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FINAL REPORT

SD 2-2 Tailings Storage Facility Alternative Assessment – Meliadine Gold Project, Nunavut

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REPORT

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EXECUTIVE SUMMARY

Golder Associates Ltd. (Golder) was retained by Agnico Eagle Mines Limited (AEM) to carry out an alternatives assessment for storage of tailings as part of the preliminary design and environmental impact studies for the Meliadine Gold Project (the Project).

The objective of the tailings alternatives assessment was to identify the most appropriate alternative for management of tailings for the Meliadine Project based on environmental, technical, social, and economic considerations, in general accordance with the Environment Canada *Guidelines for the Assessment of Alternatives for Mine Waste Disposal* (EC 2011a).

A total of 13 Tailings Storage Facility (TSF) siting locations were initially identified for the project. Each of these tailings alternative siting locations was evaluated in a pre-screening assessment based on a high-level evaluation of environmental, technical, social, and economic aspects. After evaluating the 13 locations against the pre-screening criteria, the following three locations were chosen for further evaluation:

- B7 area;
- B4 area; and
- On-land 5 (OL-5).

Once the feasible siting location options were identified from the pre-screening assessment, consideration was given to potential tailings disposal technologies. Two technologies, thickened tailings and filtered tailings, were chosen to represent hydraulic deposition and mechanical deposition, respectively. The combination of the three siting locations and two tailings technologies resulted in the following six TSF alternatives for evaluation:

- B7 Thickened;
- B7 Filtered;
- B4 Thickened;
- B4 Filtered;
- OL-5 Thickened; and
- OL-5 Filtered.

A multiple accounts analysis (MAA) approach was used to evaluate the six TSF alternatives. The MAA assessment involved relative evaluation of the TSF alternatives based on environmental, technical, social, and economic considerations (accounts). A risk assessment was also conducted in parallel with the MAA process to further evaluate the tailings technologies being considered for the TSF (thickened and filtered). The primary and significant risks associated with thickened and filtered tailings identified in the risk assessment were considered in the MAA.

The MAA analysis was split in two phases: baseline analysis and sensitivity analysis. The baseline analysis incorporated the account weightings recommended in the Environment Canada Guidelines (EC 2011a), and the sensitivity analysis evaluated the robustness of the baseline results by assigning varying emphasis on the different accounts to assess how the weightings influenced the relative ratings of the alternatives.

The following summarizes the results of the baseline and sensitivity results:

- No clear preferred alternative was identified from the baseline analysis using the suggested accounts weightings proposed by Environment Canada (EC 2011a). The B7 Thickened and B4 Thickened alternatives all scored the highest, with the other alternatives scoring just slightly lower.
- Sensitivity analysis further supports that the B7 Thickened and B4 Thickened score the best overall, with both alternatives scoring approximately the same in all cases with the exception of Case 4 and Case 5, where B7 Thickened scored slightly lower. Case 4 has an emphasis on the environment and social accounts and Case 5 has no emphasis on any of the accounts.
- Further review of the sensitivity results indicated that the B7 Thickened alternative scored comparatively lower on the social account due to the presence of heritage sites located just within or outside the facility footprint. However, these heritage sites have either been previously mitigated, can be mitigated in the future, or can be avoided with slight modification to the facility footprint (although mitigation will still likely be completed).

Based on the above, either the B7 Thickened or B4 Thickened alternatives are considered the preferred option for the Meliadine TSF. The B7 area was selected as the preferred alternative due to its relative proximity to the process plant and favourable topography.

Table of Contents

TABLES

Figures

APPENDICES

1.0 INTRODUCTION

This report presents a tailings storage facility alternatives assessment for the Meliadine Gold Mine Project in Nunavut.

Golder Associates Ltd. (Golder) was retained by Agnico Eagle Mines Limited (AEM) to carry out an alternatives assessment for storage of tailings as part of the preliminary design and environmental impact studies for the Meliadine Gold Project, Nunavut (the Project). The objective of the assessment was to identify the most appropriate alternative for management of tailings for the Project based on environmental, technical, social, and economic considerations, in general accordance with the Environment Canada *Guidelines for the Assessment of Alternatives for Mine Waste Disposal* (EC 2011a). These guidelines recommend the use of a Multiple Accounts Analysis approach, which is a well-accepted, transparent decision-making tool. A tailings alternatives assessment is required when considering placement of tailings in a water body frequented by fish for application of an amendment under Schedule 2 of the Metal Mining Effluent Regulations (EC 2011b).

This report shall be read in conjunction with the “Study of Limitations” which is included at the beginning of the report. The reader’s attention is specifically drawn to this information as it is essential that it is followed for the proper use and interpretation of this report.

2.0 PROJECT DESCRIPTION

The Project is located approximately 25 km north of the hamlet of Rankin Inlet on the west coast of Hudson Bay, in the Kivalliq Region of Nunavut. AEM’s proposed mining project comprises mineral deposits at five separate locations on the property with an anticipated operating mine life of about 13 years. The Tiriganiaq, F Zone, Pump, and Wesmeg Deposits are located on a large peninsula separating the east and west basins of Meliadine Lake, on Inuit owned land. The Project’s coordinates are centred on the underground portal of the Tiriganiaq Deposit at 63°01’30”N, 92°10’20”W. The Discovery deposit is located south and east of the main mine site.

The mine plan estimates that approximately 38 million tonnes of ore will be processed over the mine life. Mining will include both open pit and underground operations.

2.1 Topography and Surface Geology

The dominant terrain in the Meliadine area comprises glacial landforms such as drumlins (glacial till), eskers (gravel and sand), and small lakes. Topography is gently rolling with a mean elevation of 65 metres above sea level and a maximum relief of 20 m (AEM 2012). Low-lying areas are poorly drained, as a result of a low slope in the landscape, and intermittent streams connect numerous shallow ponds and lakes (AEM 2012).

The local overburden typically consists of sand and gravel deposits of various thicknesses overlying till with cobbles and boulders. Some of the surfaces are covered by a thin layer of organics.

2.2 Climate

The site lies within the Arctic Climatic Region and the climate of the Project area is characterized by short, cool summers and long, cold winters. Air temperature at the Project site may fall below 0°C on any day of the year.

The monthly mean air temperature is typically above 0°C for the months of June to September, and is below 0°C between October and May. July is typically the warmest month, and January the coldest. The mean annual temperature for the period of record is -10.4°C (Golder, 2012a).

Daylight occurs for a minimum of four hours per day in winter and a maximum of 20 hours in summer. Brisk wind is common year-round. Precipitation is typically divided evenly between rain during the summer and fall (predominantly in late summer), and snow, which can fall in any month but is most common between October and April. Surface waters are usually frozen by early October and remain that way until early June. The land is usually snow-free by late June.

Brisk wind is common year-round and the site experiences strong winds from the north-northwest, especially in winter (AEM 2012). Figure 1 presents the wind rose diagram for Rankin Inlet.

2.3 Permafrost

The Project is located within the zone of continuous permafrost. The mean annual surface temperature is between -6ºC and -9ºC (Golder, 2012b). The Project area is underlain by permafrost with intervening taliks and thaw bulbs induced by lakes. The ground ice content in the region is expected to be between 0% and 10% (dry permafrost) based on regional scale compilation data shown in the map of Canada Permafrost published by Natural Resources Canada (1995).

Based on thermal studies carried out to date, the depth of permafrost is estimated to be on the order of 360 m to 495 m. The depth of the frozen portion of the permafrost has been estimated to be at a depth of 350 to 375 m (Golder, 2012b) due to freezing point depression as a result of highly saline groundwater. The depth of the active layer ranges from approximately 1 m to 3 m. The depth of permafrost and of the active layer will vary based on proximity to lakes, soils thickness, vegetation, climate conditions and slope direction. Bathymetry data show that maximum lake depths in the project area vary from 2.5 to 5 m, and late-winter lake ice thicknesses range from 1 m to 2.3 m (Golder, 2012b).

2.4 Aquatic Environment

Most of the proposed project area is located on a large peninsula within Meliadine Lake. The surveyed lakes (*n*=28) on the Peninsula of Meliadine Lake ranged from 1.3 ha (Lake E5) to 90.5 ha (Lake A8) in surface area and were shallow (mean depths ranged from 0.7 m to 1.6 m; Section 7.5.4.2.2.2, Table 7.5-8; SD 7-2 2011 Aquatics Baseline, Appendix D3). Only 5 lakes (Lakes A6, A8, B6, B7, and B69) had maximum depths of 4.0 m or greater. Most of lake volumes (85%) were contributed by the top 2 m layer of water. The maximum recorded water depth is 5.4 m in Lake B69 (Section 7.5.4.2.2.2, Table 7.5-8).

The lakes and ponds drain into Meliadine Lake through several watersheds (designated A to X, as shown on Figure 1). The lower reaches of the larger watersheds feature short, but well-defined stream sections between lakes; however, most of the ponds in the middle and upper reaches are poorly connected and typically drain through the tundra during freshet and after rainfall events.

The lakes and ponds are generally well-oxygenated during open water conditions and do not stratify. However, most of their volume is contributed by the 2 m surface layer of water. When the ice cover reaches 2 m in depth, as is often the case during late winter, the under-ice water volume is greatly reduced and the waterbody may freeze to the bottom. This is a frequent occurrence in most of the small lakes. The proportions of deep water zones are higher in some of the larger lakes, such as Lakes A6, A8, B2, B5, B7, B69 and E3, and appear to be sufficient to allow fish to overwinter.

Meliadine Lake and the lower lakes and streams of the Peninsula watersheds are inhabited by nine fish species (lake trout, Arctic char, Arctic grayling, round whitefish, cisco, burbot, slimy sculpin, ninespine stickleback, and threespine stickleback). Four of these species (lake trout, Arctic char, round whitefish and threespine stickleback) tend to use only the lowermost sections of the basins in close proximity to Meliadine Lake and have not been encountered in the upper peninsula lakes and streams under the footprint of the proposed mine (e.g., Lake B4 and upstream). Arctic char distributions are restricted to low elevation lakes; whereas Arctic grayling are generally widespread but show a preference for large waterbodies.

Nine fish species (lake trout, Arctic char, Arctic grayling, round whitefish, cisco, burbot, slimy sculpin, ninespine stickleback, and threespine stickleback) were recorded in the lakes on the Peninsula. Four of these species (lake trout, Arctic char, round whitefish, and threespine stickleback) were typically found in the lower lakes in the basins that are in close proximity to Meliadine Lake. These species were generally not encountered in the upper lakes that are under the footprint of the proposed mine (Volume 7, Section 7.5.4.4.1.2). Ninespine sticklebacks appear to prefer the upper Peninsula waterbodies (especially shallow ponds and the smaller streams) over the open lake environment of Meliadine Lake and the lower lakes, where predators are common. Arctic grayling use the Peninsula streams extensively for spawning and rearing, and appear to overwinter in some of the deeper Peninsula lakes. It was determined that about 17 lakes and ponds on the part of the Peninsula that will be affected by the Project support Arctic grayling (Volume 7, Appendix 7.5-D).

2.5 Terrestrial Environment

2.5.1 Vegetation

In total, 10 plant community types have been classified and mapped in the Local Study Area (LSA) for the proposed mine and access road, including 4 heath vegetation classes, 3 wetlands classes, and 3 un-vegetated classes (Figure A-1, Appendix A). Heath vegetation encompasses 51% of the LSA, with the heath tundra community type dominating the landscape at 38%. Wetlands are distributed over 26% of the LSA, and the remaining 23% of the LSA is classified as un-vegetated units that are predominantly composed of waterbodies and rivers. Disturbance features and un-vegetated sand areas represent <1% and 2% of the total LSA, respectively (Volume 6, Section 6.5.3.2).

Uncommon plant community types are defined as those plant communities with a restricted distribution in the LSA and include the Birch Seep and Riparian Willow/Birch plant communities, which represent 3% and <1% of the LSA, respectively.

A total of 3 listed plant species were observed within the LSA during the 1998, 2008, 2009 and 2012 field programs, including hairy butterwort (*Pinguicula villosa*), Tyrrell's willow (*Salix tyrrellii*) and Arctic daisy *(Arctanthemum arcticum)*. All of these species are listed as “Sensitive” in Nunavut (CESCC 2011), though none are federally listed (COSEWIC 2012; SARA 2012) and no other federal listed species (COSEWIC 2012; SARA 2012) were identified as occurring within the LSA or RSA. All of the vascular plant species that are listed as sensitive are associated with wetland or riparian habitats such as meadows, seeps, marshes, are associated with the Riparian Willow/Birch, Birch Seep and Sedge Community plant community types.

2.5.2 Wildlife

A number of mammal and bird species were recorded in the Project area during baseline wildlife surveys completed in 1998, 1999, 2000, 2008, and 2009 by Golder and Arc Wildlife Services Ltd. (Golder, 2012c). Mammals recorded include barren-ground caribou of the Qamanirjuaq herd, arctic fox (*Vulpes lagopus*), arctic hare (*Lepus arcticus*), wolf (*Canis lupus*), muskox (*Ovibos moschatus*), and polar bear (*Ursus martimus*). Neither grizzly bear (*Ursus arctos*), brown bear (*Ursus arctos horribilis*), nor wolverine (*Gulo gulo*), or their signs, were seen in the study area during the wildlife surveys.

Both traditional and scientific knowledge indicate that barren-ground caribou of the Qamanirjuaq herd likely use this area during seasonal migrations (BQCMB 1999), but presence in the study area appears to be variable among years. Caribou migration routes have been identified within the Project area (Golder 2012d). Wolf, IQ muskox and polar bear are infrequently observed. Polar bear are listed as “Special Concern” by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2012) and the Species at Risk Act (SARA 2012).

There were 37 bird species recorded during baseline studies. These included 14 species of waterfowl, 5 species of shorebird, 3 species of raptor, and 2 owl species. The most common species of upland birds were Lapland Longspur (*Calcarius lapponicus*), Horned Lark (*Eremophila alpestris*), and Savannah Sparrow (*Passerculus sandwichensis*). Pacific Loons (*Gavia pacifica*), Tundra Swans (*Cygnus columbianus*) and Sandhill Cranes (*Grus canadensis*) are confirmed, regular breeding summer residents. Peregrine Falcon (*Falco peregrines*), Rough-legged Hawk (*Buteo lagopus*), and Gyrfalcon (*Falco rusticolus*) also breed in the region. Short-eared Owls (*Asio flammeus*) have been documented and nest observations indicate that they are likely breeding. Shorebirds are uncommon and were not documented breeding during baseline surveys conducted between 2008 and 2011. Peregrine Falcon and Short-eared Owl are listed as “Special Concern” by SARA (2012) and COSEWIC (2012), respectively.

2.6 Traditional land use

The area around the Project site is used for hunting when the main southern caribou migration pattern in the fall IQ followed a route across the narrows of Meliadine Lake (naluit) and through the Meliadine Project site. In the early 1950s the migration of the caribou moved north of Peter Lake, northwest of the project site and hunting became much less frequent in the area (Golder, 2012d).

Nanuk Enterprises (1999) indicated that hunting and fishing are important traditional pursuits in the Rankin Inlet area (extending towards Meliadine Lake). Traditional fishing in the area around the Project site has historically been in Peter Lake, Meliadine Lake, and the Meliadine River. Domestic fishing, on the other hand, is still an important part of the Inuit lifeway, accounting for as much as 20% of the diet of the residents of Rankin Inlet and Chesterfield Inlet. Most of the lakes in the general Meliadine area are fished for lake trout and Arctic char. The smaller lakes and ponds in the immediate project area generally don’t have the fish species that are valued by the Inuit (i.e., Arctic char and lake trout), so have not been historically used for fishing.

Inuit interviewed for traditional knowledge have commented that the area around Meliadine Lake is a good goose and other waterfowl hunting area in the fall (Volume 9, Appendix 9.3-A).

There are recreational cabins located along Meliadine Lake close to the Project site. Volume 9, Section 9.3 provides detailed information on Traditional Land Use.

2.7 Archaeology

Archaeological Impact Assessments (AIA) including mitigation activities have been conducted over five field seasons (1998, 2008, 2010, 2011, and 2012) for the project. In the 1970s, several archaeological field investigations were conducted for academic purposes by Urve Linname, University of Saskatchewan. The archaeology of the area primarily shows evidence of summer use with a focus on caribou hunting and fishing. The archaeological features that represent these activities include caches (oval and square interiors), tent rings, hunting blinds, inuksuk and expedient stone features of unknown function. There is also evidence of fox trapping, both prehistoric and historic, and limited evidence of winter occupation of the area based on sod houses along the shores of Meliadine Lake and Lake H17. Traditional knowledge trapping of Arctic fox and coloured fox was the primary occupation for the Inuit during the winter (Freeman 1976). These sites represent occupation of the area from Dorset to Thule times over a period of at least 3,000 years. Research in the 1970s suggest a Pre-Dorset occupation, which has not been confirmed by recent surveys; however, should a Pre-Dorset occupation be present this would extend the period of occupation to approximately 4,000 years ago.

There are currently 110 recorded archaeological sites within the project area. During the 2011 field season, the proposed tailings storage facility (TSF) areas were surveyed for archaeological sites. The survey methodology included low level helicopter flights followed by a foot survey to verify heritage potential (Golder, 2012e).

2.8 Geochemistry

A baseline geochemical characterization program for the Project was initiated in 2008 and consisted of static and kinetic testing methods to assess the chemical composition of the mine waste, its potential to generate acid rock drainage (ARD) and its potential to leach metals (ML) upon exposure to ambient conditions. Results of the geochemical characterization program are presented in Volume 6, SD 6-3 and are summarized below specifically for tailings and waste rock.

Most of the tested tailings samples have no potential to generate ARD. This generally stems from their low sulphide content and excess buffering capacity from reactive carbonate minerals. The Discovery deposit tailings are potentially acid generating (PAG) while F-Zone tailings that represent underground ore (should it eventually be mined) have an uncertain ARD potential. This is mainly due to the lower amount of carbonate mineral buffering capacity of these materials. Based on the current mine plan (Volume 2, Section 2.6.1.5; see particularly Table 2-12), the bulk of the tailings in the impoundment is calculated to be non acid-generating on an annual basis over most of the mine life except for short periods during operation where the acid generation potential of the bulk tailings is calculated to be uncertain and possibly PAG. Nonetheless, tailings are not anticipated to develop acidic drainage for the following reasons: they will be deposited as a water-saturated, thickened slurry which will minimize oxygen intake for sulphide oxidation; Discovery ore will be milled together with other ore resulting in a mixture that will have available excess buffering capacity (F Zone is not expected to be mined underground at this time); and the milling rate is such that fresh tailings are continually being deposited on the surface resulting in a short tailings exposure period during operations. The final three years of tailings production are calculated to be non PAG because of the small proportion of uncertain ARD tailings being deposited in the TSF (no PAG tailings are being deposited).

The concentrations of most leachate parameters from static leaching tests (shake flask extraction tests) meet mine effluent criteria (MMER; DFO 2002) with the exception of arsenic, which exceeds the MMER average monthly values in F Zone, Pump and Tiriganiaq tailings. Notwithstanding this, longer-term kinetic test results reported decreasing arsenic concentration trends in all tailings samples in time, with initial concentrations ranging from 0.05 to 0.9 mg/L (Cycle 0) and the final test cycle ranging from 0.003 to 0.05 mg/L. This is substantially lower than concentrations reported from static leach tests. Long-term chemical release from the tailings will be managed by placement of an engineered cover that is anticipated to minimize infiltration of water to the tailings surface.

Current test data indicates that the waste rock anticipated to be generated from the Tiriganiaq and Wesmeg deposits is non-acid generating (Volume 6, SD 6-3). The iron formation waste rock from the Pump and F Zone deposits has an uncertain potential to generate ARD although these rock units constitute a minor proportion of the waste from these deposits (14% and 8% by tonnage, respectively). All other rock types from these deposits have excess buffering capacity such that the overall ARD potential of waste generated from Pump and F Zone is expected to be non-PAG. At the Discovery deposit, the iron formation and the greywacke/siltstone have an uncertain ARD potential; both of these rock types contain lower buffering capacity than other rock types; the ARD potential in these rocks is sensitive to sulphur content. Only non-PAG waste rock will be used for construction of the tailings dikes. Waste rock classified as PAG or uncertain ARD potential will be managed in the waste rock storage facilities (WRSF), as discussed in Volume 2, SD 2-8.

Of all rock types investigated in the deposits, the concentrations of most leachate parameters following static testing (shake flask extraction tests) meet mine effluent criteria (MMER; DFO 2002) with the exception of arsenic in a few samples (4 samples out of 577 submitted for leaching testing). Kinetic tests completed on 34 samples at different scales returned concentrations of arsenic that are below the MMER criteria of 0.5 mg/L.

Process water will be treated to destroy cyanide prior to discharge to the TSF to meet International Cyanide Code guidance concentrations (AEM, 2012). Tailings water within the TSF is likely to require attenuation of pH, arsenic, cyanide and suspended solids to meet MMER criteria for discharge to the environment. Other parameters may also require treatment for discharge if recycling of the TSF water results in further concentration of the process water (Golder, 2012f).

3.0 TAILINGS STORAGE FACILITY ALTERNATIVES ASSESSMENT

A tailings alternative assessment was completed for the Project in general accordance with the Environment Canada *Guidelines for the Assessment of Alternatives for Mine Waste Disposal* (EC 2011a). The following were the main steps in the process:

- identification of possible TSF siting locations;
- pre-screening assessment of TSF alternatives;
- preparation of Multiple Accounts Ledger and characterization of alternatives;

- Multiple Accounts Analysis of TSF alternatives; and
- Sensitivity Analysis.

Details of each step are summarized in the following sections.

3.1 Identification of TSF Siting Locations

The first step in the alternatives assessment was to identify all possible locations for the tailings storage facility. Some of the fundamental considerations that were used for the siting exercise included:

- The maximum distance from the proposed process plant was defined as 10 km. This is typical of such analysis. An exception was considered in site OL-7 located at approximately 17 km from the proposed process plant. This site was identified with the intent of having an option that does not infringe on any important body of water based on the available topographic mapping and air photography.
- The siting exercise was limited to the southwest side of Meliadine Lake. The northeast side of Meliadine Lake was not considered given the expected challenges to transport the tailings to this area and the absence of any obvious advantages with respect to the bodies of water and topography in this area.
- Sites were selected to avoid the proposed pit delineations.
- Sites were selected to avoid any protected areas.

A base case of slurry deposition was considered for each location for the pre-screening assessment under the expectation that the deposition method would not influence the pre-screening process for the Project, and with the understanding that if during the pre-screening assessment it was determined that the deposition methods would influence the results, they would be considered.

Preliminary layouts were completed for each of the siting locations to assess the pre-screening criteria. These layouts are shown on Figure 1.

3.2 Pre-screening

Each of the tailings alternative siting locations were evaluated in the pre-screening assessment based on a high-level evaluation of environmental, technical, social, and economic aspects, to determine which alternatives are the most appropriate for the site.

The purpose of the pre-screening step was to eliminate any of the siting locations that had “fatal flaws” prior to completing the more detailed Multiple Accounts Analysis (MAA). Pre-screening criteria were formulated as simple “yes” or “no” answers to complete the evaluation. The design criteria used for the pre-screening assessment were as follows:

- provides storage for life-of-mine tailings production;
- location does not restrict the operation of the open pits and potential waste rock management areas;
- location avoids known non-mitigatable heritage/archaeological sites;

- location is within the mine claims block;
- location does not sterilize potential resources (inferred based on magnetometric survey map);
- location provides the potential for increased storage capacity;
- location is within the same sub-catchment as a mine site/pit; and
- less than 25% of the footprint is covered by an existing waterbody(ies).

Each of the thirteen locations was evaluated against these eight criteria. It was decided that the first four criteria were absolute requirements and any alternative that did not meet one of these criteria was automatically eliminated. If an alternative did not meet two or more of the remaining criteria, it was also eliminated.

The results of the pre-screening assessment are summarized in Table 1 and details of the pre-screening assessment are found in Tables B-1 to B-13 in Appendix B. After evaluating the thirteen locations against the pre-screening criteria, three locations were chosen for further evaluation as follows:

- B7 area;
- B4 area; and
- On-land 5 (OL-5).

Table 1: Pre-screening Results Summary

	B7	D7/D8	B4	A6	OL-1	OL-2	OL-3	OL-4	OL-5	OL-6	OL-7	E3	B45/B46
Pre-Screening Criteria[1]													
Storage for life-of-mine tailings production	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Location does not restrict operation of open pits (incl. waste rock)	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
Heritage – avoids known non-mitigable sites	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Location is within claim	Y	Y	Y	N	N	N	Y	N	Y	N	N	Y	N
Potential for increased capacity	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
Location does not sterilize potential resources[2]	Y	N	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y
Area is within same sub-catchment as pit/mine site	Y	Y	Y	Y	N	N	N	N	N	N	N	N	Y
Less than 25% of footprint is within existing waterbody(ies)	N	N	N	N	Y	Y	N	Y	Y	Y	Y	N	N
Potential alternative for tailings storage?	Y	N	Y	N	N	N	N	N	Y	N	N	N	N

Notes: [1] Shading of pre-screening criteria indicates absolute requirements to pass the pre-screening assessment. If an alternative did not meet two or more of the remaining criteria, it was also eliminated from the analysis

[2] Inferred based on magnetometric survey map.

3.3 Tailings Disposal Technologies

Once the feasible siting location options were identified from the pre-screening assessment, consideration was given to the potential tailings disposal technologies. Disposal technologies vary by the degree of dewatering of the tailings. Typical solids densities of tailings range from approximately 30% solids density for slurry to approximately 85% solids density for filtered tailings. Table 2 compares these tailings technologies in general terms.

Two tailings disposal technologies were retained for consideration in the tailings alternatives assessment: thickened tailings and filtered tailings. These two technologies were chosen to represent hydraulic deposition and mechanical deposition, respectively. It was decided that not all three of the hydraulic transport/deposition tailings disposal technologies needed to be evaluated separately as one technology (level of dewatering) could be chosen to represent the range of hydraulically placed tailings. Thickened tailings technology was chosen for evaluation because it is advantageous in a northern climate since there is less water to manage at the TSF in comparison to slurry deposition. Paste tailings technology was excluded from the analysis because of the lack of precedents for its use in the North, and based on experience of the logistical challenges of its use.

3.3.1 Thickened Tailings

Thickening of tailings involves placing slurry tailings in a tank, allowing the solids to settle, and then drawing off the tank underflow for pumping to the tailings storage facility. Chemical additives called flocculants are often added to increase the solids content above 50% (typically 50% to 60%), thus improving storage efficiency. Thickened tailings will bleed some water when deposited, but a greater volume is retained at the mill rather than being transported to the TSF in comparison to a slurry tailings.

Engineered containment structures are built to control the area over which tailings are placed and to prevent uncontrolled release of water and solid materials from the tailings facility to the environment. In addition to the engineered containment structures, diversion structures may be required to redirect natural surface water away from the TSF. Thickened tailings facilities also require surface water runoff and seepage management systems in the form of ditches or berms in combination with sumps or ponds to collect contact water and seepage from the facility. Reclamation strategies are to be tailored to the type of material and site characteristics; a reclamation cover is typically required at closure to restrict water contact with the tailings, prevent erosion, and prevent dust generation. Potentially acid generating tailings may require an infiltration barrier to reduce acid rock drainage (ARD) generation.

Table 2: Comparison of Tailings Technologies

Tailings Technology	Typical % Solids[1]	Transport	Deposition	Containment	Pond	Reclaim
Slurry	20 to 40	Pipeline	Spigots	Engineered containment structures with a low permeability layer	Relatively large	Reclaim pipeline required from pond back to mill
Thickened	50 to 60	Pipeline	Spigots	Engineered containment structures with a low permeability layer	Moderate	Reclaim pipeline required from pond back to mill.
Paste	60 to 70	High Pressure Pipeline	Spigots	Engineered containment structures with a low permeability layer	Very small to None	Seasonal reclaim may be required
Filtered	60 to 85	Truck	Bulldozer	Not required	None. Only run-off water	Not required for reclaim water, but could be required seasonally for run-off water.

Note: [1] The values in this column are typical ranges of solids contents for each tailings technology. The range of solids contents is dependent on the specific properties of the tailings material; therefore, the range of solids contents for Meliadine tailings may vary from those listed here.

3.3.2 Filtered Tailings

A filtered tailings system uses mechanical devices (such as high capacity vacuum filters or pressure filters), often in combination with chemical additives, to further dewater the tailings. The nature of the tailings, both the grain size and mineralogy, can play an important role in determining the effectiveness of filter processing. Tailings with a high percentage of clay-sized particles and also clay mineralogy may reduce the effectiveness of the filtering technology.

Filtered tailings are too thick to be pumped, so they are typically transported by truck or conveyor system and then “dry stacked” at the TSF. Typically, filtered tailings are dry stacked by placing, spreading, and compacting to form an unsaturated dense and stable mound. It is important to note that filtered tailings that are dry stacked are not truly “dry,” but rather have moisture contents several percentage points below saturation. These facilities may result in a smaller footprint area due to their increased density.

No additional containment structures, such as dams, are required to retain the tailings. However, dry stack facilities still require surface water runoff and seepage management systems. Ditches or berms in combination with sumps or ponds are used to redirect non-contact water away from the facility and to collect runoff from the stack. Reclamation strategies are to be tailored to the type of material and site characteristics; a reclamation cover is typically required at closure to restrict water contact with the tailings, prevent erosion, and prevent dust generation. Potentially acid generating tailings may require an infiltration barrier to reduce ARD generation.

3.4 Potential TSF Alternatives

Following completion of the pre-screening assessment and evaluation of tailings disposal technologies, six alternatives were identified for the MAA assessment, as follows:

- B7 Thickened;
- B7 Filtered;
- B4 Thickened;
- B4 Filtered;
- OL-5 Thickened; and
- OL-5 Filtered.

Preliminary layouts for each of these alternatives were prepared using the design criteria assumptions listed in Section 3.5 and are shown on Figures 2 and 3. A brief description of each alternative is provided below.

3.4.1 B7 Thickened

The B7 Thickened tailings storage facility alternative would be located north of Tiriganiaq Pit. The facility would involve staged construction of perimeter containment dikes around Lake B7 with discharge of thickened tailings into the natural basin of Lake B7. Prior to start up, it is anticipated that containment dikes would be required on the northwest, southeast and west sides of Lake B7. Lake B7 along with several small ponds within the footprint of the containment dikes will need to be dewatered. Tailings would be transported in a pipeline from the mill to the facility. During operation of the mine, the dikes would be extended and raised as additional storage is required. At the end of the mine life, the perimeter of the facility would be approximately 6.5 km with a crest elevation of 90 m. The maximum height of the dike would be approximately 32 m. A moderate pond would be maintained within the facility for reclaim of water back to the mill. Downstream water management control structures would be required in low areas along with perimeter ditching to direct and collect seepage and run-off.

Lake B7 is the largest waterbody (58 ha) affected by the B7 Thickened tailings storage facility. The lake is located at the headwaters of basin B and is one of the deepest lakes on the peninsula (maximum depth of 5.1 m). Talik calculations indicate that there is likely an open talik below Lake B7 (Golder, 2012a). Under-ice dissolved oxygen concentrations in April 2011 (5.0 to 5.6 mg/L) appear sufficient for overwintering of fish. Coarse substrates around the perimeter of the lake and across the majority of the east end of the lake provide abundant cover for rearing of Arctic grayling, burbot, cisco, slimy sculpin, and ninespine stickleback during open water periods. Patches of sand that lie among the coarse substrate may provide suitable spawning habitat for burbot and cisco. Arctic grayling do not spawn within the lake, but have been documented spawning in the outlet stream from B7. The remainder of the waterbodies within the B7 Thickened tailings facility footprint are thought to have low quality fish habitat. Several small ponds affected by the B7 Thickened tailings alternative have been investigated to assess habitat suitability for fish. These ponds were predominantly shallow (<2 m in maximum depth), with substrates dominated by fines, and contained poor fish habitat. Where fish were present, ninespine stickleback was the only species recorded (Golder, 2012a).

Most of the area considered under the B7 Thickened alternative is located in the headwaters of the B watershed, with the northeast corner located in the headwaters of the H watershed. Due to the location of the alternative within the watersheds, there are no stream diversions required for the B7 Thickened alternative.

Three archaeological sites were recorded along the exterior boundary of the B7 Thickened tailings storage facility footprint (Golder, 2012e). One, which is located just outside of the facility footprint, consisted of a stone marker and a cache and was mitigated in 2010. The other two were recorded in 2011 and consist of a cache located just outside of the facility footprint, and a stone circle, likely a hunting blind, which is located just within the facility footprint. Both sites recorded in 2011 were mitigated in 2012. All mitigation assessments must be confirmed by the Nunavut Department of Culture Language, Elders, and Youth.

3.4.2 B7 Filtered

The B7 Filtered tailings storage facility alternative would be located north of Tiriganiaq Pit and northeast of Lake B7. During operation of the mine, filtered tailings would be transported to the tailings storage facility by truck or conveyor and would be placed in lifts within the footprint of the facility using a bull dozer. An erosion protection layer would be required on the slopes of the facility. The final elevation of the facility would be 86 m and the maximum height of the facility would be approximately 23 m. Downstream water management control structures would be required in low areas along with perimeter ditching to direct run-off to the control structures.

The waterbodies within the B7 Filtered tailings facility footprint are thought to have low quality fish habitat. Several small ponds affected by the B7 Filtered tailings alternative have been investigated to assess habitat suitability for fish. These ponds were predominantly shallow (<2 m in maximum depth), with substrates dominated by fines, and contained poor fish habitat. Where fish were present, ninespine stickleback was the only species recorded (Golder, 2012a).

