintenance		$/hr
fuel		$/hr
consumables (cutters, tires)		$/hr
operator		$/hr
Owner hourly rate	$0.00	
Spreading/Dozing Cost - owner rate	$0.00	$/hr
Spreading/Dozing Cost - select contractor or owner rate (N22 or N31)		$/m3



KEY
A — D11T CD
B — D11T
C — D10T
D — D9T
E — D8T
F — D7E
G — D7R Series 2
H — D7G

NOTE: This chart is based on numerous field studies made under varying job conditions. Refer to correction factors following these charts.

Excavator

	Cat 320	Cat 325B	Cat 375
heaped bucket capacity, m3	1.5	2.2	5.4
	Typical Cycle Times (seconds)		
easy digging, shallow digging, small swing angle	16	18	20
med. to hard digging, rocky soil, swing angle to 90 deg.	23	23	25
tough digging, sandstone, caliche, at max. machine depth, swing angle > 120 deg.	27	29	35

Material	Fill Factor (% of heaped bucket capacity
Moist loam or sandy clay	100 - 110
sand and gravel (not till)	95 - 110
hard tough clay	80 - 90
rock - will blasted	60 - 75
rock - poorly blasted	40 -60

Operator Skill	poor	average	good
Correction factor	0.6	0.75	1

Machine availability	poor	average	good
Correction factor	0.9	0.95	1

Trucking

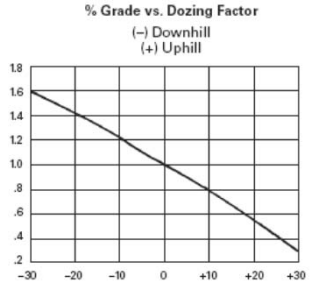
	Cat 771 D	Cat 777D	Cat 789C
Truck capacity - heaped, m3	27.5	60.5	137

Dozing

JOB CONDITION CORRECTION FACTORS

	TRACK-TYPE TRACTOR
OPERATOR —	
Excellent	1.00
Average	0.75
Poor	0.60
MATERIAL —	
Loose stockpile	1.20
Hard to cut; frozen —	
with tilt cylinder	0.80
without tilt cylinder	0.70
Hard to drift; "dead" (dry, non-cohesive material) or very sticky material	0.80
Rock, ripped or blasted	0.60-0.80
SLOT DOZING	1.20
SIDE BY SIDE DOZING	1.15-1.25
VISIBILITY —	
Dust, rain, snow, fog or darkness	0.80
JOB EFFICIENCY —	
50 min/hr	0.83
40 min/hr	0.67
BULLDOZER*	
Adjust based on SAE capacity relative to the base blade used in the Estimated Dozing Production graphs.	
GRADES — See following graph.	

*NOTE: Angling blades and cushion blades are not considered production dozing tools. Depending on job conditions, the A-blade and C-blade will average 50-75% of straight blade production.



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