The B7 Filtered alternative is located in the headwaters of the B and H watersheds. Due to the location of the alternative within the watersheds, there are no stream diversions required for the B7 Filtered alternative.

Two archaeological sites were recorded along the exterior boundary of the B7 Filtered tailings footprint in 2011 (Golder, 2012e), and consist of a cache located just outside of the facility footprint, and a stone circle, likely a hunting blind, which is located just within the facility footprint. Both sites were mitigated in 2012. All mitigation assessments must be confirmed by the Nunavut Department of Culture Language, Elders, and Youth.

3.4.3 B4 Thickened

The B4 Thickened tailings storage facility alternative would be located west of Pump Pit. The facility would involve staged construction of perimeter containment dikes around Lake B4 with discharge of thickened tailings into the natural basin of Lake B4. Lake B4 and a few small ponds within the footprint of the containment dikes may need to be dewatered. Containment dikes would need to be constructed around the majority of the perimeter of the facility prior to start up, taking advantage of some high ground on the west of the facility. Tailings would be transported in a pipeline from the mill to the facility. During operation of the mine, the dikes would be extended and raised as more storage is required. At the end of the mine life the perimeter of the facility would be approximately 5.5 km with a crest elevation of 96 m. The maximum height of the dike would be approximately 42 m. A moderate pond would be maintained within the facility for reclaim of water back to the mill. Downstream water management control structures would be required in low areas, along with perimeter ditching to direct and collect seepage and run-off.

The B4 Thickened alternative would impact 5 waterbodies, of which Lake B4 is the largest. Lake B4 has a maximum depth of 2.4 m and does not provide overwintering habitat for fish (it was nearly anoxic [0.8 mg/L] in April 2011). Talik calculations indicate that it is unlikely that there is an open talik below Lake B4 (Golder, 2012a). During the open water season, this lake provides a migration corridor and rearing habitat to Arctic grayling that spawn in its inlet and outlet streams. Ninespine stickleback also use the shallow, near-shore areas during open water. The remainder of the waterbodies within the B4 Thickened tailings storage facility footprint are thought to have low quality fish habitat. Several small ponds affected by the thickened tailings alternative have been investigated to assess habitat suitability for fish. The ponds were predominantly shallow (<2 m in maximum depth), with substrates dominated by fines, and contained poor fish habitat. Where fish were present, ninespine stickleback was the only species recorded (Golder, 2012a).

The B4 Thickened alternative is located in the middle reach of the B watershed. Lake B4 (to be covered by this TSF option) currently receives flow from Lake B5 to the north (via stream B4-5), and from Lake B45 to the southeast (via Stream B4-45). The streams that currently convey this flow are short (146 m for Stream B4-5 and 30 m for B4-45) and are proposed to be covered by the TSF infrastructure. As such, all flows from the area north of Lake B4 would have to be diverted west towards the D watershed by constructing a short diversion channel (110 m in length) between the west margin of Lake B5 and the east shore of Lake D7. These flows would then enter Meliadine Lake via Lake D1 in the lower reaches of the D watershed. In addition, all flows into Lake B4 from Lake B45 would need to be diverted on the south side of the TSF to flow west into the south basin of Meliadine Lake via waterbodies B44, P3, P2, and P1. This would require raising the water level in Lake B45 by about 0.6 m and constructing a short channel (about 50 m in length) between waterbodies B44 and P3. The flow in all of the diversion channels associated with this alternative would be gravity-fed (no pumping required). Figure 4 shows conceptually where the diversions for the B4 alternatives would be required.

No archaeological features were located near the B4 Thickened tailings storage facility alternative (Golder, 2012e).

3.4.4 B4 Filtered

The B4 Filtered tailings storage facility alternative would be located west of Pump Pit. During operation of the mine, filtered tailings would be transported to the tailings storage facility by truck or conveyor and would be placed in lifts within the footprint of the facility using a bull dozer. An erosion protection layer would be required on the slopes of the facility. The final elevation of the facility would be 76 m and the maximum height of the facility would be approximately 22 m. Downstream water management control structures would be required in low areas, along with perimeter ditching to direct run-off to the control structures.

The B4 Filtered alternative would impact 5 waterbodies, of which Lake B4 is the largest. Lake B4 has a maximum depth of 2.4 m and does not provide overwintering habitat for fish (it was nearly anoxic [0.8 mg/L] in April 2011). Talik calculations indicate that it is unlikely that there is an open talik below Lake B4 (Golder, 2012a). During the open water season, this lake provides a migration corridor and rearing habitat to Arctic grayling that spawn in its inlet and outlet streams. Ninespine stickleback also use the shallow, near-shore areas during open water. The remainder of the waterbodies within the B4 Filtered tailings facility footprint are thought to have low quality fish habitat. Several small ponds affected by the B4 Filtered tailings alternative have been investigated to assess habitat suitability for fish. The ponds were predominantly shallow (<2 m in maximum depth), with substrates dominated by fines, and contained poor fish habitat. Where fish were present, ninespine stickleback was the only species recorded (Golder, 2012a).

The B4 Filtered alternative is located in the middle reach of the B watershed. Lake B4 (to be covered by this TSF option) currently receives flow from Lake B5 to the north (via stream B4-5), and from Lake B45 to the southeast (via Stream B4-45). The streams that currently convey this flow are short (146 m for Stream B4-5 and 30 m for B4-45) and are proposed to be covered by the TSF infrastructure. As such, all flows from the area north of Lake B4 would have to be diverted west towards the D watershed by constructing a short diversion channel (110 m in length) between the west margin of Lake B5 and the east shore of Lake D7. These flows would then enter Meliadine Lake via Lake D1 in the lower reaches of the D watershed. In addition, all flows into Lake B4 from Lake B45 would need to be diverted on the south side of the TSF to flow west into the south basin of Meliadine Lake via waterbodies B44, P3, P2, and P1. This would require raising the water level in Lake B45 by about 0.6 m and constructing a short channel (about 50 m in length) between waterbodies B44 and P3. The flow in all of the diversion channels associated with this alternative would be gravity-fed (no pumping required). Figure 4 shows conceptually where the diversions for the B4 alternatives would be required.

No archaeological features were located near the B4 Thickened tailings storage facility alternative (Golder, 2012e).

3.4.5 OL-5 Thickened

The OL-5 Thickened tailings storage facility would be located approximately 2 km southeast of F Zone Pit. The facility would involve staged construction of perimeter containment dikes with discharge of thickened tailings into the facility. Prior to start up, starter containment dikes would be constructed around the perimeter of the facility. There are some small ponds within the footprint of the containment dikes that may need to be dewatered prior to construction of the dikes. Tailings would be transported in a pipeline from the mill to the facility. During operation of the mine, the dikes would be raised as more storage is required. At the end of the mine life the perimeter of the facility would be approximately 6 km with a crest elevation of 98 m. The maximum height of the dike would be approximately 39 m. A moderate pond would be maintained within the facility for reclaim of water back to the mill. Downstream water management control structures would be required in low areas, along with perimeter ditching to direct and collect seepage and run-off.

There are 19 small waterbodies within the footprint of the OL-5 Thickened alternative that are thought to have low quality fish habitat. Several small ponds affected by the OL-5 Thickened tailings alternative have been investigated to assess habitat suitability for fish. The ponds were predominantly shallow (<2 m in maximum depth) and contained poor fish habitat with substrates dominated by fines. Where fish were present, ninespine stickleback was the only species recorded (Golder, 2012a).

The OL-5 alternatives are located in the headwaters of the L watershed that drains into the east basin of Meliadine Lake via an undefined ephemeral channel. It is not anticipated that water diversion would be required for the OL-5 alternatives; however, there is the potential that water flow from the upstream ponds between the catchment boundary and the OL-5 alternatives may require some diversion.

The OL-5 Thickened alternative is just east of the proposed all weather road. This area is lower and wetter and there were no archaeological sites recorded in this area (Golder, 2012e).

3.4.6 On-Land 5 Filtered

The OL-5 Filtered tailings storage facility alternative would be located approximately 2 km southeast of F Zone Pit. During operation of the mine, filtered tailings would be transported to the facility by truck or conveyor and would be placed in lifts within the footprint of the facility using a bull dozer. An erosion protection layer would be required on the slopes of the facility. The final elevation of the facility would be 93 m and the maximum height of the facility would be approximately 26 m. Downstream water management control structures would be required in low areas, along with perimeter ditching to direct run-off to the control structures.

There are 13 small waterbodies within the footprint of the OL-5 Filtered alternative that are thought to have low quality fish habitat. Several small ponds affected by the OL-5 Filtered alternative have been investigated to assess habitat suitability for fish. The ponds were predominantly shallow (<2 m in maximum depth) and contained poor fish habitat, with substrates dominated by fines. Where fish were present, ninespine stickleback was the only species recorded (Golder, 2012a).

The OL-5 alternatives are located in the headwaters of the L watershed that drains into the east basin of Meliadine Lake via an undefined ephemeral channel. It is not anticipated that water diversion would be required for the OL-5 alternatives; however, there is the potential that water flow from the upstream ponds between the catchment boundary and the OL-5 alternatives may require some diversion.

The OL-5 Filtered alternative is just east of the proposed all weather road. This area is lower and wetter and there were no archaeological sites recorded in this area (Golder, 2012e).

3.5 Design Criteria Assumptions

The design criteria values summarized in Table 3 were estimated to relatively compare the different tailings alternatives in completion of the TSF alternatives assessment. The values are based on assumptions made at the start of the assessment process for relative comparison purposes only, and are not meant for design purposes. Final design criteria for the preferred alternative may vary from the values provided in Table 3.

Table 3: TSF Alternatives Assessment Design Criteria Assumptions

Criteria	Value	Units	Comments
Total life of mine tailings production	34	Mt	Provided by AEM.
Specific gravity	2.73		Provided by AEM. From lab testing.
Minimum set-back from pit	150	m	
Thickened Tailings (Chosen to represent hydraulically placed tailings)			
Slurry solids content	62	%	Average value. A range is anticipated during operation.
Expected in situ dry density	1.37	t/m^3	Assumed value based on experience.
	20	%	Assumed bulking due to ice. Based on experience.
	1.14	t/m^3	In situ density including bulking due to ice.
Required tailings storage volume	25	Mm^3	
Required total storage volume including ice	30	Mm^3	Calculated assuming density for 20% bulking due to ice.
Tailings beach slope - thickened	1	%	Assumed value based on experience.
Containment dike dimensions			
Crest width	15	m	
Upstream slope	3H:1V		
Downstream slope	3H:1V		
Freeboard	2	m	
Filtered Tailings (Chosen to represent mechanically placed tailings)			
Filter cake solids content	85	%	Provided by AEM.
In situ dry density	1.70	t/m^3	Assumes 80% in situ saturation.
Required tailings storage volume	20	Mm^3	
Slopes	5H:1V		
Erosion protection thickness	1	m	

3.6 Multiple Accounts Analysis (MAA) Method

A multiple accounts approach was used to evaluate the six alternatives that were identified following the pre-screening assessment and evaluation of tailings disposal technologies. Details of the MAA method are described in the Environment Canada 2011 Guidelines (EC 2011a). The MAA assessment involved relative evaluation of alternatives for management of tailings based on environmental, technical, social, and economic considerations. Evaluation criteria called sub-accounts and indicators were developed for each of these areas. The alternatives were evaluated against each criteria using a six point scale. Weightings were also used to introduce a value bias between the individual criteria. The scoring and weighting was combined to calculate individual scores for each alternative to allow for relative ranking of the alternatives and determination of the preferred option. Further details on the process are described in Section 3.7.

3.7 Preparation of Multiple Accounts Ledger

A series of evaluation criteria (called sub-accounts) were developed and grouped into four categories or accounts: environmental, social, technical, and economic. In some cases the sub-accounts required further refinement to allow for measurement and evaluation. These sub-accounts were broken down into measurement criteria called indicators. The following sections summarize the sub-accounts and indicators for each of the four accounts.

3.7.1 Environmental Sub-accounts and Indicators

The following table summarizes the sub-accounts and indicators that were developed to evaluate the alternatives with respect to environmental considerations. Descriptions of each sub-account and/or indicator are provided in the sections below Table 4.

The first group of sub-accounts and indicators in Table 4 is titled “Possible production of contaminating agents” and includes the potential “contaminants” that the TSF could produce. The second two groups of sub-accounts and indicators represent the aquatic and terrestrial environments, habitats, and species located around the TSF alternatives that could be affected by the TSF contaminants.

Table 4: Environmental Sub-accounts and Indicators

Sub-accounts	Indicators	
	Number	**Description**
Possible production of contaminating agents		
Potential for dust generation	ENV-1	Dust generation at the TSF
	ENV-2	Dust generation outside of the TSF
Potential release of potentially problematic water	ENV-3	Risk associated with the management of high volumes of water in the TSF
	ENV-4	Reclaim water pipeline
	ENV-5	Ground conditions – potential for seepage to groundwater
Tailings spill	ENV-6	TSF failure during operations
	ENV-7	Accidental spill of tailings during transport in a non-confined area
Greenhouse gas emissions	ENV-8	Emissions due to construction
	ENV-9	Emissions due to tailings transport
Water quality, aquatic habitat, and species		
Watersheds	ENV-10	Number of watershed(s) affected by TSF footprint
	ENV-11	Location within the watershed
	ENV-12	Area of affected sub-catchment(s) (ha)
Fish habitat	ENV-13	Distance from Meliadine Lake (m)
	ENV-14	Aquatic habitat loss (ha)
	ENV-15	Stream diversion
	ENV-16	Stream crossing by the road/pipeline (# of crossings)
	ENV-17	Potential effect on surrounding fish habitat (ha)
Terrestrial habitat and species		
TSF footprint area (ha)	ENV-18	N/A - No indicator required for measurement
Vegetation and terrestrial habitat	ENV-19	Presence of vegetation that is uncommon within the footprint (ha)
	ENV-20	Potential effect on surrounding vegetation
Potential effect on birds (wildfowl and shore birds) from TSF water	ENV-21	Potential effect on wildfowl and shore birds from TSF water
	ENV-22	Potential to affect raptor nesting habitat
Distance from a natural park or protected habitat (km)	ENV-23	N/A - No indicator required for measurement

N/A = not applicable; no indicator required for measurement of sub-account

3.7.1.1 Potential for dust generation

The relative potential for each option to generate dust during mine operation was qualitatively judged. The prevailing wind direction at the Meliadine Project site is from the northwest, averaging about 20 km/h to 30 km/h. Alternatives that are substantially exposed above ground would have the potential for ongoing dust generation during operations. The dispersion of dust could potentially result in deposition in lakes and on land downwind of the facility. Dust contamination can also lead to increased reclamation requirements at closure. This sub-account is dependent on the method of tailings deposition selected and on the relative area and relief of the facility, as discussed in greater detail for each indicator below.

Dust generation at the TSF

Alternatives that maintain the tailings in a relatively wet state are less likely to produce dust than alternatives that maintain the tailings relatively dry. In addition, facilities that have more relief above surrounding topography and/or a larger surface area of active, relatively dry and exposed tailings are more likely to produce dust. This dust can potentially affect surrounding areas.

Dust generation outside of the TSF

Alternatives that will promote dust generation outside of the TSF (along the road or other areas) are not preferred. Dust generation outside of the TSF mainly relates to the transportation mode for the tailings. Alternatives that involve trucked transport of tailings were scored lower (least preferred) than alternatives that would involve hydraulic transport of tailings in a pipeline. Tailings in a pipeline are confined during transport, while tailings in truck bins can more easily disperse, especially at loading/unloading points. In addition, dust dispersion can occur due to tailings material being transported and dispersed on truck tires.

3.7.1.2 Potential release of potentially problematic water

Risk associated with the management of high volumes of water in the TSF

This indicator was used to measure the relative potential for environmental contamination caused by release of process water due to seepage from the facility, or overtopping. Tailings alternatives that manage a larger tailings pond within the facility were given lower scores (least preferred) to appreciate a higher risk for release of water.

As discussed in Section 2.8, the tailings could leach arsenic and there are some years in the mine life where the tailings acid generation potential is unknown. It is anticipated that leaching of arsenic and Acid Rock Drainage (ARD) could occur from either thickened or filtered tailings. The concentration of arsenic and/or the acidity of the tailings pond may vary between the two technologies; however, for the purpose of this assessment the water from either type of tailings was considered to require monitoring and potential treatment prior to discharge to the environment.

Reclaim Water Pipeline

This indicator evaluated the potential of environmental impact caused by release of reclaim water from a pipeline that could leak or break.

Ground Conditions – Potential for seepage to groundwater

The relative potential for seepage to affect groundwater during operation was qualitatively judged. This sub-account is dependent on the ground conditions below the facility. Alternatives located “on land” with only small ponds within the footprint are expected to have permafrost foundations and therefore have the lowest relative potential to affect groundwater due to seepage. Alternatives located in a lake basin have a higher likelihood of a talik below the facility and therefore a slightly higher relative potential to affect groundwater. Each alternative was evaluated based on the relative potential for an open talik to exist below the footprint of the facility. Alternatives with a known talik within the footprint were scored the lowest (least preferred), and alternatives that are “on land” with only small ponds within the footprint were scored the highest (most preferred). It should be noted that the site specific hydraulic conductivity of the foundations, the thermal performance of each of the facilities, or potential additional design measures to control potential seepage to groundwater was not considered in the MAA analysis. Where relevant, these aspects would be considered during the design phase for the preferred alternative.

3.7.1.3 Tailings Spill

TSF failure during operations

The relative potential for a TSF failure was qualitatively judged for each facility. Failure may occur if containment dikes fail either through the man-made perimeter dikes, or through the foundation materials due to low strength. The assessment considered the volume of water that would be contained in the facility, the in situ density of the tailings, and the height of the facility. Alternatives that contain less water, have a higher tailings in situ density, and a lower height have lower mobility of the tailings in the event of a failure and will therefore have a lower consequence upon failure. Alternatives meeting these criteria were given higher scores (most preferred).

Accidental spill of tailings during transport in a non-confined area

The relative potential for an accidental tailings spill during transport was qualitatively judged for each alternative. Alternatives were evaluated based on the distance from the mill to the TSF and the type of transportation. A shorter distance from the mill to the TSF and piping transport were considered to have a lower risk for a major spill, so were given higher scores. Trucked transport of tailings was considered to have a higher risk for a major spill, and a trucking accident may also have health and safety consequences. Alternatives that require trucked transport of tailings were given lower scores (least preferred).

3.7.1.4 Greenhouse gas emissions

The relative quantity of greenhouse gas emissions that are anticipated due to construction and tailings management for each alternative were qualitatively judged.

Emissions due to construction

This indicator evaluated the relative greenhouse gas emissions due to the construction of containment dikes or the erosion protection layer for each alternative. Alternatives that require more construction and are further from the source of construction materials will result in the highest amount of greenhouse gas emissions and were therefore given the lowest scores (least preferred). For the purposes of the analysis, it was assumed that the borrow source would be the Tiriganiaq Pit. Generic scores were calculated by multiplying the construction volume by the haul distance, and the alternatives were linearly ranked based on these scores.

Emissions due to tailings deposition

This indicator was used to evaluate the relative greenhouse gas emissions due to tailings transportation and deposition. Alternatives that require truck transport and bulldozer placement of tailings, and are further away from the mill will result in the highest amount of greenhouse gas emissions and were therefore given the lowest scores (least preferred).

3.7.1.5 Watersheds

A watershed, or drainage basin, is an area of land bounded by natural high points (hills, ridges, and mountains). Surface water (rainfall and runoff) flows down through the watershed area and into one low point (a creek, river or bay). Watershed areas may be further divided into sub-catchments.

Number of watersheds affected by TSF footprint

This indicator was used to compare the relative number of watersheds affected by the alternative. Alternatives that affect a larger number of watersheds have an increased potential to impact hydrological conditions and/or water quality over a greater area in the event of a failure, seepage, and/or by the mere presence of the TSF. These alternatives were given lower scores (least preferred).

Location within the watershed

This indicator was used to compare the relative location of the alternatives within a watershed. Alternatives located in the upstream section of a watershed have a higher potential to impact hydrological conditions and/or water quality within more of the watershed than alternatives that are located in the downstream section of a watershed. Alternatives were scored based on whether they were located in the upper, middle, or lower portion of the watershed, with the latter receiving the highest score (most preferred).

Area of affected sub-catchment(s)

This indicator was used to compare the relative potential for deteriorating water quality within the sub-catchment(s) of each alternative. Sub-catchment area for the purpose of this evaluation was defined as the primary portion of the watershed that could potentially be impacted by the facility. Alternatives located within a sub-catchment with a smaller area were assigned a relatively higher score (most preferred) than alternatives located in a sub-catchment with a larger area.

3.7.1.6 Fish habitat

Distance from Meliadine Lake

Meliadine Lake is the largest lake within the vicinity of the Meliadine Project and has the most significant fish habitat. This indicator was used to compare the relative potential to affect Meliadine Lake due to a failure or seepage from each tailings storage alternative. The shortest straight line distance was measured from each alternative to Meliadine Lake, and the alternatives were scored using a linear scale with the shortest distance given the lowest score (least preferred). A straight line distance was conservatively used to evaluate this indicator rather than using flow path distances to reflect the potential for a failure to occur at any location around a facility. In reality, the seepage flow path would likely be controlled by topography, which would lead to larger flow distances to Meliadine Lake. Flow from a failure would be less controlled by topography.

Aquatic habitat loss

This indicator was used to compare the relative potential loss of fish habitat within the footprint of each facility. The expected quality of fish habitat for each lake/pond within the footprints of the alternatives were evaluated and assigned a value of 0.5 for low or unknown quality and 0.75 for medium to high quality habitat. The quality of habitat was assessed based on the number and type of species present, and seasonal versus year-round use of habitat.

High quality habitat was defined as providing overwintering potential and year-round use by all regional fish species, including lake trout and Arctic char. There were no lakes/ponds with high quality habitat within the footprints of the alternatives. Medium quality habitat was defined as providing overwintering potential and year-round use by ninespine stickleback, Arctic grayling and cisco, but not for lake trout and Arctic char. Low quality habitat was defined as habitat with no overwintering potential and open-water use by ninespine stickleback only.

Values for aquatic habitat loss were calculated for each alternative by multiplying the areas of each lake/pond by the corresponding assigned habitat quality score and adding the values together. The alternatives were then ranked using a linear scale with the alternative with the lowest aquatic habitat loss value receiving the highest score (most preferred).

The environmental impact study and the no net loss plan for the Project will involve calculations of actual habitat units using a more detailed system that classifies each pond or lake area into distinct habitat types (based on depth and substrate) and applies habitat suitability indices for each life function of each species per habitat type. Only those waterbodies identified as medium and high risk in accordance with the DFO risk characterization framework (DFO, 2010) would require a *Fisheries* Act authorization, which requires the proponent to address habitat compensation through a No Net Loss Plan. A detailed assessment of risk, habitat classification, habitat units was not possible for the alternatives assessment, since not all ponds and lakes within all the footprints had been classified in terms of available habitat types at the time of completing this MAA. Therefore, the simplified scoring evaluation system above considering all waterbodies and habitat types irrespective of risk classification was developed for the purpose of comparing the alternatives for the MAA, and the resulting values for habitat lost may differ from those presented in the Project No Net Loss Plan.

Stream diversion

This indicator was used to compare the requirement and anticipated success of stream diversions to maintain flow around each alternative. In some cases an alternative may not require a stream diversion, particularly if the facility is located in the upper section of the watershed; these alternatives were given the highest score (most preferred). Alternatives that will require significant lengths of stream diversion, and/or where the success of the diversion construction is unknown, were given lower scores (least preferred).

Stream crossings by the road/pipeline

This indicator was used to compare the relative potential for altering the water quality in water bodies along the alignment of the TSF access road and/or tailings distribution pipeline during construction or operations of each alternative. The potential to impact water quality could occur due to dust from road traffic or from an accidental tailings spill from a pipeline or from a haul truck. Alternatives were scored using a linear scale based on the total number of stream and/or pond/lake crossings.

Potential effect on surrounding fish habitat

This indicator was used to compare the relative potential for impacting medium to high quality fish habitat surrounding each of the alternatives due to potential "contaminants" that the TSF could produce (see Sections 3.7.1.1 to 3.7.1.4). High quality habitat was defined as providing overwintering potential and year-round use by all regional fish species, including lake trout and Arctic char. Medium quality habitat was defined as providing overwintering potential and year-round use by ninespine stickleback, Arctic grayling and cisco, but not for lake trout and Arctic char. The alternatives were scored based on the proximity of medium to high quality habitat using four rankings: less than 50 m, 50 to 100 m, 100 to 200 m, and greater than 200 m. Alternatives with smaller distances were given lower scores (least preferred).

As noted above, the environmental impact study and the no net loss plan for the Project will involve a more detailed system that classifies each pond or lake area into distinct habitat types (based on depth and substrate) and applies habitat suitability indices for each life function of each species per habitat type. Only those waterbodies identified as medium and high risk in accordance with the DFO risk characterization framework (DFO, 2010) would require a *Fisheries* Act authorization, which requires the proponent to address habitat compensation through a No Net Loss Plan. A detailed assessment of risk and habitat classification was not possible for the alternatives assessment, since the ponds and lakes within all the footprints had not been classified in terms of risk at the time of completing this MAA. Therefore, the simplified habitat classification system above was used for the purpose of comparing the alternatives for the MAA, and the high and medium habitat quality rankings used may differ from those presented in the Project No Net Loss Plan.

3.7.1.7 TSF footprint area

This sub-account was used to compare the footprint area of each alternative. The total footprint area, in hectares, was used to assign relative scores and judge the potential impact of each alternative on the environment due to the physical presence of the facility. The alternatives were scored using a linear scale based on the footprint area. The alternative with the largest footprint was given the lowest score (least preferred), and the alternative with the smallest footprint was given the highest score (most preferred).

The potential effects on water quality and quantity due to potential changes in flow, and in nutrient levels or food availability are evaluated when considering the TSF footprint in combination with the watershed indicators described in Section 3.7.1.5 (e.g., position in the watershed, size of the TSF footprint),. For example, a facility located in the headwaters of a catchment having a larger footprint is anticipated to result in a comparatively larger reduction in catchment runoff through collection of contact water within the facility, and would therefore result in lower flows downstream of the facility. .

3.7.1.8 Vegetation and terrestrial habitat

Presence of vegetation that is uncommon within the footprint

This indicator was used to compare the relative potential for impacting an uncommon vegetation community within the footprint of each alternative. An uncommon plant community was defined as those plant communities with a restricted distribution in the local study area, including the Birch Seep and Riparian Willow/Birch plant communities, which represent 3% and <1% of the local study area, respectively.

Potential effect on surrounding vegetation

This indicator was used to compare the relative potential for impacting an uncommon vegetation community within a 60 m buffer surrounding each alternative due to dust, failure, or seepage. Values for potential effect on surrounding vegetation were calculated for each alternative by multiplying the area within a 60 m buffer where there is presence of uncommon vegetation by 1.5, the area where there is presence of special status receptors by 2, and then adding these values together. The alternatives were scored using a linear scale with the alternative with the highest value receiving the lowest score (least preferred), and the alternative with the lowest value receiving the highest score (most preferred).

3.7.1.9 Birds

Potential effect on birds (waterfowl and shore birds) from TSF water

This indicator was used to compare the relative potential impact on bird populations that may ingest water from the TSF. Alternatives that will have a larger tailings pond are more likely to attract birds in the spring (when the tailings pond may be free of ice while surrounding lakes are still frozen) and are therefore more likely to have a negative impact on the birds should any problem arise with water quality in the TSF. The size of the pond associated with each alternative was based on the tailings technology. Alternatives that will have a larger pond were given lower scores (least preferred). Water quality was not considered to vary significantly from one alternative to another.

Potential effect on raptor nesting habitat

This indicator was used to compare the relative potential impact on raptor nesting habitat. An 800 m buffer area around the alternatives was included in the assessment. Consideration was also given to whether the alternative would affect raptor habitat that would not be affected by other aspects of the Project. The alternatives were evaluated based on the proximity of raptor nest sitings and the amount of steep cliff terrain within the footprints that could provide raptor nesting habitat. Between 1998 and 2000, and in 2008, 2009, 2011, and 2013 nest surveys were used to search for raptor nesting sites within approximately 10 km of the Project footprint. These surveys were designed to determine occupancy of historical nest sites, identify new nest sites, and monitor for occupancy and productivity (Volume 6, Section 6.7.2.1.3). The raptor nests that have been observed and documented in the general vicinity of the TSF alternatives are shown on Figure 5.

The presence of steep cliff habitat in the vicinity of the alternatives was also considered in the assessment. Raptor species prefer to nest on steep cliffs and large boulders in barren-ground tundra environments (Bechard and Swem 2002; White et al. 2002; Booms et al. 2008) as terrestrial predators have difficulty accessing these areas. Slopes of 33 degrees or more were assumed to indicate rock outcrops and were considered to be steep cliff habitat, and, therefore, potential raptor nesting habitat. The amount of steep cliff habitat within each alternative footprint (and 800 m buffer area) was assessed.

3.7.1.10 Distance from a natural park or protected habitat (km)

This sub-account was used to compare the relative potential for altering a protected or highly valued site. Iqalugaarjuup Nunanga Territorial Park is the closest protected or highly valued site to the project site. The straight line distance from each alternative to Iqalugaarjuup Nunanga Territorial Park was measured and the alternatives were scored using a linear scale with the alternative with the shortest distance receiving the lowest score (least preferred) and the alternative with the longest distance receiving the highest score (most preferred).

3.7.2 Social Indicators

The following table (Table 5) summarizes the sub-accounts and indicators that were developed to evaluate the alternatives with respect to social considerations. Descriptions of each sub-account and/or indicator are provided in the sections following the table.

Table 5: Social Sub-accounts and Indicators

Sub-accounts	Indicators	
	Number	Description
Touristic, recreational, and vacation activities and infrastructures	SOC-1	N/A - No indicator required for measurement
Archaeological site, cultural or heritage asset	SOC-2	N/A - No indicator required for measurement
Integration into the landscape	SOC-3	N/A - No indicator required for measurement
Potential to affect worker health and safety	SOC-4	Relative number of workers at higher risk of being affected by dust from the TSF
	SOC-5	Safety of workers

N/A = not applicable; no indicator required for measurement of sub-account

3.7.2.1 Touristic, recreational and vacation activities and infrastructures

This sub-account was used to compare the relative potential of the alternatives to interfere with recreational, tourist or vacation activities. The recreational, tourist or vacation activities known in the area relate to a small number of cabins in the vicinity of Meliadine Lake. The use of these cabins may be impacted by noise and/or dust from the TSF operations, which may adversely affect the enjoyment of the cabins. Each alternative was scored based on whether it could potentially impact a cabin(s) and what that potential impact might be. The lowest score (least preferred) was defined as requiring relocation of a cabin(s), but there were no alternatives that received this score. A mid-level score was given if an alternative could potentially affect a cabin(s) due to dust and/or noise, and the highest score was given if there was no anticipated interference (most preferred).

3.7.2.2 Archaeological site, cultural or heritage asset

This sub-account was used to compare the potential of affecting an archaeological site, cultural or heritage asset within the footprint of the TSF. Each alternative was scored based on whether any archaeological sites, cultural or heritage assets had been identified within, or in very close proximity to the footprint, and the ability to mitigate the sites if they exist.

3.7.2.3 Integration into the landscape

This sub-account was used to compare the relative visual effect each alternative might have on the surrounding landscape and the ability of the facility to be reclaimed to allow access for wildlife (e.g., the new landform could be used by caribou for insect avoidance). The alternatives were scored using a linear scale based on their maximum heights above surrounding topography, with the alternative with the smallest height receiving the highest score (most preferred), and the alternative with the highest height receiving the lowest score (least preferred).

3.7.2.4 Potential to affect worker health and safety

Relative number of workers at higher risk of being affected by dust from the TSF

This indicator was used to compare the relative potential to affect worker health based on the requirements for operation of each alternative. Workers that are directly involved in the tailings operation (maintenance, trucking, surfacing) are more susceptible to being exposed to tailings dust and thus are more at risk of potentially being affected by the dust. This indicator was evaluated based on the operational requirements for each tailings technology. Thickened tailings management was considered to require a minimal number of workers dealing directly with the tailings so thickened tailings alternatives received higher scores. Filtered tailings management was considered to require many workers for material transport and handling (trucking, bulldozing), as well as a dedicated team for the operation and maintenance of the filter press and associated conveyors. These workers were considered to be at a comparatively higher health risk due to dust so filtered tailings alternatives received lower scores (least preferred).

Safety of workers

This indicator was used to compare the relative risk to worker safety in the event of a failure of each alternative. Alternatives that are located in close proximity to populated areas of the site (i.e., the mill/camp or open pits) were considered to have a higher risk. The shortest straight line distance from each facility to either an open pit or the mill/camp was measured, and the alternatives were scored using a linear scale with the alternative with the shortest distance receiving the lowest score (least preferred), and the alternative with the longest distance receiving the highest score (most preferred).

3.7.3 Technical Indicators

The following table summarizes the sub-accounts and indicators that were developed to evaluate the alternatives with respect to technical issues. Descriptions of each sub-account and/or indicator are provided in the sections following the table.

Table 6: Technical Sub-accounts and Indicators

Sub-accounts	Indicators	
	Number	**Description**
Permitting		
Risk of potential delays in permitting leading to delays in overall project schedule and start-up	TECH-1	N/A - No indicator required for measurement
Construction Risks		
Risk associated with the construction phase for the TSF	TECH-2	Probability of having schedule delays
	TECH-3	Probability of reduced quality of construction
Operations		
Site access	TECH-4	N/A - No indicator required for measurement
Reliability/efficiency of operation	TECH-5	Stability and continuousness of operations
	TECH-6	Risk related to plant shut down due to tailings transportation interruptions
Equipment maintenance	TECH-7	N/A - No indicator required for measurement
Water management	TECH-8	Potential to grow/trap ice and snow
	TECH-9	Length of reclaim pipeline (km)
	TECH-10	Quantity of water to be managed/reclaimed from the TSF
	TECH-11	Sumps for collection of seepage and/or surface run-off
Storage efficiency	TECH-12	N/A - No indicator required for measurement
Expansion possibilities	TECH-13	N/A - No indicator required for measurement
Closure and reclamation		
Progressive reclamation	TECH-14	N/A - No indicator required for measurement

N/A = not applicable; no indicator required for measurement of sub-account.

3.7.3.1 Risk of potential delays in permitting leading to delays in overall project schedule and start-up

This sub-account was used to compare the relative risk of potential delays to the project due to permitting delays. Regulators and/or the general public may have more concerns related to the design of some alternatives compared to others. Designs that require the construction of dikes and maintenance of a pond may be more of a concern. Concerns may also arise regarding the location of the TSF, the number and size of lakes/ponds in the footprint area, and Non-governmental Organization (NGO) attention relative to the requirement for a Schedule 2 listing or other permitting requests. Alternatives that may be less of a concern for the regulators and the general public are less likely to result in delays to the overall project and are thus preferred (scored higher).

3.7.3.2 Risk associated with the construction phase for the TSF

Probability of having schedule delays

This indicator was used to compare the relative probability of a delay to the start-up of the project due to construction activities being impaired. Delays may occur for many reasons such as the construction plan not including sufficient margin for weather events, seasonal considerations, insufficient resources (construction materials and equipment), or design changes because conditions or materials are different than expected.

Alternatives that require less construction and preparation work (e.g., foundation preparation, dike construction, dewatering) before mill start-up have a lower risk to the project schedule and were therefore scored higher (most preferred).

Probability of reduced quality of construction

Due to the northern location of the Meliadine Project, there is a shorter construction season available for TSF infrastructure. This indicator was used to compare the relative potential for construction of major infrastructure in winter due to schedule delays. Alternatives that require less construction have less potential for construction to be conducted in winter conditions and so have less risk to the quality of the construction. These alternatives were therefore scored higher (most preferred).

3.7.3.3 Site access

This sub-account was used to compare the relative requirement for access routes for roads, utilities, tailings transport and infrastructure. TSF alternatives that are located closer to the mill will have a shorter access route resulting in lower construction costs, easier operation, and less potential to affect the environment along the route (e.g., dust).

3.7.3.4 Reliability/efficiency of operation

Stability and continuousness of operations

This indicator was used to compare the relative stability of the tailings operation. The evaluation considered the ease of operation and the requirement for specialized personnel with specialized training and experience to operate. Tailings technologies that were considered to have more stable operating conditions and that require less specialized operators, training, and experience were considered to present less risk to the continuousness of operation, and were therefore scored higher (most preferred).

Risk related to plant shut-down due to tailings transport interruptions

Tailings alternatives that have a lower risk of plant shut down due to tailings transportation interruptions are preferred. Tailings transport that is proven to be reliable in a cold climate with low risk of transport interruptions is preferred. In addition, proximity to the mill can influence the risk of interruption of tailings transport.

3.7.3.5 Equipment maintenance

This sub-account was used to compare the relative overall plant availability and costs associated with it. The evaluation considered the effort needed to train specialized personnel to do the maintenance, including unexpected and premature wear and corrosion. Alternatives that require less specialized maintenance, less spare parts inventory and less overall maintenance time are preferred as they are less likely to result in decreased plant availability.

3.7.3.6 Water management

Potential to grow/trap ice and snow

This indicator was used to compare the relative potential to grow/trap ice and snow within each alternative. Ice entrapment reduces available space for tailings storage and is less efficient from a water management and reclaim perspective. Alternatives that manage relatively large amounts of water have greater ice formation potential and were scored lower (least preferred).

Length of reclaim pipeline

This indicator was used to compare the relative length of reclaim pipeline. Alternatives located further from the mill will require more reclaim pipeline, more pumping power, and more maintenance. There is also an increased risk of a reclaim water spill with a longer pipeline. The alternatives were scored using a linear scale based on the estimated reclaim pipeline length from the TSF to the mill. The alternative with the longest pipeline received the lowest score (least preferred), and the alternative with the shortest pipeline received the highest score (most preferred).

Quantity of water to be managed/reclaimed from the TSF

This indicator was used to compare the relative quantity of water to be managed/reclaimed from each alternative. Alternatives that require management of comparatively larger volumes of reclaim water have a higher cost and a higher potential for a spill, and therefore received lower scores (least preferred).

Sumps for collection of seepage and/or surface run-off

This indicator was used to compare the relative number of sumps required for collection of seepage and/or surface run-off. The alternatives were scored using a linear scale with the alternative with the largest number of sumps receiving the lowest score (least preferred), and the alternative with the smallest number of sumps receiving the highest score (most preferred).

3.7.3.7 Storage efficiency

This sub-account was used to compare the relative storage efficiency of the alternatives. Storage efficiency is defined as the ratio of volume of tailings storage to volume of dike containment or waste rock erosion protection layer over the tailings. Alternatives that provide greater amounts of storage relative to the volume of containment dike or erosion protection fills are preferred. The storage efficiency ratio was calculated for each alternative and the alternatives were scored using a linear scale. The alternative with the lowest storage efficiency ratio received the lowest score (least preferred), and the alternative with the highest storage efficiency ratio received the highest score (most preferred).

3.7.3.8 Expansion possibilities

This sub-account was used to compare the relative expansion possibilities for each alternative. The requirement to expand a facility can occur due to many factors, such as overestimating in situ tailings density during design, or discovering more ore later in the mine life. The ability to expand each alternative either vertically or horizontally was evaluated, and a relative magnitude of expansion was estimated. Alternatives that were considered to have the most opportunity for expansion were scored higher (most preferred).

3.7.3.9 Progressive reclamation

This sub-account was used to compare the relative opportunity for progressive reclamation. Progressive reclamation allows for closure costs to be spread out during operation and often reduces the risk related to material availability as more material is typically available during operations. Progressive reclamation can often be completed using direct haul of material from the pit to the TSF, therefore reducing the requirements for re-handling of materials. Alternatives that can be progressively reclaimed received higher scores (most preferred).

3.7.4 Economic Indicators

Table 7 summarizes the sub-accounts and indicators that were developed to evaluate the alternatives with respect to economic factors. Descriptions of each sub-account and/or indicator are provided in the sections following the table.

Table 7: Economic Sub-accounts and Indicators

Sub-accounts	Indicators	
	Number	Description
Capital costs	EC-1	Initial TSF construction
	EC-2	Tailings dewatering infrastructure, equipment and parts inventory
	EC-3	Tailings transport system and reclaim water system
Operating costs	EC-4	Phased containment dike or erosion protection construction
	EC-5	Tailings plant operation
	EC-6	Tailings handling
	EC-7	Fresh water make-up
Closure/reclamation costs	EC-8	Construction of a cover over the TSF
	EC-9	Water treatment

3.7.4.1 Capital costs

Initial TSF construction costs

This indicator was used to compare the relative initial TSF construction costs. Initial TSF construction costs include, as required, the following:

- foundation preparation;
- dike construction, including lining of the dikes; and
- water collection system construction.

The volume of construction material was used in combination with the distance required to truck it from the Tiriganiaq Pit (assumed rockfill supply for initial construction) to evaluate the relative initial constructions costs, as this was considered to be the most significant construction cost. Alternatives that require less construction and are closer to the Tiriganiaq pit are preferred.

Generic cost scores were assigned by multiplying the construction fill volume by the distance from Tiriganiaq Pit. The alternatives were scored using a linear scale with the alternative with the highest generic cost score receiving the lowest score (least preferred), and the alternative with the lowest generic cost score receiving the highest score (most preferred).

Tailings dewatering infrastructure, equipment and parts inventory

This indicator was used to compare the relative capital investment required for the construction of the dewatering infrastructure, the tailings management equipment, and for parts inventory. The relative magnitude of the costs (low, mid, high) was estimated for each alternative to conduct the relative scoring.

Tailings transport system and reclaim water system

This indicator was used to compare the relative capital costs for the tailings transport system and water reclaim system. The relative magnitude of the costs (low, mid, high) was estimated for each alternative to conduct the relative scoring. Consideration was given to the length of the tailings transport pipeline and/or the truck fleet or other transport equipment requirement.

3.7.4.2 Operating costs

Phased containment dike or erosion protection construction

This indicator was used to compare the relative operating costs for construction, monitoring, and maintenance of containment dikes or erosion protection for each alternative. Alternatives that require smaller construction volumes and are located closer to Tiriganiaq Pit (assumed material source) will have lower operating costs and are therefore preferred. Generic cost scores were calculated based on the dike or erosion protection volume multiplied by the distance from Tiriganiaq Pit. The volumes used in these calculations were for construction during operations and did not include the volumes used to evaluate the capital costs for initial TSF construction above. The cost of dike liner for the thickened options was assumed to offset the costs of crushing of the erosion protection fill for the filtered options; therefore, these costs were not considered in the analysis.

Tailings plant operation

This indicator was used to compare the relative operational costs, including manpower, maintenance, and energy. The relative magnitude of the costs (low, mid, high) was estimated for each alternative to conduct the relative scoring.

Tailings handling

This indicator was used to compare the relative annual operating costs for transport and deposition/placement of tailings. Both the distance and the mode of transport are considered to have an impact on operational costs, but truck transport was considered to be much more expensive than pumping, so only the mode of transport was considered when assigning scores. The relative magnitude of the costs (low, mid, high) was estimated for each alternative to conduct the relative scoring.

Fresh water makeup

This indicator was used to compare the relative fresh water makeup requirements for each alternative. The quantity of freshwater needed has a direct cost per the Water Licence and Water Compensation Agreement, and an indirect cost due to pumping capacity requirements. The relative magnitude of the fresh water makeup volume (low, moderate, high) was estimated for each alternative to conduct the relative scoring.

3.7.4.3 Closure/reclamation costs

Construction of cover over the TSF

This indicator was used to compare the relative volume of material that would be required for a cover to be built at closure and the relative distance to the closest waste rock pile (potential source of material). Generic cost scores were assigned by multiplying the cover fill volume by the distance from the waste rock pile. The alternatives were scored using a linear scale with the alternative with the highest generic cost score receiving the lowest score (least preferred), and the alternative with the lowest generic cost score receiving the highest score (most preferred).

Alternative closure scenarios for the TSF may also be considered as the Project advances; however, details of potential alternatives were not available at the time of completing this MAA. Nevertheless, a cover is considered a representative scenario for differentiating potential closure costs between tailings alternatives.

Water treatment

This indicator was used to compare the relative size of the tailings pond requiring treatment at closure. Tailings water within the TSF is likely to require attenuation of pH, arsenic, cyanide and suspended solids to meet MMER criteria for discharge to the environment. Other parameters may also require treatment for discharge if recycling of the TSF water results in further concentration of the process water. The relative magnitude of the tailings pond volume (low, moderate, high) was estimated for each alternative to conduct the relative scoring. Concentrations in the process water may vary from one technology to another, which could affect the water treatment costs; however, water volume is considered to have the most significant influence on the costs.

3.7.5 Non-differentiating Indicators

The following indicators were considered to be non-differentiating between the tailings alternatives, and therefore were not included in the analysis.

3.7.5.1 Environmental

Potential for Acid Rock Drainage (ARD)

All the TSF alternatives were anticipated to have the same ARD generation potential; therefore, the TSF alternatives were not evaluated against this criterion.

Potential for Metal Leaching

As discussed in Section 2.8, the tailings could leach arsenic. It is anticipated that this could occur from either thickened or filtered tailings. The concentration of arsenic may vary between the two technologies; however, for the purpose of this assessment, the water from either type of tailings was considered to require monitoring and potential treatment prior to discharge to the environment, so the potential for metal leaching in to the water managed within the facility was considered to be non-differentiating. ENV-3 evaluates the alternatives based on the volume of water managed within the facility which does differentiate between the alternatives.

Special status vegetation and vegetation of interest

A vegetation community of interest is defined as a community that, although not protected by any laws or regulations, plays an important part in the ecology of the area, or plays a role in the well-being of a special status species in the form of habitat or as part of the food chain. Although listed plant species were observed within the Local Study Area (LSA, shown in Figure 1), exact locations were not recorded, so the tailings alternatives were not evaluated against listed plant species within the MAA. There were no vegetation communities of interest identified in the LSA; therefore, the tailings alternatives were not evaluated against this indicator.

Special status wildlife

Polar bear and Short-eared Owl are listed as “Special Concern” by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2012) and the Species at Risk Act (SARA 2012). No Short-eared Owl nests were found in relation to the tailings alternative footprints during baseline studies (Golder, 2012d). Although these special status species exist in the project area, their presence is not differentially associated with the footprints of the tailings facility alternatives and types of tailings (filtered versus thickened) are not expected to have differential impacts on their presence. For these reasons, these species are not included in evaluation of alternative approaches.

Post-Closure Consequence of Failure

All facilities are considered to have similar consequence of failure at closure because they will be drained and are also anticipated to freeze with time. Therefore, post-closure consequence of failure was not evaluated in the MAA assessment.

3.7.5.2 Social

Effect on traditional land use: fishing, hunting, and berry picking

The tailings alternatives were not evaluated against the potential effects on traditional land use including fishing, hunting, and berry picking for the reasons discussed below.

The potential effect on traditional fishing was not evaluated in the MAA since the fish species in the lakes that would be affected by the alternatives are not considered to be valued species to the Inuit (i.e., no Arctic char and lake trout). Traditional fishing in the area around the project site has historically been in Peter Lake, Meliadine Lake and the Meliadine River.

As discussed in Section 2.6, in the early 1950s the migration of the caribou moved northwest of the project site and hunting became much less frequent in the area. Information was collected for the Project Environmental Impact Statement (EIS) regarding caribou migration in the area of the proposed Project. Migration patterns were assessed through IQ (Inuit Traditional Knowledge) investigations, and also by mapping collar locations in the IQ region (Volume 6, Section 6.6.4.2.2, Figure 6.6-7 to Figure 6.6-12). The information collected indicates that the caribou have the potential to migrate in the general area of all of the alternatives. To date, there have been recent additional collar locations in the general area of the B7 and B4 alternatives compared with the OL-5 alternative; however, only a very small number of animals are collared so the collaring data is considered an indication of the general location of the herd only. The scale of the migration habitat is large enough that the locations of all the alternatives are within the general range of the herd. Therefore, the potential effect on caribou habitat is considered to be non-differentiating between the alternatives.

Berries such as crowberries and cloudberries have been identified in the LSA and are known to be used traditionally for food (Golder, 2012d). However, baseline studies to identify berry picking sites have not been completed within all of the alternative footprints to allow for evaluation. In addition, the berry picking sites that have been identified were not considered to differentiate between the alternatives.

Land tenure

All of the TSF alternative sites that were evaluated in the MAA were on the AEM property claim, which is on Inuit owned land. Therefore, land tenure does not differ from one alternative to the next so it was not evaluated in the MAA assessment.

3.7.5.3 Technical

Long-term seepage

Long-term seepage was not evaluated in the MAA because all of the alternatives will be drained at closure and will not have a significant source of water to drive seepage. Therefore, long-term seepage was not considered to be a differentiating factor.

Risk of dam failure

Risk is evaluated based on likelihood and consequence. Each of the alternatives would be designed with the same factor of safety, so the likelihood of failure would be the same. The consequence of failure was evaluated using indicators ENV-6 "TSF failure during operation," ENV-17 “Potential effect on surrounding aquatic habitat,” and ENV-20 “Potential effect on surrounding vegetation.”

Seismicity

A query of the Earthquake Canada website using the Project site coordinates 63° 01’ N and 92° 12’ W resulted in the peak ground accelerations for several return periods as summarized in Table 8. Due to the relatively low seismic hazard for the project site, seismicity and the potential for a failure during a seismic event, were not considered to be differentiating factors for the design of the TSF, and therefore were not evaluated in the MAA.

Table 8: 2010 National Building Code Seismic Hazard Calculation

Nominal Return Period (years)	Probability of Exceedance per Annum	Peak Ground Acceleration (g)
1 in 475	0.0021	0.011
1 in 1,000	0.001	0.019
1 in 2,475	0.000404	0.036

Reliability of closure design

The reliability of the closure design was not evaluated in the MAA assessment because all of the alternatives would have covers at closure, and the reliability of the covers was considered to be equal.

Ditching for collection of seepage and/or surface run-off

The relative lengths of ditching required for collection of seepage and/or surface run-off from around the perimeter of the facilities was very similar in all the options and was therefore not considered to be a differentiating indicator.

Site Geology and Nature of Subsurface

Detailed information regarding the foundation materials below each alternative site are not available for the MAA process and therefore, only general trends inferred from investigations on the Project property were considered. Subsurface conditions typically do not vary significantly at the Meliadine site. Based on available information, all TSF locations are anticipated to have tundra with relatively thin soils overlying bedrock within the foundations. Therefore, site specific geology and the nature of subsurface soils are considered to be non-differentiating between the alternatives. Indicator ENV-5 evaluates the ground conditions of the alternatives based on the likelihood of an underlying talik zone, which is considered to be a differentiating indicator for the nature of the sub-surface below the alternatives considered.

Regional faults have been inferred to run through the B7 and B4 locations (Volume 7, Figure 7.2-1); however, limited information is available on these faults within the alternative footprints. In addition, there is no information about potential faults in the OL-5 location because there has not been any drilling in this area.

In general, the faults are considered to be deep and have not moved for a long time so are not considered a credible failure mechanism for a dam on surface. In addition, a seismic event is likely required to cause movement along these faults and the seismic hazard for the Project is very low. Therefore, the likelihood that the faults will move is very low.

On-site hydraulic testing over intervals that included a regional fault zone has indicated that the permeability of the fault sampled is similar to that of the relatively massive rock (Volume 7, Section 7.2.2.4.2, and Section 7.2.2.8.1). Although the hydraulic conductivity of the faults locally may be higher than the surrounding bedrock, the hydraulic conductivity of the regional faults is assumed to be similar to the foundation soils based on available information. The pond in the TSF will be separated from these faults by tailings and foundation soils, and likely bedrock; therefore, these faults are not considered to be a significant concern for increased seepage from the TSF and are considered non-differentiating between the alternatives.

Detailed geotechnical issues such as faults will be evaluated and addressed during design stages of the TSF when more detailed information is available. Regardless of which alternative is chosen from the MAA, the TSF will be designed, if appropriate, using the Canadian Dam Association Guidelines (2007) to have the required minimum factor of safety against failure, accounting for all site specific conditions.

3.7.5.4 Economics

Post closure costs

Post closure costs for monitoring and maintenance were considered to be approximately the same for all alternatives and were therefore not included in the MAA assessment.

3.7.6 Risk Assessment

A risk assessment was conducted in parallel with the MAA process to further evaluate the tailings technologies being considered for the TSF. The main objective of the risk assessment was not to compare one technology to another, but to highlight the risks associated with each option. The primary and significant risks identified in the risk assessment for each tailings technology were then compared to the Multiple Accounts Ledger, and if the risks had not been identified within the sub-accounts and indicators, they were added.

Two tailings technologies were evaluated in the risk assessment:

- Option 1: Filtered Tailings; and
- Option 2: Thickened Tailings.

The risk assessment considered different phases of the project including: permitting, construction, engineering, start-up/commissioning, operation, closure and post-closure.

The areas of assessment included the mill (process area) and the tailings storage facility, including transportation and handling of tailings, and water management.

The risk assessment is included in Appendix C.

3.7.7 Scoring and Weighting

Each alternative was evaluated by assigning relative scores and weightings to the sub-accounts and indicators within each of the four accounts (e.g., Environment). Judgement and perception of the individuals conducting the analyses is inevitably part of any such decision making system, both in the assignment of qualitative scores and of weighting factors. Quantitative methods were used to assign relative scores where possible; however, some sub-accounts and indicators required the use of qualitative judgement. The following sections explain how scores and weightings were assigned and the calculations used to determine the preferred alternative.

Score

As suggested by the Environment Canada Guidelines, a six point scoring scheme was developed for each sub-account and indicator. The scores provide a relative ranking between the alternatives with the “best” (most preferred) option receiving a score of 6, and the “worst” (least preferred) a score of 1. This scoring measure was used for both quantitative and qualitative indicators.

For sub-accounts and indicators that could be quantitatively measured, the highest and lowest scale points (1 and 6) were defined based on the maximum and minimum measurements. The remaining measurements were scored using a linear interpolation rounded to the nearest whole number, between the maximum and minimum values. For sub-accounts and indicators that required qualitative evaluation, the scoring schemes were developed using the judgement of technical experts and/or the recommendations provided in the Environment Canada Guidelines.

Although a six point scoring scale was used for each sub-account or indicator, descriptions for all six points were not always defined. In some cases it was not practical to define qualitative descriptions for all six points. In these cases, definitions were always defined for the highest and lowest scale points (1 and 6).

Weighting

Accounts, sub-accounts and indicators were assigned a relative weighting (W) to introduce a value bias between the individual accounts, sub-accounts, and indicators. The weighting factors ranged from 1 to 6, following the Environment Canada Guidelines. The value bias is based on the relative subjective importance of one account/sub-account/indicator versus another. A higher weighting factor indicates a perceived greater relative value or importance. For example, the relative importance of water management was considered greater than the importance of the storage efficiency of the facilities. Consequently, the sub-account for water management was given a relative weighting factor that is greater than the weighting factor for storage efficiency.

MAA Calculations

The calculations for the MAA assessment involved taking individual scores and weightings for each indicator and sub-account within the four accounts, and converting them to a single score for each alternative. This involved several steps that are described below:

1. Sub-account merit ratings were calculated using the following steps:
   a. Calculate indicator merit scores by multiplying the score (S) by the weighting (W) for each indicator (S x W).
   b. Calculate the sub-account merit scores by summing the indicator merit scores for each sub-account ($\sum\{S \times W\}$).
   c. Calculate the sub-account merit rating (R_s) by normalizing the sub-account merit scores back to a six point scale. This was achieved by dividing the sub-account merit scores by the sum of the indicator weightings ($\sum W$) to get $R_s = \sum(S \times W)/\sum W$ to produce a value between 1 and 6 for each sub-account. This normalization is necessary so that the number of indicators associated with each sub-account does not influence the results.
2. The same set of calculations was then conducted to obtain account merit ratings.
   a. Calculate account merit scores by summing the sub-account merit ratings multiplied by the sub-account weightings ($\sum\{R_s \times W\}$).
   b. Calculate the account merit ratings by normalizing the account merit scores by the sum of the sub-account weightings ($R_a = \sum(R_s \times W)/\sum W$).
3. Alternative merit scores were then calculated as follows:
   a. Calculate alternative merit scores by summing the account merit ratings multiplied by the account weightings ($\sum\{R_a \times W\}$).
   b. Calculate the alternative merit ratings by normalizing the alternative merit scores by the sum of the account weightings ($R_a = \sum(R_s \times W)/\sum W$).

The resulting alternative merit rating (alternative score) is a value between 1 and 6 and provides a means to evaluate the relative ranking of the various alternatives considered. The highest alternative merit rating represents the preferred alternative. In accordance with the Environment Canada Guidelines (EC 2011a), this method is considered transparent, and allows stakeholders the opportunity to assess the relative weightings and scorings based on personal preference.

3.8 TSF Alternatives Multiple Accounts Analysis Results

The results of the MAA analysis calculations are summarized in the following sections. The analysis was split in to two phases; baseline analysis and sensitivity analysis. The detailed MAA matrix tables are provided in Appendix D.

3.9 Baseline Results

The baseline results incorporate the account weightings recommended in the Environment Canada Guidelines (EC 2011a). These weightings are summarized in Table 9. Results of the baseline MAA analysis calculations are presented in Table 10.

Table 9: Baseline Account Weightings (EC 2011a)

Account	Weightings
Environment	6
Social	3
Technical	3
Economic	1.5

Table 10: Summary of MAA Baseline Analysis Results

	B7 Thickened	B7 Filtered	B4 Thickened	B4 Filtered	OL-5 Thickened	OL-5 Filtered
Environment	23.5	26.4	22.9	25.9	19.9	20.9
Social	11.7	7.2	13.5	9.0	15.0	9.6
Technical	10.9	13.9	10.0	11.8	10.3	12.7
Economic	7.5	4.6	7.5	4.8	5.8	4.6
Overall Score	**4.0**	**3.9**	**4.0**	**3.8**	**3.8**	**3.7**

(white)	No Change from B7 Thickened
(green)	Higher than B7 Thickened
(orange)	Lower than B7 Thickened

The results of baseline assessment (weightings from the Environment Canada Guidelines [EC 2011a]) indicate no clear preferred alternative, with the B7 Thickened, B7 Filtered, and B4 Thickened options all scoring the highest, and the other alternatives scoring slightly lower.

3.10 Sensitivity Analysis

As discussed in Section 3.7.7, judgement and perception of the individuals conducting the MAA analysis is inevitably part of any such decision making system, both in the assignment of qualitative scores and of weighting factors. As such, a sensitivity analysis was conducted to evaluate the robustness of the baseline results. The sensitivity analysis involved varying the account weightings to put a varying emphasis on different accounts (Environment, Social, Technical, and Economic) to assess how they influence the relative ratings of the alternatives. Table 11 summarizes the account weightings that were used to define the sensitivity cases. Higher weighting values within each sensitivity case indicate an emphasis on those accounts.

Table 11: Summary of Sensitivity Analysis Cases

Account	Weightings					
	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
Environment	6	6	1	6	1	3
Social	3	3	1	6	1	3
Technical	3	3	6	1	1	3
Economic	1.5	3	6	1	1	6

The following points briefly describe where the emphasis has been put for each sensitivity case:

- **Case 1** – Baseline: The weighting values are those recommended in the Environment Canada Guidelines (EC 2011a). The most significant emphasis is on the environment account, while the economic account has the least emphasis, and the social and technical accounts have moderate emphasis.
- **Case 2** – Moderate emphasis on the environment account.
- **Case 3** – Emphasis on the technical and economic accounts.
- **Case 4** – Emphasis on the environment and social accounts.
- **Case 5** – No emphasis placed on any of the accounts.
- **Case 6** – Moderate emphasis on the economic account.

The results of the sensitivity analysis are summarized in Table 12 and Table 13.

Table 12: Sensitivity Analysis Results – Comparison to Case 1

	B7 Thickened	B7 Filtered	B4 Thickened	B4 Filtered	OL-5 Thickened	OL-5 Filtered
Case 1	4.0	3.9	4.0	3.8	3.8	3.5
Case 2	4.1	3.8	4.1	3.8	3.8	3.5
Case 3	4.2	3.8	4.2	3.6	3.7	3.6
Case 4	4.0	3.5	4.2	3.6	4.1	3.4
Case 5	4.1	3.6	4.2	3.6	3.9	3.5
Case 6	4.3	3.5	4.3	3.5	3.9	3.4

	No Change from Case 1
	Higher than Case 1
	Lower than Case 1

Table 13: Sensitivity Analysis Results – Comparison to B7 Thickened

	B7 Thickened	B7 Filtered	B4 Thickened	B4 Filtered	OL-5 Thickened	OL-5 Filtered
Case 1	4.0	3.9	4.0	3.8	3.8	3.5
Case 2	4.1	3.8	4.1	3.8	3.8	3.5
Case 3	4.2	3.8	4.2	3.6	3.7	3.6
Case 4	4.0	3.5	4.2	3.6	4.1	3.4
Case 5	4.1	3.6	4.2	3.6	3.9	3.5
Case 6	4.3	3.5	4.3	3.5	3.9	3.4

	No Change from B7 Thickened
	Higher than B7 Thickened
	Lower than B7 Thickened

Table 12 compares the results for Cases 2 to 6 to the baseline (Case 1). As indicated by the comparison shown using shading in the table, the B7 Thickened and B4 Thickened alternatives scored the best overall when considering all the sensitivity cases. The alternatives were further assessed by comparing each alternative back to the B7 Thickened alternative, which is shown using shading in Table 13. This assessment further supports that the B7 Thickened and B4 Thickened alternatives score the best overall.

3.11 Preferred Alternative

The following points summarize the results of the baseline and sensitivity results presented above:

- No clear preferred alternative was identified from the baseline analysis using the suggested account weightings proposed by Environment Canada (EC 2011a). The B7 Thickened and B4 Thickened alternatives scored the highest, with the other alternatives scoring just slightly lower.
- Sensitivity analysis further supports that the B7 Thickened and B4 Thickened alternatives score the best overall, with both alternatives scoring approximately the same in all cases with the exception of Case 4 and Case 5, where B7 Thickened scored slightly lower. Case 4 has an emphasis on the environment and social accounts and Case 5 has no emphasis on any of the accounts.

- Further review of the sensitivity results, and in particular comparison of cases 1, 2, and 4, indicates that the B7 Thickened alternative scores comparatively lower on the Social account due to the presence of heritage sites located just within or outside the facility footprint. However, as indicated in the description for the B7 Thickened alternative (Section 3.4), these heritage sites have either been previously mitigated, or can be mitigated in the future. Moreover, given their relative location, it may be possible to avoid these sites altogether with slight modification to the facility footprint (although mitigation will still likely be completed). Therefore, the presence of these sites in not considered to be a controlling factor in the decision of the preferred alternative.

Based on the above, either the B7 Thickened or B4 Thickened alternatives can be considered the preferred option for the Meliadine TSF.

The B7 area was selected as the preferred alternative for tailings storage due to its relative proximity to the process plant and favourable topography. Due to the topography in the area, the B7 Thickened alternative requires shorter dike heights and significantly less fill volume than the B4 Thickened alternative, which will result in lower construction effort, lower overall potential impacts, and lower construction costs.

4.0 SUMMARY AND CONCLUSIONS

This report presents the decision making process used to select the preferred tailings storage facility alternative (location and tailings technology) for the Meliadine Gold Project. The objective of the assessment was to identify the preferred alternative for management of tailings based on environmental, technical, social, and economic considerations, in general accordance with the Environment Canada *Guidelines for the Assessment of Alternatives for Mine Waste Disposal* (EC 2011a). These guidelines recommend the use of a Multiple Accounts Analysis approach, which is a well-accepted, transparent decision-making tool.

The MAA assessment process involved identifying all feasible locations for the tailings storage facility. A total of thirteen footprints were proposed as options based on the following fundamental considerations:

- A maximum distance from the proposed process plant to the TSF of 10 km. An exception was considered in site OL-7 located at approximately 17 km from the proposed process plant to provide an option that would not infringe on any important body of water based on the available topographic mapping and air photography.
- The siting exercise was limited to the southwest side of Meliadine Lake. The northeast side of Meliadine Lake was not considered given the expected challenges in transporting tailings to this area and the absence of any obvious advantages with respect to the bodies of water and topography in this area.
- Sites were selected to avoid the proposed pit delineations.
- Sites were selected to avoid protected areas.

The 13 TSF footprints were further evaluated in a pre-screening assessment to eliminate any of the locations that had “fatal flaws” prior to completing the more detailed MAA. The pre-screening criteria were as follows:

- provides storage for life-of-mine tailings production;
- location does not restrict the operation open pits and potential waste rock management areas;

- location avoids known non-mitigatable heritage/archaeological sites;
- location is within the mine claims block;
- location does not sterilize potential resources (inferred based on magnetometric survey map);
- location provides the potential for increased tailings storage capacity;
- location is within the same sub-catchment as a mine site/pit; and
- less than 25% of the footprint covered by an existing waterbody(ies).

After evaluating the thirteen locations against the pre-screening criteria, the following three locations were chosen for further evaluation:

- B7 area;
- B4 area; and
- On-land 5 (OL-5).

Once the pre-screening assessment had identified these three locations, consideration was given to the potential tailings disposal technologies. Two tailings disposal technologies were retained for the MAA: thickened tailings and filtered tailings. These two technologies were chosen to represent hydraulic deposition and mechanical deposition, respectively. In combining the two tailings disposal technologies with three locations identified from the pre-screening assessment, the following six tailings storage facility alternatives were identified for consideration in the MAA:

- B7 Thickened;
- B7 Filtered;
- B4 Thickened;
- B4 Filtered;
- OL-5 Thickened; and
- OL-5 Filtered.

A multiple accounts approach was used to evaluate these six alternatives. The MAA assessment involved evaluation of alternatives for management of tailings based on environmental, technical, social, and economic considerations. Evaluation criteria called sub-accounts and indicators were developed for each of these areas.

A risk assessment was also conducted in parallel with the MAA process to further evaluate the tailings technologies being considered for the TSF. The main objective of the risk assessment was to highlight the risks associated with each option. The primary and significant risks identified in the risk assessment were compared to the sub-accounts and indicators in the MAA, and if they had not been identified they were added.

The results of the MAA assessment, including the sensitivity analysis, indicated that the B7 Thickened and B4 Thickened tailings storage facility alternatives were the most appropriate options for the Meliadine Project. Based on these results, and in consideration of proximity to the process plant and the overall layout of the facility, the B7 area was selected as the preferred alternative for tailings storage at the Meliadine Project.

5.0 CLOSURE

We trust that this report meets your requirements at this time. If you have any additional questions, please do not hesitate to contact the undersigned.

Yours very truly,

GOLDER ASSOCIATES LTD.

ORIGINAL SIGNED

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Geotechnical Engineer

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Principal, Project Manager

ACI/DRW/aw/lw

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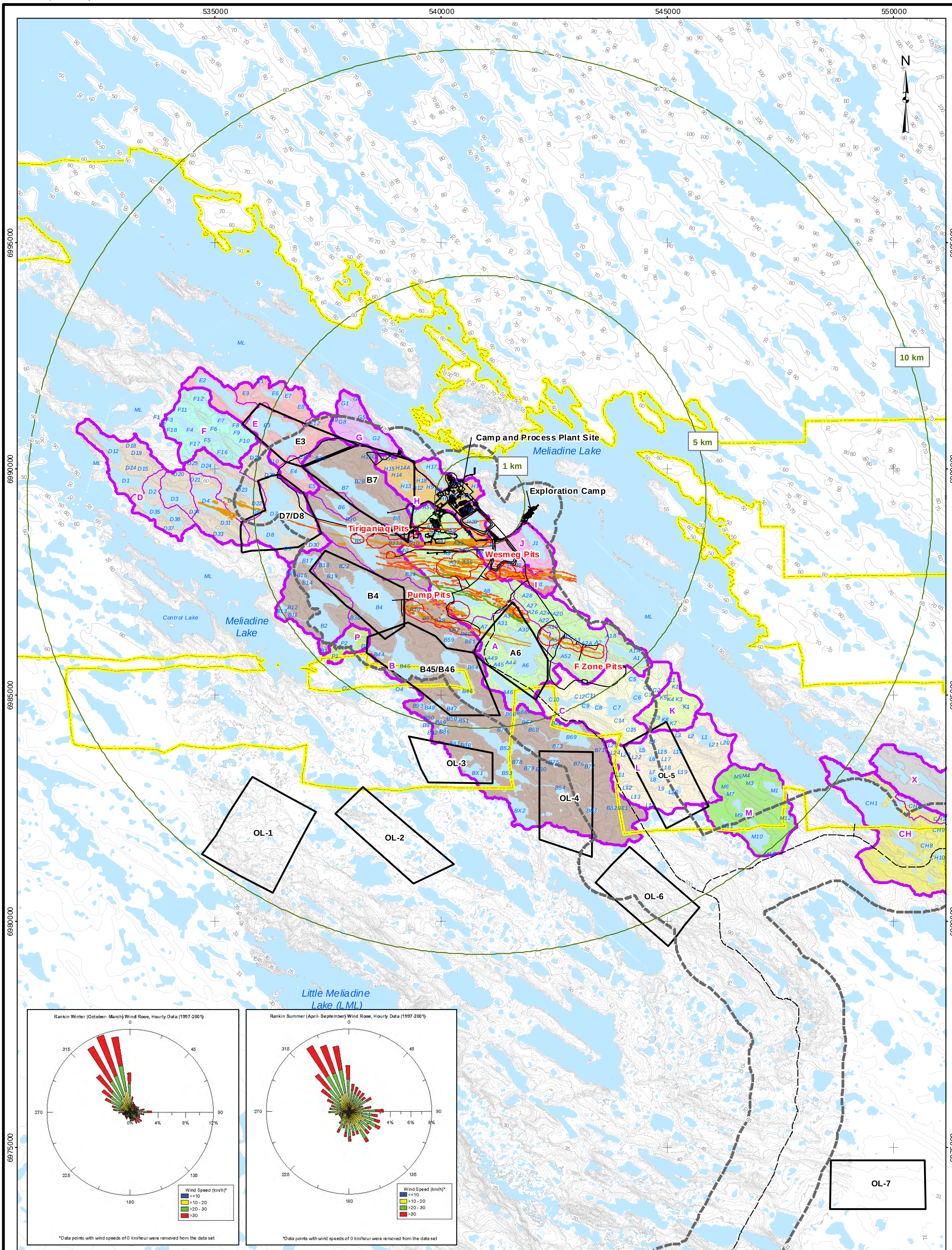

LEGEND

Proposed Infrastructure	Claim Boundary
All-weather Access Road (AWAR)	Drainage Basin Boundary (Major)
Topographic Contour (5.0 m interval)	Drainage Basin Boundary (Minor)
Topographic Contour (1.0 m interval)	Local Study Area
Watercourse	Plant Site Buffer
Geology (Mag Map Data)	Proposed Open Pit
Iron Formation	Tailings Storage Facility Alternative
Ore Zone	Waterbody
SEDS	

2 0 2
KILOMETRES

REFERENCE

Base data obtained from Agnico Eagle Mines Limited (AEM).
Projection: UTM Zone 15 Datum: NAD 83

PROJECT
AGNICO EAGLE MINES LIMITED
MELIADINE GOLD PROJECT
NUNAVUT

AGNICO EAGLE

TITLE
PRE-SCREENING TAILINGS STORAGE FACILITY LOCATIONS

Golder Associates

PROJECT NO.	11-1428-0011	FILE No.	
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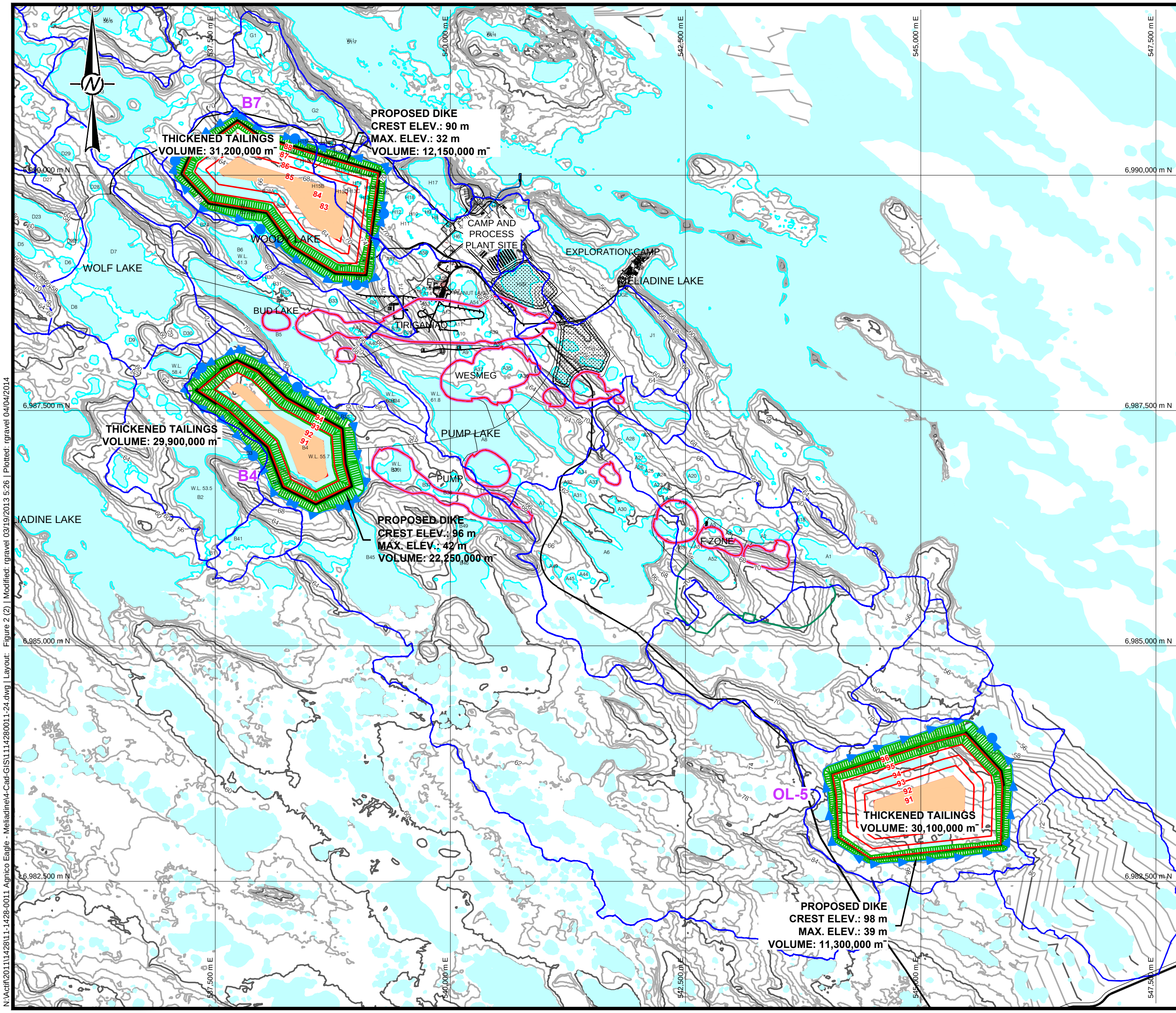
GIS	JP	02 May 2012	
CHECK	DW	15 Jan. 2013	FIGURE 1
REVIEW	DW	15 Jan. 2013	



LEGEND

- LAND-BASED TOPOGRAPHIC MAJOR CONTOURS INTERVAL 10m
- LAND-BASED TOPOGRAPHIC MINOR CONTOURS INTERVAL 2m
- WATERSHED
- PROPOSED DIKE
- TAILINGS CONTOUR (m) (93)
- TAILINGS POND
- PROPOSED DITCH
- PROPOSED SUMP
- ROAD
- PROPOSED OPEN PIT

0 800 1,600 2,400m

SCALE

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED
MELIADINE GOLD PROJECT
NUNAVUT

TITLE

THICKENED TAILINGS STORAGE FACILITY ALTERNATIVES

Golder Associates

PROJECT No.		11-1428-0011	FILE No.	1114280011-24
DESIGN	AI	30APRIL12	SCALE AS SHOWN	REV. 0
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CHECK	DW	15JAN13		
REVIEW	DW	15JAN13		

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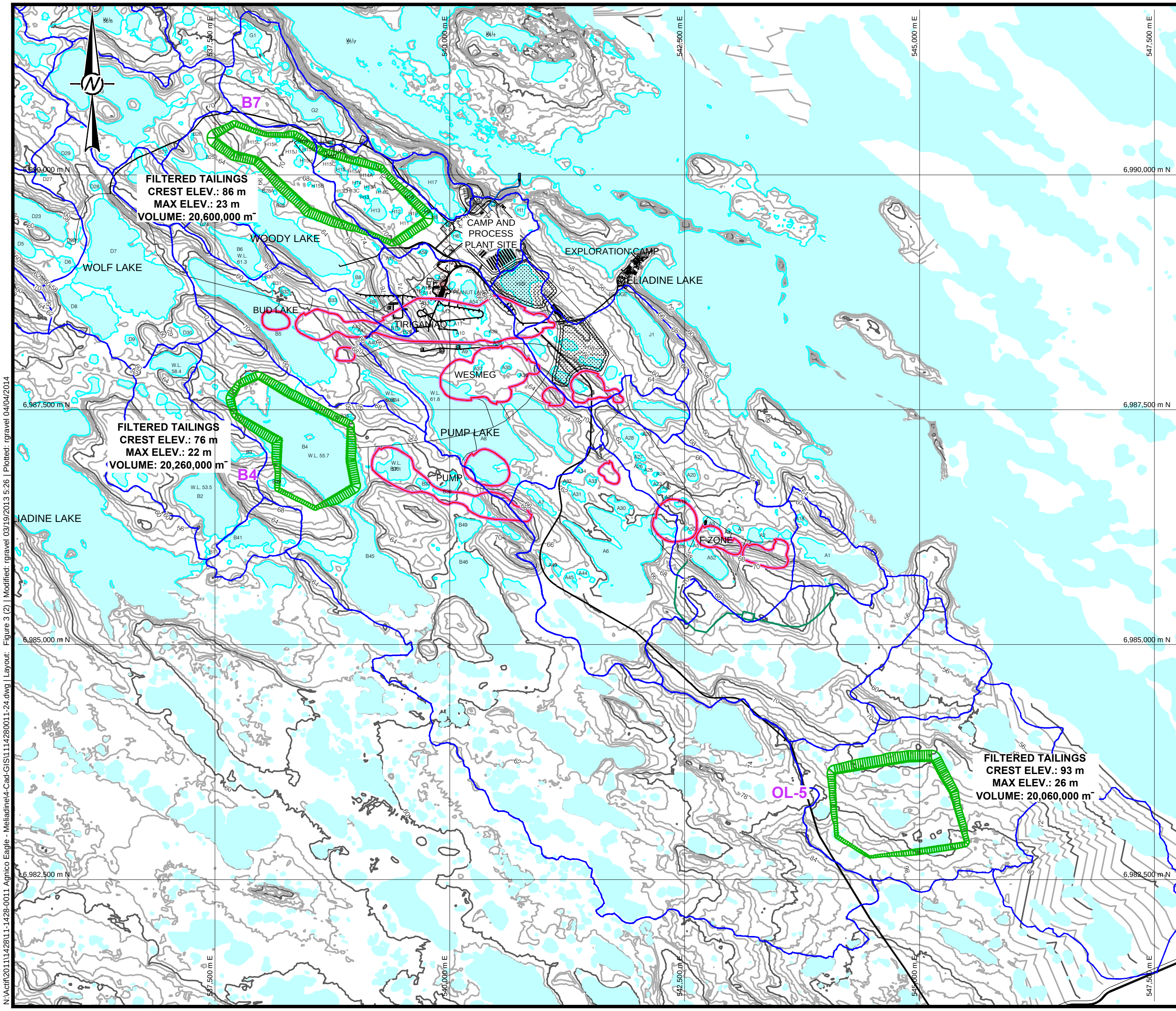

LEGEND

LAND-BASED TOPOGRAPHIC MAJOR CONTOURS INTERVAL 10m

LAND-BASED TOPOGRAPHIC MINOR CONTOURS INTERVAL 2m

WATERSHED

ROAD

PROPOSED OPEN PIT

PROPOSED STACK

0 800 1,600 2,400m

SCALE

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED
MELIADINE GOLD PROJECT
NUNAVUT

TITLE

FILTERED TAILINGS STORAGE FACILITY ALTERNATIVES

Golder Associates

PROJECT No.		11-1428-0011	FILE No.	1114280011-24
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REVIEW	DW	15JAN13		

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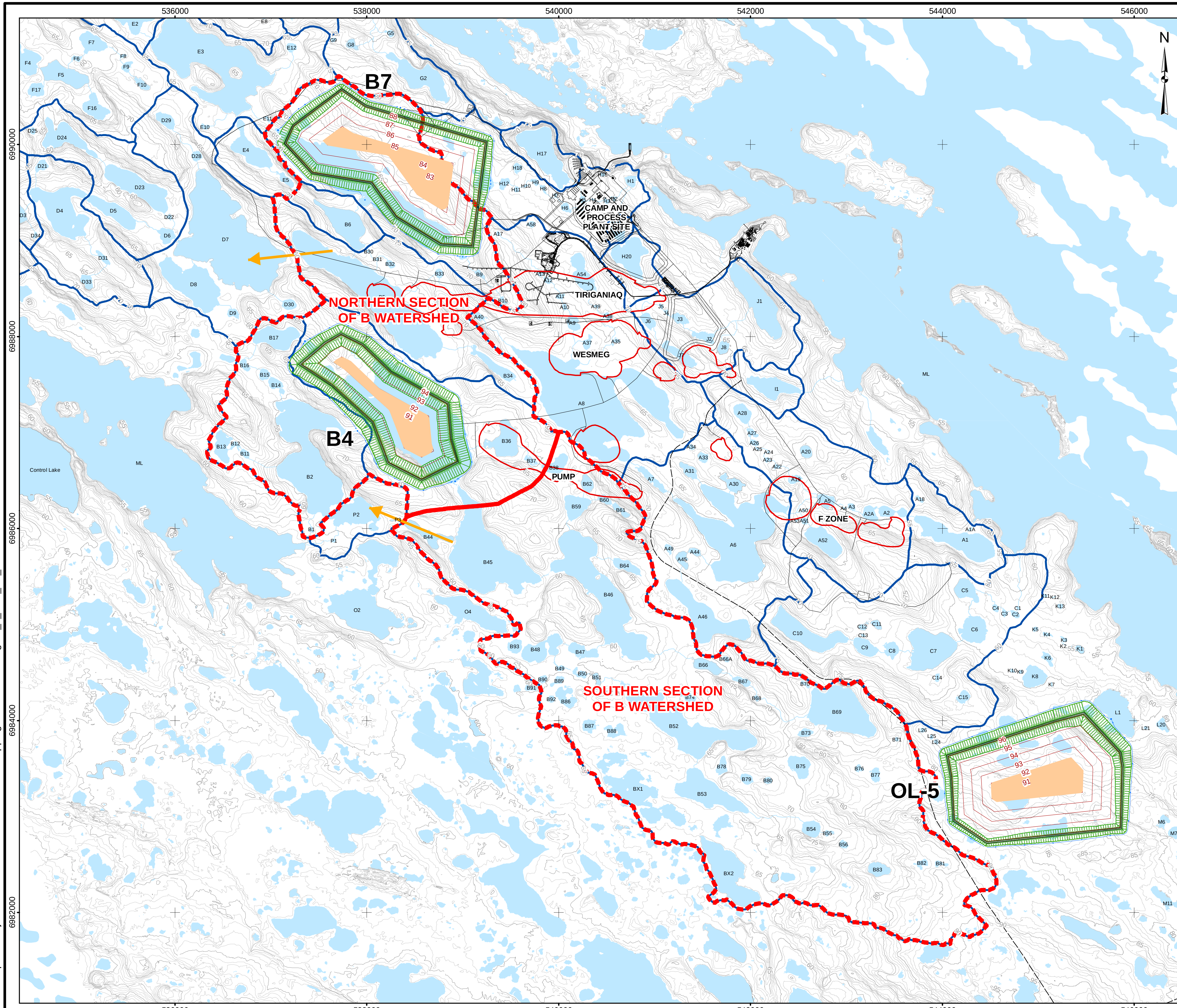

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LEGEND

- ALL-WEATHER ACCESS ROAD (AWAR)
- APPROXIMATE LOCATION OF DIVERSION FOR B4 ALTERNATIVES
- LAND-BASED TOPOGRAPHIC MINOR CONTOUR (1 m INTERVAL)
- LAND-BASED TOPOGRAPHIC MAJOR CONTOUR (5 m INTERVAL)
- TAILINGS CONTOUR (m)
- PROPOSED DITCH
- PROPOSED PROJECT INFRASTRUCTURE
- WATERCOURSE
- PROPOSED OPEN PIT
- TAILINGS POND
- WATERBODY
- WATERSHED B
- WATERSHED

REFERENCE

INFRASTRUCTURE DATA OBTAINED FROM AGNICO EAGLE MINES LIMITED (AEM).
BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
DATUM: NAD 83 PROJECTION: UTM ZONE 15

0.8 0 0.8
KILOMETRES

PROJECT

AGNICO EAGLE

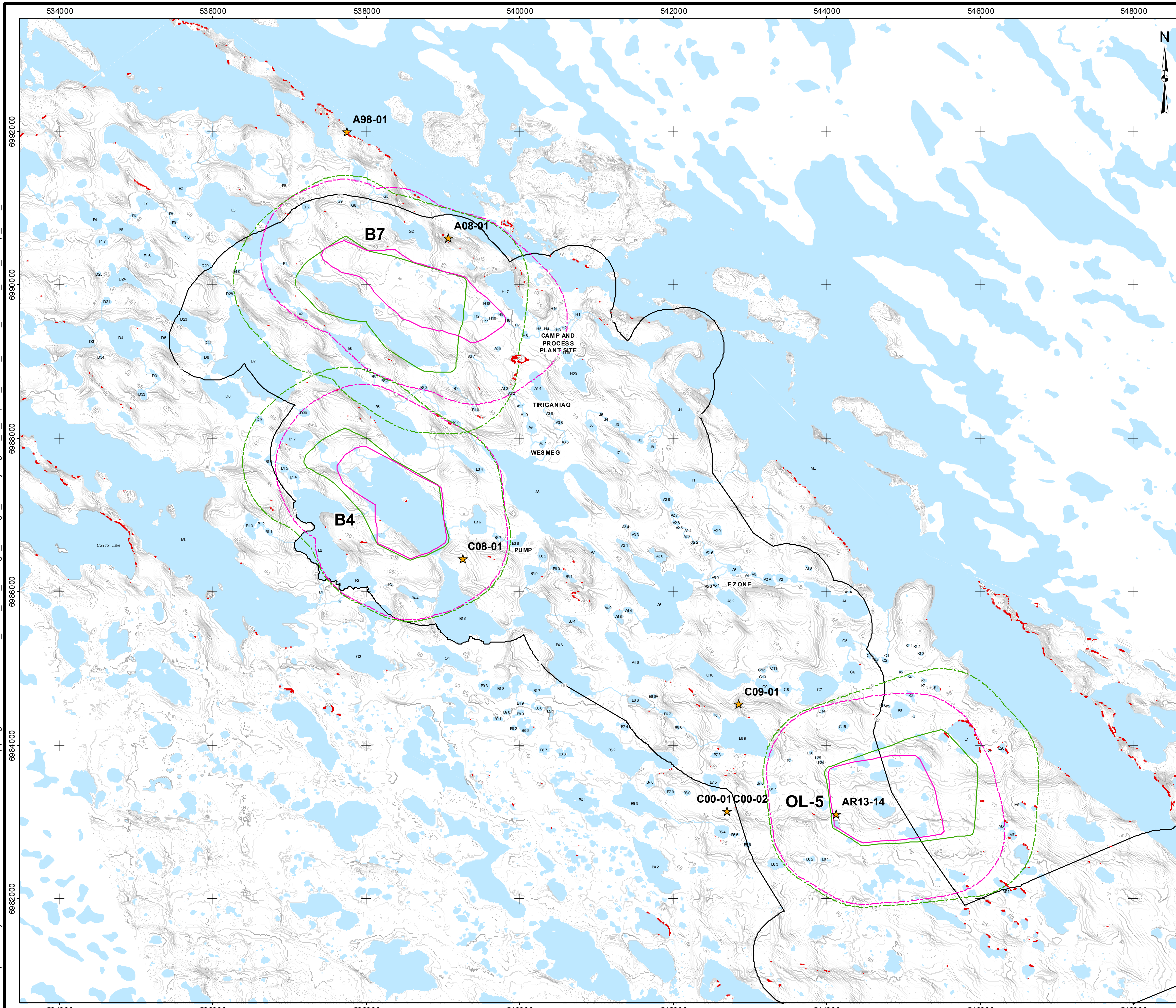
AGNICO EAGLE MINES LIMITED
MELIADINE GOLD PROJECT
NUNAVUT

TITLE

TSF B4 ALTERNATIVES -
SURFACE WATER DIVERSION REQUIREMENT

Golder Associates

PROJECT NO. 13-1428-0007		FILE No.	
DESIGN	DW	10 Sep. 2013	SCALE AS SHOWN	REV. 0
GIS	MH	23 Jan. 2014	
CHECK			**FIGURE 4**
REVIEW			



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LEGEND

- NEST WITHIN 2000m OF TAILINGS FOOTPRINT
- TAILINGS FOOTPRINT FILTERED 800m BUFFER
- TAILINGS FOOTPRINT FILTERED
- TAILINGS FOOTPRINT THICKENED 800m BUFFER
- TAILINGS FOOTPRINT THICKENED
- LOCAL STUDY AREA (LSA)
- STEEP HABITAT
- LAND-BASED TOPOGRAPHIC MINOR CONTOUR (1 m INTERVAL)
- LAND-BASED TOPOGRAPHIC MAJOR CONTOUR (5 m INTERVAL)
- WATERCOURSE
- WATERBODY

REFERENCE

INFRASTRUCTURE DATA OBTAINED FROM AGNICO EAGLE MINES LIMITED (AEM).
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DATUM: NAD 83 PROJECTION: UTM ZONE 15

1 0 1
KILOMETRES

PROJECT

AGNICO EAGLE

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MELIADINE GOLD PROJECT
NUNAVUT

TITLE

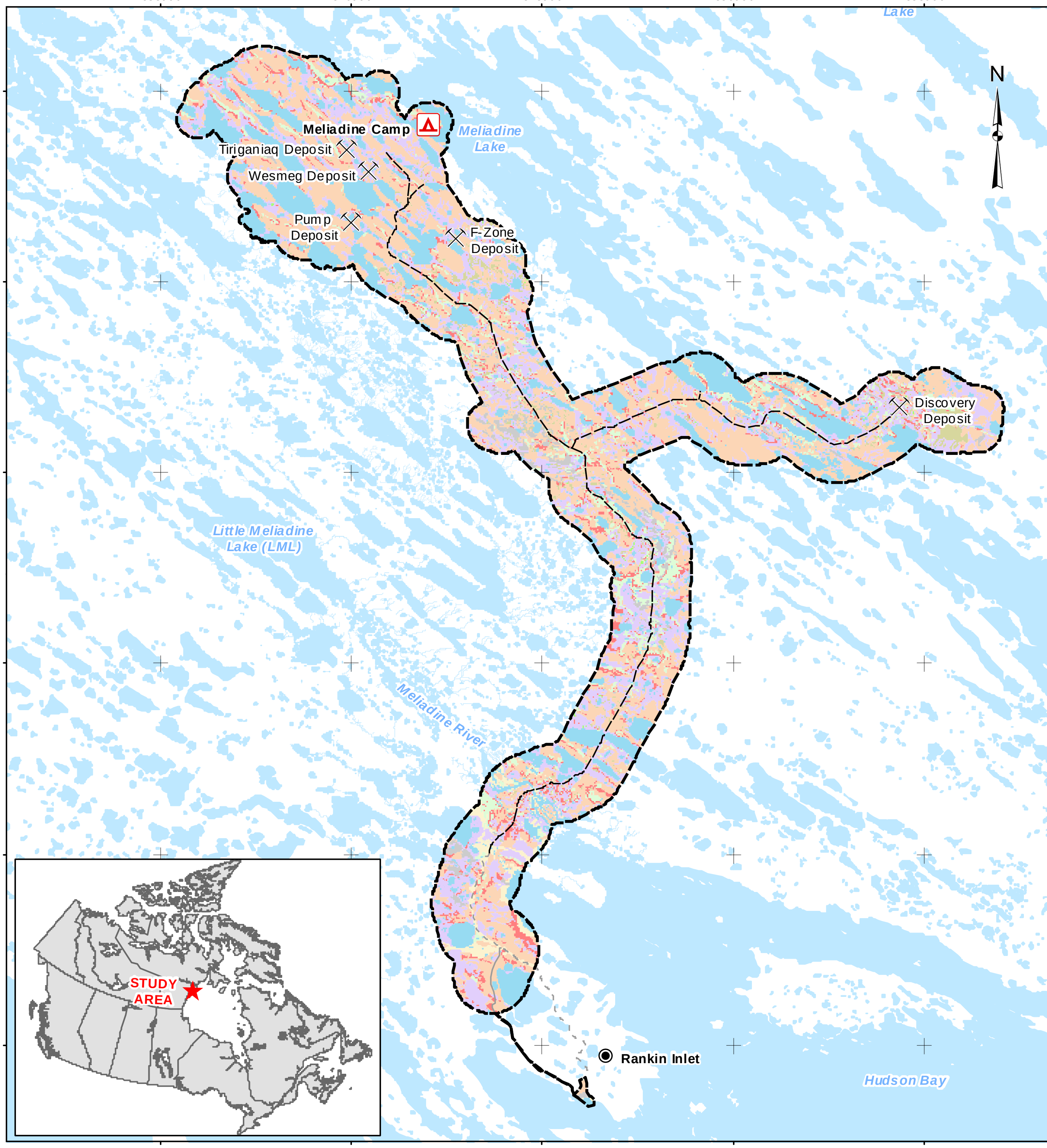
RAPTOR NESTS WITHIN 2000m OF TAILINGS ALTERNATIVE FOOTPRINTS AND STEEP CLIFF HABITAT

Golder Associates

PROJECT NO. 13-1428-0007			FILE No.	
DESIGN	AI	29 Jan. 2014	SCALE AS SHOWN	REV. 0
GIS	MH	29 Jan. 2014		
CHECK	AI	17 Apr. 2014	FIGURE 5	
REVIEW	DW	17 Apr. 2014		

APPENDIX A

Local Study Area Plant Community Map



LEGEND

- Camp
- Proposed Mine Site
- All Weather Access Road (AWAR)
- Road - New
- Road - Existing
- Watercourse
- Waterbody

Plant Community Classification

- Birch Seep
- Disturbed
- Heath Tundra Community
- Lichen-Heath (Cetraria Lichen)
- Lichen-Heath (Hair Lichen)
- Lichen-Rock Community
- Riparian Willow or Birch
- Sedge Community
- Unvegetated (Sand)
- Water

3000 0 3000

METRES

REFERENCE

Base data obtained from Agnico Eagle Mines Ltd (AEM).
Vegetation data obtained from field survey.
Datum: NAD 83 Projection: UTM Zone 15

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED
MELIADINE GOLD PROJECT
NUNAVUT

TITLE

LOCAL STUDY AREA PLANT COMMUNITY CLASSIFICATION

Golder Associates

PROJECT		10-1373-0076	FILE No.	
DESIGN	LV	23 Oct. 2012	SCALE AS SHOWN	REV. 0
GIS	CDB	23 Oct. 2012	FIGURE A-1	
CHECK	LV	23 Oct. 2012		
REVIEW	DW	23 Oct. 2012		

N:\Bur-Graphics\Projects\2013\1428\13-1428-0007\GIS\Mapping\MXD\FEIS\Volume_2\SD_2-2_Tailings_Storage_Facility\Figure_A-1_LSA_Plant_Community_Classification.mxd

APPENDIX B

Detailed Pre-screening Tables

Table B-1: B7 Alternative

Pre-Screening Criteria	Y/N	Comments
Storage for life-of mine tailings production	Y	The footprint of alternative B7, as shown on Figure 1, can provide the required life of mine storage with an approximate crest elevation of 79 m.
Location does not restrict operation of open pits (incl. waste rock)	Y	The footprint of alternative B7, as shown on Figure 1, does not interfere with any of the planned open pits or waste rock storage facilities.
Heritage - Avoids Known Non-Mitigable Sites	Y	There are some archaeological sites in the area of the B7 footprint; however, they have either been mitigated or can be mitigated.
Location is within claim	Y	The B7 footprint is within the claim as shown on Figure 1.
Potential for increased capacity	Y	The approximate maximum height of the B7 facility required to store the life of mine tailings production is 19 m. The facility could be raised to allow for additional storage.
Location does not sterilize potential resources	Y	The Iron Formation and Ore Zone, as shown on Figure 1, do not extend within the B7 footprint; therefore, the B7 alternative is not anticipated to sterilize potential resources.
Area is within same sub-catchment as pit	Y	The B7 alternative is within the same catchment as the Tiriganiaq Pit.
Less than 25% of footprint is within existing waterbody(ies)	N	Lake B7 covers more than 25% of the B7 alternative footprint.

Table B-2: Alternative D7/D8

Pre-Screening Criteria	Y/N	Comments
Storage for life-of mine tailings production	Y	The footprint of alternative D7/D8, as shown on Figure 1, can provide the required life of mine storage with an approximate crest elevation of 76 m.
Location does not restrict operation of open pits (incl. waste rock)	Y	The footprint of alternative D7/D8, as shown on Figure 1, does not interfere with any of the planned open pits or waste rock storage facilities.
Heritage - Avoids Known Non-Mitigable Sites	Y	There are no known archaeological sites in the area of the D7/D8 footprint.
Location is within claim	Y	The D7/D8 footprint is within the claim as shown on Figure 1.
Potential for increased capacity	Y	The approximate maximum height of the D7/D8 facility required to store the life of mine tailings production is 21 m. The facility could be raised to allow for additional storage.
Location does not sterilize potential resources	N	The Iron Formation, as shown on Figure 1, extends into the D7/D8 footprint, and the area is along strike of the Ore Zone deposits of the Tiriganiaq and Wolf pits. Therefore, a facility in this area could sterilize potential resources.
Area is within same sub-catchment as pit	Y	The D7/D8 alternative is within the same catchment as the Wolf Pit.
Less than 25% of footprint is within existing waterbody(ies)	N	Lakes D7 and D8 cover more than 25% of the D7/D8 alternative footprint.

Table B-3: Alternative B4

Pre-Screening Criteria	Y/N	Comments
Storage for life-of mine tailings production	Y	The footprint of alternative B4, as shown on Figure 1, can provide the required life of mine storage with an approximate crest elevation of 75 m.
Location does not restrict operation of open pits (incl. waste rock)	Y	The footprint of alternative B4, as shown on Figure 1, does not interfere with any of the planned open pits or waste rock storage facilities.
Heritage - Avoids Known Non-Mitigable Sites	Y	There are no known archaeological sites in the area of the B4 footprint.
Location is within claim	Y	The B4 footprint is within the claim as shown on Figure 1.
Potential for increased capacity	Y	The approximate maximum height of the B4 facility required to store the life of mine tailings production is 21 m. The facility could be raised to allow for additional storage.
Location does not sterilize potential resources	Y	The Ore Zone of the Pump Pit, as shown on Figure 1, ends to the east of the B4 area. Therefore, a facility in this area is not anticipated to sterilize potential resources.
Area is within same sub-catchment as pit	Y	The B4 alternative is within the same catchment as the Pump Pit.
Less than 25% of footprint is within existing waterbody(ies)	N	Lake B4 covers more than 25% of the B4 alternative footprint.

Table B-4: Alternative A6

Pre-Screening Criteria	Y/N	Comments
Storage for life-of mine tailings production	Y	The footprint of alternative A6, as shown on Figure 1, can provide the required life of mine storage with an approximate crest elevation of 81 m.
Location does not restrict operation of open pits (incl. waste rock)	N	The footprint of alternative A6, as shown on Figure 1, is located between the Pump and F Zone pits and could restrict operations, especially if the pits expand.
Heritage - Avoids Known Non-Mitigable Sites	Y	There are no known archaeological sites in the area of the B4 footprint.
Location is within claim	N	The A6 footprint extends outside the claim at its southern extent, as shown on Figure 1.
Potential for increased capacity	Y	The approximate maximum height of the A6 facility required to store the life of mine tailings production is 25 m. The facility could be raised to allow for additional storage.
Location does not sterilize potential resources	N	The Iron Formation and Ore Zone extend into the A6 footprint, as shown on Figure 1. Therefore, a facility in this area could sterilize potential resources.
Area is within same sub-catchment as pit	Y	The A6 alternative is within the same catchment as the F Zone pits.
Less than 25% of footprint is within existing waterbody(ies)	N	Lake A6 covers more than 25% of the A6 alternative footprint.

Table B-5: Alternative OL-1

Pre-Screening Criteria	Y/N	Comments
Storage for life-of mine tailings production	Y	The footprint of alternative OL-1, as shown on Figure 1, can provide the required life of mine storage with an approximate crest elevation of 71 m.
Location does not restrict operation of open pits (incl. waste rock)	Y	The footprint of alternative OL-1, as shown on Figure 1, does not interfere with any of the planned open pits or waste rock storage facilities.
Heritage - Avoids Known Non-Mitigable Sites	Y	There are no known archaeological sites in the area of the OL-1 footprint.
Location is within claim	N	The OL-1 footprint is outside the claim, as shown on Figure 1.
Potential for increased capacity	Y	The approximate maximum height of the OL-1 facility required to store the life of mine tailings production is 27 m. The facility could be raised to allow for additional storage.
Location does not sterilize potential resources	Y	The OL-1 footprint is not close to any of the open pits and the Iron Formation and Ore Zone do not extend into the OL-1 footprint, as shown on Figure 1. Therefore, a facility in this area is not anticipated to sterilize potential resources.
Area is within same sub-catchment as pit	N	The OL-1 alternative is not in the same catchment as any of the pits.
Less than 25% of footprint is within existing waterbody(ies)	Y	There are small ponds within the footprint of the OL-1 alternative; however, the combined area of the ponds is less than 25% of the footprint.

Table B-6: Alternative OL-2

Pre-Screening Criteria	Y/N	Comments
Storage for life-of mine tailings production	Y	The footprint of alternative OL-2, as shown on Figure 1, can provide the required life of mine storage with an approximate crest elevation of 80 m.
Location does not restrict operation of open pits (incl. waste rock)	Y	The footprint of alternative OL-2, as shown on Figure 1, does not interfere with any of the planned open pits or waste rock storage facilities.
Heritage - Avoids Known Non-Mitigable Sites	Y	There are no known archaeological sites in the area of the OL-2 footprint.
Location is within claim	N	The OL-2 footprint is outside the claim, as shown on Figure 1.
Potential for increased capacity	Y	The approximate maximum height of the OL-2 facility required to store the life of mine tailings production is 23 m. The facility could be raised to allow for additional storage.
Location does not sterilize potential resources	Y	The OL-2 footprint is not close to any of the open pits so the Iron Formation and Ore Zone do not extend into the OL-2 footprint, as shown on Figure 1. Therefore, a facility in this area is not anticipated to sterilize potential resources.
Area is within same sub-catchment as pit	N	The OL-2 alternative is not in the same catchment as any of the pits.
Less than 25% of footprint is within existing waterbody(ies)	Y	There are small ponds within the footprint of the OL-2 alternative; however, the combined area of the ponds is less than 25% of the footprint.

Table B-7: Alternative OL-3

Pre-Screening Criteria	Y/N	Comments
Storage for life-of mine tailings production	Y	The footprint of alternative OL-3, as shown on Figure 1, can provide the required life of mine storage with an approximate crest elevation of 79 m.
Location does not restrict operation of open pits (incl. waste rock)	Y	The footprint of alternative OL-3, as shown on Figure 1, does not interfere with any of the planned open pits or waste rock storage facilities.
Heritage - Avoids Known Non-Mitigable Sites	Y	There are no known archaeological sites in the area of the OL-3 footprint.
Location is within claim	Y	The OL-3 footprint is within the claim, as shown on Figure 1.
Potential for increased capacity	Y	The approximate maximum height of the OL-3 facility required to store the life of mine tailings production is 20 m. The facility could be raised to allow for additional storage.
Location does not sterilize potential resources	N	OL-3 is in a region that has not been explored yet and based on the regional geology map (see FEIS Volume 2, Figure 2-7) could have potential resources. Therefore, a facility in this area has the potential to sterilize resources.
Area is within same sub-catchment as pit	N	The OL-3 alternative is not in the same catchment as any of the pits.
Less than 25% of footprint is within existing waterbody(ies)	N	There are smaller ponds within the footprint of the OL-3 alternative and the combined area of the ponds is estimated to be more than 25% of the footprint.

Table B-8: Alternative OL-4

Pre-Screening Criteria	Y/N	Comments
Storage for life-of mine tailings production	Y	The footprint of alternative OL-4, as shown on Figure 1, can provide the required life of mine storage with an approximate crest elevation of 88 m.
Location does not restrict operation of open pits (incl. waste rock)	Y	The footprint of alternative OL-4, as shown on Figure 1, does not interfere with any of the planned open pits or waste rock storage facilities.
Heritage - Avoids Known Non-Mitigable Sites	Y	There are no known archaeological sites in the area of the OL-4 footprint.
Location is within claim	N	The OL-4 footprint is not within the claim, as shown on Figure 1.
Potential for increased capacity	Y	The approximate maximum height of the OL-4 facility required to store the life of mine tailings production is 27 m. The facility could be raised to allow for additional storage.
Location does not sterilize potential resources	Y	The OL-4 footprint is not close to any of the open pits and the Iron Formation and Ore Zone do not extend into the OL-4 footprint, as shown on Figure 1. Therefore, a facility in this area is not anticipated to sterilize potential resources.
Area is within same sub-catchment as pit	N	The OL-4 alternative is not in the same catchment as any of the pits.
Less than 25% of footprint is within existing waterbody(ies)	Y	There are small ponds within the footprint of the OL-4 alternative; however, the combined area of the ponds is less than 25% of the footprint.

Table B-9: Alternative OL-5

Pre-Screening Criteria	Y/N	Comments
Storage for life-of mine tailings production	Y	The footprint of alternative OL-5, as shown on Figure 1, can provide the required life of mine storage with an approximate crest elevation of 94 m.
Location does not restrict operation of open pits (incl. waste rock)	Y	The footprint of alternative OL-5, as shown on Figure 1, does not interfere with any of the planned open pits or waste rock storage facilities.
Heritage - Avoids Known Non-Mitigable Sites	Y	There are no known archaeological sites in the area of the OL-5 footprint.
Location is within claim	Y	The OL-5 footprint is within the claim, as shown on Figure 1.
Potential for increased capacity	Y	The approximate maximum height of the OL-5 facility required to store the life of mine tailings production is 33 m. The facility could be raised to allow for additional storage.
Location does not sterilize potential resources	Y	The OL-5 footprint is not close to any of the open pits and the Iron Formation and Ore Zone do not extend into the OL-5 footprint, as shown on Figure 1. Therefore, a facility in this area is not anticipated to sterilize potential resources.
Area is within same sub-catchment as pit	N	The OL-5 alternative is not in the same catchment as any of the pits.
Less than 25% of footprint is within existing waterbody(ies)	Y	There are small ponds within the footprint of the OL-5 alternative; however, the combined area of the ponds is less than 25% of the footprint.

Table B-10: Alternative OL-6

Pre-Screening Criteria	Y/N	Comments
Storage for life-of mine tailings production	Y	The footprint of alternative OL-6, as shown on Figure 1, can provide the required life of mine storage with an approximate crest elevation of 100 m.
Location does not restrict operation of open pits (incl. waste rock)	Y	The footprint of alternative OL-6, as shown on Figure 1, does not interfere with any of the planned open pits or waste rock storage facilities.
Heritage - Avoids Known Non-Mitigable Sites	Y	There are no known archaeological sites in the area of the OL-6 footprint.
Location is within claim	N	The OL-6 footprint is not within the claim, as shown on Figure 1.
Potential for increased capacity	Y	The approximate maximum height of the OL-6 facility required to store the life of mine tailings production is 36 m. The facility could be raised to allow for additional storage.
Location does not sterilize potential resources	Y	The OL-6 footprint is not close to any of the open pits and the Iron Formation and Ore Zone do not extend into the OL-6 footprint, as shown on Figure 1. Therefore, a facility in this area is not anticipated to sterilize potential resources.
Area is within same sub-catchment as pit	N	The OL-6 alternative is not in the same catchment as any of the pits.
Less than 25% of footprint is within existing waterbody(ies)	Y	There are small ponds within the footprint of the OL-6 alternative; however, the combined area of the ponds is less than 25% of the footprint.

Table B-11: Alternative OL-7

Pre-Screening Criteria	Y/N	Comments
Storage for life-of mine tailings production	Y	The footprint of alternative OL-7, as shown on Figure 1, can provide the required life of mine storage with an approximate crest elevation of 57 m.
Location does not restrict operation of open pits (incl. waste rock)	Y	The footprint of alternative OL-7, as shown on Figure 1, does not interfere with any of the planned open pits or waste rock storage facilities.
Heritage - Avoids Known Non-Mitigable Sites	Y	There are no known archaeological sites in the area of the OL-7 footprint.
Location is within claim	N	The OL-7 footprint is not within the claim, as shown on Figure 1.
Potential for increased capacity	Y	The approximate maximum height of the OL-7 facility required to store the life of mine tailings production is 27 m. The facility could be raised to allow for additional storage.
Location does not sterilize potential resources	Y	The OL-7 footprint is not close to any of the open pits and the Iron Formation and Ore Zone do not extend into the OL-7 footprint, as shown on Figure 1. Therefore, a facility in this area is not anticipated to sterilize potential resources.
Area is within same sub-catchment as pit	N	The OL-7 alternative is not in the same catchment as any of the pits.
Less than 25% of footprint is within existing waterbody(ies)	Y	There are only a couple of very small ponds within the footprint of the OL-7 alternative which are much less than 25% of the footprint.

Table B-12: Alternative E3

Pre-Screening Criteria	Y/N	Comments
Storage for life-of mine tailings production	Y	The footprint of alternative E3, as shown on Figure 1, provides the required life of mine storage with an approximate crest elevation of 83 m.
Location does not restrict operation of open pits (incl. waste rock)	Y	The footprint of alternative E3, as shown on Figure 1, does not interfere with any of the planned open pits or waste rock storage facilities.
Heritage - Avoids Known Non-Mitigable Sites	Y	There are some archaeological sites in the area of the E3 footprint; however, they have either been mitigated or can be mitigated.
Location is within claim	Y	The E3 footprint is within the claim, as shown on Figure 1.
Potential for increased capacity	N	Due to the relatively small footprint of the E3 alternative and its narrow shape, raising the facility to allow for increased storage capacity is not considered to be feasible.
Location does not sterilize potential resources	Y	The E3 footprint is not close to any of the open pits and the Iron Formation and Ore Zone do not extend into the E3 footprint, as shown on Figure 1. Therefore, a facility in this area is not anticipated to sterilize potential resources.
Area is within same sub-catchment as pit	N	The E3 alternative is not in the same catchment as any of the pits.
Less than 25% of footprint is within existing waterbody(ies)	N	Lake E3 covers more than 25% of the footprint.

Table B-13: Alternative B45/B46

Pre-Screening Criteria	Y/N	Comments
Storage for life-of mine tailings production	Y	The footprint of alternative B45/B46, as shown on Figure 1, can provide the required life of mine storage with an approximate crest elevation of 82 m.
Location does not restrict operation of open pits (incl. waste rock)	Y	The footprint of alternative B45/B46, as shown on Figure 1, does not interfere with any of the planned open pits or waste rock storage facilities.
Heritage - Avoids Known Non-Mitigable Sites	Y	There are no known archaeological sites in the area of the B45/B46 footprint.
Location is within claim	N	The B45/B46 footprint is not within the claim, as shown on Figure 1.
Potential for increased capacity	Y	The approximate maximum height of the B45/B46 facility required to store the life of mine tailings production is 20 m. The facility could be raised to allow for additional storage.
Location does not sterilize potential resources	Y	The Iron Formation and Ore Zone do not extend into the B45/B46 footprint, as shown on Figure 1. Therefore, a facility in this area is not anticipated to sterilize potential resources.
Area is within same sub-catchment as pit	Y	The B45/B46 alternative is in the same catchment as the Pump pits.
Less than 25% of footprint is within existing waterbody(ies)	N	Lakes B45 and B46 cover more than 25% of the footprint.

APPENDIX C

Tailings Technology Risk Assessment

Meliadine Project
Risk Assessment - Tailings technologies

Risk and Opportunities Register
Site: Meliadine
Project Name: Tailings Task Force Thickened (65%) Option
Document No.:
AEF No.:
Revision No.: G
Revision Date: October 17th, 2011

Date: September 16th-October 14th, 2011
Participants:
Michel Julien, Golder
Allison Isodoro, Golder
Dominic Tremblay, SNC Lavalin
Marc Lafontaine, AEM
Blandine Arseneault, AEM

Legend: Risk = Likelihood x severity of impact

RISK AND OPPORTUNITIES REGISTER

										SEVERITY OF IMPACT						
Item No	Priority	Project Phase	Discipline	Area	Event	Cause (Description)	Impact	LIKELIHOOD of event	RISK	Safety	Environment-Social	Schedule	CAPEX/Rehab	OPEX	Production / Profit	Mitigating Action / Comments
1		Permitting	Environment - Social	TSF	Tailings pond located on a fish habitat	Fish habitat destroyed	Loss of fish habitat increase CAPEX cost and adds a risk to not meeting deadline for start-up.	5 - Expected	Primary Risk	1 - Very low	3 - Moderate	4 - Severe	3 - Moderate	1 - Very low	3 - Moderate	Replace lost fish habitat
2		Permitting	Environment - Social	n/a	Delay in obtaining a permit.	Regulator concerns with respect to the TSF design, Schedule 2 application; NGO attention relative to Sched 2 listing.	Delay in start up.	4 - High	Primary Risk	1 - Very low	1 - Very low	4 - Severe	1 - Very low	1 - Very low	3 - Moderate	
3		Construction	General Works	Mill	Delay in construction schedule	Long delivery items are ordered late	Delay in start up.	2 - Low	Significant Risk	1 - Very low	1 - Very low	4 - Severe	1 - Very low	1 - Very low	1 - Very low	Establish an effective lift strategy and plan large lifts with some scheduling contingency. Review the contractor crane availability and supplement where necessary.
4		Engineering	Environment - Social	TSF	Seepage in to groundwater below facility.	If located in an area of an open talik allowing seepage from the tailings pond to reach the groundwater. Presence of tailings pond acting as recharge can induce higher mobility of arsenic in surface and ground water.	Contamination of groundwater with arsenic or other heavy metals	3 - Moderate	Primary Risk	1 - Very low	4 - Severe	1 - Very low	4 - Severe	1 - Very low	2 - Low	May require inclusion of seepage control measure; High CAPEX if problem has to be addressed
5		Engineering	Detail Engineering	TSF	Facility requires lining of entire footprint and stripping of 2 m of material to remove ice lenses.	Natural confinment may be found to be insufficient therefore requiring full lining.	Significant increase in CAPEX.	3 - Moderate	Primary Risk	1 - Very low	1 - Very low	3 - Moderate	4 - Severe	1 - Very low	2 - Low	given the possibility of using a lake for tailings storage combined to the necessity for a pond, there is a higher risk of having to line the Thickened TSF
6		Engineering	Detail Engineering	Mill	Freezing of tanks and pipes.	Insufficient provision of insulation and/or heat tracing to tanks and pipes during engineering design. No flow in the piping, combination of a very low ambiant temperature and long residence time in piping.	Production loss. Increased maintenance costs. Spill.	3 - Moderate	Low Control Risk	2 - Low	2 - Low	1 - Very low	1 - Very low	2 - Low	2 - Low	Identification of all exposed surfaces must be done during detailed engineering to address freezing / cold weather issue. Use of insulation and heat tracing as required. Spare tailings pipes available.
7		Start-up/Commissioning	Process	Mill	Operating difficulties at start-up	Lack of effective commissioning strategy (pre-, cold, & hot commissioning). Complexity of the equipment.	Inability to start-up the plant and achieve target gold production.	2 - Low	Low Control Risk	1 - Minor	1 - Minor	3 - Moderate	1 - Minor	1 - Minor	2 - Low	Establish effective pre-commissioning and commissioning strategy, plan and tactics for all equipment (during detailed engineering phase).
8		Engineering	Detail Engineering	Mill	Tailings pump undersized (pump and motor)	Engineering design flaw, underestimated flow, higher restriction in piping, higher pumping elevation deposition point required.	Reduce tonnage in order to keep the pump working; if more water is added to keep up tonnage = less space at TSF for tailings. Increase Capex	4 - High	Significant Risk	1 - Very low	1 - Very low	1 - Very low	3 - Moderate	3 - Moderate	2 - Low	Improved simulations and tests
9		Engineering	Detail Engineering	TSF	Tailings storage facility too small - requirement to expand TSF	Under estimation of the TSF needed volume (in-situ density, snow/ice encapsulation/growth). Lower % solids resulting in lower than estimated in-situ tailings density and larger volume of water in system. Also likely to have more ice entrapment with more water in system.	Life time of facility decreased. Problems with fines sedimentation. Difficulty to create tailings beaches in a smaller pond. Tailings dikes need to be raised higher. Increase Capex and Opex. Redo permitting.	4 - High	Significant Risk	1 - Very low	1 - Very low	1 - Very low	3 - Moderate	2 - Low	2 - Low	Ensure a good estimate of ice entrapment and monitoring of pond (bathymetry). Use a conservative tonnage for defining the footprint of the facility to allow for capacity if more resource is found.
10		Engineering	Detail Engineering	TSF	Dike presents more than expected seepage	Problem with TIA design or construction. Design/Construction challenges - permafrost foundation suceptible to thaw (some ice rich materials), availability of suitable liner bedding materials and filters, liner tie-in to foundation (especially on west side of Lake B7), potential for construction in winter conditions (reduced quality of construction), etc.	Seepage through or under the dikes beyond what was expected in design; contamination of the surrounding area. Increased seepage water management effort and costs.	3 - Moderate	Significant Risk	1 - Very low	2 - Low	1 - Very low	2 - Low	3 - Moderate	1 - Very low	Regular inspections.
11		Engineering	Detail Engineering	TSF	Tailings dike failure (embankment failure, massive leak or overtopping)	Problem with TSF design or construction. Design/Construction challenges - permafrost foundation suceptible to thaw (some ice rich materials), availability of suitable liner bedding materials and filters, liner tie-in to foundation (especially on west side of Lake B7), potential for construction in winter conditions (reduced quality of construction), etc.. Excessive amount of water in TSF.	Failure of a section of one of the containment dikes and contamination of the surrounding area. The process plant must be stopped during the dike repair.	2 - Low	Primary Risk	4 - Severe	5 - Extreme	1 - Very low	5 - Extreme	3 - Moderate	5 - Extreme	Proceed with more robust design and have proper monitoring program
12		Construction	Drilling & Blasting	TSF	Mining not producing sufficient suitable waste rock (i.e. Non Acid Generating, no metal leaching) to construct dikes	Not achieving mining plan for various reasons: lack of availability of mining fleet, insufficient productivity because of lack of training, insufficient manpower, less suitable rock available than originally estimated in geology model etc.	Dikes not ready on time, no place to put the tailings: mill can't start or mill shutdown.	3 - Moderate	Significant Risk	1 - Very low	1 - Very low	3 - Moderate	3 - Moderate	1 - Very low	2 - Low	Include waste rock for dike construction as part of the mine plan objectives.
13		Construction	General Materials	Mill	Long lead time for thickening equipment	Long lead item not taken into account in the schedule.	Delay on mill startup	2 - Low	Significant Risk	1 - Very low	1 - Very low	4 - Severe	1 - Very low	1 - Very low	2 - Low	Include long lead item on critical procurement list
14		Construction	General Works	TSF	Not able to complete construction according to schedule	Construction plan not including sufficient margin for weather events; insufficient resources (construction materials and equipment) to build on time. Delays due to changes required for design because conditions or materials are different than expected (eg. Waste rock gradation is coarser than expected resulting in a requirement to change the gradation of filter layers).	Dikes not ready on time, no place to put the tailings: mill can't start or mill shutdown.	4 - High	Primary Risk	1 - Very low	1 - Very low	4 - Severe	1 - Very low	1 - Very low	2 - Low	Include contingency in construction schedule
15		Construction	General Materials	TSF	Tailings pipe installation not completed in time for start-up	Construction delays; logistical problems.	Pipeline not ready on time: mill can't start	2 - Low	Low Control Risk	1 - Very low	1 - Very low	2 - Low	1 - Very low	1 - Very low	2 - Low	Include contingency in construction schedule and plan better
16		Start-up/Commissioning	Process	Mill	Difficulties to achieve specs of process equipment	too low %solids in tailings during operations	Decrease life of TSF; Higher capital costs; Lower productivity	2 - Low	Low Control Risk	1 - Very low	1 - Very low	1 - Very low	3 - Moderate	2 - Low	2 - Low	
17		Operation	Process	Mill	Unable to maintain stable operating conditions continuously	Process system is very sensitive to operational changes	Higher capital costs; Lower productivity	2 - Low	Low Control Risk	1 - Very low	1 - Very low	1 - Very low	3 - Moderate	2 - Low	2 - Low	
18		Operation	Process	Mill	Difficulty to maintain constant % solids in tailings	High variability of water usage which reports to tailings pump box.	Do not meet filling scheme; insufficient capacity at TSF;Excess water resulting in a water passive in the system; increase Capex.	3 - Moderate	Significant Risk	1 - Very low	1 - Very low	1 - Very low	3 - Moderate	2 - Low	1 - Very low	
19		Operation	Detail Engineering	Mill	Unable to pump tailings slurry at 60% solid (thickener underflow density)	The slurry viscosity increases with the slurry density. Above a given solid content, the slurry can not be pumped with conventional centrifugal pump.	Maintain the slurry more diluted increase the slurry volume to be pumped. Could lead to a tonnage reduction due to higher volume to be pumped. Increased operating and maintenance costs and reduced profits. Will also result in higher volume of water in system, which will reduce the storage available in the TSF and can also affect the density of the tailings in the facility which will also affect the total storage available.	2 - Low	Low Control Risk	1 - Very low	1 - Very low	1 - Very low	3 - Moderate	3 - Moderate	2 - Low	Test all type of possible material before selecting equipment. Good operator instructions. Good follow-up at commissioning.
20		Operation	General Materials	Mill	Tailings pipe failure	Poor installation; no testing prior to start-up; Overpressure in line, higher wear than expected, lack of maintenace, freezing dammage, manufacturing defect, construction defect.	Pipeline break: mill stops ; production loss; spill and contamination of surrounding area.	2 - Low	Low Control Risk	2 - Low	3 - Moderate	2 - Low	1 - Very low	2 - Low	2 - Low	Have spare material on site and crew for repair
21		Operation	Mechanical	Mill	Tailings line accidentally damaged by equipment	Lack of identification and protection	Stop process during repair; spill and contamination of surrounding area.	4 - High	Significant Risk	3 - Moderate	3 - Moderate	1 - Very low	1 - Very low	2 - Low	2 - Low	Have spare material on site and crew for repair

Meliadine Project
Risk Assessment - Tailings technologies

Risk and Opportunities Register
Site: Meliadine
Project Name: Tailings Task Force Thickened (65%) Option
Document No.:
AEF No.:
Revision No.: G
Revision Date: October 17th, 2011

Date: September 16th-October 14th, 2011
Participants: Michel Julien, Golder
Allison Isodoro, Golder
Dominic Tremblay, SNC Lavalin
Marc Lafontaine, AEM
Blandine Arseneault, AEM

Legend: Risk = Likelihood x severity of impact

RISK AND OPPORTUNITIES REGISTER

										SEVERITY OF IMPACT						
Item No	**Priority**	**Project Phase**	**Discipline**	**Area**	**Event**	**Cause (Description)**	**Impact**	**LIKELIHOOD of event**	**RISK**	**Safety**	**Environment-Social**	**Schedule**	**CAPEX/Rehab**	**OPEX**	**Production / Profit**	**Mitigating Action / Comments**
22		Operation	Process	Mill	Line sanding	Lack of effective operator training (vendor, in-house) on new equipment. Lack of controls, instrumentation. Manual start-up (eg: comissioning). Lower flow speed than deposition rate of the slurry. Higher grind size than expected. Wrong piping design or installation.	Stop process during repair.	3 - Moderate	Low Control Risk	1 - Very low	1 - Very low	1 - Very low	1 - Very low	2 - Low	2 - Low	Ensure that operating procedures are in place and that training is done.
23		Operation	Mechanical	Mill	Tailings pump failure (inside plant)	Lack of maintenance or uncontrolled mechanical failure.	Slowdown of production	2 - Low	Low Control Risk	1 - Very low	1 - Very low	1 - Very low	1 - Very low	2 - Low	1 - Very low	Have spare material on site and crew for repair
24		Operation	Mechanical	Mill	Tailings process maintenance error	Lack of effective mechanical training (vendor, in-house) on new equipment.	Stop process during repair Increased maintenance costs and reduced profits. Longer mill ramp-up.	2 - Low	Low Control Risk	2 - Low	1 - Very low	1 - Very low	1 - Very low	2 - Low	2 - Low	Have spare material on site and crew for repair
25		Operation	Environment - Social	TSF	Dust formation at TSF	Wind erosion/freeze-dry during winter on exposed beaches.	Contamination of the surrounding watershed.	4 - High	Significant Risk	3 - Moderate	2 - Low	1 - Very low	2 - Low	2 - Low	2 - Low	Improve tailings deposition plan. Put up wind barriers.
26		Operation	Process	TSF	Higher ARD generation and metal leaching of tailings than expected	Insufficient geochemical testing prior to project; Partially saturation of tailings that promote ARD and ML	The treatment of the water increase operating cost of the TSF (assumed water is collected but not treated)	3 - Moderate	Significant Risk	1 - Very low	1 - Very low	1 - Very low	3 - Moderate	3 - Moderate	1 - Very low	Ensure that high phréatic layer is maintained
27		Operation	Environment - Social	TSF	CN in tailings pond higher than 50 ppm prescribed for wildlife protection	Cyanide destruction not working properly	Effect on birds	3 - Moderate	Primary Risk	3 - Moderate	4 - Severe	1 - Very low	3 - Moderate	3 - Moderate	1 - Very low	Use physical or noise deterrent. Use appropriate process to ensure CN levels are below 50ppm in TSF.
28		Operation	General Works	TSF	Unable to achieve the expected beach slope as per planned in filling scheme	The tailings have higher or flatter slopes than expected	The construction/raising sequence or protection of dykes with tailings can be impacted. Difficulty to meet the raising schedule or excessive seepage or exposed liner to ice effect; Capex increased.	4 - High	Significant Risk	3 - Moderate	1 - Very low	3 - Moderate	2 - Low	3 - Moderate	2 - Low	
29		Operation	Process	Water management	Build-up of chemical agents in water	The use of chemical reagents in process plant and the recycle of the process water could lead to build-up of chemical agents.	The build-up of chemical agent could lead to process problems. Gold recovery could be decreased. Bleed the process water to purge chemical agent and release water into environment. Water treatment facilities could be expected increasing CAPEX, footprint and operational cost.	2 - Low	Low Control Risk	1 - Very low	3 - Moderate	1 - Very low	2 - Low	2 - Low	2 - Low	Bleed and treat
30		Operation	Environment - Social	Water management	Increase of fresh water consumption (zero discharge operation impratical)	Dilution: poor management of freshwater usage; Add fresh water into process in order to reduce impact of chemical build-up in water. (ex: total CN concentration, salt, ...). Water lost due to ice entrapment/growth in the TSF.	Bleed the process water to purge chemical agent and release water into environment. Water treatment facilities could be expected increasing CAPEX, footprint and operational cost. Reduced capacity at TSF for tailings. Non respect of License's limits of fresh water intake volume.	3 - Moderate	Significant Risk	1 - Very low	3 - Moderate	1 - Very low	2 - Low	2 - Low	1 - Very low	Review non-essential freshwater usage and switch to process water

Meliadine Project
Risk Assessment - Tailings technologies

Risk and Opportunities Register
Site: Meliadine
Project Name: Tailings Task Force Filtered (85%)Option
Document No.:
AEF No.:
Revision No.: G
Revision Date: October 17th, 2011

Date: September 16th-October 14th, 2011
Participants: Michel Julien, Golder
Allison Isodoro, Golder
Dominic Tremblay, SNC Lavalin
Marc Lafontaine, AEM
Blandine Arseneault, AEM

Legend: Risk = Likelihood x severity of impact

Item No	Priority	Project Phase	Discipline	Area	Event	Cause (Description)	Impact	LIKELIHOOD of event	RISK	Safety	Environmental/Social	Schedule (construction)	CAPEX/Rehab	OPEX	Profitability	Mitigating Action / Comments
1		Permitting	Environment - Social	n/a	Delay in obtaining a permit.	Regulator concerns with respect to the TSF design, etc.	Delay in start up.	2 - Low	Significant Risk	1 - Very low	2 - Low	4 - Severe	2 - Low	1 - Very low	3 - Moderate	It is understood that site for filtered tailings would aim at being placed away from fish habitat
2		Construction	General Materials	Mill	Long lead time for filtering equipment	Long lead item not taken into account in the schedule.	Delay on mill startup	2 - Low	Significant Risk	1 - Very low	1 - Very low	4 - Severe	1 - Very low	1 - Very low	1 - Very low	Include long lead item on critical procurement list - not believed to be an element that could significantly delay the project
3		Engineering	Environment - Social	TSF	Seepage in to groundwater below facility.	If located in an area of an open talik allowing seepage from the tailings pond to reach the groundwater.	Contamination of groundwater with arsenic or other heavy metals	2 - Low	Low Control Risk	1 - Very low	2 - Low	1 - Very low	3 - Moderate	1 - Very low	2 - Low	Not believed that such facility will result in significant seepage in the foundations
4		Engineering	Detail Engineering	TSF	Facility requires lining of entire footprint and stripping of 2 m of material to remove ice lenses.	Natural confinment may be found to be unsufficient therefore requiring full lining	increase in CAPEX.	2 - Low	Low Control Risk	1 - Very low	1 - Very low	3 - Moderate	3 - Moderate	1 - Very low	2 - Low	This risk would make this option significantly less attractive
5		Engineering	Detail Engineering	Mill	Freezing of tanks and pipes.	Insufficient provision of insulation and/or heat tracing to tanks and pipes during engineering design.	Production loss. Increased maintenance costs.	1 - Not likely	Low Control Risk	1 - Very low	1 - Very low	1 - Very low	1 - Very low	2 - Low	2 - Low	Identification of all exposed surfaces must be done during detailed engineering to address freezing / cold weather issue. Use of insulation and heat tracing as required.
6		Start-up/Commissioning	Process	Mill	Operating difficulties at start-up	Lack of effective commissioning strategy (pre-, cold, & hot commissioning). Complexity of the equipment.	Inability to start-up the plant and achieve target gold production.	3 - Moderate	Significant Risk	1 - Very low	1 - Very low	3 - Moderate	3 - Moderate	1 - Very low	2 - Low	Establish effective pre-commissioning and commissioning strategy, plan and tactics for all equipment (during detailed engineering phase). Plan for special deposition area for emergency and short term deposition of tailings during commissioning.
7		Operation	Process	Mill	Difficulties to achieve specs of process equipment (overall operation) - from equipment performance point of view) (% solids is too low wrt specs)	Inappropriate equipment (eg.: filter cloth not appropriate; insufficient capacity of filters).process system is very sensitive to operational changes. Higher moisture content in tailings than assumed :difficulty to place tailings;	Higher capital costs; Lower productivity (decrease tonnage to achieve solid %)	3 - Moderate	Low Control Risk	1 - Very low	1 - Very low	1 - Very low	2 - Low	2 - Low	2 - Low	Based on 10% less through-put (decrease of production) in a year representing approx. 50K oz/yr; Additional filter press.
8		Operation	Process	Mill	Unable to maintain stable operating conditions continuously (within operational range) - based on operation (from a manpower point of view)	Lack of effective operation training (vendor, in-house) and sufficient experience on equipment.	Higher operational and maintenance costs; lower productivity.	5 - Expected	Primary Risk	3 - Moderate	2 - Low	1 - Very low	1 - Very low	3 - Moderate	2 - Low	
9		Operation	Process	Mill	Filter decreases equipment availability (from a maintenance point of view)	Lack of effective maintenance training (vendor, in-house) on equipment. Wear and corrosion higher than expected.	Decreased plant availability. Increased maintenance costs and reduced profits.	5 - Expected	Primary Risk	3 - Moderate	1 - Very low	1 - Very low	2 - Low	3 - Moderate	2 - Low	Ensure that vendors are brought in to provide effective training to maintenance personnel. Note if impact would be significant, adjustments would be implemented on the system to minimize consequences (MJ)
10		Operation	Process	Mill	Dry tailing holding tank blocage	Freezing inside silo or blockage due to settling of tailings. Design lacks flexibility.	Production loss (fairly long mill shutdown) Increase Capex	3 - Moderate	Significant Risk	1 - Very low	1 - Very low	1 - Very low	3 - Moderate	3 - Moderate	3 - Moderate	
11		Operation	General Works	TSF	Truck transportation ceases for undetermined time	Road closed during Blizzard	Unplanned shutdown of Mill for lack of emergency storage space for tailings	5 - Expected	Significant Risk	1 - Very low	1 - Very low	1 - Very low	1 - Very low	1 - Very low	1 - Very low	Difficult to envisage that this aspect will be not be an intrinsic part of the design (MJ)
12		Operation	Environment - Social	TSF	Tailings contamination of road between Mill and TSF	Contaminated truck tires on road between Mill and TSF	Contamination of the road and the surrounding area with tailings. Increases rehabilitation costs (clean-up)	5 - Expected	Primary Risk	1 - Very low	3 - Moderate	1 - Very low	3 - Moderate	1 - Very low	1 - Very low	
13		Operation	Environment - Social	TSF	Spill of tailings along haulage road due to tailings truck accident in a non confined area.	Loss of control on road; blizzard conditions; inadequate SOP for trucking in difficult conditions	Contamination of environment; potential serious H&S issue.	3 - Moderate	Primary Risk	4 - Severe	3 - Moderate	1 - Very low	2 - Low	3 - Moderate	2 - Low	
14		Operation	General Earth Works	TSF	Tailing workers stuck on tailing pad during Blizzard	Road unpassible when workers are working on pad.	Isolated employees during storm. Safety risk.	5 - Expected	Primary Risk	3 - Moderate	1 - Very low	1 - Very low	1 - Very low	1 - Very low	1 - Very low	Easy mitigation measures can be put in place to reduce this risk
15		Operation	General Works	TSF	Mobil equipment stuck on tailing pad; difficulty for mobil equipment to access the deposition area of TSF.	Moisture content too high in tailings; areas of TSF too wet due to climate conditions (eg: rain and freshet); Icy access road making hauling more difficult.	Decreasing of the equipment availability, material damage and injury risk. Decrease production rate; increase opex (when double-handling tails at emergency tailings pad)	3 - Moderate	Significant Risk	3 - Moderate	1 - Very low	1 - Very low	1 - Very low	3 - Moderate	1 - Very low	Easy mitigation measures can be put in place to reduce this risk
16		Operation	Environment - Social	TSF	Dust formation at TSF	Large active zones of dry tailings	Contamination of the surrounding watershed. Contamination of the final cover build for progressive reclamation during operation. Exposure of workers at TSF to contaminants.	5 - Expected	Primary Risk	4 - Severe	4 - Severe	1 - Very low	4 - Severe	3 - Moderate	2 - Low	Effective mitigation measures like limiting active zone can be implemented to reduce this risk significantly
17		Operation	Detail Engineering	TSF	Tailings storage facility too small - requirement to expand TSF	Under estimation of the TSF needed volume (in-situ density, snow encapsulation).	Life time of TSF decreased. Increase Capex; redo permitting.	2 - Low	Low Control Risk	1 - Very low	3 - Moderate	1 - Very low	2 - Low	1 - Very low	1 - Very low	This technology tends to offer larger expansion potential
18		Operation	Environment - Social	TSF	Higher ARD generation and metal leaching of tailings than expected	Insufficient geochemical testing prior to project; Partially saturation of tailings that promote ARD and ML	The treatment of the water increase operating cost of the TSF (treatment plant is required)	3 - Moderate	Significant Risk	1 - Very low	1 - Very low	1 - Very low	2 - Low	3 - Moderate	2 - Low	
19		Operation	Environment - Social	TSF	Slope failure of TSF	Unknown or overlooked geotechnical conditions. Insufficient compaction of tailings.	Contamination of surrounding area. Loss of performance of the cover. Increased capex.	2 - Low	Low Control Risk	1 - Very low	3 - Moderate	1 - Very low	2 - Low	1 - Very low	2 - Low	
20		Operation	Process	TSF	Caving of areas at TSF	Disposal of tailings with snow	Increased capex; H&S hazard due to caving in active areas of TSF.	4 - High	Significant Risk	3 - Moderate	1 - Very low	1 - Very low	2 - Low	2 - Low	1 - Very low	
21		Operation	Environment - Social	TSF	Unable to contain water inside TSF during large storm events and freshet.	Significant water inflow during large storm events or at freshet from snow/ice accumulated in the system or from external watersheds. Sudden and important inflow of water in the system; Erosion of ditches or loss of performance.	Contamination of surrounding area with non-treated water.	3 - Moderate	Significant Risk	1 - Very low	3 - Moderate	1 - Very low	2 - Low	1 - Very low	1 - Very low	Repairs works required
22		Operation	Process	Water Management	Build-up of chemical agents in water	The use of chemical reagents in process plant and the recycle of the process water could lead to build-up of chemical agents.	The build-up of chemical agent could lead to process problems. Gold recovery could be decreased. Bleed the process water to purge chemical agent and release water into environment. Water treatment facilities could be expected increasing CAPEX, footprint and operational cost.	3 - Moderate	Significant Risk	1 - Very low	3 - Moderate	1 - Very low	2 - Low	2 - Low	2 - Low	These problems could be resolved using water treatment facilities increasing CAPEX, footprint and operational cost.
23		Operation	Environment - Social	Water management	Increase of fresh water consumption (zero discharge operation impratical)	Dilution: poor management of freshwater usage; Add fresh water into process in order to reduce impact of chemical build-up in water. (ex: total CN concentration, salt, ...).	Bleed the process water to purge chemical agent and release water into environment. Water treatment facilities could be expected increasing CAPEX, footprint and operational cost. Non respect of License's limits of fresh water intake volume.	3 - Moderate	Significant Risk	1 - Very low	3 - Moderate	1 - Very low	2 - Low	2 - Low	1 - Very low	Review non-essential freshwater usage and switch to process water
24		Operation	General Works	TSF	Inappropriate use of TSF for other waste disposal	Disposal of various wastes at TSF (sewage, ashes, filters, etc.)	Contamination of surrounding area with hydrocarbones, other chemicals and bioharzard products.	4 - High	Significant Risk	3 - Moderate	3 - Moderate	1 - Very low	3 - Moderate	1 - Very low	1 - Very low	Strict rules for usage should be implemented to avoid this situation all too common given the opportunities this zone to offer to store all sorts of waste materials
25		Closure / Post-closure	Environment - Social	TSF	Rehabilitation: Tailing water can not be treated as expected	Higher level of contaminant or stable chemical agents build-up in water.	Water treatment will be more expensive than expected. More complex water process treatment could be required.	3 - Moderate	Significant Risk	1 - Very low	1 - Very low	1 - Very low	3 - Moderate	1 - Very low	1 - Very low	
26		Closure / Post-closure	Environment - Social	TSF	Post-closure: Higher ARD generation and metal leaching of tailings than expected	Unsufficient geochemical testing prior to project	The treatment of the water increase closure cost of the TSF	2 - Low	Significant Risk	1 - Very low	3 - Moderate	1 - Very low	4 - Severe	1 - Very low	1 - Very low	
27		Closure / Post-closure	Environment - Social	TSF	Major non performance of final cover	Design doesn't withstand the test of time. Inappropriate desig for northern conditions.	Contamination and/or release of tailings in surrounding environment. Increased costs associated with treatment of water.	2 - Low	Significant Risk	2 - Low	3 - Moderate	1 - Very low	4 - Severe	1 - Very low	1 - Very low	
28		Closure / Post-closure	Environment - Social	TSF	Difficulty to construct the final cover	Difficulty to find appropriate construction material and equipments.	Increased costs for reclamation.	3 - Moderate	Significant Risk	2 - Low	1 - Very low	1 - Very low	3 - Moderate	1 - Very low	1 - Very low	

	Total	%
Results	6	21
	16	57
	6	21

Meliadine Project
Risk Assessment - Tailings technologies

Risk and O Date:
Site: Melia Participants: Michel Julien, Golder
Project Name: Tailings Task Force Flottation + 85% of T Allison Isodoro, Golder
Document No.: Dominic Tremblay, SNC Lavalin
AEF No.: Marc Lafontaine, AEM
Revision Blandine Arseneault, AEM
Revision Date: October 21th, 2011

Legend:

RISK AND OPPORTUNITIES REGISTER

Item No	Area	Event	Cause (Description)	Impact	LIKELIHOOD of event	RISK	SEVERITY OF IMPACT: Safety	Environment-Social	Schedule	CAPEX/Rehab	OPEX	Production / Profit	Mitigating Action / Comments
1	TSF	Tailings Storage Facility located on a fish habitat (Inert thickened tailings)	Fish habitat destroyed	Loss of fish habitat increase CAPEX cost and adds a risk to not meeting deadline for start-up.	5 - Expected	Primary Risk	1 - Very low	3 - Moderate	4 - Severe	3 - Moderate	1 - Very low	3 - Moderate	Replace lost fish habitat
2	n/a	Delay in obtaining a permit.	Regulator concerns with respect to the TSF design, Schedule 2 application; NGO attention relative to Sched 2 listing.	Delay in start up.	4 - High	Primary Risk	1 - Very low	1 - Very low	4 - Severe	1 - Very low	1 - Very low	3 - Moderate	
3	Mill	Delay in construction schedule	Long delivery items are ordered late (e.g. filtering equipment)	Delay in start up.	2 - Low	Significant Risk	1 - Very low	1 - Very low	4 - Severe	1 - Very low	1 - Very low	1 - Very low	Establish an effective lift strategy and plan large lifts with some scheduling contingency. Review the contractor crane availability and supplement where necessary.
4	TSF	Seepage in to groundwater below facility.	If located in an area of an open talik allowing seepage from the TSF to reach the groundwater. Presence of tailings pond acting as recharge can induce higher mobility of arsenic in surface and ground water.	Contamination of groundwater with arsenic or other heavy metals	3 - Moderate	Primary Risk	1 - Very low	4 - Severe	1 - Very low	4 - Severe	1 - Very low	2 - Low	May require inclusion of seepage control measure; High CAPEX if problem has to be addressed
5	TSF	Facility requires lining of TSF footprint for filtered / reactive tailings. Additionnaly, stripping of 2 m of material to remove ice lenses could be required.	Natural confinment may be found to be insufficient therefore requiring full lining.	CAPEX.	3 - Moderate	Primary Risk	1 - Very low	1 - Very low	3 - Moderate	2 - Low	1 - Very low	2 - Low	Thickened portion will not require lining because tailings will be inert. It is a given that AEM will line the filtered portion that will contain higher concentrations of contaminants.
6	Mill	Freezing of tanks and pipes.	Insufficient provision of insulation and/or heat tracing to tanks and pipes during engineering design. No flow in the piping, combination of a very low ambiant temperature and long residence time in piping.	Production loss. Increased maintenance costs. Spill.	3 - Moderate	Low Control Risk	2 - Low	2 - Low	1 - Very low	1 - Very low	2 - Low	2 - Low	Identification of all exposed surfaces must be done during detailed engineering to address freezing / cold weather issue. Use of insulation and heat tracing as required. Spare tailings pipes available.
7	Mill	Operating difficulties at start-up	Lack of effective commissioning strategy (pre-, cold, & hot commissioning). Complexity of the equipment.	Inability to start-up the plant and achieve target gold production.	2 - Low	Low Control Risk	1 - Minor	1 - Minor	3 - Moderate	1 - Minor	1 - Minor	2 - Low	Establish effective pre-commissioning and commissioning strategy, plan and tactics for all equipment (during detailed engineering phase).
8	Mill	Tailings pump undersized (pump and motor)	Engineering design flaw, underestimated flow, higher restriction in piping, higher pumping elevation deposition point required.	Reduce tonnage in order to keep the pump working; if more water is added to keep up tonnage = less space at TSF for tailings. Increase Capex	4 - High	Significant Risk	1 - Very low	1 - Very low	1 - Very low	3 - Moderate	3 - Moderate	2 - Low	Improved simulations and tests
9	TSF	Tailings storage facility too small - requirement to expand TSF	Under estimation of the TSF needed volume (in-situ density, snow/ice encapsulation/growth). Lower % solids resulting in lower than estimated in-situ tailings density and larger volume of water in system. Also likely to have more ice entrapment with more water in system.	Life time of facility decreased. Problems with fines sedimentation. Difficulty to create tailings beaches in a smaller pond. Tailings dikes need to be raised higher. Increase Capex and Opex. Redo permitting.	4 - High	Significant Risk	1 - Very low	1 - Very low	1 - Very low	3 - Moderate	2 - Low	2 - Low	Ensure a good estimate of ice entrapment and monitoring of pond (bathymetry). Use a conservative tonnage for defining the footprint of the facility to allow for capacity if more resource is found.
10	TSF	Dike presents more than expected seepage (Filtered tailings with As/sulfure content)	Problem with TIA design or construction. Design/Construction challenges - permafrost foundation sceptible to thaw (some ice rich materials), availability of suitable liner bedding materials and filters, liner tie-in to foundation (especially on west side of Lake B7), potential for construction in winter conditions (reduced quality of construction), etc.	Seepage through or under the dikes beyond what was expected in design; contamination of the surrounding area. Increased seepage water management effort and costs.	3 - Moderate	Significant Risk	1 - Very low	2 - Low	1 - Very low	2 - Low	3 - Moderate	1 - Very low	Regular inspections.
11	TSF	Tailings dike failure (embankment failure, massive leak or overtopping) (Filtered tailings with As/sulfure content)	Problem with TSF design or construction. Design/Construction challenges - permafrost foundation sceptible to thaw (some ice rich materials), availability of suitable liner bedding materials and filters, liner tie-in to foundation (especially on west side of Lake B7), potential for construction in winter conditions (reduced quality of construction), etc.. Excessive amount of water in TSF.	Failure of a section of one of the containment dikes and contamination of the surrounding area. The process plant must be stopped during the dike repair.	2 - Low	Primary Risk	4 - Severe	5 - Extreme	1 - Very low	5 - Extreme	3 - Moderate	5 - Extreme	Proceed with more robust design and have proper monitoring program
12	TSF	Mining not producing sufficient suitable waste rock (i.e. Non Acid Generating, no metal leaching) to construct dikes	Not achieving mining plan for various reasons: lack of availability of mining fleet, insufficient productivity because of lack of training, insufficient manpower, less suitable rock available than originally estimated in geology model etc.	Dikes not ready on time, no place to put the tailings: mill can't start or mill shutdown.	3 - Moderate	Significant Risk	1 - Very low	1 - Very low	3 - Moderate	3 - Moderate	1 - Very low	2 - Low	Include waste rock for dike construction as part of the mine plan objectives.
13	Mill	Long lead time for thickening equipment	Long lead item not taken into account in the schedule.	Delay on mill startup	2 - Low	Significant Risk	1 - Very low	1 - Very low	4 - Severe	1 - Very low	1 - Very low	2 - Low	Include long lead item on critical procurement list
14	TSF	Not able to complete construction of dikes according to schedule	Construction plan not including sufficient margin for weather events; insufficient resources (construction materials and equipment) to build on time. Delays due to changes required for design because conditions or materials are different than expected (eg. Waste rock gradation is coarser than expected resulting in a requirement to change the gradation of filter layers).	Dikes not ready on time, no place to put the tailings: mill can't start or mill shutdown.	4 - High	Primary Risk	1 - Very low	1 - Very low	4 - Severe	1 - Very low	1 - Very low	2 - Low	Include contingency in construction schedule
15	TSF	Tailings pipe installation not completed in time for start-up (thickened tails)	Construction delays; logistical problems.	Pipeline not ready on time: mill can't start	2 - Low	Low Control Risk	1 - Very low	1 - Very low	2 - Low	1 - Very low	1 - Very low	2 - Low	Include contingency in construction schedule and plan better
16	Mill	Difficulties to achieve specs of process equipment (thickened tails)	too low %solids in tailings during operations	Decrease life of TSF; Higher capital costs; Lower productivity	2 - Low	Low Control Risk	1 - Very low	1 - Very low	1 - Very low	3 - Moderate	2 - Low	2 - Low	
17	Mill	Unable to maintain stable operating conditions continuously (thickened tails)	Process system is very sensitive to operational changes	Higher capital costs; Lower productivity	2 - Low	Low Control Risk	1 - Very low	1 - Very low	1 - Very low	3 - Moderate	2 - Low	2 - Low	
18	Mill	Difficulty to maintain constant % solids in tailings (thickened)	High variability of water usage which reports to tailings pump box.	Do not meet filling scheme; insufficient capacity at TSF;Excess water resulting in a water passive in the system; increase Capex.	3 - Moderate	Significant Risk	1 - Very low	1 - Very low	1 - Very low	3 - Moderate	2 - Low	1 - Very low	

Meliadine Project
Risk Assessment - Tailings technologies

Risk and O Date:
Site: Melia Participants: Michel Julien, Golder
Project Name: Tailings Task Force Flottation + 85% of ~ Allison Isodoro, Golder
Document No.: Dominic Tremblay, SNC Lavalin
AEF No.: Marc Lafontaine, AEM
Revision Blandine Arseneault, AEM
Revision Date: October 21th, 2011

Legend:

RISK AND OPPORTUNITIES REGISTER

Item No	Area	Event	Cause (Description)	Impact	LIKELIHOOD of event	RISK	SEVERITY OF IMPACT: Safety	Environment-Social	Schedule	CAPEX/Rehab	OPEX	Production / Profit	Mitigating Action / Comments
19	Mill	Unable to pump tailings slurry at 60% solid (thickener underflow density)	The slurry viscosity increases with the slurry density. Above a given solid content, the slurry can not be pumped with conventional centrifugal pump.	Maintain the slurry more diluted increase the slurry volume to be pumped. Could lead to a tonnage reduction due to higher volume to be pumped. Increased operating and maintenance costs and reduced profits. Will also result in higher volume of water in system, which will reduce the storage available in the TSF and can also affect the density of the tailings in the facility which will also affect the total storage available.	2 - Low	Low Control Risk	1 - Very low	1 - Very low	1 - Very low	3 - Moderate	3 - Moderate	2 - Low	Test all type of possible material before selecting equipment. Good operator instructions. Good follow-up at commissioning.
20	Mill	Tailings pipe failure (thickened)	Poor installation; no testing prior to start-up; Overpressure in line, higher wear than expected, lack of maintenace, freezing dammage, manufacturing defect, construction defect.	Pipeline break: mill stops ; production loss; spill and contamination of surrounding area.	2 - Low	Low Control Risk	2 - Low	3 - Moderate	2 - Low	1 - Very low	2 - Low	2 - Low	Have spare material on site and crew for repair
21	Mill	Tailings line accidentally damaged by equipment (thickened)	Lack of identification and protection	Stop process during repair; spill and contamination of surrounding area.	4 - High	Significant Risk	3 - Moderate	3 - Moderate	1 - Very low	1 - Very low	2 - Low	2 - Low	Have spare material on site and crew for repair
22	Mill	Line sanding (thickened)	Lack of effective operator training (vendor, in-house) on new equipment. Lack of controls, instrumentation. Manual start-up (eg: comissioning). Lower flow speed than deposition rate of the slurry. Higher grind size than expected. Wrong piping design or installation.	Stop process during repair.	3 - Moderate	Low Control Risk	1 - Very low	1 - Very low	1 - Very low	1 - Very low	2 - Low	2 - Low	Ensure that operating procedures are in place and that training is done.
23	Mill	Tailings pump failure (inside plant) (thickened)	Lack of maintenance or uncontrolled mechanical failure.	Slowdown of production	2 - Low	Low Control Risk	1 - Very low	1 - Very low	1 - Very low	1 - Very low	2 - Low	1 - Very low	Have spare material on site and crew for repair
24	Mill	Tailings process maintenance error (thickened)	Lack of effective mechanical training (vendor, in-house) on new equipment.	Stop process during repair Increased maintenance costs and reduced profits. Longer mill ramp-up.	2 - Low	Low Control Risk	2 - Low	1 - Very low	1 - Very low	1 - Very low	2 - Low	2 - Low	Have spare material on site and crew for repair
25	TSF	Dust formation at TSF (thickened)	Wind erosion/freeze-dry during winter on exposed beaches.	Contamination of the surrounding watershed.	4 - High	Significant Risk	3 - Moderate	2 - Low	1 - Very low	2 - Low	2 - Low	2 - Low	Improve tailings deposition plan. Put up wind barriers.
26	TSF	Higher ARD generation and metal leaching of tailings than expected	Insufficient geochemical testing prior to project; Partially saturation of tailings that promote ARD and ML	The treatment of the water increase operating cost of the TSF (assumed water is collected but not treated)	3 - Moderate	Significant Risk	1 - Very low	1 - Very low	1 - Very low	3 - Moderate	3 - Moderate	1 - Very low	Ensure that high phréatic layer is maintained
27	TSF	CN in tailings pond higher than 50 ppm prescribed for wildlife protection	Cyanide destruction not working properly	Effect on birds	3 - Moderate	Primary Risk	3 - Moderate	4 - Severe	1 - Very low	3 - Moderate	3 - Moderate	1 - Very low	Use physical or noise deterrent. Use appropriate process to ensure CN levels are below 50ppm in TSF.
28	TSF	Unable to achieve the expected beach slope as per planned in filling scheme	The tailings have higher or flatter slopes than expected	The construction/raising sequence or protection of dykes with tailings can be impacted. Difficulty to meet the raising schedule or excessive seepage or exposed liner to ice effect; Capex increased.	4 - High	Significant Risk	3 - Moderate	1 - Very low	3 - Moderate	2 - Low	3 - Moderate	2 - Low	
29	Water management	Build-up of chemical agents in water	The use of chemical reagents in process plant and the recycle of the process water could lead to build-up of chemical agents.	The build-up of chemical agent could lead to process problems. Gold recovery could be decreased. Bleed the process water to purge chemical agent and release water into environment. Water treatment facilities could be expected increasing CAPEX, footprint and operational cost.	2 - Low	Low Control Risk	1 - Very low	3 - Moderate	1 - Very low	2 - Low	2 - Low	2 - Low	Bleed and treat
30	Water management	Increase of fresh water consumption (zero discharge operation impratical)	Dilution: poor management of freshwater usage; Add fresh water into process in order to reduce impact of chemical build-up in water. (ex: total CN concentration, salt, ...). Water lost due to ice entrapment/growth in the TSF.	Bleed the process water to purge chemical agent and release water into environment. Water treatment facilities could be expected increasing CAPEX, footprint and operational cost. Reduced capacity at TSF for tailings. Non respect of License's limits of fresh water intake volume.	3 - Moderate	Significant Risk	1 - Very low	3 - Moderate	1 - Very low	2 - Low	2 - Low	1 - Very low	Review non-essential freshwater usage and switch to process water

APPENDIX D

Detailed MAA Matrix Tables

Tailings MAA Table - Meliadine Gold Project

Environmental Indicators TAILINGS 43.5

	Description of Sub-Account	Description of Indicator	Rationale	Scoring Scheme	Weighting: Indicator	Weighting: Sub-account	B7 Thickened: Description	B7 Thickened: Score	B7 Filtered: Description	B7 Filtered: Score	B4 Thickened: Description	B4 Thickened: Score	B4 Filtered: Description	B4 Filtered: Score	OL-5 Thickened: Description	OL-5 Thickened: Score	OL-5 Filtered: Description	OL-5 Filtered: Score	B7 Thickened Weighted Score	B7 Filtered Weighted Score	B4 Thickened Weighted Score	B4 Filtered Weighted Score	OL-5 Thickened Weighted Score	OL-5 Filtered Weighted Score
1	**Possible production of contaminating agents**																							
ENV-1	Potential for dust generation	Dust generation at the Tailings Storage Facility (TSF)	Alternatives that maintain the tailings in a relatively wet state are less likely to produce dust than alternatives that maintain the tailings relatively dry. In addition, facilities that have more relief above surrounding topography and/or a larger surface area of active, dry and exposed tailings are more likely to produce dust. This dust can potentially contaminate surrounding watersheds as well as the cover built as progressive reclamation.	1: Predominantly unsaturated tailings with high relief and/or large surface area of exposed dry tailings. 2: Predominantly unsaturated tailings with high relief and comparatively small surface area of exposed dry tailings. 3: Predominantly unsaturated tailings in a basin (low relief) and comparatively large surface area of exposed dry tailings. 4: Predominantly unsaturated tailings in a basin (low relief) and comparatively small surface area of exposed dry tailings. 5: Predominantly saturated tailings, high relief with minimal surface area of exposed dry tailings. 6: Predominantly saturated tailings, low relief with minimal exposed surface area of exposed dry tailings.	6	6	Thickened tailings deposition is expected to produce predominantly saturated tailings. Areas of the facility that are not covered by the tailings pond or have not had recent deposition may be unsaturated and dry and, therefore, produce dust. The B7 thickened TSF is based in a lake basin, but will extend above the surrounding topography as the facility is raised to a maximum El. 90 m and maximum height of 32 m. The final surface area of the tailings is 1,766,000 m^2. It is anticipated that most of the surface will be wet or partially wet and therefore not cause dust.	5	Filtered tailings deposition is expected to produce predominantly unsaturated tailings. The B7 filtered tailings storage facility will be located in the on-land area to the north east of Lake B7 and will have a maximum El. 86 m and a maximum height of 23 m. The final surface area of the tailings is 1,431,000 m2.	2	Thickened tailings deposition is expected to produce predominantly saturated tailings. Areas of the facility that are not covered by the tailings pond or have not had recent deposition may be unsaturated and dry and ,therefore, produce dust. The B4 thickened TSF is based in a lake basin, but will extend above the surrounding topography as the facility is raised to a maximum El. 96 m and maximum height of 42 m. The final surface area of the tailings is 1,022,000 m^2. It is anticipated that most of the surface will be wet or partially wet and therefore not cause dust.	5	Filtered tailings deposition is expected to produce predominantly unsaturated tailings. The B4 filtered tailings storage facility will be located in the shallow Lake B4 basin and will have a maximum El. 76 m and a maximum height of 22 m. The final surface area of the tailings is 1,197,000 m2.	3	Thickened tailings deposition is expected to produce predominantly saturated tailings. Areas of the facility that are not covered by the tailings pond or have not had recent deposition may be unsaturated and dry and, therefore, produce dust. The OL-5 thickened TSF is located on relatively flat topography and the containment will have a maximum El. 98 m and maximum height of 39 m. The final surface area of the tailings is 1,808,000 m^2. It is anticipated that most of the surface will be wet or partially wet and therefore not cause dust.	5	Filtered tailings deposition is expected to produce predominantly unsaturated tailings. The OL-5 filtered tailings storage facility will be located on relatively flat topography and will have a maximum El. 93 m and a maximum height of 26 m. The final surface area of the tailings is 1,390,000 m2.	1	33.0	9.0	33.0	12.0	33.0	6.0
ENV-2		Dust generation outside of the TSF	Alternatives that will promote dust generation outside of the TSF (along the road or other areas) are not preferred. This mainly relates to the transportation mode for the tailings.	1: Relatively high dust generation outside the TSF. 2: 3: Relatively moderate dust generation outside the TSF. 4: 5: 6: Relatively low dust generation outside of the TSF.	6		Thickened tailings will be hydraulically transported in a pipeline; therefore dust generation outside of the TSF is not a concern.	6	Filtered tailings requires truck transport which will result in dust contamination along the road.	1	Thickened tailings will be hydraulically transported in a pipeline; therefore dust generation outside of the TSF is not a concern.	6	Filtered tailings requires truck transport which will result in dust contamination along the road.	1	Thickened tailings will be hydraulically transported in a pipeline; therefore dust generation outside of the TSF is not a concern.	6	Filtered tailings requires truck transport which will result in dust contamination along the road.	1						
ENV-3	Potential release of potentially problematic water	Risk associated with the management of high volumes of water within the TSF	Measures the potential of environmental contamination caused by release of process water (seepage, overtopping). Tailings alternatives that manage a larger tailings pond within the facility are not preferred.	1: Alternative that requires the management of comparatively larger volumes of water within the TSF. 2: 3: Alternative that requires the management of comparatively moderate volumes of water within the TSF. 4: 5: 6: Alternative that requires the management of minimal volumes of water within the TSF.	4	5	Thickened tailings deposition will result in a moderate tailings pond volume. The thickened tailings slurry is expected to be in the range of 50 to 65% solids by weight so a significant amount of water will be removed at the mill, resulting in management of a moderate volume of water within the TSF.	3	Filtered tailings deposition will not require a tailings pond within the facility as the filtered tailings will be dewatered to approximately 85% solids by weight and will typically be unsaturated when placed in the facility.	6	Thickened tailings deposition will result in a moderate tailings pond volume. The thickened tailings slurry is expected to be in the range of 50 to 65% solids by weight so a significant amount of water will be removed at the mill, resulting in management of a moderate volume of water within the TSF.	3	Filtered tailings deposition will not require a tailings pond within the facility as the filtered tailings will be dewatered to approximately 85% solids by weight and will typically be unsaturated when placed in the facility.	6	Thickened tailings deposition will result in a moderate tailings pond volume. The thickened tailings slurry is expected to be in the range of 50 to 65% solids by weight so a significant amount of water will be removed at the mill, resulting in management of a moderate volume of water within the TSF.	3	Filtered tailings deposition will not require a tailings pond within the facility as the filtered tailings will be dewatered to approximately 85% solids by weight and will typically be unsaturated when placed in the facility.	6	12.1	30.0	12.1	27.9	14.3	30.0
ENV-4		Reclaim water pipeline	Measures the potential of environmental contamination caused by release of process water through a pipeline that could leak or break.	1: Presence of a process water reclaim pipeline from the TSF to the mill. 2: 3: 4: 5: 6: No need for a reclaim pipeline as the water will be kept at mill site.	2		Thickened tailings deposition will result in the creation of a tailings pond from which reclaim water for milling operations will be pumped back to the mill in a pipeline.	1	Filtered tailings will typically be unsaturated when placed in the facility; no reclaim pipeline necessary.	6	Thickened tailings deposition will result in the creation of a tailings pond from which reclaim water for milling operations will be pumped back to the mill in a pipeline.	1	Filtered tailings will typically be unsaturated when placed in the facility; no reclaim pipeline necessary.	6	Thickened tailings deposition will result in the creation of a tailings pond from which reclaim water for milling operations will be pumped back to the mill in a pipeline.	1	Filtered tailings will typically be unsaturated when placed in the facility; no reclaim pipeline necessary.	6						
ENV-5		Ground conditions	Tailings alternatives located in a lake basin have a higher likelihood of a talik below the facility and therefore a higher potential to affect groundwater. An open talik that extends through the permafrost layer is unfavourable as it may allow a connection to deep groundwater.	1: Deposition in a lake basin with known open talik. 2: 3: Deposition in a lake basin with potential open talik or known closed talik. 4: 5: 6: Deposition on-land, no talik.	1		Two thermistors have been installed below Lake B7 in 2009 and 2011 and the temperature readings indicate that there is likely an open talik below the lake. Calculations for estimating whether an open talik exists below a water body (Mackay, 1962) also indicate that there is likely an open talik below Lake B7.	3	The B7 filtered tailings storage facility is located on the "on-land" area to the northeast of Lake B7. This area only has very small, shallow lakes that freeze to the bottom during the winter and therefore it is very unlikely that there is a talik in this area.	6	Lake B4 has a maximum depth of approximately 2.5 m and ice thicknesses measured for the lake ranged from 1-1.3 m; therefore, a portion of the lake would remain unfrozen during the winter. A thermistor has not been installed under Lake B4; however, calculations for estimating whether an open talik exists below a water body (Mackay,1962), indicate that there is likely an open talik below Lake B4.	3	Lake B4 has a maximum depth of approximately 2.5 m and ice thicknesses measured for the lake ranged from 1-1.3 m; therefore, a portion of the lake would remain unfrozen during the winter. A thermistor has not been installed under Lake B4; however, calculations for estimating whether an open talik exists below a water body (Mackay,1962), indicate that there is likely an open talik below Lake B4.	3	The OL-5 thickened tailings storage facility is located in an "on land" area south of the project site. This area only has very small, shallow lakes that freeze to the bottom during the winter and therefore it is very unlikely that there is a talik in this area.	6	The OL-5 filtered tailings storage facility is located in an "on land" area south of the project site. This area only has very small, shallow lakes that likely freeze to the bottom during the winter and therefore it is very unlikely that there is a talik in this area.	6						
ENV-6	Tailings spill	TSF failure during operations	Alternatives that contain less water, have a higher in-situ density of the tailings, have a lower height, have lower mobility of the tailings in the event of a failure, and will therefore have a lower consequence upon failure.	1: Relatively large to moderate volume of water within TSF, low in-situ tailings density, and higher facility height. 2: Relatively large to moderate volume of water within TSF, intermediate in-situ tailings density, and higher facility height. 3: Relatively large to moderate volume of water within TSF, low to intermediate in-situ tailings density, and higher facility height. 4: Relatively large to moderate volume of water within TSF, low to intermediate in-situ tailings density, and lower facility height. 5: Minimal water within TSF, relatively high in-situ tailings density, higher facility height. 6: Minimal water within TSF, relatively high in-situ tailings density, lower facility height.	6	6	Thickened tailings deposition is expected to result in a moderate volume of water and an intermediate in-situ tailings density. The maximum height of the B7 thickened tailings storage facility is approximately 32 m.	4	Filtered tailings deposition is expected to result in minimal water within the TSF and relatively high in-situ tailings densities. The maximum height of the B7 filtered tailings storage facility is 23 m.	6	Thickened tailings deposition is expected to result in a moderate volume of water and an intermediate in-situ tailings density. The height of the B4 thickened tailings storage facility is 42 m.	3	Filtered tailings deposition is expected to result in minimal water within the TSF and relatively high in-situ tailings densities. The maximum height of the B4 filtered tailings storage facility is 22 m.	6	Thickened tailings deposition is expected to result in a moderate volume of water and an intermediate in-situ tailings density. The height of the OL-5 thickened tailings storage facility is 39 m.	3	Filtered tailings deposition is expected to result in minimal water within the TSF and relatively high in-situ tailings densities. The maximum height of the OL-5 filtered tailings storage facility is 26 m.	5	30.0	27.0	24.0	24.0	21.0	18.0
ENV-7		Accidental spill of tailings during transport in a non confined area	Alternatives that can result in a major tailings spill are not preferred. The distance from the mill to the TSF has to be considered as well as the type of transportation. A shorter distance from the mill to the TSF and piping transport are less likely to result in major spills. Trucking accidents that result in a spill may also have health and safety consequences.	1: Relatively higher potential for tailings spill during transport, longest distance from the mill. 2:Relatively higher potential for tailings spill during transport, medium distance from the mill. 3: Relatively higher potential for tailings spill during transport, shortest distance from the mill. 4: Relatively low potential for tailings spill during transport, longest distance from the mill. 5: Relatively low potential for tailings spill during transport, medium distance from the mill. 6: Relatively low potential for tailings spill during transport, shortest distance from the mill.	6		Thickened tailings will be hydraulically transported in a pipeline from the mill to the TSF. Hydraulic transport is considered to have less potential for a spill during transport than trucked transport. The distance from the mill to the B7 thickened tailings storage facility is approximately 1.5 km.	6	Filtered tailings will be deposited using truck transport from the mill to the TSF. Truck transport is considered to have a higher potential for a spill during transport than hydraulic transport. The distance from the mill to the B7 filtered tailings storage facility is approximately 0.84 km.	3	Thickened tailings will be hydraulically transported in a pipeline from the mill to the TSF. Hydraulic transport is considered to have less potential for a spill during transport than trucked transport. The distance from the mill to the B4 thickened tailings storage facility is approximately 4.4 km.	5	Filtered tailings will be deposited using truck transport from the mill to the TSF. Truck transport is considered to have a higher potential for a spill during transport than hydraulic transport. The distance from the mill to the B4 filtered tailings storage facility is approximately 4.4 km.	2	Thickened tailings will be hydraulically transported in a pipeline from the mill to the TSF. Hydraulic transport is considered to have less potential for a spill during transport than trucked transport. The distance from the mill to the OL-5 thickened tailings storage facility is approximately 8.8 km.	4	Filtered tailings will be deposited using truck transport from the mill to the TSF. Truck transport is considered to have a higher potential for a spill during transport than hydraulic transport. The distance from the mill to the OL-5 filtered tailings storage facility is approximately 8.8 km.	1						
ENV-8	Greenhouse gas emissions	Emissions due to construction	Measures the relative greenhouse gas emissions due to the construction of containment dikes or erosion protection. Alternatives that require more construction and are further away from the source of the construction materials will result in the highest amount of greenhouse gas emissions. It is assumed that the borrow source will be Tiriganiaq pit. Generic scores were calculated by multiplying the construction volume by the haul distance.	1: Score all alternatives using a linear scale. Alternatives that are further from the mill and have the largest construction fill volume score lower. Alternatives that are a shorter distance to the mill and have smaller construction fill volumes score higher. 6:	1	1	The B7 thickened facility is approximately 3 km from the Tiriganiaq pit, and the containment dikes will require approximately 12,200,000 m3 of fill.	4	The B7 filtered facility is approximately 2.3 km from the Tiriganiaq pit, and the erosion protection will require approximately 1,431,000 m^3 of fill.	5	The B4 thickened facility is approximately 1.8 km from the Tiriganiaq pit and the containment dikes will require approximately 22,200,000 m3 of fill.	4	The B4 filtered facility is approximately 1.8 km from the south side of the Tiriganiaq pit, and the erosion protection will require approximately 1,197,000 m^3 of fill.	6	The OL-5 thickened facility is approximately 7.5 km from the Tiriganiaq pit, and the containment dikes will require approximately 11,300,000 m3 of fill.	1	The OL-5 filtered facility is approximately 7.5 km from the southeast side of the Tiriganiaq pit, and the erosion protection will require approximately 1,390,000 m^3 of fill.	6	5.0	4.0	5.0	4.0	3.5	3.5
ENV-9		Emissions due to tailings transport	Measures the relative greenhouse gas emissions due to tailings transport. Alternatives that require truck transport of tailings and are further away from the mill, will result in the highest amount of greenhouse gas emissions.	1: Relatively high emissions due to tailings transport. 2: 3: Relatively moderate emissions due to tailings transport. 4: 5: 6: Relatively low emissions due to tailings transport.	1		The thickened tailings will be deposited using hydraulic transport from the mill to the TSF which is considered to have the lowest GHG emissions.	6	The filtered tailings will be deposited using truck transport from the mill to the TSF which is considered to have higher emissions than hydraulic transport. The distance from the mill to the B7 filtered facility is approximately 0.84 km. GHG emissions are considered to be high relative to hydraulic transport, but the B7 filtered alternative is closer to the mill than the other filtered options so is considered to have moderate emissions relative to the other alternatives.	3	The thickened tailings will be deposited using hydraulic transport from the mill to the TSF which is considered to have the lowest GHG emissions.	6	The filtered tailings will be deposited using truck transport from the mill to the TSF. The distance from the mill to the B4 filtered facility is approximately 4.4 km. GHG emissions are considered to be high relative to hydraulic transport, and the B4 filtered alternative is a moderate distance to the mill compared to the other filtered options so is considered to have moderate to high emissions relative to the other alternatives.	2	The thickened tailings will be deposited using hydraulic transport from the mill to the TSF which is considered to have the lowest GHG emissions.	6	The filtered tailings will be deposited using truck transport from the mill to the TSF. The distance from the mill to the OL-5 filtered facility is approximately 8.8 km. GHG emissions are considered to be high relative to hydraulic transport, and the OL-5 filtered alternative is the furthest distance to the mill compared to the other filtered options so is considered to have high emissions relative to the other alternatives.	1						

Environmental Indicators TAILINGS 43.5

	Description of Sub-Account	Description of Indicator	Rationale	Scoring Scheme	Weighting		B7 Thickened		B7 Filtered		B4 Thickened		B4 Filtered		OL-5 Thickened		OL-5 Filtered		B7 Thickened	B7 Filtered	B4 Thickened	B4 Filtered	OL-5 Thickened	OL-5 Filtered
2	**Water quality, aquatic habitat and species**																							
ENV-10	Watersheds	Number of watershed(s) affected by TSF footprint	Increasing the number of affected watersheds increases the chance to impact hydrological conditions and water quality over a greater area in the event of a failure, acid rock drainage (ARD), chemical release, seepage, and/or by the mere presence of the TSF.	1: 3 or more watersheds are affected. 2: 3: 2 watersheds are affected. 4: 5: 6: 1 watershed is affected.	1		The B7 thickened tailings storage facility footprint will affect 2 watersheds, the B and H watersheds.	3	The B7 filtered tailings storage facility footprint will affect 2 watersheds, the B and H watersheds.	3	The B4 thickened tailings storage facility footprint will affect 1 watershed, the B watershed.	6	The B4 filtered tailings storage facility footprint will affect 1 watershed, the B watershed.	6	The OL-5 thickened tailings storage facility footprint will affect 1 watershed, the L watershed.	6	The Lake OL-5 filtered tailings storage facility footprint will affect 1 watershed, the L watershed.	6						
ENV-11		Location within the watershed	Measures the potential for deteriorating water quality in a larger area in the event of a failure, ARD, chemical release, and/or seepage. Alternatives located in the upstream section of the watershed have a higher potential to affect more of the watershed than alternatives that are located in the downstream section of the watershed.	1: Upstream section of the watershed. 2: 3: Middle section of the watershed. 4: 5: 6: Downstream section of watershed.	1	1	The B7 thickened tailings storage facility is located in the upstream section of both the B and H watersheds.	1	The B7 filtered tailings storage facility is located in the upstream section of both the B and H watersheds.	1	The B4 thickened tailings is located in the middle to downstream section of B watershed.	4	The B4 filtered tailings is located in the middle to downstream section of B watershed.	4	The OL-5 thickened facility is located within the upstream and middle section of the L watershed.	1	The OL-5 filtered facility is located within the upstream and middle section of the L watershed.	1	3.3	3.3	3.7	4.0	4.3	4.3
ENV-12		Area of affected sub-catchment(s) (hectares)	Measures the potential for deteriorating water quality within the sub-catchment(s) the facility is located within due to a failure, ARD, chemical release, and/or seepage.	1: Score all alternatives using a linear scale. Alternatives that have larger catchments score lower and alternatives with smaller catchments score higher. 6:	1		The area of the Lake B7 sub-catchment is 240 ha, and the area of the Lake H1 sub-catchment is of 170 ha, for a total of 410 ha.	6	The area of the Lake B7 sub-catchment is 240 ha, and the area of the Lake H1 sub-catchment is 170 ha, for a total of 410 ha.	6	The area of the Lake B2 sub-catchment is 230 ha, and the area of the Lake B4 sub-catchment is 1,320 ha, for a total of 1,550 ha.	1	The area of the Lake B4 sub-catchment is 1,320 ha.	2	The area of the Lake L sub-catchment/ watershed is 390 ha.	6	The area of the Lake L sub-catchment/ watershed is 390 ha.	6						
ENV-13	Fish habitat	Distance from Meliadine Lake (m)	Measures the safety margin for the potential affects on Meliadine Lake due to a failure, ARD, chemical release, or seepage.	1: Score all alternatives using a linear scale. Alternatives that are closer to Meliadine lake score lower and alternatives that are further from Meliadine Lake score higher. 6:	5		The shortest distance from the B7 thickened tailings storage facility to Meliadine Lake is approximately 600 m.	2	The shortest distance from the B7 filtered tailings storage facility to Meliadine Lake is approximately 600 m.	2	The shortest distance from the B4 thickened tailings storage facility to Meliadine Lake-SE is approximately 1,200 m.	6	The shortest distance from the B4 filtered tailings storage facility to Meliadine Lake-SE is approximately 1,200 m.	6	The shortest distance from the Lake OL-5 thickened tailings storage facility to Meliadine Lake is approximately 550 m.	1	The shortest distance from the Lake OL-5 filtered tailings storage facility to Meliadine Lake is approximately 1,000 m.	4						
ENV-14		Aquatic habitat loss (hectares)	Measures the potential loss of fish habitat within the tailings impoundment. Measurement is by multiplying the area of the habitat within the tailings footprint by 0.5 for low or unknown quality habitat and multiplying by 0.75 for medium to high quality habitat. The quality of habitat is assessed based on the number and type of species present and seasonal versus year-round use of habitat. Medium quality habitat is defined here as habitat capable of providing overwintering potential and used by species other than ninespine stickleback.	1: Score all alternatives using a linear scale. Alternatives with higher habitat loss values score lower and alternatives with lower habitat loss values score higher. 6:	6		The B7 thickened tailings storage facility will affect 10 ponds/lakes with total area of 67 ha. The largest lake (B7) has medium habitat quality and has an area of 58 ha. The remainder of the waterbodies have low quality habitat and a combined area of 9 ha. The total score after applying the habitat quality weightings is 48.0.	1	The B7 filtered tailings storage facility affects 13 ponds/lakes with total area of 8.6 ha. All waterbodies have low habitat quality, therefore the total score is 4.3.	6	The B4 thickened tailings storage facility affects 5 ponds/lakes with total area of 90.4 ha. All have low habitat quality, therefore the total score is 45.2.	1	The B4 filtered tailings storage facility affects 4 ponds/lakes with total area of 88.9 ha. All have low habitat quality, therefore the total score is 44.5.	1	The OL-5 thickened tailings storage facility affects 19 ponds/lakes with total area of 37.8 ha. All have low habitat quality, therefore the total score is 18.9.	3	The OL-5 filtered tailings storage facility affects 13 ponds/lakes with total area of 20.2 ha. All have low habitat quality, therefore the total score is 10.1.	2						
ENV-15		Stream diversion	Evaluates requirement and anticipated success of stream diversions constructed around tailings storage facility.	1: Diversion not possible. 2: Diversion possible, but uncertainty of success. 3: Larger diversion of equal quality habitat required. 4: Moderate diversion of equal quality habitat required. 5: Smaller diversion of equal quality habitat required. 6: Diversion not required.	2	4	Headwater area; therefore diversions are not required.	6	Headwater area; therefore diversions are not required.	6	Large areas require diversion, but diversion of equal quality habitat is possible.	3	Large areas require diversion, but diversion of equal quality habitat is possible.	3	Near headwater area; only small diversions of equal quality habitat are required.	5	Near headwater area; only small diversions of equal quality habitat are required.	5	13.5	17.7	13.3	13.3	14.5	16.4
ENV-16		Stream crossing by the road/pipeline (# of crossings)	Compares the relative potential for altering the water quality in water bodies along the alignment of the TSF access road and/or tailings distribution pipeline during construction or operations of each alternative. The potential to impact water quality could occur due to dust from road traffic or from an accidental tailings spill from a pipeline or from a haul truck.	1: Score all alternatives using a linear scale. Alternatives with more stream crossings score lower and alternatives with fewer stream crossings score higher. 6:	1		There are 2 stream and 0 lake/pond crossings on the road/pipeline alignment from the B7 thickened tailings storage facility to the mill.	6	There are 2 stream and 0 lake/pond crossings on the road/pipeline alignment from the B7 filtered tailings storage facility to the mill.	6	There are 2 stream and 2 lake/pond crossings on the road/pipeline alignment from the B4 thickened tailings storage facility to the mill.	1	There are 2 stream and 2 lake/pond crossings on the road/pipeline alignment from the B4 filtered tailings storage facility to the mill.	1	There are 2 stream and 0 lake/pond crossings on the road/pipeline alignment from the OL-5 thickened tailings storage facility to the mill.	6	There are 2 stream and 0 lake/pond crossings on the road/pipeline alignment from the OL-5 filtered tailings storage facility to the mill.	6						
ENV-17		Potential effect on surrounding aquatic habitat (hectares)	Measures the potential for impacting "medium to high quality" fish habitat surrounding the TSF. Medium to high quality habitat is defined here as habitat capable of providing overwintering potential and used by species other than ninespine stickleback.	1: Medium to high quality fish habitat < 50 m from TSF. 2: Medium to high quality fish habitat 50-100 m from TSF. 3: 4: Medium to high quality fish habitat 100-200 m from TSF. 5: 6: Medium to high quality fish habitat > 200 m from TSF.	5		There is no high quality fish habitat within 200°m surrounding the B7 thickened tailings storage facility. Lake B6 is medium quality fish habitat, but is > 200 m from the facility.	6	Lake B7 is medium quality fish habitat and is located between 100 m and 200 m of the B7 filtered tailings storage facility.	4	Lake B5 is medium quality fish habitat and is located between 100 m and 200 m from the B4 thickened tailings storage facility. Lake B45 is between 50 m and 100 m of the facility; however, it is too shallow to provide overwintering habitat.	4	Lake B5 is medium quality fish habitat and is located between 100 m and 200 m from the B4 filtered tailings storage facility. Lake B45 is between 50m and 100m of the facility; however, it is too shallow to provide overwintering habitat.	4	The OL-5 thickened tailings storage facility is outside of the local study area for the project; therefore, sampling of resident fish has not been completed for the lakes in this area. Based on the review of aerial photos, lakes and ponds in this area are too small and too shallow to be used for overwintering and are likely limited to ninespine stickleback use during open water season.	6	The OL-5 filtered tailings storage facility is outside of the local study area for the project; therefore, sampling of resident fish has not been completed for the lakes in this area. Based on the review of aerial photos, lakes and ponds in this area are too small and too shallow to be used for overwintering and are likely limited to ninespine stickleback use during open water season.	6						
3	**Terrestrial habitat and species**																							
ENV-18	TSF footprint area (hectares)		Measures the impact to natural conditions, including potential effects on downstream water quantity and quality.	1: Score all alternatives using a linear scale. Alternatives with larger footprints score lower and alternatives with smaller footprints score higher. 6:		2	The footprint area for the B7 thickened tailings storage facility is 2,292,000 m2.	1	The footprint area for the B7 filtered tailings storage facility is 1,431,000 m2.	5	The footprint area for the B4 thickened tailings storage facility is 1,657,000 m2.	4	The footprint area for the B4 filtered tailings storage facility is 1,197,000 m2.	6	The footprint area for the OL-5 thickened tailings storage facility is 2,316,000 m2.	1	The footprint area for the OL-5 filtered tailings storage facility is 1,390,000 m2.	5	2.0	10.0	8.0	12.0	2.0	10.0
ENV-19	Vegetation and terrestrial habitat	Presence of vegetation that is uncommon within the footprint (hectares)	Measures the potential for impacting an uncommon vegetation community within the footprint of the TSF. Uncommon vegetation is defined as Birch Seep and Riparian Willow/Birch plant communities.	1: Score all alternatives using a linear scale. Alternatives that impact larger areas of uncommon vegetation score lower and alternatives that impact smaller areas of uncommon vegetation score higher. 6:	2	2	0.41 ha of uncommon LSA vegetation communities will be impacted.	6	No uncommon LSA vegetation communities will be impacted.	6	1.37 ha of uncommon LSA vegetation communities will be impacted.	5	0.8 ha of uncommon LSA vegetation communities will be impacted.	6	7.62 ha of uncommon LSA vegetation communities will be impacted.	3	12.34 ha of uncommon LSA vegetation communities will be impacted.	1	12.0	12.0	9.3	11.3	6.0	2.0
ENV-20		Potential effect on surrounding vegetation	Measures the potential for impacting an uncommon vegetation community within a 60 m buffer surrounding each alternative due to dust, failure, or seepage. Values for potential effect on surrounding vegetation were calculated for each alternative by multiplying the area within a 60 m buffer where there is presence of uncommon vegetation by 1.5, the area where there is presence of special status receptors by 2, and then adding these values together.	1: Score all alternatives using a linear scale. Alternatives that have the potential to affect larger areas of uncommon vegetation or special status receptors surrounding the TSF score lower and alternatives that have the potential to affect smaller areas of uncommon vegetation or special status receptors surrounding the TSF score higher. 6:	1		No uncommon LSA vegetation communities will be affected in the 60m buffer zone; 0 *1.5= 0	6	0.11 ha of uncommon LSA vegetation communities will be affected in the 60 m buffer zone; 0.11*1.5= 0.17	6	0.63 ha of uncommon LSA vegetation communities will be affected in the 60 m buffer zone; 0.63*1.5= 0.95	4	0.34 ha of uncommon LSA vegetation communities will be affected in the 60 m buffer zone; 0.34*1.5= 0.51	5	0.81 ha of uncommon LSA vegetation communities will be affected in the 60 m buffer zone; 0.81*1.5= 1.22	3	1.66 ha of uncommon LSA vegetation communities will be affected in the 60 m buffer zone; 1.66*1.5= 2.49	1						
ENV-21	Birds	Potential effect on waterfowl and shore birds from TSF water	Measures the potential for affecting the bird population that may ingest water from the TSF. Tailings alternatives that have a larger tailings pond are more likely to attract birds in the spring (when the tailings pond is free of ice but lakes are still frozen). This could result in a negative impact on the bird population should any problem arise with water quality in the TSF. Surface water run-off/seepage collection ponds were not considered as they are considered to be about the same for all alternatives.	1: Large pond size. 2: 3: Moderate pond size. 4: 5: Small pond size. 6: No pond.	6	5	Thickened tailings deposition will manage a moderate volume of water. The majority of the water will be process water that is sent to the TSF in the tailings. Because the tailings are continuously (all year-long) deposited in the TSF, the tailings pond is likely to be ice free early in the spring, thereby attracting migratory birds (almost no other open water available). The ingestion of water by the birds could be an issue and result in mortalities should water quality problems arise at the tailings pond.	2	Filtered tailings deposition will not have a tailings pond. Minimal water is expected to seep out of the filtered tailings after placement.	6	Thickened tailings deposition will manage a moderate volume of water. The majority of the water will be process water that is sent to the TSF in the tailings. Because the tailings are continuously (all year-long) deposited in the TSF, the tailings pond is likely to be ice free early in the spring, thereby attracting migratory birds (almost no other open water available). The ingestion of water by the birds could be an issue and result in mortalities should water quality problems arise at the tailings pond.	2	Filtered tailings deposition will not have a tailings pond. Minimal water is expected to seep out of the filtered tailings after placement.	6	Thickened tailings deposition will manage a moderate volume of water. The majority of the water will be process water that is sent to the TSF in the tailings. Because the tailings are continuously (all year-long) deposited in the TSF, the tailings pond is likely to be ice free early in the spring, thereby attracting migratory birds (almost no other open water available). The ingestion of water by the birds could be an issue and result in mortalities should water quality problems arise at the tailings pond.	2	Filtered tailings deposition will not have a tailings pond. Minimal water is expected to seep out of the filtered tailings after placement.	6	12.5	26.3	13.8	30.0	10.0	23.8
ENV-22		Potential effect on raptor nesting habitat	Measures the potential effect on raptor habitat. The alternatives were evaluated based on the proximity of raptor nest sitings and the amount of steep slope terrain within the footprints. Consideration was also given to whether the alternative would affect raptor habitat that would not be affected by other portions of the Project. An 800 m buffer area around the alternatives was included in this assessment.	1: Highest potential to affect raptor habitat 6: Lowest potential to affect raptor habitat	2		Raptor nest A08-01 is within the 800 m buffer of the B7 thickened tailings storage facility. 0.21 ha of steep slope terrain is within the footprint (including 800 m buffer); however, a significant portion of that terrain is south of the B7 thickened facility and would be affected by other mine infrastructure and activities.	4	Raptor nest A08-01 is within the 800 m buffer of the B7 filtered tailings storage facility. 0.26 ha of steep slope terrain is within the footprint (including 800 m buffer); however, a significant portion of that terrain is south of the B7 filtered facility and would be affected by other mine infrastructure and activities.	3	Raptor nest C08-01 is within the 800 m buffer of the B4 thickened tailings storage facility. 0.03 ha of steep slope terrain is within the footprint (including 800 m buffer); however, a reasonable portion of that terrain would already be potentially affected by the Tiriganiaq and Pump Pits.	5	Raptor nest C08-01 is within the 800 m buffer of the B4 filtered tailings storage facility. 0.02 ha of steep slope terrain is within the footprint (including 800 m buffer); however, a reasonable portion of that terrain would already be potentially affected by the Tiriganiaq and Pump pits.	6	Raptor nest 14 (observed in 2013) is within the footprint of the OL-5 thickened tailings storage facility. 0.17 ha of steep slope terrain is within the footprint (including 800 m buffer) and would not otherwise be affected by the Project.	2	Raptor nest 14 (observed in 2013) is within the footprint of the OL-5 filtered tailings storage facility. 0.08 ha of steep slope terrain is within the footprint (including 800 m buffer) and would not otherwise be affected by the Project.	1						
ENV-23	Distance from a natural park or protected habitat (km)		Measures the potential for altering a highly valued site.	1: Score all alternatives using a linear scale. Alternatives that are closer to a highly valued site score lower and alternatives that are further from a highly valued site are scored higher. 6:		1	The B7 thickened tailings storage facility is approximately 12 km to Iqalugaarjuup Nunanga Park.	6	The B7 filtered tailings storage facility is approximately 12 km to Iqalugaarjuup Nunanga Park.	6	The B4 thickened tailings storage facility is approximately 9.6 km to Iqalugaarjuup Nunanga Park.	4	The B4 filtered tailings storage facility is approximately 9.6 km to Iqalugaarjuup Nunanga Park.	4	The OL-5 thickened tailings storage facility is approximately 6.5 km to Iqalugaarjuup Nunanga Park.	1	The OL-5 filtered tailings storage facility is approximately 6.5 km to Iqalugaarjuup Nunanga Park.	1	6.0	6.0	4.0	4.0	1.0	1.0

Tailings MAA Table - Meliadine Gold Project

Social Indicators TAILINGS

	Description of Sub-Account	Description of Indicator	Rationale	Scoring Scheme	Weighting		B7 Thickened		B7 Filtered		B4 Thickened		B4 Filtered		OL-5 Thickened		OL-5 Filtered	
					Indicator	Sub-account	Description	Score	Description	Score	Description	Score	Description	Score	Description	Score	Description	Score
1	**Traditional use**																	
SOC-1	Touristic, recreational and vacation activities and infrastructures		Measures the potential that the site interferes with recreational, tourist and vacation activities. Cabins were considered to be the main recreational use in the area so each alternative was evaluated based on the proximity of recreational cabins.	1: Cabin requires relocation. 2: 3: Cabin is in close proximity and may be affected by dust and/or noise. 4: 5: 6: No interference with cabins.		2	There is a cabin on the esker north of the camp and Lake B7 area. It may be impacted by noise and occasionally dust if the wind is from the right direction.	3	There is a cabin on the esker north of the camp and Lake B7 area. It may be impacted by noise and occasionally dust if the wind is from the right direction.	3	No impacts.	6	No impacts.	6	There are at least two cabins in the area along the shore of Meliadine Lake. These may be impacted by noise and occasionally dust if the wind is from the right direction.	3	There are at least two cabins in the area along the shore of Meliadine Lake. These may be impacted by noise and occasionally dust if the wind is from the right direction.	3
SOC-2	Archaeological site, cultural or heritage asset		Measures the potential of affecting an archaeological site, cultural or heritage asset that can be mitigated within the footprint of the TSF.	1: Unmitigatable heritage site. 4: Presence of an archaeological site, cultural or heritage asset that requires mitigation. 6:No archaeological sites, cultural or heritage assets would be affected.		1	There are several archaeology sites that have been recorded between the B7 thickened tailings storage facility and Meliadine Lake on high ground. Three archaeological sites have been recorded just along the exterior boundary of the TSF. One, which is located just outside of the facility footprint, consisted of a stone marker and a cache and was mitigated in 2010. The other two were recorded in 2011 and consist of a cache located just outside of the facility footprint, and a stone circle, likely a hunting blind, which is located just within the facility footprint. Both sites recorded in 2011 will require further mitigation. Previous studies in the general area (1975) recorded and mitigated several sites.	4	There are several archaeology sites that have been recorded between the B7 filtered tailings storage facility and Meliadine Lake on high ground. Two archaeological sites were recorded along the exterior boundary of the B7 filtered tailings footprint in 2011, and consist of a cache located just outside of the facility footprint, and a stone circle, likely a hunting blind, which is located just within the facility footprint. Both sites will require further mitigation. Previous studies in the general area (1975) recorded and mitigated several sites.	4	No archaeological features were located in the area near the B4 thickened tailings storage facility alternative.	6	No archaeological features were located in the area near the B4 filtered tailings storage facility alternative.	6	The OL-5 thickened tailings storage facility is just east of the proposed all weather road and there were sites located along the road; however, the area east of the proposed road is lower and wetter and there were no archaeological sites recorded in this area.	6	The OL-5 filtered tailings storage facility is just east of the proposed all weather road and there were sites located along the road; however, the area east of the proposed road is lower and wetter and there were no archaeological sites recorded in this area.	6
2	**Visual aspects**																	
SOC-3	Integration into the landscape		Measures the visual effect (height above surrounding topography) the TSF may have on the surrounding landscape. It also measures the ability of the facility to be reclaimed to allow access for wildlife (e.g. the new landform could be used by caribou for insect avoidance).	1: Score all alternatives using a linear scale. Alternatives that have larger heights score lower and alternatives that have lower heights score higher. 6:		1	The maximum height of the B7 thickened tailings storage facility is 32 m.	3	The maximum height of the B7 filtered tailings storage facility is 23 m.	6	The maximum height of the B4 thickened tailings storage facility is 42 m.	1	The maximum height of the B4 filtered tailings storage facility is 22 m.	6	The maximum height of the Lake OL-5 thickened tailings storage facility is 39 m.	2	The maximum height of the Lake OL-5 filtered tailings storage facility is 26 m.	4
3	**Health & Safety**																	
SOC-4	Potential to affect worker health and safety	Relative number of workers higher at risk of being affected by dust from the TSF	Workers that are directly involved in the tailings operation (maintenance, trucking, surfacing) are more susceptible to being frequently exposed to tailings dust and thus are more at risk of potentially being affected by the dust.	1: Larger number of workers directly involved in tailings management operations. 2: 3: 4: 5: 6: Fewer number of workers directly involved in tailings management operations.	6	6	Thickened tailings management requires minimal number of workers dealing directly with the material. Activities at risk are maintenance and inspection of the tailings impoundment and associated systems as well as progressive reclamation works.	6	Filtered tailings require many workers for material transport and handling (trucking, buldozing), as well as a dedicated team for the operation and maintenance of the filter press and associated conveyors. All workers are at risk.	1	Thickened tailings management requires minimal number of workers dealing directly with the material. Activities at risk are maintenance and inspection of the tailings impoundment and associated systems as well as progressive reclamation works.	6	Filtered tailings require many workers for material transport and handling (trucking, buldozing), as well as a dedicated team for the operation and maintenance of the filter press and associated conveyors. All workers are at risk.	1	Thickened tailings management requires minimal number of workers dealing directly with the material. Activities at risk are maintenance and inspection of the tailings impoundment and associated systems as well as progressive reclamation works.	6	Filtered tailings require many workers for material transport and handling (trucking, buldozing), as well as a dedicated team for the operation and maintenance of the filter press and associated conveyors. All workers are at risk.	1
SOC-5		Safety of workers	Evaluates the risk to worker safety in the event of a failure. Alternatives that are located in close proximity to populated areas of the site (i.e. the mill/camp or open pits) are less preferred.	1 Score all alternatives using a linear scale. Alternatives with shorter distances from the TSF to an area with workers score lower and alternatives with longer distances from the TST to an area with workers score higher. 6	3		The closest area with workers to the B7 thickened tailings storage facility is Tiriganiaq Pit, which is approximately 100 m away at the closest point.	1	The closest area with workers to the B7 filtered tailings storage facility is the mill/camp, which is approximately 600 m away at the closest point.	2	The closest area with workers to the B4 thickened tailings storage facility are the Tiriganiaq and Wesmeg pits, which are both approximately 100 m away at the closest point.	1	The closest area with workers to the B4 filtered tailings storage facility is Pump pit, which is approximately 100 m away at the closest point.	1	The closest area with workers to the OL-5 thickened tailings storage facility is the F-Zone pit approximately 1,800 m away.	6	The closest area with workers to the OL-5 filtered tailings storage facility is the F-Zone pit approximately 1,800 m away.	6
						10		17		16		20		20		23		20

	B7 Thickened	B7 Filtered	B4 Thickened	B4 Filtered	OL-5 Thickened	OL-5 Filtered
	Weighted Score	Weighted Score	Weighted Score	Weighted Score	Weighted Score	Weighted Score
SOC-1	6.0	6.0	12.0	12.0	6.0	6.0
SOC-2	4.0	4.0	6.0	6.0	6.0	6.0
SOC-3	3.0	6.0	1.0	6.0	2.0	4.0
SOC-4 / SOC-5	26.0	8.0	26.0	6.0	36.0	16.0
	39.00	24	45	30	50	32
	3.90	2.40	4.50	3.00	5.00	3.20

Tailings MAA Table - Meliadine Gold Project

Technical Indicators TAILINGS

	Description of Sub-Account	Description of Indicator	Rationale	Scoring Scheme	Weighting: Indicator	Weighting: Sub-account
1	**Permitting**					
TECH-1	Risk of potential delays in permitting leading to delays in overall project schedule and start-up		The regulators and general public may have more concerns related to the design of some TSF alternatives compared to others. Designs necessiting the construction of dikes and maintenance of a pond may be more of a concern. Concerns may also arise regarding the location of the TSF, the number and size of lakes/ponds in the footprint area, and NGO attention relative to Schedule 2 listing or other permitting requests. Alternatives that may be less of a concern for the regulators and the population are less likely to result in delays and are thus preferred.	1: High probability of concern with TSF design and moderate to high probability of concern with location. 2: High probability of concern with TSF design, low probability of concern with location. 3: Moderate probability of concern with TSF design, moderate to high probability of concern with location. 4: Moderate probability of concern with TSF design, low probability of concern with location. 5: Low probability of concern with TSF design, moderate to high probability of concern with location. 6: Low probability of concern with TSF design and low probability of concern with location		6
2	**Construction risks**					
TECH-2	Risk associated with the construction phase for the TSF	Evaluates the probabilities of having schedule delays due to construction activities being impaired: construction plan not including sufficient margin for weather events, insufficient resources (construction materials and equipment), delays due to changes required for design because conditions or materials are different than expected.	Tailings alternatives that require less construction and preparation work (scraping, dewatering) before mill start-up have a lower risk to the project schedule.	1: Alternatives with lots of preparation work and initial construction (starter dikes construction, imprevious layer required, water control management works, dewatering). 2: 3: Alternatives with moderate preparation and inital construction work. 4: 5: 6: Alternatives with minimal preparation and initial construction work.	6	6
TECH-3		Potential for construction of major infrastructure in winter due to schedule delays can enhance the probability of reduced quality of construction.	Tailings alternatives that require less construction are less likely to be constructed in winter conditions so have less risk to the quality of the construction.	1: Containment dikes required. 2: 3: 4: 5: 6: No containment dikes required.	4	
2	**Operation**					
TECH-4	Site access		Includes access routes for roads, utilities, tailings transport and infrastructure. Tailings alternatives that have a shorter access route will result in lower construction costs, allow for easier operation and have less potential to affect the environment along the route (for example dust).	1: Score all alternatives using a linear scale. Alternatives with longer access routes score lower and alternatives with shorter access routes score higher. 6:		3
TECH-5	Reliability/efficiency of operation	Stability and continuousness of operations	Tailings management that will favour stable operating conditions and that require less specialized operators, training and experience are more likely to generate stability of the operation and are thus preferred.	1: Hardest operability; necessitates specialized operators, training and experience. 2: 3: 4: 5: 6: Easiest operability.	6	6
TECH-6		Risk related to plant shut down due to tailings transportation interruptions	Tailings alternatives that have a lower risk of plant shut down due to tailings transportation interruptions are preferred. Tailings transport that is proven to be reliable in a cold climate with low risk of transport interruptions is preferred. In addition, proximity to the mill can influence the risk of interruption of tailings transport.	1 : High risk of plant shut down due to transportation interruption. 2: 3: Moderate risk of plant shut down due to transportation interruption. 4: 5: 6: Low risk of plant shut down due to transportation interruption.	2	
TECH-7	Equipment maintenance		Relates to overall plant availability and costs associated with it. Evaluates the effort needed to train specialized personnel and actually do the maintenance, including unexpected and premature wear and corrosion. Alternatives that require less specialized maintenance, less spare parts inventory and less overall maintenance time are preferred as they are less likely to result in decrease plant availability.	1: Tailings management requiring specialized personnel for maintenance, inventory of specialized parts, and relatively longer maintenance time. 2: 3: 4: 5: 6: Tailings management not requiring specialized personnel for maintenance, inventory of specialized parts; maintenance time is considered relatively normal.		5
TECH-8		Potential to grow/trap ice and snow	Tailings technologies that have less potential to grow/trap ice and snow are preferred as ice entrapment reduces available space for tailings storage and is less efficient from a water management point of view. Tailings technologies that manage large amounts of water have greater ice formation potential, which leads to a larger storage requirement, and potentially less water available for reclaim.	1. Proven to trap large volumes of ice/snow. 2: 3: Potential to trap moderate amounts of ice/snow. 4: 5: 6: Potential to trap small amounts of ice/snow.	3	

	B7 Thickened: Description	Score	B7 Filtered: Description	Score	B4 Thickened: Description	Score	B4 Filtered: Description	Score
TECH-1	Thickened tailings will require management of a moderate volume of water and the design and construction of containment dikes, which may lead to general concerns. This alternative is located in a Lake basin; Lake B7 and several small, shallow ponds are within the proposed footprint. Compared to the other options, this location is considered to present moderate probability of concerns.	3	Filtered tailings will not require a reclaim pond and does not require the design and construction of containment dikes, so design is considered to be less of a concern. The B7 filtered TSF is located on land. A total of 41 small, shallow ponds are within the proposed footprint; location probability of concerns is considered to be high.	6	Thickened tailings will require management of a moderate volume of water and the design and construction of containment dikes, which may lead to general concerns. The B4 thickened alternative is located in a Lake basin; Lake B4 and 4 small, shallow ponds are within the proposed footprint. Compared to the other options, this location is considered to present moderate probability of concerns.	3	Filtered tailings will not require a reclaim pond and does not require the design and construction of containment dikes, so design is considered to be less of a concern. The B4 filtered alternative is located in a Lake basin; Lake B4 and 3 small, shallow ponds are within the proposed footprint. Compared to the other options, this location is considered to present low to moderate probability of concerns.	5
TECH-2	The B7 thickened tailings storage facility will require the construction of starter dikes with an imprevious layer, the construction of the water control management system, and the dewatering of most of Lake B7 before tailings can be disposed of in the TSF.	1	The B7 filtered tailings storage facility will require minimal preparation and initial construction work. Minimal dewatering.	6	The B4 thickened tailings storage facility will require the construction of starter dikes with an imprevious layer, the construction of the water control management system, and the dewatering of a portion of Lake B4 before tailings can be disposed of in the TSF.	1	The B4 filtered tailings storage facility will require minimal preparation and initial construction work, but dewatering of Lake B4.	3
TECH-3	The B7 thickened tailings storage facility will require containment dikes.	1	The B7 filtered tailings storage facility will not require containment dikes.	6	The B4 thickened tailings storage facility will require containment dikes.	1	The B4 filtered tailings storage facility will not require containment dikes.	6
TECH-4	The B7 thickened tailings storage facility is located approximately 1.5 km from the mill.	6	The B7 filtered tailings storage facility is located approximately 0.85 km from the mill.	6	The B4 thickened tailings storage facility is located approximately 4.4 km from the mill.	4	The B4 filtered tailings storage facility is located approximately 4.4 km from the mill.	4
TECH-5	Thickened tailings management is reliable and easy to operate; as a consequence, it favors stable operating conditions. It does not necessitate specialized operators and can be managed as part of the overall mill operations.	6	Filtered tailings equipment necessitates specialized personnel with specialized training and experience to operate. Considering the high rotation rate of personnel usually seen in northern operations, this may represent a challenge.	1	Thickened tailings management is reliable and easy to operate; as a consequence, it favors stable operating conditions. It does not necessitate specialized operators and can be managed as part of the overall mill operations.	6	Filtered tailings equipment necessitates specialized personnel with specialized training and experience to operate. Considering the high rotation rate of personnel usually seen in northern operations, this may represent a challenge.	1
TECH-6	Thickened tailings are hydraulically transported. Typically the challenge with hydraulic transport in a northern climate is freezing of the pipelines. The risk of plant shut down due to interruption of talings transport can be minimized by installation of heat tracing and duplicate pipelines, so the risk is considered to be low relative to the other alternatives.	6	Filtered tailings would be trucked to the TSF. In case of a white out, problems with the truck loading system, or with the truck fleet and personnel, there are risks of interuption of tailings transportation that can lead to a plant shut down. In some cases a temporary tailings storage pad may be utilized to keep the plant running in the short term; however, if the event extends longer than the storage available on the pad then it can lead to a plant shut down. After the event the tailings would have to be re-handled from the temporary pad to the TSF. The B7 filtered tailings storage facility is located approximately 0.85 km from the mill. The risk of plant shut down is considered to be high relative to hydraulic transport, but the B7 filtered alternative is closer to the mill than the other filtered options so is scored as a moderate risk.	3	Thickened tailings are hydraulically transported. Typically the challenge with hydraulic transport in a northern climate is freezing of the pipelines. The risk of plant shut down due to interruption of talings transport can be minimized by installation of heat tracing and duplicate pipelines, so the risk is considered to be low relative to the other alternatives.	6	Filtered tailings would be trucked to the TSF. In case of a white out, problems with the truck loading system, or with the truck fleet and personnel, there are risks of interuption of tailings transportation that can lead to a plant shut down. In some cases a temporary tailings storage pad may be utilized to keep the plant running in the short term; however, if the event extends longer than the storage available on the pad then it can lead to a plant shut down. After the event the tailings would have to be re-handled from the temporary pad to the TSF. The B4 filtered tailings storage facility is located approximately 4.4 km from the mill. The risk of plant shut down is considered to be high relative to alternatives that use hydraulic transport, and the B4 filtered alternative is a moderate distance to the mill compared to the other filtered options so is scored as a moderate to high risk.	2
TECH-7	Technology to thicken the tailings is relatively simple, does not require specialized equipment parts or specialized personnel for maintenance. Maintenance can be included in the general mill maintenance schedule.	6	Filtered tailings requires specialized equipment and specialized and regular maintenance to minimize the risks of operation shut-down due to equipment failure. It requires a filtering plant with separate maintenance team and a significant inventory of specialized parts.	1	Technology to thicken the tailings is relatively simple, does not require specialized equipment parts or specialized personnel for maintenance. Maintenance can be included in the general mill maintenance schedule.	6	Filtered tailings requires specialized equipment and specialized and regular maintenance to minimize the risks of operation shut-down due to equipment failure. It requires a filtering plant with separate maintenance team and a significant inventory of specialized parts.	1
TECH-8	Hydraulic deposition of tailings is known to lead to entrapment of ice and snow when tailings is inadvertently deposited over ice that forms on the pond in the winter. Ice lenses can also form as the tailings freeze and these ice lenses can grow further with access to water from the tailings pond. Thickened tailings deposition is expected to lead to a moderate amount of ice entrapment/growth.	3	Filtered tailings is not expected to trap significant amounts of ice or snow. Snow will be cleared from the surface prior to placing tailings during the winter. There will not be a tailings pond that contributes to ice entrapment/growth as in hydraulic deposition.	6	Hydraulic deposition of tailings is known to lead to entrapment of ice and snow when tailings is inadvertently deposited over ice that forms on the pond in the winter. Ice lenses can also form as the tailings freeze and these ice lenses can grow further with access to water from the tailings pond. Thickened tailings deposition is expected to lead to a moderate amount of ice entrapment/growth.	3	Filtered tailings is not expected to trap significant amounts of ice or snow. Snow will be cleared from the surface prior to placing tailings during the winter. There will not be a tailings pond that contributes to ice entrapment/growth as in hydraulic deposition.	6

	OL-5 Thickened: Description	Score	OL-5 Filtered: Description	Score	B7 Thickened Weighted Score	B7 Filtered Weighted Score	B4 Thickened Weighted Score	B4 Filtered Weighted Score	OL-5 Thickened Weighted Score	OL-5 Filtered Weighted Score
TECH-1	Thickened tailings will require management of a moderate volume of water and the design and construction of containment dikes, which may lead to general concerns. The OL-5 alternative is located on land. A total of 19 small, shallow ponds are within the proposed footprint. Compared to the other options, this location is considered to present low to moderate probability of concerns.	4	Filtered tailings will not require a reclaim pond and does not require the design and construction of containment dikes, so design is considered to be less of a concern. The OL-5 filtered facility is located on land. A total of 13 small, shallow ponds are within the proposed footprint.Compared to the other options, this location is considered to present low probability of concerns.	6	18	36	18	30	24	36
TECH-2	The OL-5 thickened tailings storage facility will require the construction of starter dikes with an imprevious layer and the construction of the water control management system,but minimal dewatering.	3	The OL-5 filtered tailings storage facility will require minimal preparation and initial construction work. Minimal dewatering.	6	6.0	36.0	6.0	25.2	13.2	36.0
TECH-3	The OL-5 thickened tailings storage facility will require containment dikes.	1	The OL-5 filtered tailings storage facility will not require containment dikes.	6						
TECH-4	The OL-5 thickened tailings storage facility is located approximately 8.8 km from the mill.	1	The OL-5 filtered tailings storage facility is located approximately 8.8 km from the mill.	1	18.0	18.0	12.0	12.0	3.0	3.0
TECH-5	Thickened tailings management is reliable and easy to operate; as a consequence, it favors stable operating conditions. It does not necessitate specialized operators and can be managed as part of the overall mill operations.	6	Filtered tailings equipment necessitates specialized personnel with specialized training and experience to operate. Considering the high rotation rate of personnel usually seen in northern operations, this may represent a challenge.	1	36.0	9.0	36.0	7.5	36.0	6.0
TECH-6	Thickened tailings are hydraulically transported. Typically the challenge with hydraulic transport in a northern climate is freezing of the pipelines. The risk of plant shut down due to interruption of talings transport can be minimized by installation of heat tracing and duplicate pipelines, so the risk is considered to be low relative to the other alternatives.	6	Filtered tailings would be trucked to the TSF. In case of a white out, problems with the truck loading system, or with the truck fleet and personnel, there are risks of interuption of tailings transportation that can lead to a plant shut down. In some cases a temporary tailings storage pad may be utilized to keep the plant running in the short term; however, if the event extends longer than the storage available on the pad then it can lead to a plant shut down. After the event the tailings would have to be re-handled from the temporary pad to the TSF. The OL-5 filtered tailings storage facility is located approximately 8.8 km from the mill. The risk of plant shut down is considered to be high relative to alternatives that use hydraulic transport, and the OL-5 filtered alternative is the furthest distance to the mill compared to the other filtered options so is scored as a high risk.	1						
TECH-7	Technology to thicken the tailings is relatively simple, does not require specialized equipment parts or specialized personnel for maintenance. Maintenance can be included in the general mill maintenance schedule.	6	Filtered tailings requires specialized equipment and specialized and regular maintenance to minimize the risks of operation shut-down due to equipment failure. It requires a filtering plant with separate maintenance team and a significant inventory of specialized parts.	1	30.0	5.0	30.0	5.0	30.0	5.0
TECH-8	Hydraulic deposition of tailings is known to lead to entrapment of ice and snow when tailings is inadvertently deposited over ice that forms on the pond in the winter. Ice lenses can also form as the tailings freeze and these ice lenses can grow further with access to water from the tailings pond. Thickened tailings deposition is expected to lead to a moderate amount of ice entrapment/growth.	3	Filtered tailings is not expected to trap significant amounts of ice or snow. Snow will be cleared from the surface prior to placing tailings during the winter. There will not be a tailings pond that contributes to ice entrapment/growth as in hydraulic deposition.	6						

Technical Indicators TAILINGS

	Description of Sub-Account	Description of Indicator	Rationale	Scoring Scheme	Weighting	
TECH-9	Water Management	Length of reclaim pipeline	Tailings alternatives that require less reclaim pipeline are preferred.	1: Score all alternatives that have a reclaim pipeline from 1 to 5 using a linear scale. Alternatives with longer reclaim pipelines score lower and alternatives with shorter reclaim pipelines score higher. 5: 6: No reclaim pipeline.	1	4
TECH-10		Quantity of water to be managed/reclaimed from the TSF	Tailings alternatives that require less water management within the TSF are preferred.	1: High volume of water to manage in the TSF area. 2: 3: Moderate volume of water to manage in the TSF area. 4: 5: 6: Low volume of water to manage in the TSF area.	1	
TECH-11		Sumps for collection of seepage and/or surface run-off	Tailings alternatives with fewer requirements for sump construction for collection of seepage and run-off are preferred.	1: Score all alternatives using a linear scale. Alternatives with more surface water management sumps score lower and alternatives with fewer surface water management sumps score higher. 6:	1	
TECH-12	Storage efficiency		Storage efficiency is the ratio of volume of tailings storage to volume of fill for the containment dikes or the erosion protection layer. Tailings alternatives which provide greater amounts of storage relative to the volume of containment dike or erosion protection fills, are preferred.	1: Score all alternatives using a linear scale. Alternatives with lower storage efficiency ratios score lower and alternatives with higher storage efficiency ratios score higher. 6:		2
TECH-13	Expansion possibilities		Tailings alternatives that allow for expansion are preferred.	1: No expansion possible. 2: Minimal expansion possible vertically or horizontally. 3: Moderate expansion possible vertically or horizontally. 4: Moderate expansion possible vertically and horizontally. 5: Significant expansion possible vertically or horizontally. 6: Significant expansion possible both vertically and horizontally.		6
3	**Closure and reclamation**					
TECH-14	Progressive reclamation		Tailings alternatives that allow for progressive reclamation are preferred as they spread the costs out during operation, and typically have less risk related to material availability, and fewer requirements for rehandling of materials.	1 : Limited progressive reclamation is feasible. 2: 3: 4: 5: 6: Significant progressive reclamation is feasible.		3
						41

	B7 Thickened		B7 Filtered		B4 Thickened		B4 Filtered		OL-5 Thickened		OL-5 Filtered	
TECH-9	The length of reclaim pipeline required for the B7 thickened tailings storage facility is approximately 2.1 km.	5	No reclaim pipeline.	6	The length of reclaim pipeline required for the B4 thickened tailings storage facility is approximately 4.9 km.	3	No reclaim pipeline.	6	The length of reclaim pipeline required for the OL-5 thickened tailings storage facility is approximately 9.6 km.	1	No reclaim pipeline.	6
TECH-10	Thickened tailings will be partially dewatered at the mill; therefore, a moderate volume of reclaim will be required from the TSF.	2	Filtered tailings will be dewatered at the mill such that there will not be a reclaim pond at the TSF; minimal water to manage at TSF (only run-off and possible seepage).	6	Thickened tailings will be partially dewatered at the mill; therefore, a moderate volume of reclaim will be required from the TSF.	2	Filtered tailings will be dewatered at the mill such that there will not be a reclaim pond at the TSF; minimal water to manage at TSF (only run-off and possible seepage).	6	Thickened tailings will be partially dewatered at the mill; therefore, a moderate volume of reclaim will be required from the TSF.	2	Filtered tailings will be dewatered at the mill such that there will not be a reclaim pond at the TSF; minimal water to manage at TSF (only run-off and possible seepage).	6
TECH-11	The B7 thickened tailings storage facility will require 6 perimeter sumps to collect run-off and seepage for pumping back to the tailings pond.	1	The B7 filtered tailings storage facility will require 4 perimeter sumps to collect run-off and seepage. One of the 4 sump locations will require a larger sump or pond to collect all the water from the other sumps to be managed. It is proposed that the large sump or pond be located within the TSF footprint for the first 6-7 years and then moved downstream of the south-east corner of the facility for the last few years once the ore stockpiles will not be required in this area.	3	The B4 thickened tailings storage facility will require 4 perimeter sumps to collect run-off and seepage.	3	The B4 filtered facility will require 4 perimeter sumps to collect run-off and seepage. One of the 4 sump locations will require a larger sump or pond to collect all the water from the other sumps. It is proposed that the large sump or pond be located at the northwest corner of the facility.	3	The OL-5 thickened tailings storage facility will require 1 perimeter sump to collect run-off and seepage.	6	The OL-5 filtered tailings storage facility will require 1 large perimeter sump or pond to collect run-off and seepage. It is proposed that the sump be located north of the facility.	6
TECH-12	The storage efficiency for the B7 thickened tailings storage facility is 2.6.	1	The B7 filtered tailings storage facility will require placement of an erosion protection layer during operation to minimize erosion and dust. The storage efficiency for the B7 filtered tailings storage facility is 14.0.	5	The B4 thickened facility will require construction of containment dikes. The storage efficiency for the B4 thickened tailings storage facility is 1.3.	1	The B4 filtered tailings storage facility will require placement of an erosion protection layer during operation to minimize erosion and dust. The storage efficiency for the B4 filtered tailings storage facility is 16.9.	6	The OL-5 thickened facility will require construction of containment dikes. The storage efficiency for the OL-5 thickened tailings storage facility is 2.7.	1	The OL-5 filtered tailings storage facility will require placement of an erosion protection layer during operation to minimize erosion and dust. The storage efficiency for the OL-5 filtered tailings storage facility is 14.4.	5
TECH-13	The B7 thickened tailings storage facility could be moderately expanded horizontally to the northwest into Lake E2 sub-catchment, or to the northeast into Lake G2 sub-catchment. Can also be moderately expended vertically.	4	The B7 filtered tailings storage facility could be significantly expanded horizontally to the northwest into Lake E2 sub-catchment, or to the northeast into Lake G2 or H17 sub-catchments. Can also be significantly expanded vertically.	6	The B4 thickened tailings storage facility could be moderately expanded horizontally to the northeast into the B5 sub-catchment, to the west-northwest in the Lake B2 sub-catchment, or to the south into Lake B45, which is in the same sub-catchment. It cannot be expanded vertically as it is considered to be a reasonable maximum height.	3	The B4 filtered tailings storage facility could be moderately expanded horizontally to the northeast into the Lake B5 sub-catchment, to the west into the Lake B2 sub-catchment, or to the south into Lake B45 which is in the same sub-catchment. Can also be significantly expanded vertically.	5	The OL-5 thickened tailings storage facility could be minimally expanded within the same sub-catchment or moderately expanded to the north or south into new sub-catchments. It cannot be expanded vertically as it is considered to be a reasonable maximum height.	3	The OL-5 filtered tailings storage facility could be significantly expanded vertically, and to the northeast within the same sub-catchment.	6
3												
TECH-14	Thickened tailings deposition will only allow limited progressive reclamation. Progressive reclamation of the tailings will only be possible very close to the end of the mine life if an area of deposition is complete.	1	Filtered tailings deposition is very amenable to progressive reclamation. As the filtered tailings is stacked higher, the slopes of the facility can be reclaimed.	6	Thickened tailings deposition will only allow limited progressive reclamation. Progressive reclamation of the tailings will only be possible very close to the end of the mine life if an area of deposition is complete.	1	Filtered tailings deposition is very amenable to progressive reclamation. As the filtered tailings is stacked higher, the slopes of the facility can be reclaimed.	6	Thickened tailings deposition will only allow limited progressive reclamation. Progressive reclamation of the tailings will only be possible very close to the end of the mine life if an area of deposition is complete.	1	Filtered tailings deposition is very amenable to progressive reclamation. As the filtered tailings is stacked higher, the slopes of the facility can be reclaimed.	6
		46		**67**		**43**		**60**		**44**		**63**

	B7 Thickened	B7 Filtered	B4 Thickened	B4 Filtered	OL-5 Thickened	OL-5 Filtered
TECH-9 to TECH-11	11.3	22.0	11.3	22.0	12.0	24.0
TECH-12	2.0	10.0	2.0	12.0	2.0	10.0
TECH-13	24.0	36.0	18.0	30.0	18.0	36.0
3						
TECH-14	3.0	18.0	3.0	18.0	3.0	18.0
	148.33	**190.00**	**136.33**	**161.70**	**141.20**	**174.00**
	3.62	**4.63**	**3.33**	**3.94**	**3.44**	**4.24**

Tailings MAA Table - Meliadine Gold Project

Economics Indicators TAILINGS

	Description of Sub-Account	Description of Indicator	Rationale	Scoring Scheme	Weight: Indicator	Weight: Sub-account	B7 Thickened: Description	B7 Thickened: Score	B7 Filtered: Description	B7 Filtered: Score	B4 Thickened: Description	B4 Thickened: Score	B4 Filtered: Description	B4 Filtered: Score	OL-5 Thickened: Description	OL-5 Thickened: Score	OL-5 Filtered: Description	OL-5 Filtered: Score
EC-1	Capital costs	Initial TSF construction costs will include, if needed, foundation preparation, dike construction, including lining of the dikes, and construction of the water collection system. For the purpose of evaluating initial costs, the volume of construction material has been used in combination with the distance required to truck it from Tiriganiaq pit (assumed rockfill supply for initial construction), as this is considered to be the most significant construction cost.	Alternatives that require less construction and are closer to the Tiriganiaq pit are preferred. Generic cost scores were assigned by multiplying the construction fill volume by the distance from Tiriganiaq pit.	1: Score all alternatives that require initial construction from 1 to 5 using a linear scale. Alternatives with higher generic cost scores lower and alternatives with lower generic cost scores score higher. 5: 6: No containment dike.	5	6	Initial construction requires 2,900,000 m³ of rockfill to be transported 3 km from Tiriganiaq pit. The generic cost score is 8.7.	4	The filtered tailings storage facility will not require containment dikes.	6	Initial construction requires 5,600,000 m³ of rockfill to be transported 1.8 km from Tiriganiaq pit. The generic cost score is 10.1.	4	The filtered tailings storage facility will not require containment dikes.	6	Initial construction requires 3,700,000 m³ of rockfill to be transported 7.5 km from Tiriganiaq pit. The generic cost score is 27.8.	1	The filtered tailings storage facility will not require containment dikes.	6
EC-2		Tailings dewatering infrastructure, equipment and parts inventory.	Alternatives that require less capital investment for construction of the dewatering infrastructure, tailings management equipment and parts inventory are preferred.	1: High range cost. 2: 3: Mid-range cost. 4: 5: 6: Low range cost.	6		The dewatering facility required to thicken the tailings will have a low relative capital cost. No parts inventory needed.	6	The filtering facility will have a high relative capital cost. An inventory of parts will be required for the filter press.	1	The dewatering facility required to thicken the tailings will have a low relative capital cost. No parts inventory needed.	6	The filtering facility will have a high relative capital cost. An inventory of parts will be required for the filter press.	1	The dewatering facility required to thicken the tailings will have a low relative capital cost. No parts inventory needed.	6	The filtering facility will have a high relative capital cost. An inventory of parts will be required for the filter press.	1
EC-3		Tailings transport system (pipeline/pumps or trucks), and reclaim water system (pipeline, pump/barge).	Alternatives that require less capital for the tailings transport system and water reclaim system are preferred.	1: High range cost. 2: 3: Mid-range cost. 4: 5: 6: Low range cost.	4		Pipeline capital costs will include approximately 7,500 m of tailings pipeline and 2,100 m of reclaim pipeline, with associated puping capacity. This is a relatively low capital cost when compared to a truck fleet.	6	Filtered tailings will be trucked so a truck fleet has to be purchased, which represents a significant capital cost. In addition, approximately 1,500 m of pipeline for water management will also be required.	1	Pipeline capital costs will include approximately 9,100 m of tailings pipeline and 4,900 m of reclaim pipeline, with associated puping capacity. This is a relatively low capital cost when compared to a truck fleet.	6	Filtered tailings will be trucked so a truck fleet has to be purchased, which represents a significant capital cost. In addtion, approximately 6,000 m of pipeline for water management will also be required.	1	Pipeline capital costs will include approximately 14,200 m of tailings pipeline and 9,600 m of reclaim pipeline, with associated puping capacity. This is a relatively low capital cost when compared to a truck fleet.	5	Filtered tailings will be trucked so a truck fleet has to be purchased, which represents a significant capital cost. Approximately 10,300 m of pipeline for water management will also be required.	1
EC-4	Operating costs	Phased containment dike or erosion protection construction.	Alternatives that require less construction, during operation and are closer to Tiriganiaq Pit will have lower operating costs and are therefore preferred. Generic cost scores are based on the dike or erosion protection volume multiplied by the distance from Tiriganiaq Pit. The cost of liner for the thickened options is considered to offset the costs of crushing of the erosion protection fill for the filtered options.	1: Score all alternatives using a linear scale. Alternatives with higher generic cost scores score lower and alternatives with lower generic cost scores score higher. 6:	3	5	The requirements for raising the containment dikes for the B7 thickened facility during operations will include 9,300,000 m³ of rockfill transported 3°km from Tiriganiaq pit. The generic cost score is 27.9.	4	The requirements for construction of the B7 filtered facility during operations will include 1,431,000 m³ of rockfill for erosion protection transported 2.3°km from Tiriganiaq pit. The generic cost score is 2.5.	6	The requirements for raising the containment dikes for the B4 thickened facility during operations will include 16,600,000 m³ of rockfill transported 1.8 km from Tiriganiaq pit. The generic cost score is 30.0.	4	The requirements for construction of the B4 filtered facility during operations will include 1,197,000 m³ of rockfill for erosion protection transported 1.8 km from Tiriganiaq pit. The generic cost score is 2.1.	6	The requirements for raising the containment dikes for the OL-5 thickened facility during operations will include 7,600,000 m³ of rockfill transported 7.5 km from Tiriganiaq pit. The generic cost score is 57.0.	1	The requirements for construction of the OL-5 filtered facility during operations will include 1,390,000 m³ of rockfill for erosion protection transported. 7.5 km from Tiriganiaq pit. The generic cost score is 10.5.	5
EC-5		Tailings plant operation.	Operational costs include manpower, maintenance, and energy. The less costly operation is preferred.	1: High range cost. 2: 3: Mid-range cost. 4: 5: 6: Low range cost.	6		A conventional thickener does not necessitate extra manpower to operate, nor does it require separate maintenance capacities. Energy needed to power the equipment is considered in the low range when compared to the energy needed to operate the filter press.	6	A tailings filtering plant needs a dedicated operational team, extra manpower and maintenance capacities. It also requires more energy to operate than a conventional thickener. In a northern context, where energy efficiency is important, this may represent a challenge.	1	A conventional thickener does not necessitate extra manpower to operate, nor does it require separate maintenance capacities. Energy needed to power the equipment is considered in the low range when compared to the energy needed to operate the filter press.	6	A tailings filtering plant needs a dedicated operational team, extra manpower and maintenance capacities. It also requires more energy to operate than a conventional thickener. In a northern context, where energy efficiency is important, this may represent a challenge.	1	A conventional thickener does not necessitate extra manpower to operate, nor does it require separate maintenance capacities. Energy needed to power the equipment is considered in the low range when compared to the energy needed to operate the filter press.	6	A tailings filtering plant needs a dedicated operational team, extra manpower and maintenance capacities. It also requires more energy to operate than a conventional thickener. In a northern context, where energy efficiency is important, this may represent a challenge.	1
EC-6		Tailings handling.	Alternatives that have lower annual operating costs for transport, and deposition/placement of tailings are preferred. The distance the tailings have to be transported will have an impact on operational costs for both types of transportation, but trucking is much more expensive than pumping, so only the mode of transport is considered.	1: High range cost. 2: 3: Mid-range cost. 4: 5: 6: Low range cost.	6		Thickened tailings are hydraulically transported, so annual transportation costs are related to the pumping operation, which is in the low range. No further deposition effort is needed once in the TSF. The water in the TSF is to be reclaimed back to the mill; however, the pumping effort is in the low range.	6	Handling costs for filtered tailings include a conveyor and truck loading system , truck transport (including man power), as well as leveling of the tailings at the TSF (bulldozer). These represent a high range cost.	1	Thickened tailings are hydraulically transported, so annual transportation costs are related to the pumping operation, which is in the low range. No further deposition effort is needed once in the TSF. The water in the TSF is to be reclaimed back to the mill; however, the pumping effort is in the low range.	6	Handling costs for filtered tailings include a conveyor and truck loading system , truck transport (including man power), as well as leveling of the tailings at the TSF (bulldozer). These represent a high range cost.	1	Thickened tailings are hydraulically transported, so annual transportation costs are related to the pumping operation, which is in the low range. No further deposition effort is needed once in the TSF. The water in the TSF is to be reclaimed back to the mill; however, the pumping effort is in the low range.	5	Handling costs for filtered tailings include a conveyor and truck loading system , truck transport (including man power), as well as leveling of the tailings at the TSF (bulldozer). These represent a high range cost.	1
EC-7		Fresh water make up.	Alternatives that require less fresh water make up are preferred.The quantity of freshwater needed has a direct cost as per the Water Licence and Water Compensation Agreement, and an indirect cost due to extra pumping capacity needed.	1: High volume of fresh water make up required. 2: 3: Moderate volume of fresh water make up required. 4: 5: 6: Low volume of fresh water make up required.	1		Tailings will be partially dewatered at the mill to produce a thickened tailings. Process water will also be reclaimed from the TSF back to the mill. However, some water will be lost to pore spaces in the tailings and also due to ice entrapment during the winter. It is expected that a moderate to high volume of fresh water make up will be required.	3	Tailings will be significantly dewatered at the mill to produce filtered tailings, relatively less water will be lost to the pore spaces in the tailings and water will not be lost due to ice entrapment. Therefore, it is expected that minimal fresh water make up water will be required.	6	Tailings will be partially dewatered at the mill to produce a thickened tailings. Process water will also be reclaimed from the TSF back to the mill. However, some water will be lost to pore spaces in the tailings and also due to ice entrapment during the winter. It is expected that a moderate to high volume of fresh water make up will be required.	3	Tailings will be significantly dewatered at the mill to produce filtered tailings, relatively less water will be lost to the pore spaces in the tailings and water will not be lost due to ice entrapment. Therefore, it is expected that minimal fresh water make up water will be required.	6	Tailings will be partially dewatered at the mill to produce a thickened tailings. Process water will also be reclaimed from the TSF back to the mill. However, some water will be lost to pore spaces in the tailings and also due to ice entrapment during the winter. It is expected that a moderate to high volume of fresh water make up will be required.	3	Tailings will be significantly dewatered at the mill to produce filtered tailings, relatively less water will be lost to the pore spaces in the tailings and water will not be lost due to ice entrapment. Therefore, it is expected that minimal fresh water make up water will be required.	6
EC-8	Closure/reclamation costs	Construction of waste rock cover over the TSF.	Alternatives that have a smaller surface area will require less waste rock cover on closure, and those that are closer to a waste rock pile will have a lower cost and are therefore preferred. Generic cost scores were assigned by multiplying the cover fill volume by the distance from the waste rock pile.	1: Score all alternatives using a linear scale. Alternatives with higher generic cost scores score lower and alternatives with lower generic cost scores score higher. 6:	1	3	The cost for construction of a 2-m thick cover over the B7 thickened tailings storage facility will be associated with approximately 3,500,000 m³ of rockfill transported from a waste rock pile less than 1 km away. The generic cost score is 3.5.	5	The cost for construction of a 1-m thick cover (1 m of erosion protection placed during operations for a total of 2 m) over the B7 filtered tailings storage facility will be associated with approximately 1,430,000 m³ of rockfill from a waste rock pile less than 1 km away. The generic cost score is 1.4.	6	The cost for construction of a 2- m thick cover over the B4 thickened tailings storage facility will be associated with approximately 2,000,000 m³ of rockfill transported from a waste rock pile less than 1 km away. The generic cost score is 2.0.	6	The cost for construction of a 1-m thick cover (1 m of erosion protection placed during operations for a total of 2 m) over the B4 filtered tailings storage facility will be associated with approximately 1,200,000 m³ of rockfill from a waste rock pile less than 1 km away. The generic cost score is 1.2.	6	The cost for construction of a 2-m thick cover over the OL-5 thickened tailings storage facility will be associated with approximately 3,600,000 m³ of rockfill transported from a waste rock pile less than 3 km away. The generic cost score is 10.8.	1	The cost for construction of a 1-m thick cover (1 m of erosion protection placed during operations for a total of 2 m) over the OL-5 filtered tailings storage facility will be associated with approximately 1,400,000 m³ of rockfill transported from a waste rock pile less than 3 km away. The generic cost score is 4.2.	4
EC-9		Water treatment.	Alternatives that have a smaller pond requiring treatment will have a lower cost and are therefore preferred.	1: Large pond volume. 2: 3: Moderate pond volume. 4: 5: 6: Small pond volume.	3		The B7 thickened tailings storage facility is expected to have a moderate sized pond.	3	The B7 filtered tailings storage facility will not have a tailings pond, but it will have a small pond/sump for collection of surface run-off water that may require treatment.	6	The B4 thickened tailings storage facility is expected to have a moderate sized pond.	3	The B4 filtered tailings storage facility will not have a tailings pond, but it will have a small pond/sump for collection of surface run-off water that may require treatment.	6	The OL-5 thickened tailings storage facility is expected to have a moderate sized pond.	3	The OL-5 filtered tailings storage facility will not have a tailings pond, but it will have a small pond/sump for collection of surface run-off water that may require treatment.	6
						14		43.00		34.00		44.00		34.00		31.00		31.00

	B7 Thickened Weighted Score	B7 Filtered Weighted Score	B4 Thickened Weighted Score	B4 Filtered Weighted Score	OL-5 Thickened Weighted Score	OL-5 Filtered Weighted Score
Capital costs	32.0	16.0	32.0	16.0	24.4	16.0
Operating costs	27.2	9.4	27.2	11.3	22.5	10.3
Closure/reclamation costs	10.5	18.0	11.3	18.0	7.5	16.5
	69.69	43.38	70.44	45.25	54.40	42.81
	4.98	3.10	5.03	3.23	3.89	3.06

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